8 AIR QUALITY, ODOUR AND CLIMAT

8.1 Introduction

This odour and air quality impact assessment has been prepared to assess the [illegible]tial odour and air quality impact on the nearest neighbouring residential properties in proximity to the proposed Sustainable Bio-Energy Limited Biogas Plant development. The proposed Sustainable Bio-Energy Limited biogas development site is located on lands to the north-west of Gort town in the townlands of Ballynamantan, Glenbrack and Kinincha.

The proposed biogas facility will be capable of accepting up to 90,000 tonnes of feedstock per annum which will be predominately sourced from agricultural sources. Solid and liquid feedstocks will be delivered by suitable road tankers from off-site sources. All solid feedstocks will be accepted and unloaded within the feedstock reception building, which includes provision for quarantine. Liquid feedstocks will be delivered to feedstock reception tanks, vented to a gas management system /odour control unit to prevent escape of odours to the receiving environment. An average of 10 no. lorry movements will be delivering material to the facility each day during normal operating hours (07:00 to 19:00 Monday to Sunday inclusive). The activity will operate on a 24 hour basis, 7 days per week.

The plant will accept and process feedstocks to maximise energy recovery through the production of renewable biogas and organic fertiliser. The feedstocks comprise material predominately sourced from agriculture such as animal manure /dung and slurries, energy crops (e.g. grass silage), and residues from the agri-food industry. Biogas from the plant will be upgraded to biomethane and utilised to produce renewable energy (to serve house load and primarily for off-site end users). The digestate produced at the plant will meet the requirements of an agreed quality standard (such as PAS110 or similar) and it will comply with DAFM transformation parameters and testing requirements as per CN11. Digestate produced at the plant will be used as an organic fertiliser (OF/SI) for use on agricultural lands.

Under normal conditions the plant will be powered by the onsite CHP engine. Back-up dual fuel boilers are provided for occasions when the CHP might not be available, e.g. during commissioning, digester start-up or CHP maintenance activities. The heat generated in the CHP engine will be used at the installation to supply to heat to the digesters, pasteurisation process, gas purification process, and carbon dioxide purification process. A proportion of the biogas that is produced onsite will be consumed in the CHP engine, while the remainder (majority) will be upgraded, compressed and bottled and sent

exported off-site as a flexible renewable fuel to serve users in the transport and heat sectors.

In accordance with the First Schedule to the EPA Act 1992 to 2013, the facility will require an Industrial Emissions Licence and accordingly the plant will be regulated by the Environmental Protection Agency (EPA).

The assessment and evaluation of the potential odour and air quality impact arising from the proposed development involved the following methodology:

- Identification of odour and air quality pollutant sources;
- Identification of odour and air quality pollutant emission rates;
- Dispersion modelling of odour and air quality pollutant emissions; and,
- Comparison of modelling results with relevant criteria.
- Reference to the following documentation;
    - EPA, Office of Environmental Enforcement (OEE), Air Guidance Note 5 (AG5) Odour Impact Assessment Guidance for EPA Licensed Sites.
    - EPA, Odour Impacts and Odour Emission Control Measures for Intensive Agriculture
    - EPA, Air Guidance Note 4: Air Dispersion Modelling from Industrial Installations Guidance Note (AG4).
    - Environment Agency (UK), Draft Horizontal Guidance for Odour - Part 1- Regulation and Permitting & Part 2 Assessment & Control.

The purpose of the odour and air quality impact assessment is to determine the extent of the odour and air quality impact from the emission stacks on nearby residential properties. A dispersion modelling assessment has allowed for the prediction of odour and air quality impact on the receiving environment. The potential odour impact has been compared to an appropriate odour annoyance criterion and graphically illustrated in the form of 'contours of equal concentration' or isopleths for the 98%ile of maximum 1-hour odour concentrations. The potential air quality impact has been compared to the relevant ambient air quality standards outlined in the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011).

8.2 Assessment Methodology and Significance Criteria

8.2.1 Assessment Criteria and Impact Assessment Methodology

AIR QUALITY IMPACT

The relevant air pollutant limit values from the Air Quality Standards Regulations 2011 are outlined in Table 8.1 below.

Table 8.1 Relevant Limit values from the Air Quality Standards Regulations 2011.

Pollutant	Limit Value Objective	Averaging Period	Limit Value µg/m³	Basis of Application of the Limit Value	Limit Value Attainment Date
SO_2	Protection of human health	1 hour	350	Not to be exceeded more than 24 times in a calendar year	1 Jan 2005
	Protection of human health	24 hours	125	Not to be exceeded more than 3 times in a calendar year	1 Jan 2005
	Protection of vegetation	calendar year	20	Annual mean	19 July 2001
	Protection of vegetation	1 Oct to 31 Mar	20	Winter mean	19 July 2001
NO_2	Protection of human health	1 hour	200	Not to be exceeded more than 18 times in a calendar year	1 Jan 2010
	Protection of human health	calendar year	40	Annual mean	1 Jan 2010
NOx (NO + NO_2)	Protection of ecosystems	calendar year	30	Annual mean	19 July 2001
PM_{10}	Protection of human health	24 hours	50	Not to be exceeded more than 35 times in a calendar year	1 Jan 2005
	Protection of human health	calendar year	40	Annual mean	1 Jan 2005
$PM_{2.5}$ - Stage 1	Protection of human health	calendar year	25	Annual mean	1 Jan 2015
$PM_{2.5}$ - Stage 2	Protection of human health	calendar year	20	Annual mean	1 Jan 2020
Carbon Monoxide	Protection of human health	8 hours	10,000	Not to be exceeded	1 Jan 2005
Benzene	Protection of human health	calendar year	5	Annual mean	1 Jan 2010

Significance of Potential Environmental Effects

In terms of the 'Significance of Potential Environmental Effects' the magnitude (scale of change) has been determined by considering the impacts of the proposed development on air quality with reference to the baseline conditions and environmental assessment criteria.

Describing the Impact:

The rationale for describing the impact of the proposed development is derived from the Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) guidance (EPUK & IAQM) "Land-Use Planning & Development Control: Planning for Air Quality (January 2017).

There is a two-stage process to be followed in the assessment of air quality impacts:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts

The suggested framework for describing the impacts is set out in Table 6.3 of the EPUK & IAQM guidance document and is shown in Table 8.2 below. The term Air Quality Assessment Level (AQAL) has been adopted as it covers all pollutants, i.e. those with and without formal standards. AQAL is used to include air quality objectives or limit values where these exist. The Environment Agency uses a threshold criterion of 10% of the short term AQAL as a screening criterion for the maximum short-term impact. The EPUK & IAQM guidance adopts this as a basis for defining an impact that is sufficiently small in magnitude to be regarded as having an insignificant effect.

Table 8.2 Impact descriptors for individual receptors

Long term average Concentration at Receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Moderate
103-109% f AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Explanation

1. AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.
2. The Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as Negligible.
3. The Table is only designed to be used with annual mean concentrations.
4. Descriptors for individual Receptors only; the overall significance is determined using professional judgement (see Chapter 7). For example, a 'moderate' adverse impact at one Receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.
5. When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.
6. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.
7. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the [illegible] year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

Assessing Significance:

The rationale for the assessment of significance is derived from the EPUK & IAQM Guidance (paragraphs 7.1-7.12 referring to Table 6.3) and relates to Table 8.2 above.

Impacts on air quality, whether adverse or beneficial, will have an effect on human health that can be judged as 'significant' or 'not significant'. An 'impact' is the change in the concentration of an air pollutant, as experienced by a Receptor. This may have an 'effect' on the health of a human Receptor, depending on the severity of the impact and other factors that may need to be taken into account. The impact descriptors set out in Table 8.2 are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual

Receptors. Whilst it may be that there are 'slight', 'moderate' or 'substantial' impacts at one or more Receptors, the overall effect may not necessarily be judged as being significant in some circumstances.

- Any judgement on the overall significance of effect of a development will need to take into account such factors as:
- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts; and
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts.
- Other factors may be relevant in individual cases.

ODOUR IMPACT

Odour is the property of a substance that activates the human sense of smell. The human olfactory system is a sensory system used for the detection of odours. It is highly sensitive and as such is capable of detecting extremely low concentrations of a wide range of odorous chemicals. Due to the complex nature of odour perception by the human olfactory system, levels of sensitivity to odour within a population will vary from person to person. In addition, the context in which the odour occurs will affect the nuisance value of the odour.

To put odour concentrations and odour impact assessment criteria guidelines into context, an odour threshold of $1ou_E/m^3$ is the level at which an odour is detectable by 50% of screened panellists. The recognition threshold is about 5 times this concentration i.e. $5ou_E/m^3$. Furthermore, odour concentration of between 5 and 10 ou_E/m^3 above background will give rise to a faint odour and concentrations greater than 10 ou_E/m^3 constitutes a distinct odour and are likely to give rise to nuisance complaints. The exposure of the population to a particular odour consists of two factors; the concentration and the length of time that the population may perceive the odour.

Currently there is no general statutory odour standard in Ireland relating to industrial installations. The EPA has issued guidance specific to intensive agriculture which has outlined the following standards:

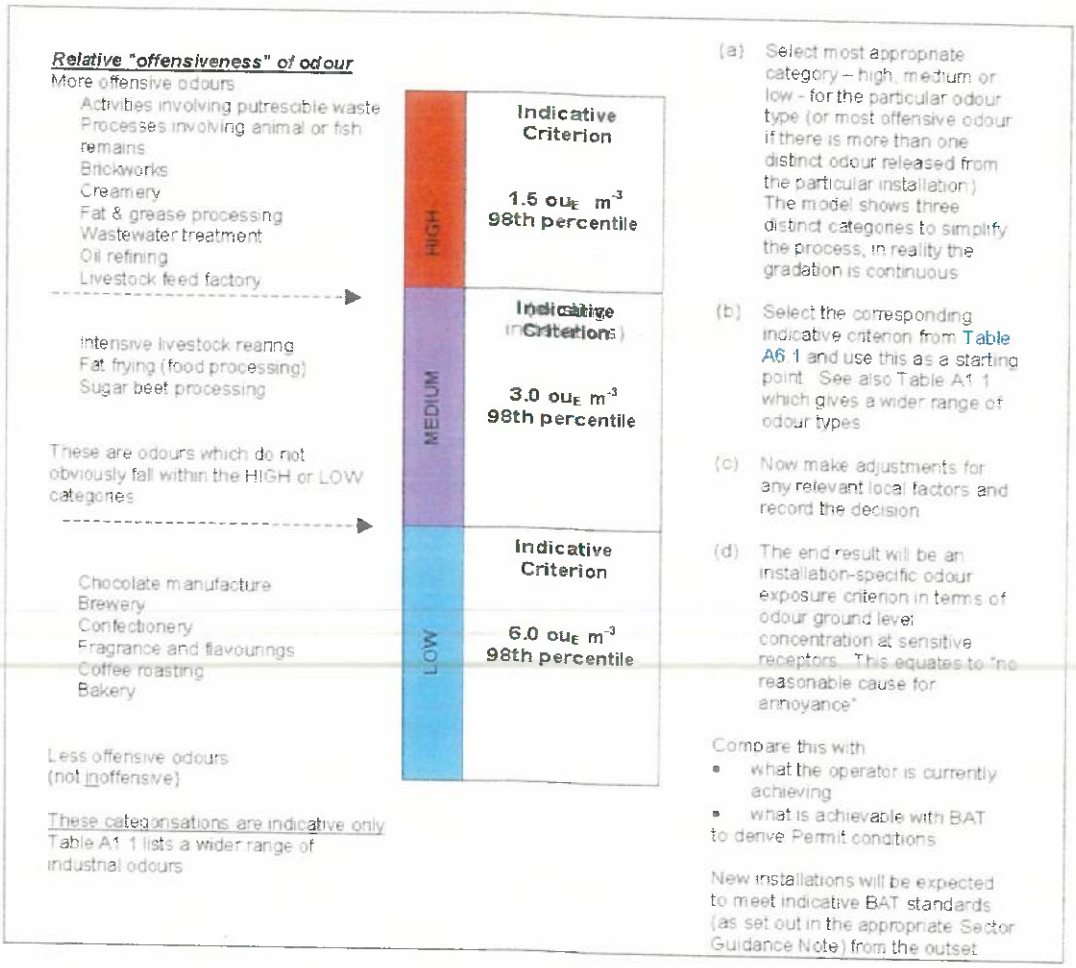
- Target value for new pig-production units of 1.5 ou_E/m^3 as a 98th%ile of 1-hour averaging periods,
- Limit value for new pig-production units of 3.0 ou_E/m^3 as a 98th%ile of 1-hour averaging periods,

- Limit value for existing pig-production units of 6.0 ou_E/m^3 as a 98th%ile of 1-hour averaging periods.

Guidance from the UK recommends that odour standards should vary from 1.5 – 6.0 ou_E/m^3 as a 98th percentile of 1-hour averaging periods at the worst-case sensitive receptor based on the offensiveness of the odour and with adjustments for local factors such as population density.

As outlined in the Technical Guidance Note IPPC H4, Integrated Pollution Prevention and Control (IPPC) DRAFT Horizontal Guidance for Odour Part 1 – Regulation and Permitting as published by the Northern Ireland Environment Agency in conjunction with the Environment Agency and the Scottish Environmental Protection Agency, *"annoyance potential is the likelihood that a specific odorous mixture will give reasonable cause for annoyance in an exposed population. Not all odours have the same potential to cause annoyance – for example odours arising from putrescible materials, are typically considered to be more 'offensive' than odours from a bakery which might be better tolerated. It should be remembered however that **ANY** odour has the potential to cause offence if, for example, the odour is strong and/or exposure is frequent. The list below (Table A6.1) is based around a ranking of industrial-type odours which was carried out in the UK recently (as described in Appendix 1). The results are consistent with those from the Netherlands and Germany. A larger UK study is currently underway and the table below will be reviewed in line with any different outcomes. This ranking gives some indication of **relative** offensiveness. These have then been categorised as 'low', 'medium' and 'high' offensiveness and exposure criteria have been assigned to each category. These categories are indicative only and do not have definite cut-off points in terms of the industry types listed. Although this ranking is based upon the views of a number of people; within this there may be individuals who respond differently, (see Appendix 1 – "Offensiveness")".*

Table A6.1: *Indicative odour exposure criteria for ground level concentration of mixtures of odorants*



Based on the criteria outlined in Table A6.1 above and sector experience, a benchmark of 1.5 ou_E/m^3 is recommended based on the potential odours emanating from the Sustainable Bio-Energy Limited facility being deemed to be potentially highly offensive odours. On the basis of all of the above, the following recommended odour target value should be achieved at the surrounding worst affected sensitive receptors

- $C_{98,\ 1\text{-Hour}}$ 1.5 ou_E/m^3

Impact on Habitats:

As the activity falls under the Industrial Emissions Directive (IED), the installation is required to demonstrate compliance with air quality assessment levels (for the protection of human health and the environment) and to demonstrate appropriate odour control as well as assessing the risk of air pollution impacts to ecosystems.

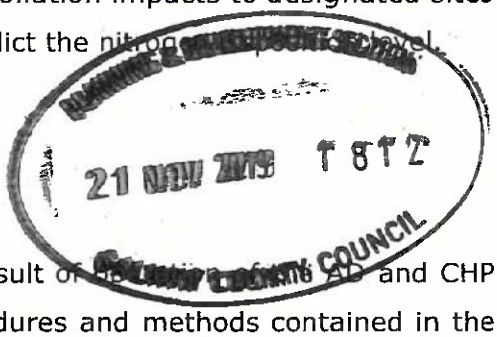
The Air Quality Impact Assessment on sensitive habitats has made reference to the UK Department of Agriculture, Environment & Rural Affairs Standing Advise Note 20, *Energy*

Generation – Anaerobic Digestion Advice for Planning Officers and Applicants seeking planning permission for Anaerobic Digestion which may impact on Natural Heritage (Issue 2, June 2017).

The Habitats Directive (92/43/EEC) requires every public body to consider the implications of a proposal, such as AD plants, on European designated sites and make an appropriate assessment where there are any likely significant effects. In terms of air pollution, the main environmental impacts from AD relate to the potential for impacts on sensitive habitat generated from storage of feedstock on site and the spreading of digestate. There is also the potential for odour impacts at the nearest residential properties to such developments.

SCAIL-Agriculture (Simple Calculation of Atmospheric Impact Limits from Agriculture Sources) is a screening tool for assessing the impact from agricultural sources on designated sites such as Special Areas of Conservation (SAC). SCAIL-Agriculture produces an estimate of the ammonia concentration, nitrogen and acid deposition rates, PM_{10} and odour concentrations at a specific distance downwind of the source, using a 'deposition velocity' specific to the habitat or human health receptor of interest. SCAIL-Agriculture also estimates the potential for critical load exceedance at the nearest edge of the habitat, considering the background deposition at that location and the critical load of the habitat.

To do this, the SCAIL model uses both Critical Load/Levels and sensitive habitat information as on the APIS website. Critical loads and levels are a tool for assessing the risk of air pollution impacts to ecosystems. Critical loads/Levels are provided for different pollutants. The critical load relates to the quantity of pollutant deposited from air to the ground, whereas the critical level is the gaseous concentration of a pollutant in the air. Where the SCAIL-Agriculture Screening Model indicates potential exceedances, it is recommended that a Detailed Dispersion Modelling Assessment is undertaken. To assess the process contribution and subsequent air pollution impacts to designated sites and sensitive habitat AERMOD has been used to predict the nit[illegible]



8.2.2 Assessment Methodology

AERMOD DISPERSION MODELLING

The predicted odour and air quality impacts as a result of [illegible] AD and CHP Plant have been assessed in accordance with procedures and methods contained in the following publications:

- Air Dispersion Modelling from Industrial Installations Guidance Note (AG4), EPA 2010.

- H4 Odour Management, Guidance Parts 1 and 2, Environment agency, UK, 2011.

The AMS/EPA Regulatory Model (*Aermod*) is the current US EPA regulatory model used to predict pollutant concentrations from a wide range of sources that are present at typical industrial facilities.

The model accepts hourly meteorological data to define the conditions for plume rise, transport, diffusion and deposition. It estimates the concentration or deposition value for each source and receptor combination for each hour of input meteorology and calculates user-selected short-term averages. Since most air quality standards are stipulated as averages or percentiles, AERMOD allows further analysis of the results for comparison purposes.

Percentile analysis for emissions is calculated for the maximum averages using the AERMOD-percent post-processing utility. This utility calculates the maximum concentration of a pollutant from all receptors at a specific percentile, for a specific period. Employing the percentile method facilitates the omission of unusual short-term meteorological events that may cause elevated pollutant concentrations and hence a more accurate representation of the likely average pollutant concentrations over an averaging period.

AERMODs main limitations are as follows:

1. Steady State – does not deal with transient conditions well, limited to a 50km radius.
2. Homogeneous meteorological field – not well suited to areas where the meteorological conditions change quickly.
3. Does not model atmospheric chemistry.

It should be noted that none of these limitations affect the output of the air dispersion model with regard to the assessment of the Sustainable Bio-Energy Limited facility. The Environmental Protection Agency also widely uses and approves AERMOD dispersion models submitted as part of the Industrial Licencing and Planning Applications.

ODOUR DISPERSION MODELLING INPUTS

The following information was input into the model for the prediction of maximum ground level ambient odour and air pollutant concentrations due to emissions from the stacks at the Sustainable Bio-Energy Limited facility.

On-Site Odour Sources

The Sustainable Bio-Energy Limited site layout map and building plans and elevations were used as the template for all sources, relevant structures and the boundary of the facility within the model. The stacks were modelled as individual point sources. A point source is one that releases pollutants from a limited opening, such as a stack or vent. The AERMOD package uses the steady state Gaussian plume equation for a continuous elevated point source. The rate of production of an emission, such as gaseous pollutants or odours, is quantified as an emission rate. For a gaseous pollutant or odour emission rate, this is equivalent to the gaseous pollutant or odour concentration (mg/m^3 or ou_E/m^3) multiplied by the air flow rate (m^3/s). It is the mass of gaseous pollutant or odour emitted from a source per second and expressed in g/s or ou_E/s.

All input parameters including mass emission rates, volume flows, temperatures, concentrations, periods of operation etc. were determined on the basis of the information provided by the applicant.

Site Map and Cartesian Grid

The site layout map was supplied in AutoCAD format and imported into the dispersion model. The map included the site boundary and all relevant buildings. The boundary, all relevant structures and emission sources were traced and included in the model. The site map was grid referenced (tagged) and imported into the model. Cartesian receptor grids with the following grid co-ordinates were created;

- Cartesian Grid 1 - Centre ITM Coordinates – 545425, 703410 with a spacing of 25m x 25m = 500 m^2
- Cartesian Grid 2 - Centre ITM Coordinates – 545425, 703410 with a spacing of 50m x 50m = 1 km^2
- Cartesian Grid 3 - Centre ITM Coordinates – 545425, 703410 with a spacing of 100m x 100m = 2 km^2
- Cartesian Grid 4 - Centre ITM Coordinates – 545425, 703410 with a spacing of 7500m x 750m = 15 km^2

Building Downwash

When one or more buildings in the vicinity of a point source interrupt wind flow, an area of turbulence known as a building wake is created. Pollutants emitted from a relatively low level can be caught in this turbulence, affecting their dispersion. This phenomenon is called building downwash. In order to conduct an extensive analysis of downwash effects of all point sources, the dimensions (including heights) of all significant buildings on-site

were input into the model. The downwash effects are determined using the building profile input programme (BPIP-Prime) which was run prior to all modelling runs.

8.2.3 Identification of Potential Receivers

HUMAN RECEIVERS

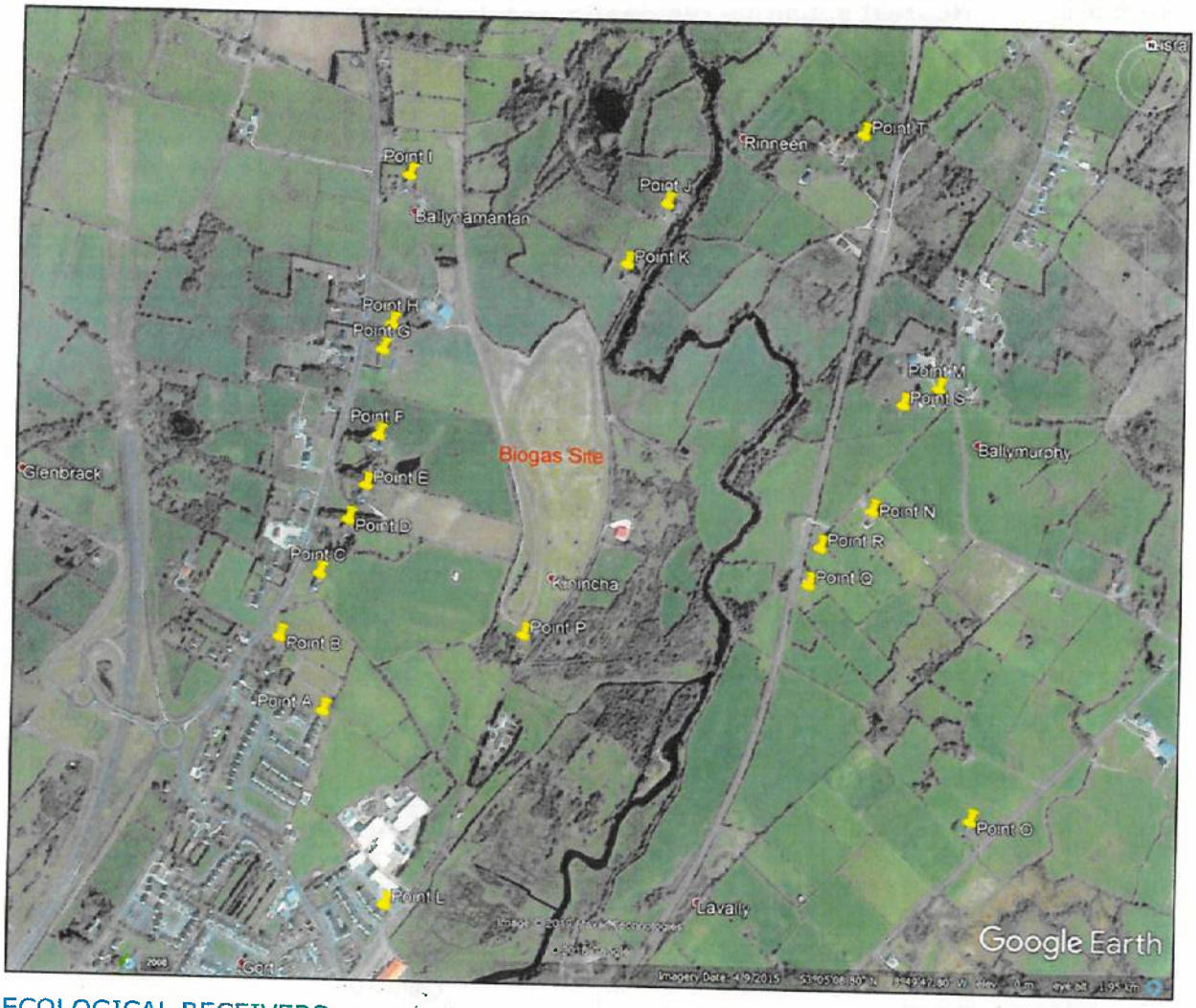
Twenty (20 no.) representative sensitive residential receiver locations in proximity to the proposed Biogas facility were selected. The locations of the 20 sensitive receiver locations are illustrated in Table 8.3 and Figure 8.1 below.

Table 8.3 Nearest sensitive residential receiver locations in proximity to the Biogas facility.

Ref.	ITM		Irish Grid		Address
A	544986.6	702852.9	145024	202819	19 Cúirt Bhreac, Galway Rd, Gort, An Gort, Co. Galway
B	544893	702990	144938	202962	1 Galway Rd, Co. Galway
C	544971	703113	145016	203086	R458, Kinincha, Co. Galway
D	545026	703220	145071	203193	R458, Kinincha, Co. Galway
E	545060	703288	145105	203261	Glenbrack Lodge, Glenbrack, Gort, Co. Galway,
F	545084	703385	145129	203358	Kilderry Lodge, Glenbrack, Gort, Co. Galway
G	545090	703553	145135	203526	R458, Ballynamantan, Co. Galway
H	545107	703603	145152	203575	R458, Ballynamantan, Co. Galway
I	545139	703894	145184	203867	R458, Ballynamantan, Co. Galway
J	545633	703843	145678	203816	Kinincha Road, Co. Galway
K	545556	703725	145601	203698	Kinincha Road, Co. Galway
L	545103	702471	145148	202443	6 Kinincha Road, The Grove, Gort, Co. Galway, H91 P5C2
M	546159	703488	146204	203461	Pound Rd, Ballymurphy, Co. Galway
N	546034	703247	146079	203220	Pound Rd, Ballymurphy, Co. Galway
O	546228	702645	146273	202617	R380, Co. Galway
P	545363	702998	145408	202971	Derelict Cottage, L85314, Kinincha, Gort
Q	545913	703102	145958	203075	Lavally, Gort (Extant Permission)

Ref.	ITM		Irish Grid		Address
R	545935	703174	145980	203147	Rinneen, Gort (Extant Permission)
S	546091	703456	146136	203429	Rinneen, Gort (Extant Permission)
T	546014	703983	146059	203956	Rinneen, Kiltartan (Extant Permission)

Figure 8.1 **Nearest sensitive residential receiver locations in proximity to the Biogas facility.**



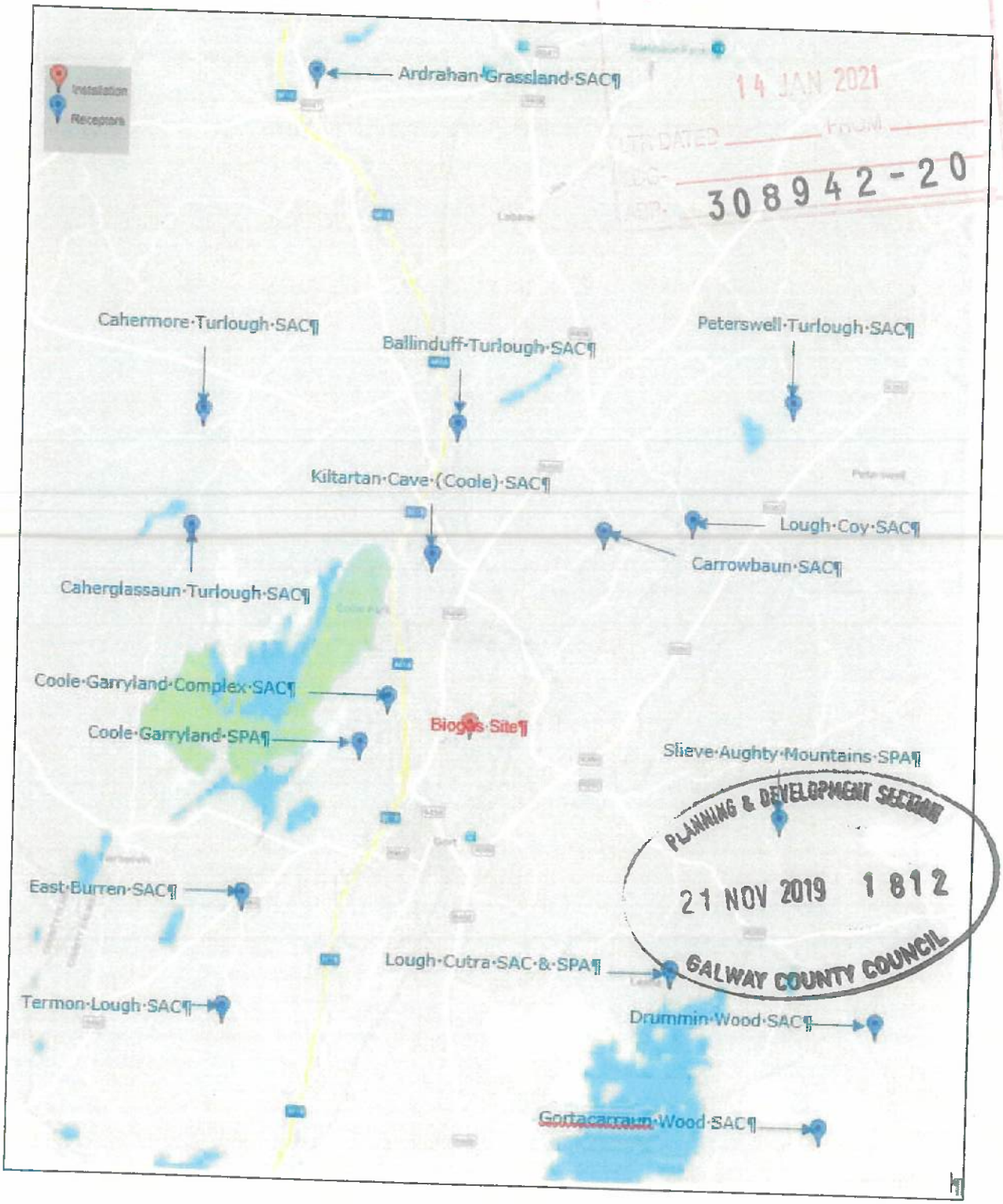
ECOLOGICAL RECEIVERS

The Air Dispersion Modelling Assessment has considered the contribution of nitrogen deposition rates at designated habitat sites within 10 Km of the Biogas facility as outlined in Table 8.4. Coole-Garryland Complex SAC and East Burren Complex SAC are the two primary SACs within 10Km of the area of the [illegible] which are sensitive to nitrogen deposition.

Table 8.4 Ecologically sensitive receptor sites within 10 km of the Biogas facility (See Figure 8.2).

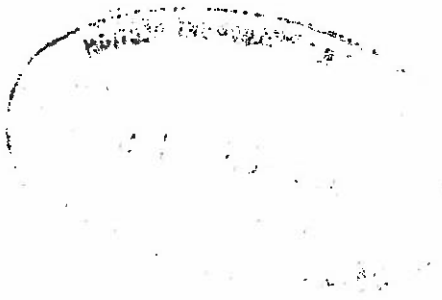
Site No.	Name	Distance(km)	Designation	Easting	Northing
1	Coole-Garryland Complex	1.11	SAC	144401	203702
2	Coole-Garryland SPA	1.451	SPA	144039	203087
3	Kiltartan Cave (Coole)	2.26	SAC	144949	205577
4	Carrowbaun, Newhall and Ballylee Turloughs	3.033	SAC	147141	205901
5	East Burren Complex	3.759	SAC	142480	201086
6	Lough Coy	3.914	SAC	148297	206074
7	Ballinduff Turlough	3.924	SAC	145250	207294
8	Lough Cutra	4.139	SAC	148071	200163
9	Lough Cutra SPA	4.147	SPA	148078	200159
10	Slieve Aughty Mountains SPA	4.207	SPA	149494	202178
11	Caherglassaun Turlough	4.477	SAC	141762	205896
12	Termon Lough	4.961	SAC	142253	199592
13	Cahermore Turlough	5.394	SAC	141901	207427
14	Peterswell Turlough	5.942	SAC	149606	207634
15	Drummin Wood	6.561	SAC	150771	199521
16	Gortacarnaun Wood	6.977	SAC	150051	198120
17	Ardrahan Grassland	8.765	SAC	143337	211879

Figure 8.2 **Ecologically sensitive receptor sites within 10 km of the Biogas facility.**



Meteorological Data

The air dispersion modeling assessment was completed using five years of hourly sequential meteorological data from the Shannon meteorological station (2011 to 2015). A meteorological data sensitivity analysis indicated a worst-case year (2013) was selected

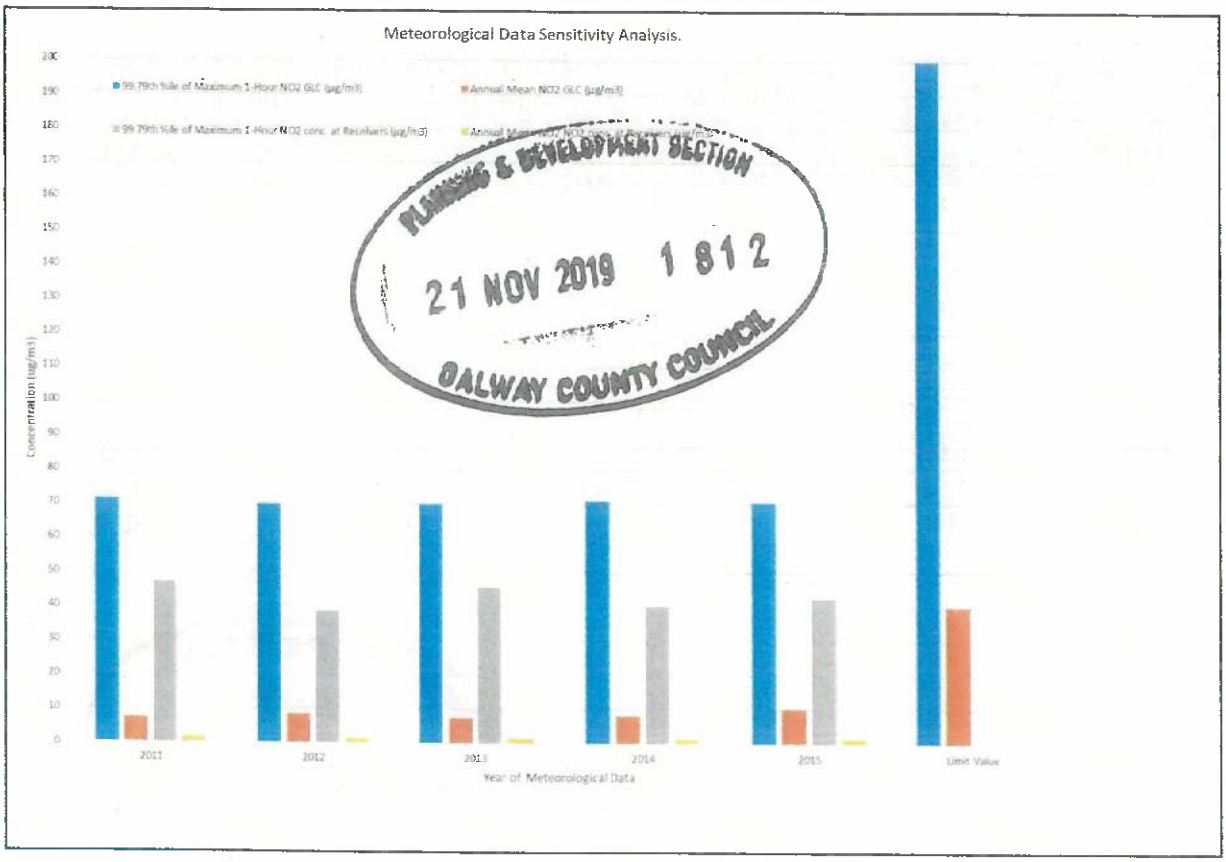


for all subsequent model runs based on worst-case annual mean impacts at the receiver locations.

Table 8.5 Meteorological data Sensitivity Analysis

Year	99.79th %ile of Maximum 1-Hour NO_2 GLC ($\mu g/m^3$)	Annual Mean NO_2 GLC ($\mu g/m^3$)	99.79th %ile of Maximum 1-Hour NO_2 conc. at Receivers ($\mu g/m^3$)	Annual Mean NO_2 conc. at Receivers ($\mu g/m^3$)
2011	71.13	7.11	46.85	1.46
2012	69.75	8.31	38.51	1.31
2013	69.88	7.31	45.55	1.47
2014	70.97	7.92	40.02	1.32
2015	70.62	10.24	42.50	1.43
Limit Value	**200**	**40**	**200**	**40**

Figure 8.3 Meteorological data Sensitivity Analysis



Stack Heights

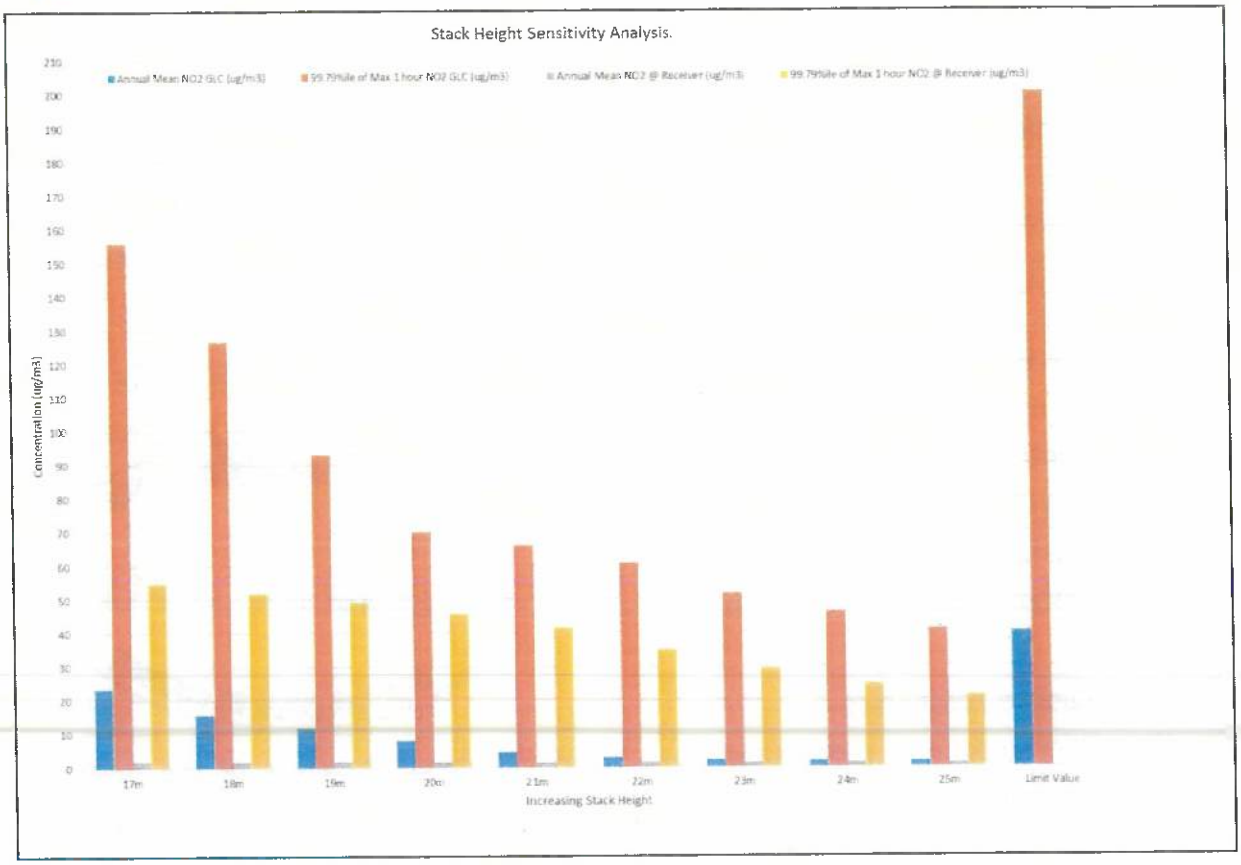
An appropriate stack height determination study was undertaken as reported below. An appropriate minimum stack height of 22m has been recommended for the Feedstock

Reception Building Odour Control Unit stack and the CHP stack, which is 7.6m above the highest roof level on the proposed facility, i.e. the Feedstock Reception Building which has a height of 13.4m. The Flare stack will be 8m high but will be used very infrequently. The two temporary boiler emission points will emit at 3m above the Feedstock Reception Building height, i.e. 16.4m.

Table 8.6 Stack Height Sensitivity Analysis

Maximum Ground Level Concentration				
Stack Height	**Annual Mean NO_2 GLC ($\mu g/m^3$)**	**99.79%ile of Max 1 hour NO_2 GLC ($\mu g/m^3$)**	**%age Reduction Annual Mean NO_2**	**%age Reduction 99.79%ile of Max 1 hour NO_2**
17m	23.45	155.78	-	-
18m	15.67	126.5	33.2	18.8
19m	11.91	92.81	49.2	40.4
20m	7.91	69.86	66.3	55.2
21m	4.43	65.88	81.1	57.7
22m	2.79	60.51	88.1	61.2
23m	2.11	51.45	91.0	67.0
24m	1.73	45.96	92.6	70.5
25m	1.39	40.77	94.1	73.8
Maximum GLC at Receiver				
Stack Height	**Annual Mean NO_2 @ Receiver ($\mu g/m^3$)**	**99.79%ile of Max 1 hour NO_2 @ Receiver ($\mu g/m^3$)**	**%age Reduction Annual Mean NO_2**	**%age Reduction 99.79%ile of Max 1 hour NO_2**
17m	1.84	54.62	-	-
18m	1.7	51.69	7.6	5.4
19m	1.6	49.07	13.0	10.2
20m	1.49	45.6	19.0	16.5
21m	1.38	41.43	25.0	24.1
22m	1.26	34.77	31.5	36.3
23m	1.14	29.21	38.0	46.5
24m	1.03	24.58	44.0	55.0
25m	0.92	21.08	50.0	61.4
Limit Value	40	200	40.0	200.0

Figure 8.4 Stack Height Sensitivity Analysis



NOX TO NO_2 CHEMISTRY

During the combustion processes, a mixture of both nitric oxide (NO) and nitrogen dioxide (NO_2) (termed NOx) is released and once released a series of complex chemical reactions takes place over time periods varying from seconds to days during which a portion of the nitric oxide is converted to nitrogen dioxide. Detailed modelling of NO_2/NOx chemistry has been carried out using the PVMRM method in *AERMOD*. The volume fraction of NO_2 in the exhaust gas is typically assumed to be between 5 – 10%. In terms of atmospheric chemistry, NO reacts with ozone (O_3) to form NO_2 and O_2:

(1) $NO + O_3 \rightarrow NO_2 + O_2$

Additional reactions can occur to reform NO and O_3 from the reaction of NO_2 with sunlight:

(2) $NO_2 + h\nu \rightarrow NO + O$

(3) $O + O_2 \rightarrow O_3$

The Plume Volume Molar Ratio Method (PVMRM), assumes that the amount of NO converted to NO_2 via reaction (1) is proportional to the ambient ozone concentration. Where the ozone concentration is greater than NO, full conversion to NO_2 is assumed. Reactions (2) and (3) are ignored and it is assumed that initially 10% of the plume is NO_2.

The PVMRM additionally uses both plume size and O_3 concentration to derive the amount of O_3 available for the reaction between NO and O_3. NOx moles are determined by emission rate and travel time through the plume segment. The number of O_3 moles is determined by the size of the plume segment and the background ambient O_3 concentration. For a given NOx emission rate and ambient ozone concentration, the NO_2/NOx conversion ratio is primarily controlled by the volume of the plume. The current default options in AERMOD-PVMRM are:

- for background ozone, a single representative value or hour-by-hour data from a representative monitoring station can be used; in this case a background O_3 concentration of 75 $\mu g/m^3$, based on ozone monitoring at [illegible] monitoring site on the west coast.
- NO_2/NOx equilibrium ratio = 0.90;
- NO_2/NOx in-stack ratio = 0.10.

Time Averaging & Percentiles

The time averaging and percentiles have been calculated in terms of the pollutant concentration limit values criteria detailed in the air quality standards. The averaging times for NO_2, SO_2, CO and PM_{10} were selected in terms of the relevant air quality standards. NO_2 emissions were calculated as a 99.79th percentile of 1-hour average and as an annual average as these represent the time averaged limit values specified for NO_2 in the relevant air quality standards. CO emissions were calculated as a running 8-hour average as this represents the averaged limit value specified for CO in the relevant air quality standards. SO_2 emissions were calculated as a 99.7th percentile of 1-hour average, as a 99.2th percentile of 24-hour average and as an annual average as these represent the time averaged limit values specified for SO_2 in the relevant air quality standards. PM_{10} has been calculated as a 90.41th percentile of 24-hour average. As appropriate, the time averaging and percentiles have been calculated in terms of the pollutant concentration limit values criteria detailed in Table 8.1. Odour emissions were calculated as a 98th percentile of 1-hour average as this represents the time averaged limit values specified in the relevant Target Limit Value.

Emission Points & Relevant Odour & Air Pollutant Emission Rates

The three scheduled emission points are as follows;

- CHP Gas Engine, vented through one stack with a height of 22m - emission point A2-1 (Stack Location – ITM Grid Ref. 545488, 703349);
- Feedstock Reception Building, Odour control stack, vented through a stack of 22m - emission point A2-2 (Stack Location – ITM Grid Ref. 545391, 703344);

- Biogas flare stack, vented through a stack of 8m - emission point A2-3 (Stack Location – ITM Grid Ref. 545385, 703352) (Note: it is assumed that the flare unit will be operational for <1% of any operational year).
  Minor Emission Points (Two temporary boilers on site) vented through a stack of 16.4m, i.e. 3m above Feedstock Reception Building height. Boiler No.1 RLS 250/M MZ Stack Location and Boiler No.2 RLS M MZ.

Appropriate Emission Limit Values (ELV) for the proposed CHP Engine[92], vented through one stack, emission point A2-1 are outlined below. These ELVs are defined as Best Available Technique (BAT) for the sector to ensure environmental impacts are not significant at any location within the vicinity of the site.

- Nitrogen Oxides (NOx) - ELV = 500 mg/m^3 (as per technical data sheet)
- Sulphur Dioxide (SO_2) - ELV = 350 mg/m^3
- Non-methane volatile organic compounds (NMVOCs) - ELV = 75 mg/m^3
- Carbon Monoxide (CO) - ELV = 1,400 mg/m^3

In terms of Nitrogen Deposition Modeling assumptions, the assumptions with regards to nitrogen formation and deposition included the following;

- The molecular diffusivity in air of the pollutant being modeled (cm^2/s)
- The diffusivity in water of the pollutant being modeled (cm^2/s)
- The cuticular resistance to uptake by lipids for individual leaves for the pollutant (s/cm)
- The Henry's Law coefficient (Pa) for the parameter (m^3/mol).

The raw biogas produced by anaerobic digestion is primarily methane (CH_4). There are also additional trace gases in digester gas. Digester biogas is approximately 60% CH_4 and 35% carbon dioxide (CO_2), with the remainder consisting of other components such as oxygen (O_2), nitrogen (N_2) and hydrogen sulphide (H_2S). The combustion of digester biogas results in emissions of pollutants such as oxides of nitrogen (NOx), carbon monoxide (CO), volatile organic compounds (VOC), particulate matter and oxides of sulphur (SOx) as well as greenhouse gases (carbon monoxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). H_2S is a corrosive gas which can cause problems during combustion of biogas. The H_2S concentration in the gas will need to be kept below the recommendations of the manufacturer of the equipment used for the combustion and bottling of the gas. Therefore, the digester biogas will be treated in order to remove H_2S as well as water, dust and CO_2. During anaerobic digestion, the H_2S concentration in

[92] *Jenbacher Type 6 (J620) modelled*

digester biogas can range from 100 to 10,000 ppm (150 – 15,000 mg/m^3), depending on the raw materials used. In order to achieve the specification similar to natural gas required for bottling and use off-site after purification the H_2S concentration will be required to be less than 3.3 ppm (5 mg/m^3). In the process of upgrading the digester biogas quality the methane content will be increased to at least 95%, due to the removal of H_2S, CO_2, NH_3, particles and water.

At the Sustainable Bio-Energy Limited Biogas plant, desulphurisation will be undertaken by absorbing H_2S on inner surfaces of engineered activated carbon with defined pore sizes. The addition of oxygen (in the presence of water) oxidises H_2S to elemental sulphur that binds to the surface. Activated carbon is either impregnated or doped with permanganate or potassium iodide (KI), potassium carbonate, or zinc oxide (ZnO) as catalysers. Due to limits on oxygen levels in biomethane, oxidisation of sulphur is not a suitable technique where the gas is intended for grid injection or use as vehicle fuel. Use of KI-doped carbon or permanganate impregnated carbon is used to effect oxidation without the need for oxygen. ZnO impregnated carbon is expensive but extremely efficient. H_2S concentrations of less than 1 ppm (1.5 mg/m^3) will be achieved. During combustion, all remaining H_2S will be oxidised to SO_2 and therefore, there will be no H_2S emissions. Also, by ensuring the H_2S level in the biogas is sufficiently low will allow for compliance with the environmental regulations for SO_2 emissions. It has been predicted that SO_2 emissions will be in accordance with ambient air quality standards. Therefore, on the basis of the above outlined project design proposals, screening or modelling for the parameter H_2S was not undertaken as H_2S will not be emitted from the CHP stack.

It is the Feedstock Reception Building and its associated Odour Control Unit stack that will be the only significant potential odour source on site. The effective operation of Activated Carbon in the odour control unit will result in a very high odour removal efficiency rate of > 90%. A high efficiency rate of odour removal is known to be achieved if deep bed systems are used, as is proposed in this case. Therefore, as a worst-case assumption it has been assumed that odour removal will result in an odour emission concentration from the Feedstock Reception Building Stack of 1,000ou/m^3. In accordance with BAT, the volumetric emission rate from the Feedstock Reception Building should be three times the building volume. Therefore, the volume to be emitted will be ~75,000m^3/hour. The odour dispersion model assumes the effective operation of the 'negative pressure' system in the Feedstock Reception Building, thereby negating the potential for unattenuated fugitive odour emissions.

The biogas development includes four covered digestate storage tanks with direct connectivity to the biogas facility as they are required to store digestate from the anaerobic

the closed spreading season or other times (e.g. during periods of poor weather conditions). Digestate will be used for spreading on agricultural lands in lieu of chemical fertilisers. There will be no odour escape form the four digestate storage tanks located within the Biogas facility.

The digestate produced will meet prescribed standards for digestate quality; respiration activity, metals, pathogenic organisms, impurities, organic matter and maturity. The digestate storage tanks will be covered to prevent rain water ingress and as they will contain spent digestate there will be a low odour potential from the digestate storage tanks. The digestate will be 'spent' by the time it is sent to the digestate storage tanks because of the digestion process by which time all biogas will have been extracted. The digestate will also have undergone pasteurisation during the process. Therefore, the potential for noxious odours will be much reduced.

Table 8.7 shows the emission rates from the stacks at the Biogas facility.

Table 8.7 Emission Rates input in to the Air Dispersion Model.

CHP Stack A2-1 Emission Rates

Pollutant	Stack Diameter (m)	Stack Cross Sectional Area (m^2)	Temp. (K)	Stack Exit Velocity (m/s)	Volume Flow (m^3/s)	Volume Flow (m3/hr)	Emission Conc. Limit (mg/Nm^3)	Mass Emission Rate (g/s)	Emission Conc. (Kg/hour)	Emission Conc. (Kg/year)
Oxides of Nitrogen (as NO2)	0.3	0.071	453	15	1.1	3815.1	500	0.530	1.908	16710
Sulphur Dioxide	0.3	0.071	453	15	1.1	3815.1	350	0.371	1.335	11697
Total Organic Carbon	0.3	0.071	453	15	1.1	3815.1	75	0.079	0.286	2507
Carbon Monoxide	0.3	0.071	453	15	1.1	3815.1	1400	1.484	5.341	46788
Total Dust	0.3	0.071	453	15	1.1	3815.1	50	0.053	0.191	1671

Waste Acceptance Building OCU Stack A2-2 Emission Rates

Pollutant	Stack Diameter (m)	Stack Cross Sectional Area (m^2)	Temp. (K)	Stack Exit Velocity (m/s)	Volume Flow (m^3/s)	Volume Flow (m3/hr)	Odour Emission Conc. (ou/Nm^3)	Odour Emission Rate (ou/s)	Emission Conc. (ou/hour)	Emission Conc. (ou/year)
Odour Emissions @ ~75,000 m3/h	1.3	1.327	293	15.7	20.8	74982.3	1000	20.828	74.982	656845

Stack A2-3 Flare Emission Rates (Back Up)

Pollutant	Stack Diameter (m)	Stack Cross Sectional Area (m2)	Temp. (K)	Stack Exit Velocity (m/s)	Volume Flow (m^3/s)	Volume Flow (m3/hr)	Emission Conc. Limit (mg/Nm^3)	Mass Emission Rate (g/s)	Emission Conc. (Kg/hour)	Emission Conc. (Kg/year)
Oxides of Nitrogen (as NO2)	1.78	2.487	850	15	37.3	134308.5	150	5.596	20.146	9670
Sulphur Dioxide	1.78	2.487	850	15	37.3	134308.5	30	1.119	4.029	1934
Total Organic Carbon	1.78	2.487	850	15	37.3	134308.5	10	0.373	1.343	645
Carbon Monoxide	1.78	2.487	850	15	37.3	134308.5	50	1.865	6.715	3223
Total Dust	1.78	2.487	850	15	37.3	134308.5	10	0.373	1.343	645

Boiler Stacks - Minor Emission Points
Boiler No. 1 RLS 250/M MZ

Pollutant	Stack Diameter (m)	Stack Cross Sectional Area (m2)	Temp. (K)	Stack Exit Velocity (m/s)	Volume Flow (m^3/s)	Volume Flow (m^3/hr)	Emission Conc. (mg/Nm^3)	Mass Emission Rate (g/s)	Emission Conc. (Kg/hour)	Emission Conc. (Kg/year)
Oxides of Nitrogen (as NO2)	0.25	0.049	409	12.5	0.6	2207.8	102.84	0.063	0.227	1989
Carbon Monoxide	0.25	0.049	409	12.5	0.6	2207.8	8.57	0.005	0.019	166

Boiler No. 2 RLS M MZ (Assumed emissions based on data for Boiler No. 1)

Pollutant	Stack Diameter (m)	Stack Cross Sectional Area (m2)	Temp. (K)	Stack Exit Velocity (m/s)	Volume Flow (m^3/s)	Volume Flow (m^3/hr)	Emission Conc. (mg/Nm^3)	Mass Emission Rate (g/s)	Emission Conc. (Kg/hour)	Emission Conc. (Kg/year)
Oxides of Nitrogen (as NO2)	0.25	0.049	409	12.5	0.6	2207.8	102.84	0.063	0.227	1989
Carbon Monoxide	0.25	0.049	409	12.5	0.6	2207.8	8.57	0.005	0.019	166

Boiler No. 1	Type RLS 250/M MZ	Pollutant	mg/KWh	mg/m3
		CO	10	8.57
		NOx	120	102.84

Emission conc calculated form details in spec sheets for the burners of the boilers using equations in;
https://www.breeam.com/domrefurbmanual/content/13calculations/08pol01.htm
G20 Gas => 1 mg/m^3 = 0.857 mg/kWh [Ref. BREEAM]

8.2.4 Legislation and Guidance

In accordance with the First Schedule to the EPA Act 1992 to 2013, the facility will require an Industrial Emissions Licence and accordingly the plant will be regulated by the Environmental Protection Agency (EPA). The assessment and evaluation of the potential odour and air quality impact arising from the proposed development involved the following methodology:

- Identification of odour and air quality pollutant sources;
- Identification of odour and air quality pollutant emission rates;
- Dispersion modelling of odour and air quality pollutant emissions; and,
- Comparison of modelling results with relevant criteria.

The purpose of the odour and air quality impact assessment is to determine the extent of the odour and air quality impact from the emission stacks on nearby residential properties. A dispersion modelling assessment has allowed for the prediction of odour and air quality impact on the receiving environment. The potential odour impact has been compared to an appropriate odour annoyance criterion and graphically illustrated in the form of 'contours of equal concentration' or isopleths for the 98%ile of maximum 1-hour odour concentrations. The potential air quality impact has been compared to the relevant ambient air quality standards outlined in the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011).

8.2.5 Desktop Study

The following documentation was referenced;

- EPA, Office of Environmental Enforcement (OEE), Air Guidance Note 3 (AG3) Odour Impact Assessment Guidance for EPA Licensed Sites.
- EPA, Odour Impacts and Odour Emission Control Measures for Intensive Agriculture
- EPA, Air Guidance Note 4: Air Dispersion Modelling from Industrial Installations Guidance Note (AG4).
- Environment Agency (UK), Draft Horizontal Guidance for Odour – Part 1: Regulation and Permitting & Part 2 Assessment & Control.

8.2.6 Field Work

Baseline air quality monitoring has been undertaken at monitoring locations representative of the nearest point of the two closest designated European sites to the proposed AD development site between the 11th June – 10th July 2019. . Characterisation of the

existing environment was undertaken using the results from this survey and data available from public bodies (ref. Section 8.3).

8.2.7 Consultation

No consultation was undertaken with regulatory stakeholders during preparation of this assessment. As part of proposed Industrial Emission Licence application works, the accepted standard methodology for modelling of atmospheric emissions and modelling outputs will be submitted to the Environmental Protection Agency for verification in the determination of the licence application.

8.3 Description of the Receiving Environment

8.3.1 Introduction

The background air quality in the area of the development is of very good quality and the site is located in 'Zone D' as denoted by the EPA. The EPA has divided the country into zones for the assessment and management of air quality. The zones adopted in Ireland are Zone A, the Dublin conurbation; Zone B, the Cork conurbation; Zone C, comprising 21 large towns in Ireland with a population >15,000; and Zone D, the remaining area of Ireland. Concentrations of air quality pollutants in Zone D are very low and well below the relevant air quality limit values. Background odours are most likely to be typical of intermittent rural area odours influenced by existing agricultural activities etc.

AMBIENT AIR QUALITY SURVEY

To verify publicly available data used to characterise the receiving environment, air quality monitoring was undertaken in proximity to the proposed AD development site. Site specific baseline air quality monitoring has been carried out in proximity to the site and specifically in proximity to the nearest designated European sites. The site-specific monitoring identifies the existing pollutant levels in the area and establishes compliance with relevant ambient air legislation.

Baseline air quality monitoring has been undertaken at monitoring locations representative of the nearest point of the two closest designated European sites to the proposed AD development site. Baseline air quality monitoring has also been undertaken at a monitoring location along the R458 at the entrance to the proposed AD development site. Nitrogen oxides (NOx) and nitrogen dioxide (NO_2) was monitored using diffusion tube monitoring at three locations from 11th June – 10th July 2019. The diffusion tubes were analysed using ultra-violet spectrophotometry at a UKAS accredited laboratory, giving an

average concentration over the monitoring period. The diffusion tube monitoring locations are presented in Figure 8.5.

Nitrogen dioxide (NO_2) is classed as both a primary and a secondary pollutant. As a primary pollutant NO_2 is emitted from all combustion processes (such as a gas / oil fired boiler or a car engine). As a secondary pollutant NO_2 is derived from atmospheric reactions of pollutants that are themselves, derived mainly from traffic sources. NO_2 has been shown to reduce the pulmonary function of the lungs. Long-term exposure to high concentrations of NO_2 can cause a range of effects, primarily in the lungs, but also in the liver and blood. The NO_2 annual mean limit for the protection of human health is 40 $\mu g/m^3$.

Oxides of nitrogen (NO_x) are the sum of NO_2 and NO and is both a primary and secondary pollutant. NO_x is an atmospheric precursor for acid rain on reaction with water to form nitric acid. NO_x may have a positive or negative impact by acting as a fertiliser or a phytotoxicant. Effects are mainly on growth, photosynthesis and nitrogen assimilation / metabolism. The NOx annual mean limit for the protection of vegetation is 30 $\mu g/m^3$.

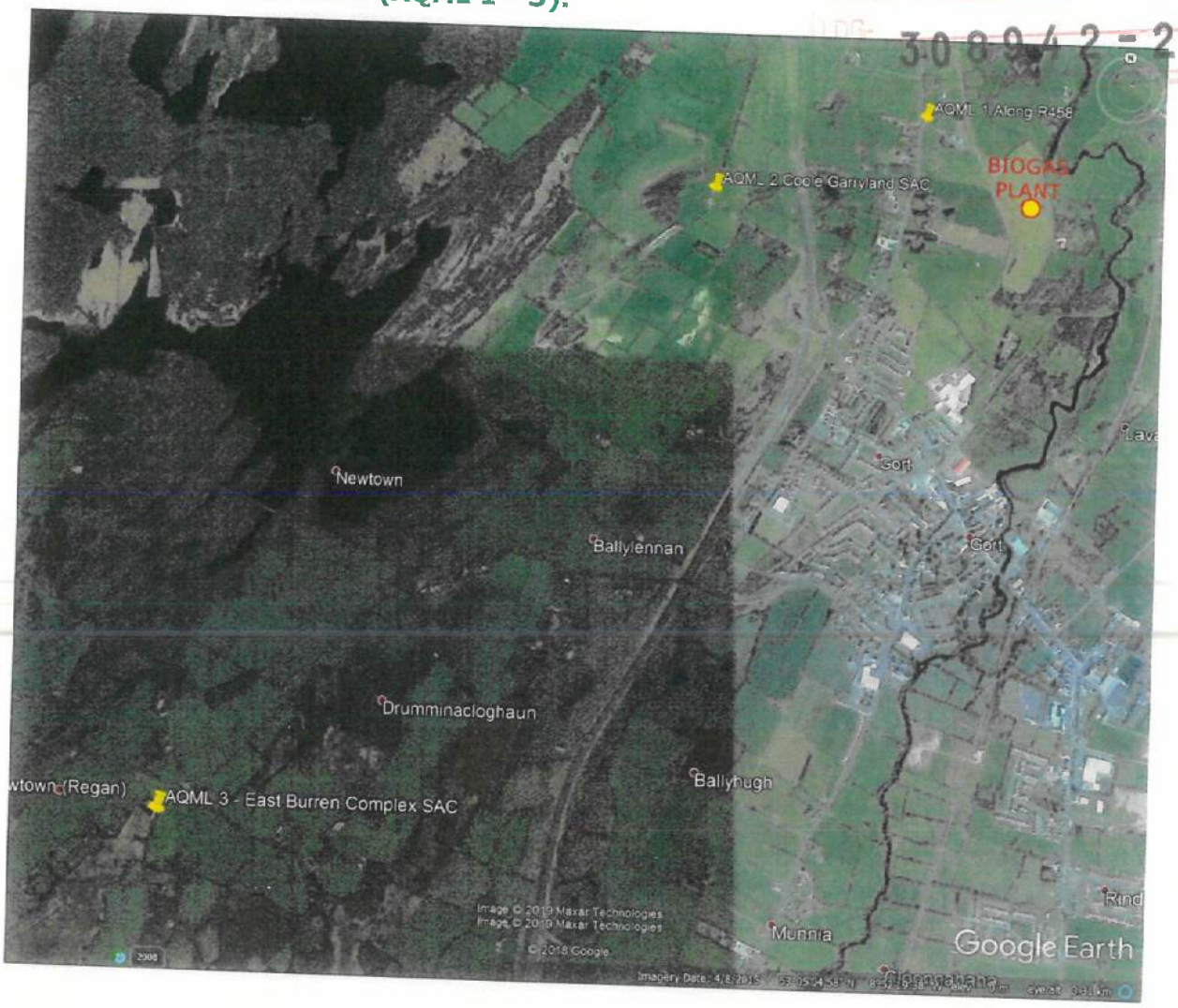
The diffusion tube monitoring results for the selected monitoring locations are presented in Table 8.8.

Table 8.8 Results of diffusion tube baseline monitoring.

Location Reference	*Location Description*	*Grid Reference*	*NO Conc. ($\mu g/m^3$)*	*NO_2 Conc. ($\mu g/m^3$)*	*NOx Conc. ($\mu g/m^3$)*
AQML 1	At entrance to site off R458	145143, 203683	3.3	3.4	6.7
AQML 2	Coole Garryland SAC	144386, 203331	< 1	2.0	2.0
AQML 3	East Burren Complex SAC	142503, 201094	2.4	1.6	4.0
Annual Mean Limit			-	40 - for protection of human health	30 - for protection of vegetation

The results indicate that existing NOx concentrations in the area are less than 25% of the annual limit for the protection of vegetation (30 $\mu g/m^3$). The results indicate that existing NOx concentrations at the nearest point of the two closest designated European sites to the proposed AD development site are less than 15% of the annual limit for the protection of vegetation (30 $\mu g/m^3$). The results indicate that existing NO_2 concentrations at the residential properties in closest proximity to the proposed AD development site are less than 10% of the annual limit for the protection of human health (40 $\mu g/$ Hence, as previously reported, the air quality is very good in the study area.

Figure 8.5 **Oxides of nitrogen (NO_x) and nitrogen dioxide (NO_2) monitoring locations (AQML 1 - 3).**



The Environmental Protection Agency's Air Quality Index for Health (AQIH) is a number from one to 10 that identifies the current air quality currently in a region and whether or not this might affect human health. A reading of 10 means the air quality is very poor and a reading of one to three inclusive means that the air quality is good. The AQIH indicates that the area of the proposed development is in an area of good air quality.

Rural West	Towns with population less than 5,000, villages and rural areas in Counties Clare, Cork, Donegal, Galway, Kerry, Leitrim, Limerick, Mayo, Roscommon and Sligo.	Corresponds to part of Zone D

Based on the Environmental Protection Agency's Air Quality in Ireland Report 2016, the following background concentrations have been used in the air quality significance assessment;

Nitrogen dioxide (NO_2) – Zone D Average - ~ 10 µg/m^3
Sulphur dioxide (SO_2) – Zone D Average - <5 µg/m^3

Particulate Matter (PM_{10}) – Zone D Average - ~ 15 µg/m^3

Particulate Matter ($PM_{2.5}$) – Zone D Average - ~ 8 µg/m^3

There is no significant individual odour source in proximity to the proposed development site. Background odours are most likely to be typical of intermittent rural area odours influenced by existing agricultural activities, etc.

BACKGROUND CONCENTRATIONS USED IN AIR QUALITY IMPACT ASSESSMENT:

As outlined in LAQM TG(16), the following approach to adding industrial installation contributions to the background NO_2 and PM_{10} concentrations should be adopted.

NO_2

Where this approach suggests that the predicted increase in the 99.8th percentile above the background is more than 75% of the available headroom (the difference between the objective and background), then a more detailed approach will be required.

The 99.8th percentile of total NO_2 is equal to the minimum of either equation a or b:

a) 99.8th percentile hourly background total oxidant + 0.05 × (99.8th percentile process contribution NOx); or

b) the maximum of either:

b1) 99.8th percentile process contribution of NOx + (2 × annual mean background NO2); or

b2) 99.8th percentile hourly background NO_2 + (2 × annual mean process contribution of NOx).

Note: In equation a, the total oxidant is the sum of O_3 and NO_2 (as NO_2 equivalents) and should be based on summing the hour by hour concentrations from a suitable background monitoring site in order to derive the 99.8th percentile.

PM_{10}

Where this approach suggests that the predicted increase in the 90.4th percentile above the background is more than 50% of the available headroom (the difference between the objective and background), then a more detailed approach will be required.

The 90.4th percentile total 24-hour mean is equal to the maximum of either equation a or b;

a) 90.4th percentile 24-hour mean background + annual mean process contribution; or

b) 90.4th percentile 24-hour mean process contribution + annual mean background.

Note: for the 90.4th percentile for 24-hour mean, the method does not incorporate twice the annual mean contribution of the process or background.

A representative baseline air quality level has been identified for the area in proximity to the nearest residential receptors to the proposed Biogas facility to provide a realistic worst-case estimate of baseline air quality levels in the study area, based on the representative available background data, as set out in Table 8.9.

Table 8.9 Baseline data summary table of background air quality concentrations in the study area.

Pollutant	Averaging time	AQ Standard / Guideline	Baseline concentration ($\mu g/m^3$)	Notes
NO_2	99.79th %ile of hourly means	200	~ 20	2x annual mean.
	Annual mean	40	~ 10	Based on data from EPA (Note: greater than twice what was measured in the area).
NOx	Annual mean	30	~ 15	Assumed worst-case based on NO_2 data from EPA (Note: greater than twice what was measured in the area).
CO	Running 8-hour mean	10,000	~ 500	Based on data from EPA.
PM_{10}	90.4th %ile of 24 hour means	50	~ 15	1 x annual mean.
	Annual mean	40	~ 15	Based on data from EPA.
$PM_{2.5}$	Annual mean	25	~ 8	Based on data from EPA.
SO_2	99.7th %ile of hourly means	350	~ 10	2x annual mean.
	99.2th %ile of 24 hour means	125	~ 10	2x annual mean.
	Annual mean	20	~ 5	Based on data from EPA.

Other than typical agricultural practices in the area of the proposed AD development site, there were no significant existing sources of odours noted in the area of the development. The site of the proposed AD plant contains horses and associated sheds. The area surrounding the proposed AD development site includes improved grassland indicative of the area being farmed relatively intensely. Baseline odour monitoring has been undertaken in proximity to the proposed AD development site.

In addition to the ambient air quality monitoring survey, baseline odour assessment surveys were carried out on 11th June 2019 and 10th July 2019 in the vicinity of the proposed AD development site in accordance with the site inspection procedures outlined in the Environmental Protection Agency, Odour Impact Assessment Guidance for EPA Licensed Sites (AG5). The odour assessments were undertaken during what would be deemed to be suitable meteorological conditions for odours to be detected. The weather conditions during the assessment period were described as follows;

- 11th June 2019 – sunny with intermittent cloud cover, dry, 17°C with moderate breeze from a north-westerly direction.
- 10th July 2019 – sunny, dry, 20°C with light breeze from a south-westerly direction.

During the odour assessment surveys, each individual observation at each location was undertaken for a period of five minutes. Of the observations undertaken, which included upwind and downwind locations of the proposed development site, odours were occasionally be detected that could be considered to be typical of rural areas and sourced from typical agricultural activities. No odours that could be considered to have the potential to give rise to nuisance, or to significant impairment of, or significant interference with the environment, were detected.

8.3.2 Climate Change and Greenhouse Gases

The Life Cycle Assessment (LCA) of such a plant shows that in terms of environmental and energy impact, the manufacture of biogas from the raw materials proposed, its subsequent use in the electricity, transport or heat sectors, and the production of a fertiliser show that compared with alternative energy production and fertiliser processing, the production and use of biogas is beneficial in terms of greenhouse gases and fossil fuel use.

In relation to the environmental benefits of biogas production, SEAI states that "*The most important contribution of biogas technology to environmental protection is that it avoids additional carbon dioxide (CO_2) emissions compared with fossil energy sources. Producing energy from biogas is largely CO_2 neutral, i.e. the CO_2 released by burning biogas was previously removed from the atmosphere during the generation of biomass through photosynthesis. The fermentation of manure also reduces emissions of methane, a gas that has an effect on the climate and would otherwise escape uncontrolled from raw liquid manure with far more damaging effects for the climate than CO_2. New research suggests that emissions of laughing gas (N_20) – which also has an effect on the climate – can also be reduced by fermentation. Furthermore, fermentation reduces the development of odours during liquid manure storage and spreading since the odours contained in it are*

broken down and neutralised during the fermentation process. In addition, fermentation improves the quality of manure as pathogens and weed seeds are killed and nutrients made more available for plants, enabling the manure to be applied in a more targeted fashion as a substitute for inorganic fertilisers. Therefore, the digestate is an ideal fertilizer in arable farming/crop production and a good soil conditioner".

As stated above, digester biogas will comprise approximately 60% CH_4 and 35% carbon dioxide (CO_2), with the remainder consisting of other components such as oxygen (O_2), nitrogen (N_2) and hydrogen sulphide (H_2S). In order to achieve the specification similar to natural gas required for bottling and use off-site after purification the H_2S concentration will be required to be less than 3.3 ppm (5 mg/m^3). In the process of upgrading the digester biogas quality the methane content will be increased to at least 95%, due to the removal of H_2S, CO_2, NH_3, particles and water. The CO_2 compression building will allow for the bottling and storage of CO_2 for transport off-site. The overall processing on site will ensure that the potential for the emissions of greenhouse gases is reduced.

Therefore, in comparison to typical fossil energy sources, the proposed biogas and CO_2 compression technology will result in an overall reduction in carbon dioxide (CO_2) emissions.

8.4 Air Quality & Odour Impact Assessment

The potential impacts to air quality resulting from the construction phase have been assessed on a local scale to determine impacts on human health and ecological receptors. The aspects considered include construction dust and its potential to impact on sensitive receptors and to cause an environmental nuisance and construction traffic emissions and their potential for impacts on sensitive receptors.

Construction activities such as excavation and earth moving can generate dust, particularly in dry weather conditions. The extent of dust generation is dependent on the nature of the material (soils, peat, sands, gravels, silts etc.) and the location of the construction activity. In addition, the potential for dust dispersion depends on the local meteorological factors such as rainfall, wind speed and wind direction. Vehicles transporting material to and from the site also have the potential to cause dust generation along the selected haul routes.

Table 8.9 presents the distances within which dust could be expected to result in a nuisance from construction sites for impacts such as soiling (dust nuisance), PM10 deposition and vegetation effects. This data has been taken from the National Roads Authority (NRA) *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* and is considered a worst-case assessment. These

distances present the potential for dust impact with standard mitigation in place. Details of proposed mitigation measures to be implemented as part of the construction phase of the project are presented.

Table 8.10 Assessment criteria for the impact of dust from construction, with standard mitigation in place

Scale	Description	Potential distance for significant effects (distance from source)		
		Soiling	PM_{10}	Vegetation effects
Major	Large construction sites with high use of haul roads	100m	25m	25m
Moderate	Moderate sized construction sites with moderate use of haul roads	50m	15m	15m
Minor	Minor construction sites with minor use of haul roads	25m	10m	10m

Source: National Roads Authority, 2006.

The construction phase of this proposal is deemed for the purposes of this assessment to be of a moderate scale. Using this screening assessment tool, at a moderate construction site there is a risk that dust may cause an impact at sensitive receptors within 25m of the source of the dust generated. The nearest residential sensitive receptors to the site is located at a distance of over 250m. Therefore, the impact from construction activities can be considered to be imperceptible. All sensitive habitats are located at a distance greater than 25m from the emission source as a result the impact on habitats will be imperceptible.

8.4.1 Operational Phase

GASEOUS POLLUTANT EMISSIONS

Dispersion models have been run based on the stack dimensions, volume flows, temperatures and odour and air pollutant rates outlined above.

The proposed CHP plant will release combustion gases through the burning of biogas, which will give rise to emissions of nitrogen oxides (NOx), sulphur dioxide (SO_2), non-methane volatile organic compounds (NMVOCs), carbon monoxide (CO) and particulates (PM_{10} & $PM_{2.5}$). The Maximum Ground Level Air Pollutant Concentrations and the Maximum Air Pollutant Concentrations at Receptors Locations predicted by the air dispersion modeling assessment are presented in Table 8.11 and in Aermod Dispersion Modelling Outputs presented in Appendix 8.1 (Figure 1-12). These are the highest predicted concentrations in the vicinity of the proposed CHP plant.

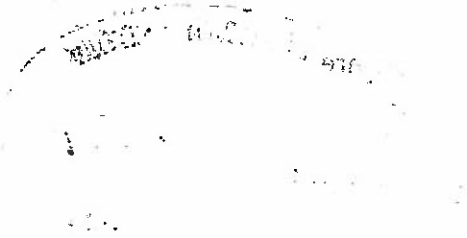
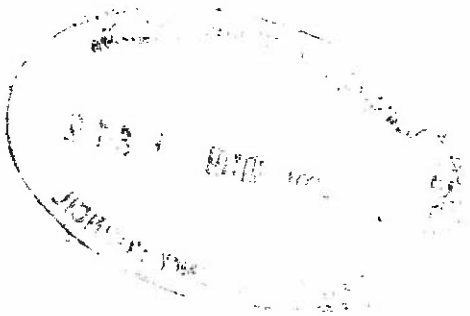


Table 8.11 Predicted maximum ground level air pollutant concentrations due to the Sustainable Bio-Energy Limited CHP plant emissions.

Predicted maximum ground level concentrations								
Pollutant	Period Average	Ambient Concentration (AC) (µg/m³)	Predicted Maximum Ground Level Concentration (µg/m³) - Process Contributions (PC)	Predicted Environmental Concentration (PEC) (µg/m³)	Limit Value µg/m³	PC %age of limit value	PEC %age of limit value	Figure No.
Nitrogen Dioxide (NO2)	99.8th %ile of Max. 1 Hour Conc.	20.0	60.51	80.5	200	30.3	40.3	1
	Annual Mean Conc.	10.0	2.79	12.8	40	7.0	32.0	2
Carbon Monoxide (CO)	Running 8 - Hour Mean	500.0	131.39	631.4	10000	1.3	6.3	3
PM10	90.4th %ile of Max. 24 Hour Conc.	15.0	0.92	15.9	50	1.8	31.8	4
	Annual Mean Conc.	15.0	0.31	15.3	40	0.8	38.3	5
PM2.5	Annual Mean Conc.	8.0	0.31	8.3	25	1.2	33.2	6
Sulphur Dioxide (SO_2)	99.7th %ile of Max. 1 Hour Conc.	10.0	43.18	53.2	350	12.3	15.2	7
	99.2th %ile of Max. 24 Hour Conc.	10.0	17.94	27.9	125	14.4	22.4	8
	Annual Mean Conc.	5.0	2.18	7.2	20	10.9	35.9	9
Total Organic Compound (TOC)	Annual Mean Conc.	-	0.46	0.5	5	9.2	9.2	10

Predicted maximum ground level concentrations at sensitive receiver locations								
Pollutant	Period Average	Ambient Concentration (AC) (µg/m³)	Predicted Maximum Ground Level Concentration (µg/m³) - Process Contributions (PC)	Predicted Environmental Concentration (PEC) (µg/m³)	Limit Value µg/m³	PC %age of limit value	PEC %age of limit value	Notes
Nitrogen Dioxide (NO2)	99.8th %ile of Max. 1 Hour Conc.	20.0	34.77	54.8	200	17.4	27.4	@ AQR K
	Annual Mean Conc.	10.0	1.26	11.3	40	3.2	28.2	@ AQR K
Carbon Monoxide (CO)	Running 8 - Hour Mean	500.0	59.10	559.1	10000	0.6	5.6	@ AQR K
PM10	90.4th %ile of Max. 24 Hour Conc.	15.0	0.39	15.4	50	0.8	30.8	@ AQR K
	Annual Mean Conc.	15.0	0.14	15.1	40	0.4	37.9	@ AQR G
PM2.5	Annual Mean Conc.	8.0	0.14	8.1	25	0.6	32.6	@ AQR G
Sulphur Dioxide (SO_2)	99.7th %ile of Max. 1 Hour Conc.	10.0	21.99	32.0	350	6.3	9.1	@ AQR K
	99.2th %ile of Max. 24 Hour Conc.	10.0	5.61	15.6	125	4.5	12.5	@ AQR G
	Annual Mean Conc.	5.0	0.98	6.0	20	4.9	29.9	@ AQR K
Total Organic Compound (TOC)	Annual Mean Conc.	-	0.21	0.2	5	4.2	4.2	@ AQR K

The modelling results presented in Table 8.11 for emissions of nitrogen oxides (NOx), sulphur dioxide (SO_2), non-methane volatile organic compounds (NMVOCs), carbon monoxide (CO) and particulates (PM_{10}) from the CHP Plant indicate that the maximum short term and annual mean ambient ground level concentrations are below the relevant air quality standards.



The worst-case dispersion modelling results from the Aermod dispersion models as presented in Table 8.10 indicate the maximum short term and annual mean ground level pollutant concentrations. As shown in Figures 1-12 (Appendix 8.1), the worst-case ground level concentrations are in close proximity to the Biogas facility. The predicted ground level concentrations at the nearest residential receptors are significantly lower than the maximum ground level concentrations. The predicted concentrations at all Air Quality Sensitive Receptors in the area are presented in Table 8.11.

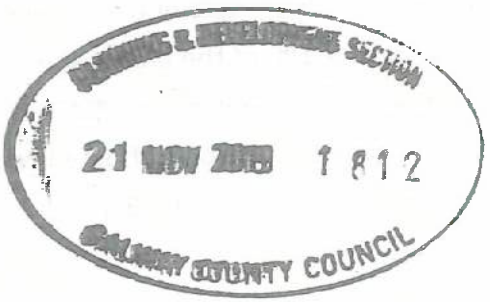
In terms of the 'Significance of Potential Environmental Effects' the magnitude (scale of change) has been determined by considering the impacts of the proposed development on air quality at the worst-affected sensitive receptor with reference to the baseline conditions and environmental assessment criteria.

NITROGEN DIOXIDE (NO_2)

The predicted NO_2 emissions equate to a predicted environmental concentration (PEC) of 54.8 $\mu g/m^3$ as a 99.8th %ile of the 1-hour NO_2 concentrations at the worst affected residential receptor, i.e. 27.4% of the limit value. The PEC of Annual Mean NO_2 concentrations of 11.3 $\mu g/m^3$ is 28.2% of the annual mean limit value of 40 $\mu g/m^3$ at the worst affected residential receptor (See Figures 1 and 2 in Appendix 8.1).

The predicted maximum ground level NO_2 process contribution (PC) value of 60.51 $\mu g/m^3$ as a 99.8th %ile of the 1-hour limit value (30.3% of the limit value of 200 $\mu g/m^3$) occurs at a location approximately 100m north-east of the proposed CHP stack within the boundary of the Biogas facility. This is not a sensitive receiver location. The maximum ground level Annual Mean NO_2 PC concentration of 12.8 $\mu g/m^3$ is 32% of the annual mean limit value of 40 $\mu g/m^3$.

In terms of annual mean NO_2 concentrations, as impact descriptors for individual receptors, there will be a 'negligible' change due to the Process Contribution (PC) from the CHP stack emissions. The long-term average concentration at receptors will be less than 75% of the relevant Air Quality Assessment Level (AQAL) and the percentage change in concentration will be 3.2% of the AQAL.



CARBON MONOXIDE (CO)

The predicted CO emissions equate to a PC of 0.6% and a PEC of 5.6% of the running 8-hour mean limit value at the worst affected residential receptor. The maximum ground level process contribution (PC) value of 131.9 µg/m^3 as a running 8-hour mean limit value occurs at a location approximately 100m north-east of the proposed CHP stack within the boundary of the Biogas facility. This is not a sensitive receiver location (see Figure 3 Appendix 8.1).

PARTICULATES (PM_{10} & $PM_{2.5}$)

The predicted PM_{10} emissions equate to a PC of 0.39 µg/m^3 as a 90.4th %ile of the 24-hour PM_{10} concentrations at the worst affected residential receptor, i.e. 0.8% of the limit value. The PC of Annual Mean PM_{10} concentrations of 0.14 µg/m^3 is 0.4% of the annual mean limit value of 40 µg/m^3 at the worst affected residential receptor. The PEC of 90.4th %ile of the 24-hour PM_{10} concentrations of 15.9 µg/m^3, as a maximum ground level concentration, is 31.8% of the limit value of 50 µg/m^3. The PEC of Annual Mean PM_{10} concentrations of 15.3 µg/m^3, as a maximum ground level concentration, is 38.3% of the annual mean limit value of 40 µg/m^3 (See Figures 4 and & 5 of Appendix 8.1).

In terms of annual mean PM_{10} concentrations, as impact descriptors for individual receptors as outlined in Table 8.2, there will be a 'negligible' change due to the Process Contribution (PC) from the CHP stack emissions. The long-term average concentration at receptors will be less than 75% of the relevant Air Quality Assessment Level (AQAL) and the percentage change in concentration will be less than 1% of the AQAL.

The PC of Annual Mean $PM_{2.5}$ concentrations of 0.14 µg/m^3 is 0.6% of the annual mean limit value of 25 µg/m^3 at the worst affected residential receptor. The PEC of Annual Mean $PM_{2.5}$ concentrations of 8.3 µg/m^3, as a maximum ground level concentration, is 33.2% of the annual mean limit value of 25 µg/m^3.

SULPHUR DIOXIDE (SO_2)

The predicted SO_2 emissions equate to a predicted environmental concentration (PEC) of 32 µg/m^3 as a 99.7th %ile of the 1-hour SO_2 concentrations at the worst affected residential receptor, i.e. 9.1% of the limit value. The predicted SO_2 emissions equate to a predicted environmental concentration (PEC) of 15.6 µg/m^3 as a 99.2th %ile of the 24-hour SO_2 concentrations at the worst affected residential receptor, i.e. 12.5% of the limit value (See Figures 6 and 7 of Appendix 8.1).

VOLATILE ORGANIC COMPOUNDS (VOCS)

There are no assessment levels for total VOC emissions as they comprise a mixture of volatile organic compounds. Furthermore, there is no information available about the proportion of benzene, or other harmful hydrocarbon species, that may be present in the total VOC emission from the CHP emissions, although, it is likely to be a very small percentage of the total. The model predicted a maximum annual mean ground level VOC concentration of 0.46 µg/m^3 from the proposed CHP stack, which occurs at a location approximately 100m north-east of the proposed CHP stack, with values decreasing markedly with distance from the site (See Figure 8 of Appendix 8.1).

Table 8.12 Predicted maximum ground level air pollutant concentrations due to the Sustainable Bio-Energy Limited CHP plant emissions at the nearest residential receiver locations.

Ref.	Receptor Location	98 %ile of 1-Hour Odour Concs (Limit Value = 1.5 ou/m³)	99.79 %ile of Max. 1-Hour NO2 (Limit Value = 200 µg/m³)	Annual Mean NO2 (Limit Value = 40 µg/m³)	99.7th %ile of 1-Hour SO2 Conc. (Limit Value = 350 µg/m³)	99.2nd %ile of 24-Hour SO2 Conc. (Limit Value = 125 µg/m³)	Running 8-Hour Average CO Conc. (Limit Value = 10,000 µg/m³)	Annual Mean PM10 Conc. (Limit Value = 40 µg/m³)	90.4 %ile of Maximum 24-Hour PM10 Conc. (Limit Value = 50 µg/m³)	Annual Mean PM2.5 Conc. (Limit Value = 25 µg/m³)	Annual Mean TOC Conc. (as Benzene) (Limit Value = 5 µg/m³)
A	19 Cúirt Bhreac, Galway Rd, Gort, An Gort, Co. Galway	0.000005	9.646	0.128	6.509	1.686	28.410	0.014	0.037	0.014	0.021
B	1 Galway Rd, Co. Galway	0.000008	9.570	0.125	5.783	1.697	18.003	0.014	0.033	0.014	0.020
C	R458, Kinincha, Co. Galway	0.000013	9.626	0.158	6.774	1.959	21.225	0.018	0.034	0.018	0.025
D	R458, Kinincha, Co. Galway	0.000017	10.984	0.187	7.638	2.394	24.505	0.021	0.040	0.021	0.030
E	Glenbrack Lodge, Glenbrack, Gort, Co. Galway	0.000020	17.556	0.267	11.971	3.320	37.446	0.030	0.064	0.030	0.045
F	Kilderry Lodge, Glenbrack, Gort, Co. Galway	0.000044	28.111	0.552	19.838	4.643	52.115	0.061	0.199	0.061	0.092
G	R458, Ballynamantan, Co. Galway	0.000059	31.314	0.741	18.872	5.607	56.281	0.082	0.237	0.082	0.122
H	R458, Ballynamantan, Co. Galway	0.000062	30.883	0.725	19.866	4.754	58.242	0.081	0.257	0.081	0.119

Ref.	Receptor Location	98 %ile of 1-Hour Odour Concs (Limit Value = 1.5 ou/m³)	99.79 %ile of Max. 1-Hour NO2 (Limit Value = 200 µg/m³)	Annual Mean NO2 (Limit Value = 40 µg/m³)	99.7th %ile of 1-Hour SO2 Conc. (Limit Value = 350 µg/m³)	99.2nd %ile of 24-Hour SO2 Conc. (Limit Value = 125 µg/m³)	Running 8-Hour Average CO Conc. (Limit Value = 10,000 µg/ m³)	Annual Mean PM10 Conc. (Limit Value = 40 µg/m³)	90.4 %ile of Maximum 24-Hour PM10 Conc. (Limit Value = 50 µg/m³)	Annual Mean PM2.5 Conc. (Limit Value = 25 µg/m³)	Annual Mean TOC Conc. (as Benzene) (Limit Value = 5 µg/m³)
I	R458, Ballynamantan, Co. Galway	0.000059	17.049	0.476	11.410	2.028	21.226	0.053	0.169	0.053	0.078
J	Kinincha Road, Co. Galway	0.000114	23.642	0.782	15.312	3.950	37.499	0.087	0.245	0.087	0.130
K	Kinincha Road, Co. Galway	0.000127	34.774	1.260	21.993	5.129	59.094	0.141	0.394	0.141	0.210
L	6 Kinincha Road, The Grove, Gort, Co. Galway	0.000007	7.918	0.090	5.519	0.713	11.611	0.010	0.032	0.010	0.015
M	Pound Rd, Ballymurphy, Co. Galway	0.000035	7.681	0.209	5.633	1.402	16.115	0.023	0.076	0.023	0.035
N	Pound Rd, Ballymurphy, Co. Galway	0.000070	19.648	0.364	11.784	2.980	32.823	0.041	0.130	0.040	0.060
O	R380, Co. Galway	0.000031	5.781	0.125	4.125	1.477	12.286	0.014	0.042	0.014	0.021
P	Derelict Cottage, L85314, Kinincha, Gort	0.000028	26.670	0.481	18.936	3.084	34.930	0.054	0.172	0.054	0.080
Q	Lavally, Gort (Extant Permission)	0.000104	9.535	0.293	6.897	2.306	25.721	0.033	0.109	0.033	0.049
R	Rinneen, Gort (Extant Permission)	0.000101	10.699	0.331	8.005	2.572	21.894	0.037	0.139	0.037	0.055

Ref.	Receptor Location	98 %ile of 1-Hour Odour Concs (Limit Value = 1.5 ou/m^3)	99.79 %ile of Max. 1-Hour NO2 (Limit Value = 200 µg/m^3)	Annual Mean NO2 (Limit Value = 40 µg/m^3)	99.7th %ile of 1-Hour SO2 Conc. (Limit Value = 350 µg/m^3)	99.2nd %ile of 24-Hour SO2 Conc. (Limit Value = 125 µg/m^3)	Running 8-Hour Average CO Conc. (Limit Value = 10,000 µg/ m^3)	Annual Mean PM10 Conc. (Limit Value = 40 µg/m^3)	90.4 %ile of Maximum 24-Hour PM10 Conc. (Limit Value = 50 µg/m^3)	Annual Mean PM2.5 Conc. (Limit Value = 25 µg/m^3)	Annual Mean TOC Conc. (as Benzene) (Limit Value = 5 µg/m^3)
S	Rinneen, Gort (Extant Permission)	0.000045	9.921	0.257	6.839	1.734	18.166	0.029	0.099	0.029	0.043
T	Rinneen, Kiltartan (Extant Permission)	0.000053	11.285	0.311	7.303	1.648	20.378	0.035	0.108	0.034	0.051

ODOUR EMISSIONS

Table 8.13 below indicates the maximum odour concentration (ou/m^3) at the nearest residential receptors (98th percentile of maximum 1-hour ground level odour concentrations) in the vicinity of the proposed Biogas Plant due to emissions from the Feedstock Reception Building Odour Control Stack, based on an odour emission rate of 75,000 m^3/hr at a concentration of 1,000 ou/m^3.

Table 8.13 Odour Dispersion Modeling Results. Odour concentrations in the vicinity of the Sustainable Bio-Energy Limited site due to emissions from the Feedstock Reception Building Odour Control Stack.

Scenario	Maximum Ground Level Odour Concentration (ou/m^3)
Odour Emissions @ 75,000 m^3/hr @ 1,000 ou/m^3	0.0011 ou/m^3 - Maximum Ground Level Odour Concentration 0.00012 ou/m^3 - Maximum Ground Level Odour Concentration at Receiver
Odour Concentration Target Value	$C_{98,\ 1\text{-Hour}}$ 1.5 ou_E/m^3

The odour concentrations outlined in Table 8.13 and the concentration isopleths in Figure 9 (Appendix 8.1), indicate that worst-case odour impact will be well below the odour target value of $C_{98,\ 1\text{-Hour}}$ 1.5 ou_E/m^3 at the sensitive residential receptors in the area. The emissions from the Feedstock Reception Building Odour Control Stack results in effective dispersion of the odours from the proposed Biogas Plant.

IMPACTS ON DESIGNATED SITES

Nitrogen Deposition

The nearest and most sensitive designated sites to the proposed Biogas Plant are the Coole-Garryland Complex SAC and the East Burren Complex SAC. The Coole-Garryland Complex SAC is located approximately 1Km to the east of the proposal and is a sensitive habitat on account of the presence of limestone pavements. The East Burren Complex SAC is located approximately 3.75Km to the south-west of the Biogas facility and is a sensitive habitat due to the presence of Alpine and Boreal heaths. As shown in Table 8.13, the predicted nitrogen deposition rate at the Coole-Garryland Complex SAC (0.394 Kg/Ha/Yr) is 7.9% of the relevant Critical Load of 5 Kg/Ha/Yr. The predicted nitrogen deposition rate at the East Burren Complex SAC (0.02 Kg/Ha/Yr) is 0.2% of the relevant Critical Load of 5 Kg/Ha/Yr. As the maximum predicted nitrogen deposition rate at the Coole-Garryland Complex SAC and the East Burren Complex SAC is less than 10% of the relevant Critical Level (Cle) and 3.9% of the existing background nitrogen deposition level, the proposed Plant will not have a significant impact on nitrogen deposition rates at nearby designated sites or sensitive habitats.

Table 8.14 Annual mean nitrogen deposition rates at the designated sites within 10 Km of the Sustainable Bio-Energy Limited facility relative to the Critical Load.

Name	Habitat Type	Nitrogen Deposition (NDEP) and Critical Loads						
		PC NDEP (kgN/ha/yr)	NDEP Background (kgN/ha/yr)	NDEP TOTAL (kgN/ha/yr)	NDEP Critical Load (kgN/ha/yr	%PC of Critical Load	%PC of NDEP Background	Nitrogen Sensitive Habitat
Coole-Garryland Complex	SAC	0.3943	10.1	10.55	5	7.9%	3.9%	Limestone pavements
Coole-Garryland SPA	SPA	0.1129	10.1	10.23	N/A		1.1%	No sensitive habitat or species
Kiltartan Cave (Coole)	SAC	0.2079	16.48	16.7	10	2.1%	1.3%	Rhinolophus hipposideros
Carrowbaun Newhall and Ballylee Turloughs	SAC	0.1178	10.24	10.36	N/A		1.2%	Turloughs
East Burren Complex	SAC	0.0202	10.1	10.12	5	0.4%	0.2%	Alpine and Boreal heaths
Lough Coy	SAC	0.0569	10.24	10.3	N/A		0.6%	Turloughs
Ballinduff Turlough	SAC	0.0908	10.24	10.33	N/A		0.9%	Turloughs
Lough Cutra	SAC	0.038	17.56	17.6	10	0.4%	0.2%	Rhinolophus hipposideros
Lough Cutra SPA	SPA	0.0379	10.48	10.52	N/A		0.4%	No sensitive habitat or species
Slieve Aughty Mountains SPA	SPA	0.0415	10.48	10.52	N/A		0.4%	No sensitive habitat or species
Canerglassaun Turlough	SAC	0.0448	16.48	16.53	10	0.4%	0.3%	Rhinolophus

Name	Habitat Type	Nitrogen Deposition (NDEP) and Critical Loads						
		PC NDEP (kgN/ha/yr)	NDEP Background (kgN/ha/yr)	NDEP TOTAL (kgN/ha/yr)	NDEP Critical Load (kgN/ha/yr	%PC of Critical Load	%PC of NDEP Background	Nitrogen Sensitive Habitat
								hipposidero s
Termon Lough	SAC	0.0106	10.37	10.38	N/A		0.1%	Turloughs
Cahermore Turlough	SAC	0.0357	9.81	9.85	N/A		0.4%	Turloughs
Peterswell Turlough	SAC	0.0302	10.24	10.27	N/A		0.3%	Turloughs
Drummin Wood	SAC	0.0239	11.17	11.19	N/A		0.2%	No sensitive habitat or species
Gortacarnaun Wood	SAC	0.0174	11.17	11.19	N/A		0.2%	No sensitive habitat or species
Ardrahan Grassland	SAC	0.0241	9.63	9.65	5	0.5%	0.3%	Alpine and Boreal heaths

Note 1: Critical Load for Nitrogen Deposition (Kg/Ha/Yr) from SCAIL Agriculture and dependent on habitat type present on the designated site as outlined in the Citation Documents for the relevant ASSI's and SACs.
PC = Process Contribution / NDEP = Nitrogen Deposition / EAL = Environmental Assessment / Process Contributions taken from AERMOD Air Dispersion Model Outputs

Table 8.15 outlines the maximum process contribution ground level Annual Mean NOx and SO_2 concentrations at the designated sites within 10km of the Biogas facility versus the relevant annual mean limit values for the protection of vegetation (See Figures 10 and 11 of Appendix 8.1).

Table 8.15 Annual mean nitrogen dioxide (NOx) and sulphur dioxide (SO_2) concentrations at the designated sites within 10 Km of the Sustainable Bio-Energy Limited facility relative to the limit value for the protection of vegetation.

Name	Annual Mean NOx Conc.	Annual Mean SO_2 Conc.
Coole-Garryland Complex SAC	0.156	0.113
Coole-Garryland SPA	0.037	0.027
Kiltartan Cave (Coole) SAC	0.097	0.070
Carrowbaun, Newhall and Ballylee Turloughs SAC	0.055	0.041
East Burren Complex SAC	0.013	0.010
Lough Coy SAC	0.033	0.024
Ballinduff Turlough SAC	0.046	0.034
Lough Cutra SAC	0.021	0.016
Lough Cutra SPA	0.021	0.016
Slieve Aughty Mountains SPA	0.022	0.016
Caherglassaun Turlough	0.031	0.023
Termon Lough SAC	0.007	0.005
Cahermore Turlough SAC	0.028	0.021
Peterswell Turlough SAC	0.021	0.016
Drummin Wood SAC	0.017	0.013
Gortacarnaun Wood SAC	0.013	0.010
Ardrahan Grassland SAC	0.024	0.018
Limit Value for the protection of vegetation	30 µg/m³	20 µg/m³

TRAFFIC EMISSIONS

The proposed development will be accessed from the R458. The activity will operate on a 24-hour basis, 7 days per week. Approximately 25 two way HGV movements will be delivering and removing material to and from the facility each day during normal operating hours (07:00 to 19:00 Monday to Sunday inclusive). Approximately 22 two way car movements will go to and from the facility each day. The existing Annual Average Daily Traffic (AADT) flow on the R458 is 5,169 with a HGV percentage of 2.9%. An additional flow of 47 two-way vehicular movements will not result in a significant air quality impact.

The proposed biogas facility will be capable of accepting up to 90,000 tonnes of feedstock per annum. Solid and liquid feedstocks will be delivered by suitable road tankers from off-site sources. Approximately 10 no. lorry movements will be delivering material to the facility each day during normal operating hours (07:00 to 19:00 Monday to Sunday inclusive). The activity will operate on a 24-hour basis, 7 days per week.

HGV traffic movements will not occur during night-time hours. HGV movements will be delivering material or taking material off the site each day. In the worst-case scenario there would be approximately 45 two-way lorry movements each day, with feedstock deliveries from off-site sources and stored digestate taken off site. Such a level of vehicular movements will not result in a significant air quality impact.

8.5 Mitigation Measures and Monitoring

8.5.1 Construction Phase

During the construction phase, there may be associated air quality and dust impacts that are typical of such a development. In order to avoid significant impacts from dust emissions during the construction phase, the following measures should be adopted. Using these measures will reduce the potential for construction dust nuisance to a negligible impact:

- A daily site walk-over to inspect the perimeter and check for dust deposition on fencing and any trees close to the edge of the site.
- It is also recommended that a weekly inspection of the local area be carried out to check for any evidence of excessive levels of dust deposition as a result of the construction site activities.
- Provision of easily cleaned hard standing area within the site for vehicles entering, parking and leaving the construction site. Where necessary, vehicles should be cleaned prior to exit from the construction site. However, the nature of the proposed development should not result insignificance mud generation in proximity to the site.
- Provision of site personnel and mechanical road sweepers to clean the site hard standing area and to clean any mud or debris deposited by works vehicles from the public roads in the vicinity of the site.
- Fine, dry materials will be stored within buildings or in areas that are either enclosed or shielded from the wind.
- Handling areas will be maintained in as clean a condition as practicable in order to reduce the risk of dust emissions.

8.5.2 Operational Phase

The following operational procedures will be enforced on site for controlling odours;

- The design and operation of the proposed Biogas facility will ensure that waste is not handled outside the Feedstock Reception Building.
- The Feedstock Reception Building will be totally enclosed with access into or out of the building only possible through automatic rapid open/shut doors and an airlock area. This will ensure the risk of fugitive odours escaping from the Feedstock Reception Building is eliminated. An odour control extraction system in the Feedstock Reception Building will maintain negative pressure in the abuilding. The air extracted from the Feedstock Reception Building will be treated in a Carbon Filter Bed system prior to being exhausted through a 22m high stack.
- There will be no emissions to atmosphere from the AD tanks or other process vessels containing odorous materials as waste will be contained within fully sealed tanks.
- The combustion of biogas in the CHP Gas Engine will destroy any odorous compounds contained in the biogas prior to being exhausted through a 22m high stack.
- The proposed 22m high stacks will ensure adequate dispersion of odours and air pollutants to allow for compliance with relevant environmental standards.
- An operating manual will be created for the facility which states the operational procedures to be followed in order to maintain and operate plant to agreed standards. These standards will include procedures for ensuring that generation of odour is kept to a minimum.
- Records of all key operational tasks will be kept on site. These records will include:
  - Total volumes and type of materials received on site;
  - Vehicle movements associated with material imports, compressed gas removal and digestate removal;
  - Subjective Odour Assessment daily log sheets;
- Any spillages significant enough to cause odour emission will be cleared as soon as practicable.
- In addition to the routine operational tasks, planned preventative and defect maintenance of all plant will be carried out. For plant which may have a significant odour release it is critical to ensure that effective performance is maintained.
- A Neighbour / Stakeholder Communication Plan will identify how and when contact will be made with stakeholders in relation to odour emissions off-site and establish a Complaints Records Procedure and a Response Protocol.

8.5.3 Decommissioning Phase

During the decommissioning phase, the potential impacts and mitigations are similar to that of those in the construction phase. As required by EPA IE licensing, the licensee will be required to prepare a site closure and decommissioning plan for the site. Due to similarity of activities associated with decommissioning (as described in Chapter 2) no further mitigation recommended.

8.5.4 Cumulative Impacts

Cumulative effects are described as "impacts that result from incremental changes caused by other development, plans or projects together with the proposed development or developments". There are no other significant air pollutant sources in the area of the development other than road traffic sources. Currently, air quality is of good quality. There will be no significant cumulative impacts.

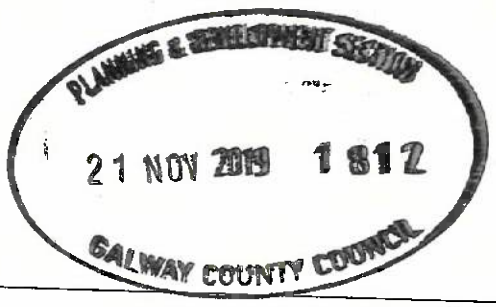
8.6 Residual Impacts

The impact of emissions from the proposed Biogas facility will not be significant on local air quality in relation to the relevant Air Quality Standards Regulations. There will be no significant residual impact from the operation of the Sustainable Bio-Energy Limited Biogas Plant.

8.7 Statement of Significance

The scheduled emission points in the proposed AD and CHP plant will be regulated through the EPA Licensing process. This Odour and Air Quality Impact Assessment has demonstrated that the emissions will result in an acceptable air quality impact in accordance with the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011).

A stringent odour target value of $C_{98,\ 1\text{-Hour}}$ 1.5 ou_E/m^3, based on EPA and Environment Agency criteria relevant to potentially highly offensive odours, will be achieved at the surrounding sensitive receptors. The dispersion modelling indicates that based on worst-case odour emission concentrations the existing odour dispersion experienced in the vicinity of the site allows for the sites odour emissions to achieve the stringent odour target value of $C_{98,\ 1\text{-Hour}}$ 1.5 ou_E/m^3.



9 NOISE AND VIBRATION

9.1 Introduction

A noise impact assessment has been prepared to assess the potential noise impact on the nearest neighbouring residential properties in proximity to the proposed Sustainable Bio-Energy Limited biogas development.

The proposed Sustainable Bio-Energy Limited Biogas development site is located in a rural area with few sensitive residential locations in the immediate vicinity of the proposed development location on lands to the north-west of Gort town in the townlands of Ballynamantan, Glenbrack and Kinincha.

The proposed biogas facility will be capable of accepting up to 90,000 tonnes of feedstock per annum which will be predominately sourced from agricultural sources. Solid and liquid feedstocks will be delivered by suitable road tankers from off-site sources. All solid feedstocks will be accepted and unloaded within the feedstock reception building, which includes provision for quarantine. Liquid feedstocks will be delivered to feedstock reception tanks, vented to a gas management system /odour control unit to prevent escape of odours to the receiving environment. An average of 10 no. lorry movements will be delivering material to the facility each day during normal operating hours (07:00 to 19:00 Monday to Sunday inclusive). The activity will operate on a 24 hour basis, 7 days per week.

The plant will accept and process feedstocks to maximise energy recovery through the production of renewable biogas and organic fertiliser. The feedstocks comprise material predominately sourced from agriculture such as animal manure /dung and slurries, energy crops (e.g. grass silage), and residues from the agri-food industry. Biogas from the plant will be upgraded to biomethane and utilised to produce renewable energy (to serve house load and primarily for off-site end users). The digestate produced at the plant will meet the requirements of an agreed quality standard (such as PAS110 or similar) and it will comply with DAFM transformation parameters and testing requirements as per CN11. Digestate produced at the plant will be used as an organic fertiliser (OF/SI) for use on agricultural lands.

Under normal conditions the plant will be powered by the onsite CHP engine. Back-up dual fuel boilers are provided for occasions when the CHP might not be available, e.g. during commissioning, digester start-up or CHP maintenance activities. The heat generated in the CHP engine will be used at the installation to supply to heat to the

digesters, pasteurisation process, gas purification process, and carbon dioxide purification process. A proportion of the biogas that is produced onsite will be consumed in the CHP engine, while the remainder (majority) will be upgraded, compressed and bottled and sent exported off-site as a flexible renewable fuel to serve users in the transport and heat sectors.

In accordance with the First Schedule to the EPA Act 1992 to 2013, the facility will require an Industrial Emissions Licence and accordingly the plant will be regulated by the Environmental Protection Agency (EPA).

The assessment and evaluation of the noise impact arising from the proposed development involved the following methodology:

- Reference to the EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (January 2016 Update)
- Baseline Noise Survey – long-term noise monitoring survey during daytime, evening and night-time in proximity to existing residential receivers in the vicinity of the site. The purpose of the noise monitoring survey was to evaluate the existing noise climate in the area.
- Noise prediction modelling using Cadna_A noise prediction software.
- A comparison of the measured noise levels and the noise impact on the nearest residential receivers against the World Health Organisation (WHO) *Guidelines for Community Noise*.

9.2 Assessment Methodology & Significance Criteria

9.2.1 Setting Appropriate Noise Limits for am IE Licensed Site

In the EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) the steps to be followed in order to derive appropriate noise limit criteria are outlined as follows;

- Step 1 – Quiet Area Screening of the Development Location
- Step 2 – Baseline Environmental Noise Survey
- Step 3 – Screen for Areas of Low Background Noise
- Step 4 – Determine Appropriate Noise Criteria

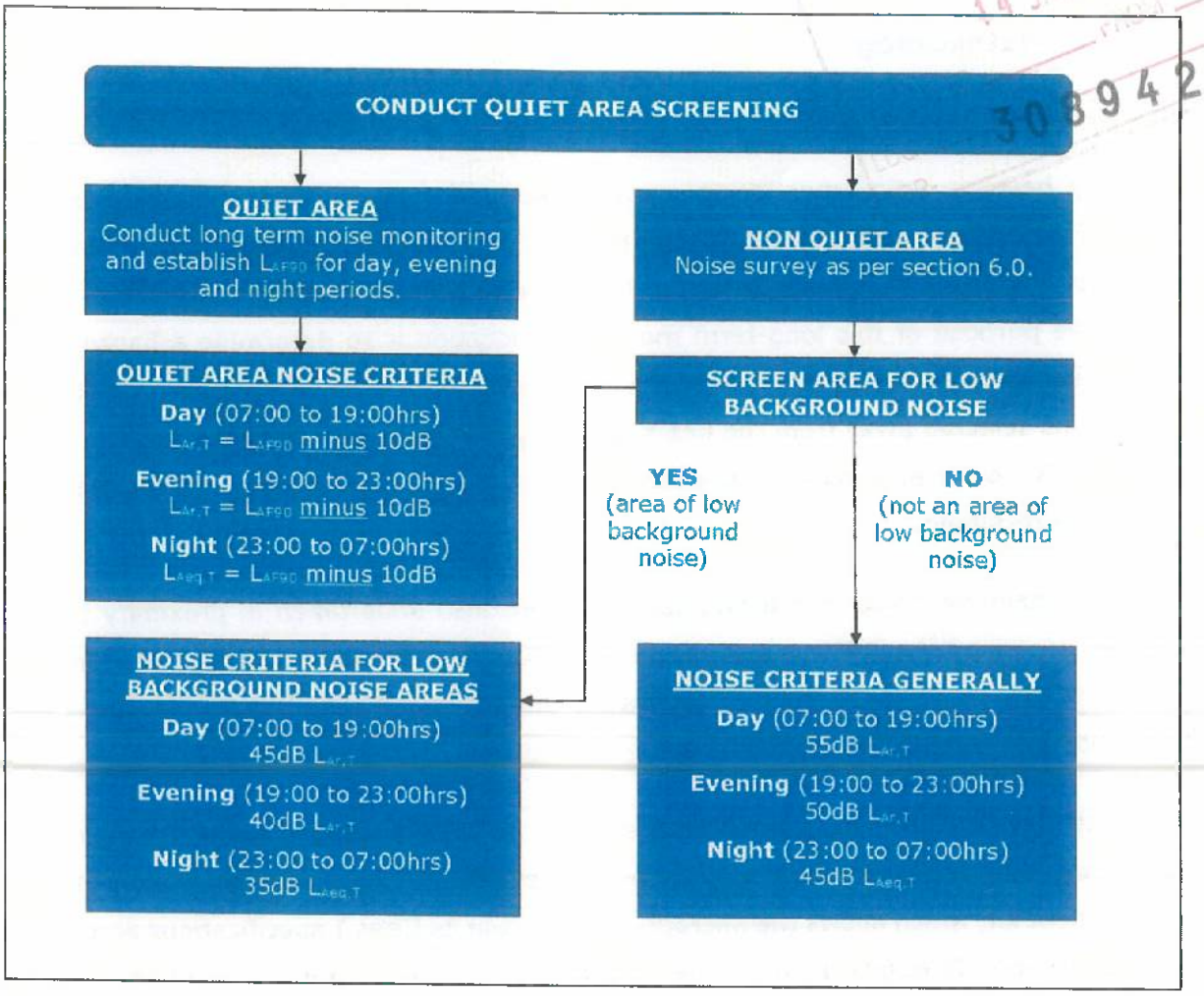


Table 9.1 outlines the noise limit criteria to be applied depending on the results of the screening processes in Steps 1 and 3, and the noise survey discussed in Step 2.

Table 9.1 The noise limit criteria to be applied depending on the results of the screening processes.

Scenario	Daytime Noise Criterion, dB $L_{Ar,T}$ (07:00 to 19:00hrs)	Evening Noise Criterion, dB $L_{Ar,T}$ (19:00 to 23:00hrs)	Night-time Noise Criterion, dB $L_{Aeq,T}$ (23:00 to 07:00hrs)
Quiet Area	Noise from the licensed site to be at least 10dB below the average daytime background noise level measured during the baseline noise survey.	Noise from the licensed site to be at least 10dB below the average evening background noise level measured during the baseline noise survey.	Noise from the licensed site to be at least 10dB below the average night-time background noise level measured during the baseline noise survey.
Areas of Low Background Noise	45dB	40dB	35dB
All other Areas	55dB	50dB	45dB

9.2.2 Methodology

FIED SURVEYS

A 10-day baseline noise monitoring survey was undertaken at the boundary of the proposed development site closest to the nearest residential properties from Friday 19th January to Monday 22nd January 2018 and from Friday 26th January to Friday 2nd February 2018. The purpose of this long-term monitoring location is to determine a background (LA_{90}) noise level for the area of the proposed development. The fact that the monitoring location was selected away from the nearest main noise sources in the area, i.e. the R458 and the M18 motorway ensures that a realistic background (LA_{90}) noise level for the area has been determined.

Short-term daytime noise monitoring surveys were also undertaken in proximity to the proposed access off the R458 and at residential properties located along the R458 on 11th June 2019. The noise monitoring surveys were undertaken in accordance with ISO 1996 Description and Measurement of Environmental Noise.

For the 10-day baseline noise monitoring survey, an EM2010 Sound Level Analyser was used during the long-term noise monitoring survey, fitted with a suitable outdoor noise measurement kit, which allows the microphone to retain its Class 1 specifications according to IEC6051 and IEC61672-1 when the weather protection system is in place. Noise measurements were taken at a height of 1.5m above ground level and measurements were free-field. The noise monitoring location was selected in an open area to minimise the potential effect of reflections from buildings and is representative of the existing background noise climate in the area. The sound level meter was set to record data over 15-minute intervals. The sound level meter was calibrated before and after the survey. The Time Weighting used was Fast and the Frequency Weighting was A-weighted.

Weather conditions during the 10-day baseline noise survey ranged from cold to mild conditions (1 - 13°C) with light breeze to windy conditions and intermittent rainfall. Wind speeds were recorded using a Logic Energy LEWL Windlogger. The wind speed was recorded at a height of approximately 2m throughout the survey period and a wind speed in the range of approximately 0 - 8m/s was recorded during the survey period. The noise levels and wind speeds were recorded in synchronised 15-minute periods during the daytime, evening and night-time survey. Rainfall levels were also recorded during the survey period.

For the short-term baseline noise monitoring surveys on 11th June 2019, a Norsonic Nor 140 Sound Level Analyser was used. Noise measurements were taken at a height of 1.5m

above ground level and measurements were free-field. The noise monitoring locations were selected to minimise the potential effect of reflections from buildings and are representative of the existing daytime noise levels in the area along the R458. The sound level meter was set to record data over 15-minute intervals. The sound level meter was calibrated before and after the survey. The Time Weighting used was Fast and the Frequency Weighting was A-weighted.

Weather conditions during the short-term baseline noise monitoring surveys on 11th June 2019, were warm (17°C) with a moderate breeze from a north-westerly direction and no rainfall.

The main measurement parameters recorded during the baseline surveys are defined as follows:

- L_{Aeq} is the A-weighted equivalent continuous steady sound level during the sample period and effectively represents an average value.
- L_{A10} is the A-weighted sound level that is exceeded for 10% of the sample period and is used to quantify traffic noise.
- L_{A90} is the A-weighted sound level that is exceeded for 90% of the sample period and is used to quantify background noise in the absence of the main noise source.

NOISE PREDICTION MODELLING METHODOLOGY

Noise modelling has been undertaken using Cadna_A noise modelling software. This allows for detailed prediction of noise levels to be undertaken for large numbers of receptor points and different noise emission scenarios. Noise level predictions have enabled the potential impact on the noise climate in the vicinity of the proposed development resulting from the construction and operation of the proposed development to be determined. Noise modelling has been used to predict impacts from noise sources on the nearest noise sensitive receptors to the site. Models have been run for worst-case night-time scenarios to determine if the future noise impact will be in compliance with the relevant guidelines as outlined above. The modelling software calculates noise levels based on the emission parameters and spatial settings. Table 9.2 outlines the parameters, sources, settings and assumptions that have been incorporated into the model.

Table 9.2 Modeling Parameters, Sources and Assumptions

Parameter	Details
Horizontal distances	Scaled development drawings in AutoCAD format outlining the noise levels specific distances from each potential noise source.
Proposed development dimensions	Scaled development drawings in AutoCAD format. Including location of buildings and dimensions.
Building heights	Scaled development drawings in AutoCAD format.
Receptor Locations	1m from building façades at 4m receiver height.
Reflections	First order reflections applied
Façade Correction	Façade corrections have been incorporated into the modelling. All surfaces have been assumed to be "smooth, reflective surfaces". The facades of nearest neighbouring residents included.

9.2.3 Legislation and Guidance

In accordance with the First Schedule to the EPA Act 1992 to 2013, the facility will require an Industrial Emissions Licence and accordingly the plant will be regulated by the Environmental Protection Agency (EPA).

The assessment and evaluation of the noise impact arising from the proposed development involved the following methodology:

- Baseline Noise Survey – long-term noise monitoring survey during daytime, evening and night-time in proximity to existing residential receivers in the vicinity of the site. The purpose of the noise monitoring survey was to evaluate the existing noise climate in the area.
- Noise prediction modelling using Cadna_A noise prediction software.
- A comparison of the measured noise levels and the noise impact on the nearest residential receivers against the World Health Organisation (WHO) *Guidelines for Community Noise*.

9.2.4 Desktop Study

For the production of a detailed Noise Impact Assessment reference was made to the EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (January 2016 Update).

9.2.5 Consultation

No consultation with bodies was undertaken as part of this assessment.

9.3 Description of the Receiving Environment

9.3.1 Introduction

A 10-day baseline noise monitoring survey was undertaken at the boundary of the proposed development site closest to the nearest residential properties from Friday 19th January to Monday 22nd January 2018 and from Friday 26th January to Friday 2nd February 2018. The noise monitoring survey was undertaken in accordance with ISO 1996 Description and Measurement of Environmental Noise.

9.3.2 Site Description and Environs

The existing environment in the area of the Biogas facility is described in accordance with the EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4).

STEP 1 – QUIET AREA SCREENING OF THE DEVELOPMENT LOCATION

Site Details	
Site Name	Sustainable Bio-Energy Limited
Licence Application Reference	N/A
Site Address	Kinincha, Gort, Co. Galway
Quiet Area Screening of the Development Location	
Screening Question	**Answer – Yes / No**
Is the site >3km away from urban areas with a population >1,000 people?	No, ~1.2 Km to centre of Gort
Is the site >10km away from urban areas with a population >5,000 people?	No
Is the site >15km away from urban areas with a population >10,000 people?	No
Is the site >3km away from any local industry?	No
Is the site >10km away from any major industry centre?	Yes
Is the site >5km away from any national primary route?	No
Is the site >7.5km away from any motorway or dual carriageway?	No, ~775m to the M18 motorway
QUIET AREA?	No.
Other Relevant Comments	The site is not considered to be a "Quiet Area" as per the EPA NG4 definition.

STEP 2 – BASELINE ENVIRONMENTAL NOISE SURVEY

While the screening process in Step 1 has not identified a quiet area, a long-term 10-day day, evening and night time noise measurement survey has been undertaken at the boundary of the proposed development site closest to the nearest residential properties. The noise monitoring location is shown in Figure 9.1. The noise monitoring location (208180, 396090) is representative of a background noise level for the area. While the site area is rural with infrequent traffic noise on the Kinincha Road with agricultural noise sources in proximity to the site, the background noise climate of the area is dominated by traffic noise from the M18 motorway and distant urban and traffic noise sources in Gort.

Figure 9.1 Nearest sensitive residential receiver locations and Noise monitoring locations in proximity to the Biogas facility.

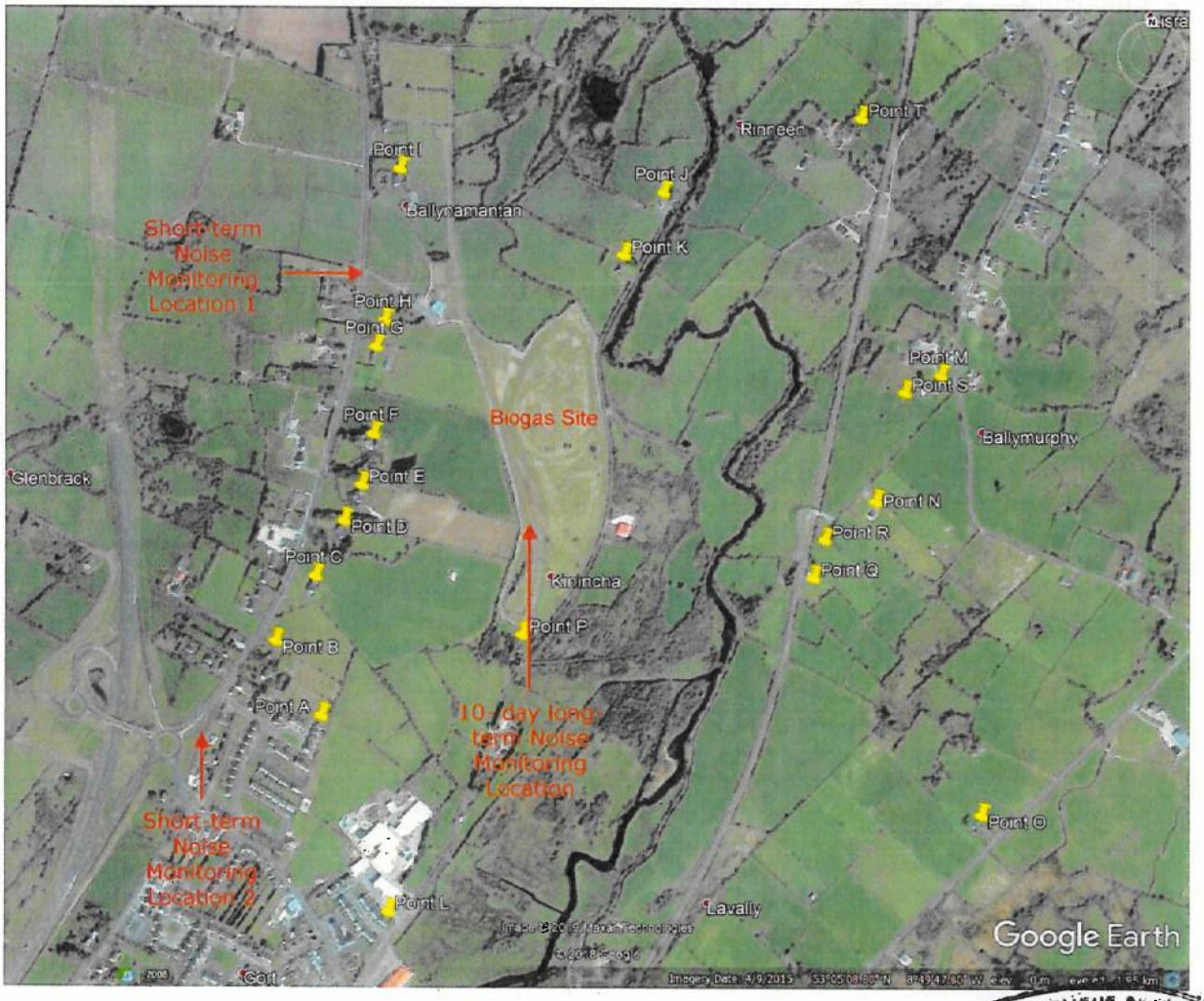


Table 9.3 Sensitive residential receiver locations in proximity to the Biogas facility.

Ref.	Irish Grid		Address
A	145024	202819	19 Cúirt Bhreac, Galway Rd, Gort, An Gort, Co. Galway
B	144938	202962	1 Galway Rd, Co. Galway
C	145016	203086	R458, Kinincha, Co. Galway
D	145071	203193	R458, Kinincha, Co. Galway
E	145105	203261	Glenbrack Lodge, Glenbrack, Gort, Co. Galway,
F	145129	203358	Kilderry Lodge, Glenbrack, Gort, Co. Galway
G	145135	203526	R458, Ballynamantan, Co. Galway
H	145152	203575	R458, Ballynamantan, Co. Galway
I	145184	203867	R458, Ballynamantan, Co. Galway
J	145678	203816	Kinincha Road, Co. Galway
K	145601	203698	Kinincha Road, Co. Galway
L	145148	202443	6 Kinincha Road, The Grove, Gort, Co. Galway, H91 P5C2
M	146204	203461	Pound Rd, Ballymurphy, Co. Galway
N	146079	203220	Pound Rd, Ballymurphy, Co. Galway
O	146273	202617	R380, Co. Galway
P	145408	202971	Derelict Cottage, L85314, Kinincha, Gort
Q	145958	203075	Lavally, Gort (Extant Permission)
R	145980	203147	Rinneen, Gort (Extant Permission)
S	146136	203429	Rinneen, Gort (Extant Permission)
T	146059	203956	Rinneen, Kiltartan (Extant Permission)

Site Details				
Site Name			Sustainable Bio-Energy Limited	
Licence Application Reference			N/A	
Site Address			Kinincha, Gort, Co. Galway	
Baseline Noise Survey – Set Up of Equipment				
Date			Friday 19th January 2018	
Start Time (hh:mm)			13.00	
Noise Meter Set to Record	L_{Aeq}		Yes	
	L_{AF90}		Yes	
	L_{AFMax}		Yes	
	Set to record LLeq in 1/3 octaves		Yes	
	At 15-minute intervals		Yes – 15-minute intervals	
	Set to nearest 15-minute period		Yes – to nearest 15-minute interval	
Noise Meter Calibration Date (dd/mm/yy)			9th January, 2018	
Noise Calibrator Calibration Date (dd/mm/yy)			9th January, 2018	
Noise Meter Check Calibrated			Before – Yes / After - Yes	
Wind Speed Data	Equipment	LEWL Windlogger	**Start of Survey –** Friday 19th January 2018 @ 13.00	**End of Survey -** Friday 2nd February 2018 @ 16.30
Recorded Wind Speeds (m/s)			Average = 3.6 m/s over monitoring period. Maximum = 10.83 m/s Minimum = 0 m/s	
Wind Direction (m/s)			Predominantly South - Westerly	
Set Up By:			Name: Mervyn Keegan	
			Position: Director	
			Signed:	

A summary of the results of the background noise monitoring survey are presented in Table 9.4 below. The individual 15-minute noise measurement data is presented in Appendix 9.1. The background noise levels recorded were dictated by distant motorway and local road traffic noise, agricultural activities and wind noise.

Table 9.4 Summary of the results of the 10-day baseline noise monitoring survey from Friday 19th January to Monday 22nd January 2018 and from Friday 26th January to Friday 2nd February 2018.

Period	Logarithmic Average of L_{Aeq}	Maximum Recorded $L_{A(max)}$	Logarithmic Average of L_{A10}	Logarithmic Average of L_{A90}
Daytime (07:00 to 19:00hrs)	58.1	86.4	62.4	45.7
Evening (19:00 to 23:00hrs)	56.1	85.3	60.2	42.8
Night-time (23:00 to 07:00hrs)	59.5	88.3	64.2	38.9

The results of the short-term noise monitoring survey on 11th June 2019 are presented in Table 9.5. The noise levels recorded were impacted by local road traffic noise on the R458 and distant motorway road traffic noise.

Table 9.5 Results of the short-term noise monitoring survey on 11th June 2019

Location	Time	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
NML 1	11:46	56.9	69.7	35.9	61.3	39.3
	12:01	56.3	67.9	40.5	61.5	43.8
	12:16	56.2	69.9	37.3	60.9	40.5
	12:31	59.1	71.3	36.8	63.6	44.8
	12:46	59.8	74.5	39.7	64.4	46.1
	13:01	61.3	75	39.6	64.3	44.3
	13:16	58.2	73.4	38.1	62.8	43.9
	13:31	58.3	71.9	38.7	63	43.2
	13:46	58.8	70	39.9	63.5	44.4
	14:01	59.2	71.3	43.2	63.8	46.5
	14:16	58.5	69.6	36.3	63.1	43
	14:31	51.1	66.3	36.5	52.1	38.4
NML 2	14:44	53	61.5	40.4	55.5	49
	14:59	54.7	62.9	47.7	57.1	50.8
	15:14	56.9	68.6	46.6	59.6	50.8
	15:29	55.3	58.6	54.4	56.5	54.5

STEP 3 – SCREEN FOR AREAS OF LOW BACKGROUND NOISE

For all areas not identified as Quiet Areas in Step 1, the existing background noise levels measured during the environmental noise survey, should be examined to determine if they satisfy the following criteria:

- Average Daytime Background Noise Level ≤40dB LAF90 - No
- Average Evening Background Noise Level ≤35dB LAF90 - No

- Average Night-time Background Noise Level ≤30dB LAF90 - No

As all three of the above criteria are not satisfied, this location is not deemed to be an area of low background noise, and the reduced noise limits detailed in Step 4 are not applicable at receptors in proximity to this proposed development location.

STEP 4 – DETERMINE APPROPRIATE NOISE CRITERIA

The noise limit criteria, as outlined below in Table 9.6, have been determined based on the on the results of the screening processes discussed in Steps 1 and 3, and the noise survey discussed in Step 2 above.

Table 9.6 Recommended EPA Noise Limits.

Scenario	Daytime Noise Criterion, dB $L_{Ar,T}$ (07:00 to 19:00hrs)	Evening Noise Criterion, dB $L_{Ar,T}$ (19:00 to 23:00hrs)	Night-time Noise Criterion, dB $L_{Aeq,T}$ (23:00 to 07:00hrs)
'All other areas'	55dB	50dB	45dB

9.4 Impact Assessment

9.4.1 Construction Phase

PREDICTED CONSTRUCTION NOISE LEVELS AT NOISE SENSITIVE RECEIVERS

There are no Irish statutory limits regarding construction noise. BS5228-1:2009+A1:2014 *'Code of practice for noise and vibration control on construction and open site – Part 1: Noise'*, provides guidance on assessing the potential significance of noise effects from construction activities in Annex E.

In relation to Construction Noise Limits, BS 5228-1:2009+A1: 2014 Noise and Vibration Control on Construction and Open Sites Part 1: Noise details the 'ABC method', which recommends a construction noise limit based on the existing ambient noise level. General and short-term construction noise impacts that are deemed typical of any construction site noise sources, including activities such as ground preparation, site clearance, foundation earthworks, roadway construction, erection of new buildings, etc. are assessed in accordance with the 'ABC method' defined in BS 5228. The ambient noise levels have been determined through the baseline noise survey and then rounded to the nearest 5dB to determine the appropriate category (A, B or C) and subsequent threshold value. A potential significant effect is indicated if the construction noise level exceeds the appropriate category threshold value. If the existing ambient level exceeds the threshold category threshold values, then a potential significant impact is indicated if the total noise level, including both the ambient noise and the various contributions of construction noise,

is greater than the ambient noise level by more than 3dB. Table 9.7, reproduced from BS 5228, demonstrates the criteria for selection of a noise limit for a specific receptor location.

Table 9.7 Construction noise threshold levels based on the BS 5228 'ABC' method.

Assessment Category and Threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A (A)	Category B (B)	Category C (C)
Night time (23.00 to 07.00)	45	50	55
Evening and weekends (D)	55	60	65
Daytime (07.00 – 19.00) and Saturdays (07.00 - 13.00)	65	70	75

Notes:

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

No night-time or evening construction works will take place. At the nearest noise sensitive receptors, the ambient noise levels (rounded to the nearest 5 dB) are approximately 55 - 60 dB $L_{Aeq,T}$ during daytime and evening. Therefore, all noise sensitive receptors fall into Category A of the 'ABC' assessment methodology. Hence, daytime construction noise will be subject to a limit of 65 dB $L_{Aeq,T}$.

The main sources of noise due to construction of the proposed development will be from activities such as earth movement and excavations, foundations and general building construction activities. There is likely to be temporary and intermittent increases in noise levels during the construction phase of the proposed development at the adjacent properties. The following construction practices have the potential to produce intermittent and temporary noise impacts:

- Infilling / Levelling Excavators & concrete pour
- Foundations Excavators, Concrete lorries, dumpers
- Building Erection Block-laying & Delivery vehicles
- General Construction Masonry construction, services, drainage, road building and surfacing etc.

The Construction of the proposed development will include associated construction site traffic, comprising of contractors' vehicles, excavators, diggers, possibly generators and other diesel-powered vehicles. During the construction phase, the proposed development will generate HGV movements throughout the duration of the construction period. The noise impact of passing HGVs will be short-term at receiver locations in the area.

Construction noise can be assessed in terms of the equivalent continuous sound level and/or in terms of the maximum level. The level of sound that arises from a construction site depends on a number of factors and the estimation procedures need to take into account the following significant factors;

- the sound power outputs of processes and plant;
- the periods of operation of processes and plant;
- the distances from sources to receptor;
- the presence of screening by barriers;
- the reflection of sound;
- ground attenuation
- meteorological conditions (particularly wind speed and direction), and
- atmospheric absorption

Typical noise levels from construction works likely to take place during construction phase of proposed development are outlined in Table 9.7.

Table 9.8: Typical Noise Levels from Construction Works likely to take place during the construction phase of proposed development (Ref: BS 5228, Update of Noise Database for the Prediction of Noise on Construction and Open sites).

Activity	Plant	L_{Aeq} at 10m
Site clearance / excavation	Lorries (drive by)	70 dB
Removal of waste/rubble	Dozers	87 dB
	HGV and tippers	84 dB
Foundations	Compressor	81 dB
	Water Pump	to 80 dB
	Concrete Pour	to 86 dB
	Place and vibrate concrete cycle	80 dB
	Cement Mixers	74 dB
General Construction Works	Internal fit/ bricklaying	70 dB
Road works/landscaping	Surfacing/rolling	76 - 86 dB
Infilling / Levelling	Dump truck	82 dB

Activity	Plant	L_{Aeq} at 10m
	Wheeled excavator/ Loader	76 dB
	Dozers	81 – 89 dB

Worst-case construction noise levels at specific distances from the area of construction have been predicted assuming the use of the following equipment with a 75% operating 'on' time as outlined in Table 9.9. The closest noise sensitive receptors are in excess of 200m from the main areas of construction on the development site and hence, there should be no exceedance of the daytime construction noise limit of 65 dB $L_{Aeq,T}$ at the noise sensitive receptors in the area. It will be incumbent on the contractor to ensure that construction works are undertaken with particular sensitivity to ensure no significant construction noise impact. As stated, all construction works will take place during daytime hours and so the relative construction noise impact will not be significant.

Table 9.9 Predicted worst-case noise levels at various distances from construction noise source (Plant & equipment noise levels as outlined in BS5228).

Plant Type / Noise Source	BS 5228 Ref.	BS 5228 L_{Aeq} @ 10m	Predicted Cumulative Noise Level @100m	@200m	@300m	@400m
30T Excavator	C.2.16	75	~53 dB(A)	~45 dB(A)	~41 dB(A)	~38 dB(A)
40T Dumper Truck	C.6.26	79				
Lorry Tipper	C.2.30	79				
Concrete Pump	C3.26	75				
Concrete Mixer	C4.20	80				
Asphalt Spreader	D.8.26	80				
Vibratory Roller	D.3.16	78				

The period of construction projected to have the highest construction traffic volumes will occur during months 6, 7 & 8 during which time there will be 360 two-way HGV movements per month. This equates to an average of 17 two-way HGV movements per day. During construction it is expected that an average of 40 cars will be arriving at the site each day. Therefore, this equates to 40 two-way car movements per day and 17 two-way HGV movements per day. The proposed development will be accessed from the R458 during construction and will take place during daytime and weekday only. The existing Annual Average Daily Traffic (AADT) flow on the R458 is 5,169 with a HGV percentage of 2.9%. An additional traffic flow during construction of 40 two-way car movements per day and

17 two-way HGV movements per day will result in less than a 1 dB(A) increase in noise levels at properties along the R458. A 1 dB(A) increase in noise levels is imperceptible to the human ear and this will not cause a significant noise impact.

9.4.2 Operational Phase

PREDICTED OPERATIONAL NOISE LEVELS AT NOISE SENSITIVE RECEIVERS

Based on the drawings and information provided, the proposed development will consist of the following aspects of which some have the potential to be the main noise sources. The following sound power level have been input in to the Cadna_A noise model; (*Note: the Cadna_A noise models are available to the EPA upon request*). The sound power levels used in the noise prediction model are based on worst-case assumptions and actual on-site noise measurements undertaken at the Glenmore Biogas Plant in Ballybofey, Co. Donegal on Thursday 18th January 2018 in proximity to the main noise sources on site.

Feedstock Reception Building – this is a sealed building maintained under negative pressure with automatic roller doors. It has been assumed that there will be a worst-case internal noise level of 85 dB(A) and that the building envelope, i.e. walls, roof, doors and windows will allow for a conservative transmission loss of 25 dB(A). The OCU stack emission point has been allocated a sound power level corresponding to 80dB(A) @ 1m. A sound pressure level of 84.5 dB(A) @ 1m from the OCU stack fan at ground level has been measured at this noise source. An appropriate sound power level has been calculated and this noise source has been represented as a vertical area source in the noise model. The OCU Exhaust stack has been assessed with a worst-case noise level of 75 dB(A) @ 1m at a release height of 22.5m.

CHP Engines. Ref. supplier's information; Jenbacher Type 6 (J624) CHP Engine

- Sound pressure level (engine, average value 1m) = 101 dB(A)
- Sound pressure level exhaust gas (1m, 30° off engine) = 123 dB(A)

The CHP Engine will include an external weatherproof container for external use designed to reduce noise emitted to a level of 65 dB (A) @ 1 metre distance (free field conditions, according to DIN 45635). Welded steel construction, complete with integral acoustically treated base. Acoustic lining to internal walls and ceiling complete with perforated sheet steel protection. Access doors complete with acoustic seals, lockable slam fasteners and wind restraints. Internally mounted cooling air inlet and outlet attenuators with ventilation fan together with internally mounted exhaust gas silencers with thermal lagging. Finish painted white internally and externally in acrylic urethane to BS4800 or RAL colour.

Exhaust gas silencers - Stainless steel, absorption and resonance type 75dB (A) @ 1m supplied loose for site installation. Dry Air Cooler (DAC) Galvanized framework Rated at 30 deg C ambient temperature. With noise level of 65dB(A) @ 1m (free field conditions, according to DIN45635).

Therefore, the CHP engine unit will give a worst-case noise level of 65 dB(A) @ 1m. The Exhaust gas silencers will give a worst-case noise level of 75 dB(A) @ 1m. The CHP Exhaust stack has been assessed with a worst-case noise level of 75 dB(A) @ 1m at a release height of 22.5m.

Carbon Dioxide (CO_2) Compression Building – It has been assumed that there will be a worst-case internal noise level of 85 dB(A) and that the building envelope, i.e. walls, roof, doors and windows will allow for a conservative transmission loss of 25 dB(A).

Biogas Purification & Bottling Plant – It has been assumed that there will be a worst-case internal noise level of 85 dB(A) and that the building envelope, i.e. walls, roof, doors and windows will allow for a conservative transmission loss of 25 dB(A).

Biogas Purification & Bottling Plant – Compressors – A sound pressure level of 75 dB(A) @ 1m has been measured at these noise sources at the Glenmore Biogas Plant in Ballybofey, Co. Donegal. An appropriate sound power level of 70 dB L_w has been calculated and these noise sources have been represented as a vertical area source in the noise model.

Standby Boiler Building – A maximum sound level of 70 dB(A) @ 1m will occur at the sides of the standby boiler building. This has not been represented in the noise model as it is a temporary and backup – not a significant noise source.

Digestate Tanks – These are sealed units – not a significant noise source.

Digestate Storage Tanks – The biogas development includes four digestate storage tanks with direct pumped connectivity to the digestate tanks as they are required to store digestate produced during the closed spreading season or other times (e.g. during periods of poor weather conditions). Digestate will be used for spreading on agricultural lands in lieu of chemical fertilisers. These are sealed units – not a significant noise source.

Pump House Buildings – These are not a significant noise source. As a worst-case assessment, it has been assumed that there will be a worst-case internal noise level of 70 dB(A) and that the building envelope, i.e. walls, roof, doors and windows will allow for a conservative transmission loss of 25 dB(A).

Flare – To be used only in emergency – not a significant noise source.

Table 9.10 Predicted worst-case 1-hour noise from plant and equipment noise sources only versus EPA daytime, evening and night-time noise limits (See Figure 9.2)

Location	Daytime dB(A)	Evening dB(A)	Night-time dB(A)
NSR A	25.4	25.4	25.4
NSR B	25.6	25.6	25.6
NSR C	27.8	27.8	27.8
NSR D	29.6	29.6	29.6
NSR E	29.9	29.9	29.9
NSR F	30.1	30.1	30.1
NSR G	29.3	29.3	29.3
NSR H	28.5	28.5	28.5
NSR I	23.2	23.2	23.2
NSR J	27	27	27
NSR K	29.5	29.5	29.5
NSR L	22.3	22.3	22.3
NSR M	26.5	26.5	26.5
NSR N	28.3	28.3	28.3
NSR O	21.9	21.9	21.9
NSR P	30.5	30.5	30.5
NSR Q	28.9	28.9	28.9
NSR R	29	29	29
NSR S	27.8	27.8	27.8
NSR T	23.7	23.7	23.7
EPA Noise Limit for 'All other areas'	55dB	50dB	45dB

In terms of development generated traffic when operational, the following traffic movements entering and exiting the site are predicted:

Table 9.10 Predicted development generated traffic when operational.

Trip Type	Daily two-way movements (PCUs)
Workforce	22
Feedstock deliveries	10
Whole digestate collection	4
Dry digestate collection	3
Biomethane collection	4
CO_2 collection	4
TOTAL Daily Biogas Two-Way Trips	47

The proposed development will be accessed from the R458. The activity will operate on a 24-hour basis, 7 days per week. Approximately 25 two way HGV movements will be delivering and removing material to and from the facility each day during normal operating hours (07:00 to 19:00 Monday to Sunday inclusive). Approximately 22 two way car

movements will go to and from the facility each day. The existing Annual Average Daily Traffic (AADT) flow on the R458 is 5,169 with a HGV percentage of 2.9%. The existing Annual Average Daily Traffic (AADT) flow on the R458 is 5,169 with a HGV percentage of 2.9%. An additional traffic flow during construction of 22 two-way car movements per day and 25 two-way HGV movements per day will result in less than a 1 dB(A) increase in noise levels at properties along the R458. A 1 dB(A) increase in noise levels is imperceptible to the human ear and this will not cause a significant noise impact.

Thus, for the purposes of a robust assessment it has been assumed that there will be a worst-case 10 HGV movements at the site during a one hour period during daytime. There will be a maximum of 47 two-way daily movements during daytime and such traffic movements will not occur during night-time. The HGV movements on the Biogas facility access road have been represented as a "Moving Point Source" at a speed of 15 Km/hr with a sound power level of 105 dB(A) on the basis of a worst-case 10 movements during peak hour. The car movements on the Biogas facility access road have been represented as a "Moving Point Source" at a speed of 15 Km/hr with a sound power level of 95 dB(A) on the basis of a worst-case 22 movements during peak hour.

The results of the predicted noise levels at the noise sensitive receivers in the area during daytime due to plant and equipment and traffic noise sources are presented in Table 9.11. It is assumed that, as per the worst-case noise impact during evening and night-time data presented in Table 9.9 there will be no traffic movements on site.

Table 9.11 Predicted worst-case 1-hour noise from plant and equipment and site traffic movements during daytime versus EPA daytime noise limits (See Figure 1 & 2 Appendix 9.2)

Location	Daytime dB(A)
NSR A	28.3
NSR B	28.3
NSR C	30.5
NSR D	32.1
NSR E	32.7
NSR F	33.1
NSR G	34.9
NSR H	36.2
NSR I	32.8
NSR J	29.5
NSR K	32
NSR L	25.7
NSR M	28.6
NSR N	30.5
NSR O	24.9
NSR P	40.7

Location	Daytime dB(A)
NSR Q	31.1
NSR R	31.2
NSR S	29.7
NSR T	26
EPA Noise Limit for 'All other areas'	55dB

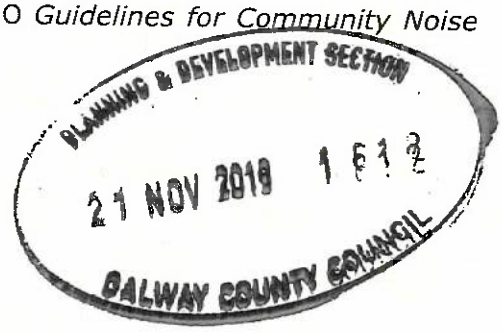
COMPARISON OF OPERATIONAL NOISE LEVELS AGAINST EPA NOISE LIMIT CRITERIA

The noise limit criteria, as outlined in Table 9.5 based on the EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), will not be exceeded at the nearest residential properties during daytime, evening and night-time when the proposed AD facility is in operation.

COMPARISON OF MEASURED AND OPERATIONAL NOISE LEVELS AGAINST WHO GUIDELINES

The WHO has published *Guidelines for Community Noise*, the outcome of a WHO expert task force meeting in April 1999. The WHO guidelines recommend a daytime limit of 50 – 55 dB(A) for outdoor living areas. The report states that "*to protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady continuous noise should not exceed 55 dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq}. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development*". According to the WHO guidelines noise impacts within dwellings include annoyance, speech interference and sleep disturbance. WHO considers that for bedrooms, the critical effect is sleep disturbance. Guideline values for bedrooms consider that the sleep disturbance criteria should be taken as internal noise levels of 30 dB L_{Aeq} or 45 dB L_{Amax} or external levels of 45 dB L_{Aeq} or 60 dB L_{Amax}.

The measured noise levels at the noise monitoring location are in accordance with the relevant guideline noise limits outlined in the World Health Organisation (WHO) *Guidelines for Community Noise.* As outlined above, the predicted noise levels at the nearest residential properties during daytime, evening and night-time when the proposed Biogas facility is in operation are in accordance with the WHO *Guidelines for Community Noise* during daytime and night-time.



9.5 Mitigation Measures and Monitoring

9.5.1 Construction Phase

Appropriate mitigation measures have been recommended to ensure the Construction Phase target noise limits are not exceeded. The contractor should take note of the control measures recommended in BS 5228 and apply the appropriate measures where applicable. Other measures recommended include:

Working hours during site construction operations will be restricted to daytime hours as outlined;

- 07.00 hours to 19.00 hours (Monday to Friday)
- 08.00 hours to 14.00 hours (Saturdays)

An on-site speed limit will be enforced for all traffic. Drivers of vehicles will be advised of the speed limits through the erection of signs i.e. a typically recommended on site speed limit of 10 km/hr.

Where practicable the use of quiet working methods will be selected and the most suitable plant will be selected for each activity, having due regard to the need for noise control.

Best practicable means will be employed to minimise noise emissions and will comply with the general recommendations of BS 5228, 1997. To this end operators will use "*noise reduced*" plant and/or will modify their construction methods so that noisy plant is unnecessary.

By positioning potentially noisy plant as far as possible from noise sensitive receivers the transmission of sound can be minimised. Earth mounds and/or stacks of material or buildings on site can be used in such a way that they act as a physical barrier between the source and the receiver.

Mechanical plant used on site will be fitted with effective exhaust silencers. Vehicle reverse alarms will be silenced appropriately in order to minimise noise breakout from the site while still maintaining their effectiveness.

All plant will be maintained in good working order. Where practicable, machines will be operated at low speeds and will be shut down when not in use.

If required, compressors will be of the "noise reduced" variety and fitted with properly lined and sealed acoustic covers.

In all cases engine and/or machinery covers should be closed whenever the machines or engines are in use.

All pneumatic percussive tools will be fitted with mufflers or silencers as recommended by the equipment manufactures. Where practicable all mechanical static plant will be enclosed by acoustic sheds or screens.

Employees working on the site will be informed about the requirement to minimise noise and will undergo training on the following aspects:

- The proper use and maintenance of tools and equipment
- The positioning of machinery on-site to reduce the emission of noise to the noise sensitive receptors
- Avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment
- The use and maintenance of sound reduction equipment fitted to power pressure tools and machines
- Cognisance should also be taken of the 'Environmental good practice site guide' 2005 compiled by CIRIA and the UK Environment Agency. This guide provides useful and practical information regarding the control of noise at construction sites.
- It is recommended that should complaints be received from nearby residential properties; periodic noise monitoring should be undertaken during construction works to determine noise levels at noise sensitive receptors. On the basis of the findings of such noise monitoring and appropriate noise mitigation measures should be implemented to reduce noise impacts. Where excessive noise levels are recorded, further mitigation measures should be employed which may include temporary screening of the nearest receptor to on-site activities.
- Responsible Person - It is recommended that the Contractor should appoint a responsible and trained person who will be present on site and who will be willing to answer and act upon complaints and queries from the local public.
- Night-time working - If there are items of plant (e.g. dewatering pumps and similar) in use during night-time hours they should be chosen, sited and enclosed such that levels at the nearest properties do not exceed the measured background noise levels.

9.5.2 Operational Phase

The worst-case assessment of operational noise from the proposed plant and traffic movements associated with the proposed development has indicated that the EPA's noise limit criteria will not be exceeded at the nearest residential properties. Therefore, no

additional specific mitigation measures beyond those which are already proposed within the design have been recommended to reduce operational noise.

9.5.3 Decommissioning Phase

During the decommissioning phase, the potential impacts and mitigations are similar to that of those in the construction phase. As required by EPA IE licensing, the licensee will be required to prepare a site closure and decommissioning plan for the site. Due to similarity of activities associated with decommissioning (as described in Chapter 2) no further mitigation recommended.

9.5.4 Cumulative Impacts

A detailed background noise monitoring survey has been undertaken. The proposed development has been assessed in accordance with the relevant methodologies versus the background noise level. There are no other significant noise sources in the area of the development other than road traffic sources. There will be no significant cumulative impacts.

9.6 Residual Impacts

The noise impact of the Biogas facility will not be significant in addition to the existing background noise level in the area. There will be no significant residual impact from the operation of the Biogas facility.

9.7 Statement of Significance

This noise impact assessment has compared the measured noise levels in proximity to the nearest noise sensitive properties to the relevant guideline noise limits outlined in the WHO *Guidelines for Community Noise* and the EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4).

The measured noise levels at the noise monitoring location are in accordance with the relevant guideline noise limits outlined in the WHO *Guidelines for Community Noise* and the predicted noise levels at the nearest residential properties are in accordance with the WHO *Guidelines for Community Noise* during daytime and night-time.

The worst-case assessment of operational noise from the proposed plant and traffic movements associated with the proposed development has indicated that the EPA's noise limit criteria will not be exceeded at the nearest residential properties.

No site-specific operational noise mitigation measures are deemed necessary. However, as part of an Environmental Improvement Programme for the site, the project developer will focus on reducing noise breakout off site where possible and aim to improve noise attenuation measures on the site.

10 LANDSCAPE AND VISUAL

10.1 Introduction

This Landscape and Visual Assessment (LVIA) has been prepared in respect of a planning application for the proposed Gort Biogas Plant in County Galway. The LVIA report describes the landscape context of the proposed biogas plant and assesses the likely landscape and visual impacts of the scheme on the receiving environment. Although closely linked, landscape and visual impacts are assessed separately.

Landscape Impact Assessment (LIA) relates to assessing effects of a Development on the landscape as a resource in its own right and is concerned with how the proposal will affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character.

Visual Impact Assessment (VIA) relates to assessing effects of a development on specific views and on the general visual amenity experienced by people. This deals with how the surroundings of individuals or groups of people may be specifically affected by changes in the content and character of views as a result of the change or loss of existing elements of the landscape and/or introduction of new elements. Visual impacts may occur from; Visual Obstruction (blocking of a view, be it full, partial or intermittent) or; Visual Intrusion (interruption of a view without blocking).

Cumulative landscape and visual impact assessment is concerned with additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future.

This LVIA uses methodology as prescribed in the following guidance documents:

- Environmental Protection Agency (EPA) publication *'Guidelines on the Information to be contained in Environmental Impact Assessment Reports' (updated draft 2017)* and the accompanying *Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (updated draft 2017);*
- Landscape Institute and the Institute of Environmental Management and Assessment publication entitled Guidelines for Landscape and Visual Impact Assessment (2013).

10.1.1 Outline of Proposed Development

The developer proposes to construct a biogas plant on a site of approximately 10.1 hectares located on lands to the northwest of Gort town in the townlands of Ballynamantan, Glenbrack and Kinincha.

The proposed development will construction of a new access road from from the R458/N18 and construction of a Biogas Plant capable of accepting up to 90,000 tonnes of non-hazardous biodegradable feedstock per annum. The proposed Biogas Plant will process both liquid and solid biodegradable materials sourced from the agri-food sector. With relevance to the potential landscape and visual impact, the proposed Biogas Plant includes, but is not limited to:

- Gated secured entrance
- 1 no. weighbridge;
- Office and Control Room Building;
- Feedstock Reception Building;
- Process drainage and effluent storage tank;
- Odour Control unit (OCU), with a stack height of 22m;
- Digesters and storage tank vessels positioned within a tank farm bund;
- 2 no. boilers, each with a stack height of 16.4m;
- Pump houses located within tank farm bund
- Biogas upgrading (methane and carbon dioxide) and bottling plant and structures;
- Gas Flare and gas booster station (approx. 8m in height);
- Administration Building;
- Combined Heat and Power (CHP) Building, with a stack height of 22m;
- Storm Water Drainage;
- Lighting Fencing and Security Gates along roads and around site perimeter.

A tree planted /grassed soil berm will be constructed along the eastern boundary of the site to provide for visual screening of the development. Existing ground levels in certain areas of the site will be lowered to suitably position some components of the development (e.g. tank farm).

For a more comprehensive description of the proposed development please refer to Chapter 2 of this EIAR.

10.2 Assessment Methodology and Significance Criteria

10.2.1 Assessment Methodology

Production of this Landscape and Visual Impact Assessment involved:

- A desktop study to establish an appropriate study area, relevant landscape and visual designations in the Galway County Development Plan (CDP) 2015-2021, as well as other sensitive visual receptors. This stage culminates in the selection of a set of potential viewpoints from which to study the effects of the proposal;
- Fieldwork to establish the landscape character of the receiving environment and to confirm and refine the set of viewpoints to be used for the visual assessment stage;
- Assessment of the significance of the landscape impact of the Development as a function of landscape sensitivity weighed against the magnitude of the landscape impact;
- Assessment of the significance of the visual impact of the Development as a function of visual receptor sensitivity weighed against the magnitude of the visual impact. This aspect of the assessment is supported by photomontages prepared in respect of the selected viewpoints;
- Incorporation of mitigation measures to reduce potential impacts and estimation of residual impacts once mitigation has become established.

10.2.2 Landscape Impact Assessment Criteria

When assessing the potential impacts on the landscape resulting from a proposed development, the following criteria are considered:

- Landscape character, value and sensitivity;
- Magnitude of likely impacts;
- Significance of landscape effects.

The sensitivity of the landscape to change is the degree to which a particular landscape receptor, Landscape Character Area (LCA) or landscape feature can accommodate changes or new elements, without unacceptable detrimental effects to its essential characteristics. Landscape Value and Sensitivity is classified using the following criteria set out in Table 10.1.

Table 10-1 Landscape Value and Sensitivity

Sensitivity	Description
Very High	Areas where the landscape character exhibits a very low capacity for change in the form of development. Examples of which are high value landscapes, protected at an international or national level (World Heritage Site/National Park), where the principal management objectives are likely to be protection of the existing character.
High	Areas where the landscape character exhibits a low capacity for change in the form of development. Examples of which are high value landscapes, protected at a national or regional level (Area of Outstanding Natural Beauty), where the principal management objectives are likely to be considered conservation of the existing character.
Medium	Areas where the landscape character exhibits some capacity and scope for development. Examples of which are landscapes, which have a designation of protection at a county level or at non-designated local level where there is evidence of local value and use.
Low	Areas where the landscape character exhibits a higher capacity for change from development. Typically, this would include lower value, non-designated landscapes that may also have some elements or features of recognisable quality, where landscape management objectives include, enhancement, repair and restoration.
Negligible	Areas of landscape character that include derelict, mining, industrial land or are part of the urban fringe where there would be a reasonable capacity to embrace change or the capacity to include the development proposals. Management objectives in such areas could be focused on change, creation of landscape improvements and/or restoration to realise a higher landscape value.

The magnitude of a predicted landscape impact is a product of the scale, extent or degree of change that is likely to be experienced as a result of the proposed Development. The magnitude takes into account whether there is a direct physical impact resulting from the loss of landscape components and/or a change that extends beyond the Application Site boundary that may have an effect on the landscape character of the area. Table 10.2 refers.

Table 10.2 Magnitude of Landscape Impacts

Magnitude of Impact	Description
Very High	Change that would be large in extent and scale with the loss of critically important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
High	Change that would be more limited in extent and scale with the loss of important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
Medium	Changes that are modest in extent and scale involving the loss of landscape characteristics or elements that may also involve the introduction of new uncharacteristic elements or features that would lead to changes in landscape character, and quality.
Low	Changes affecting small areas of landscape character and quality, together with the loss of some less characteristic landscape elements or the addition of new features or elements.
Negligible	Changes affecting small or very restricted areas of landscape character. This may include the limited loss of some elements or the addition of some new features or elements that are characteristic of the existing landscape or are hardly perceivable.

The significance of a landscape impact is based on a balance between the sensitivity of the landscape receptor and the magnitude of the impact. The significance of landscape impacts is arrived at using the following matrix set out in Table 10.3.

Table 10.3 Impact Significance Matrix

	Sensitivity of Receptor				
Scale/Magnitude	**Very High**	**High**	**Medium**	**Low**	**Negligible**
Very High	Profound	Profound-substantial	Substantial	Moderate	Minor
High	Profound-substantial	Substantial	Substantial-moderate	Moderate-slight	Slight-imperceptible
Medium	Substantial	Substantial-moderate	Moderate	Slight	Imperceptible
Low	Moderate	Moderate-slight	Slight	Slight-imperceptible	Imperceptible
Negligible	Slight	Slight-imperceptible	Imperceptible	Imperceptible	Imperceptible

Note: The significance matrix provides an indicative framework from which the significance of impact is derived. The significance judgement is ultimately determined by the assessor using professional judgement. Due to nuances within the constituent sensitivity and magnitude judgements, this may be up to one category higher or lower than indicated by the matrix. Judgements indicated in orange are considered to be 'significant impacts' in EIA terms.

10.2.3 Visual Impact Assessment Criteria

As with the landscape impact, the visual impact of the proposed Development will be assessed as a function of sensitivity versus magnitude. In this instance the sensitivity of the visual receptor, weighed against the magnitude of the visual effect.

SENSITIVITY OF VISUAL RECEPTORS

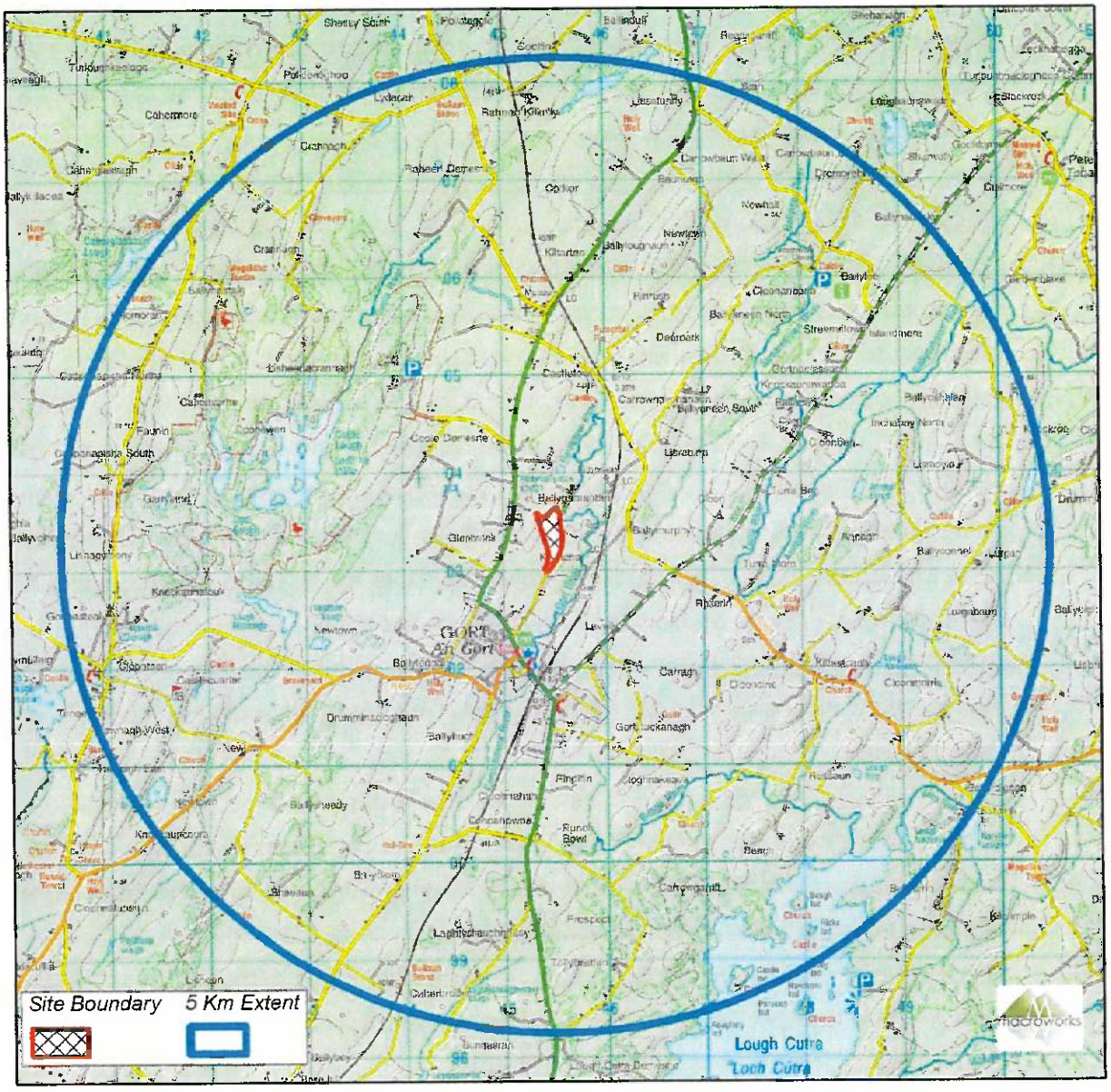
Unlike landscape sensitivity, the sensitivity of visual receptors has an anthropocentric basis. It considers factors such as the perceived quality and values associated with the view, the landscape context of the viewer, the likely activity they are engaged in and whether this heightens their awareness of the surrounding landscape. A list of the factors considered by the assessor in estimating the level of sensitivity for a particular visual receptor is outlined below and used in Table 10.6 below to establish visual receptor sensitivity at each VRP:

1. Susceptibility of Receptors - In accordance with the Institute of Environmental Management and Assessment ("IEMA") Guidelines for Landscape and Visual Assessment (3rd edition 2013) visual receptors most susceptible to changes in views and visual amenity are;
   - "Residents at home;
   - People, whether residents or visitors, who are engaged in outdoor recreation, including use of public rights of way, whose attention or interest is likely to be focussed on the landscape and on particular views;
   - Visitors to heritage assets, or to other attractions, where views of the surroundings are an important contributor to the experience;
   - Communities where views contribute to the landscape setting enjoyed by residents in the area; and
   - Travellers on road rail or other transport routes where such travel involves recognised scenic routes and awareness of views is likely to be heightened".

   Visual receptors that are less susceptible to changes in views and visual amenity include;
   - "People engaged in outdoor sport or recreation, which does not involve or depend upon appreciation of views of the landscape; and
   - People at their place of work whose attention may be focussed on their work or activity, not their surroundings and where the setting is not important to the quality of working life".

2. Recognised scenic value of the view (County Development Plan designations, guidebooks, touring maps, postcards etc). These represent a consensus in terms of which scenic views and routes within an area are strongly valued by the population because in the case of County Developments Plans, for example, a public consultation process is required;
3. Views from within highly sensitive landscape areas. Again, highly sensitive landscape designations are usually part of a county's Landscape Character Assessment, which is then incorporated within the County Development Plan and is therefore subject to the public consultation process. Viewers within such areas are likely to be highly attuned to the landscape around them;
4. Primary views from dwellings. A proposed development might be seen from anywhere within a particular residential property with varying degrees of sensitivity. Therefore, this category is reserved for those instances in which the design of dwellings or housing estates, has been influenced by the desire to take in a particular view. This might involve the use of a slope or the specific orientation of a house and/or its internal social rooms and exterior spaces;
5. Intensity of use, popularity. This relates to the number of viewers likely to experience a view on a regular basis and whether this is significant at county or regional scale;
6. Connection with the landscape. This considers whether or not receptors are likely to be highly attuned to views of the landscape i.e. commuters hurriedly driving on busy national route versus hill walkers directly engaged with the landscape enjoying changing sequential views over it;
7. Provision of elevated panoramic views. This relates to the extent of the view on offer and the tendency for receptors to become more attuned to the surrounding landscape at locations that afford broad vistas;
8. Sense of remoteness and/or tranquillity. Receptors taking in a remote and tranquil scene, which is likely to be fairly static, are likely to be more receptive to changes in the view than those taking in the view of a busy street scene, for example;
9. Degree of perceived naturalness. Where a view is valued for the sense of naturalness of the surrounding landscape it is likely to be highly sensitive to visual intrusion by distinctly manmade features;
10. Presence of striking or noteworthy features. A view might be strongly valued because it contains a distinctive and memorable landscape feature such as a promontory headland, lough or castle;
11. Historical, cultural and / or spiritual significance. Such attributes may be evident or sensed by receptors at certain viewing locations, which may attract visitors

Figure 10.1 Landscape and Visual Study Area for the Proposed Development.



10.2.5 Consultation

No consultation with bodies was undertaken as part of this assessment.

10.3 Description of the Receiving Environment

10.3.1 Landscape Baseline

The landscape baseline represents the existing landscape context and is the scenario against which any changes to the landscape brought about by the Development will be assessed.

A description of the landscape context of the proposed application site and wider study area is provided below under the headings of landform and drainage, vegetation and land use, centres of population and houses, transport routes and public amenities and facilities. Although this description forms part of the landscape baseline, many of the landscape elements identified also relate to visual receptors i.e. places and transport routes from which viewers can potentially see the proposed Development.

LANDFORM AND DRAINAGE

The study area is located in and around the town of Gort in south County Galway. Undulating and generally low-lying, the area tends to range between 10 and 40m AOD. It is characterised by undulating scrubby grassland, with a high degree of watercourses and damp, water-retaining regions within fields, as well as a plentiful array of turloughs about the area: small seasonal/disappearing/reappearing lakes found mostly west of the Shannon River.

The application site is located approximately 1km north of Gort town centre and is a considerably modified environment. It is understood that ground conditions, ground levels and field boundaries were significantly disturbed and modified circa year 2000, to facilitate development of a horse gallop and associated horse-training facilities. These site works also involved the excavation of soils, profiling of ground, removal of field boundaries, importation of screened fine soils, grass re-seeding, as well as the construction of a perimeter track and fencing. The resulting landform lends the impression that the site was once subjected to either industrial or extractive activities, or both. The site generally lifts from approx. 20m AOD in the east of the site, to approx. 30m AOD in the west and north of the site, in what takes the much-modified form of relatively flat field that abruptly lifts in a re-profiled embankment. In that regard, the site resembles a three-sided, paisley-shaped hollow enclosed by large embankments on two of those sides, leaving the east side topographically open.

Figure 10.2 Embankment and perimeter track along the northern boundary of the site

Immediately east of the site is the low-lying Gort River, while immediately west the land once more plateaus out until it reaches the former N18 (now R458). The topography of lands surrounding the site undulates less dramatically. Being south Galway, watercourses run aplenty in the study area, most of which run a raged northeast-southwest orientation and all of which are prone to flooding, particularly in the winter months. The Gort River is the defining watercourse of the area, which runs within 12m of the northeast corner of the site, and south towards Gort. The Cannahowna River and Beagh River are prominent south of the town, while in the northern realm of the study area the Streamstown River, Ballylee River, Coole River and Castletown River (that feeds into the Gort River) are also evident. The two lakes in the study area are Coole Lough, approx. 2km west of the site, and Lough Cultra, approx. 4km southeast of the site.

VEGETATION AND LAND USE

The site is characterised by improved grassland/pasture, for agricultural grazing and equine activities. Most of the surrounding land use is used for pasture (i.e. dairy, sheep or beef), bound by field hedgerows without mature trees. There is limited coniferous or deciduous forestry in this area of south Galway. As referred to previously, in the recent past the site was subjected to the excavation of soils, re-profiling of terrain, importation of screened fine soils and grass re-seeding. Consequently, the pasture/grass now found within the site is at odds with that of the surrounding countryside.

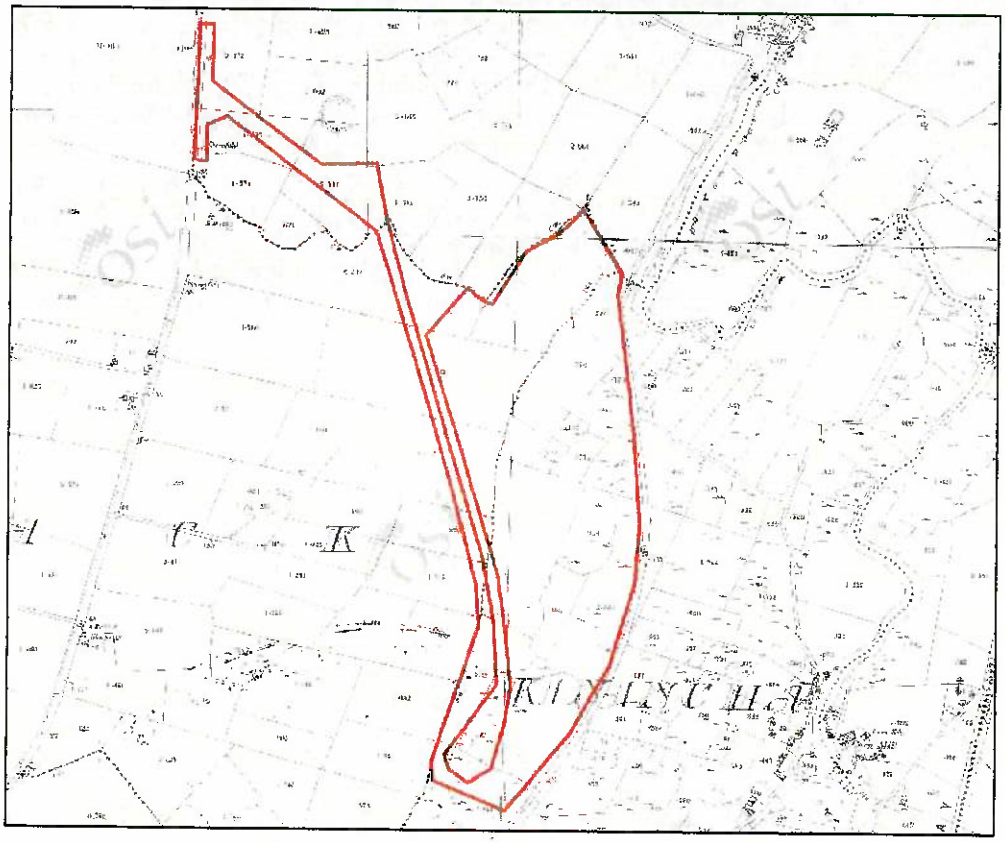
Figure 10.3 Land/land use in the northern half of the site

Figure 10.4 Land/land use in the southern half of the site

As evidenced in Figures 10.3 and 10.4, there are numerous equine jumps across the site, irregular, manmade mini-hillocks of spoil, the remnants of a perimeter track, as well as plentiful pockets of scrub. South of the site is the peri-urban northern margins of Gort, while west and north of it are plentiful fields of pasture. East of the site is occupied with much low-lying scrub in the damp approach towards the Gort River. The vast extent to which land use, field boundaries, settlement patterns and roads within and around the vicinity of the site has radically altered in the last century is best evidenced by comparing Figure 10.5 & 10.6 below.

Figure 10.5 **Aerial view of the proposed site, outlined in red (Google Earth Pro, captured in 2015)**

Figure 10.6 **Approx. outline of site boundary (in red) overlaid onto an O.S. Historic 25 Inch map 1888-1913**



CENTRES OF POPULATION AND HOUSES

With a population of approximately 3,000 residents and located within 1km south of the site, Gort is the centre of population not just for the study area, but for south Galway as well. There are low-density residential housing estates in the peri-urban margins of Gort, within 500m of the southern boundary of the site. Gort is connected to the gas pipeline network and has access to the electricity transmission grid of 38kV, 110kV and 220kV.

While in a rural location, the site is close to, and in some cases adjoins, semi-industrial land use of peri-urban Gort. The town's municipal wastewater treatment plant is located 150m south of the site, along Kinincha Road, while a large and brightly coloured council storage building and yard is located along the road, immediately east of the site. Within 500-800m south of the site, Gort Tyre Centre, Williams Motors and a bottle recycling station are located. Two residences are located within 250m north of the site, along the *cul de sac* local Kinincha Road that aligns the site's eastern boundary. A third (albeit derelict) residence is located along the same road, immediately south of the site. There is a sizeable array of one-off rural housing located 300-500m west of the site on the N18 and along a third-class road linking the townlands of Ballymurphy and Castletown, approximately 1km northeast of the site.

TRANSPORT ROUTES

In the eastern half of the study area, the M18 links Limerick city to Galway city. Since its opening in 2017, the former N18, which runs 300-500m west of the application site and dissects the study in a north-south orientation, has been downgraded to a regional road (R458). The only other non-local road in the study area is the N66 that runs, in places, within 1km east of the site, and the R460 approximately 1.5km southwest of the site. Otherwise, a litter of local/third class roads flow through the study area, with many preferring a general northeast-southwest alignment. The proposed development will be accessed via a new private lane which will be construced from the N18/R458. The Kinincha Road defines most of the eastern boundary of the developmentsite. The road is a narrow local road with an average carriageway width of less than 4m. Dumping of household items is prevalent along certain stretches of this road, particularly adjacent to the site.

Figure 10.7 View north east along Kinincha Road

Figure 10.8 Historical dumping of household items has been prevalent along stretches of Kinincha Road

Gort rail station, located 900m southeast of the site, was reopened in 2010 as part of the Western Rail Corridor linking Limerick and Galway, having been closed in 1976. The rail line runs within 400m east of the site.

PUBLIC AMENITIES AND FACILITIES

With deep and intractable connections with Ireland's national poet, WB Yeats, Coole Park is the most well-known public amenity in the study area, located within 2km west of the site. Coole Park is a nature reserve of approximately 1,000 acres operated by the Irish National Parks & Wildlife Service. Lough Cutra offers a variety of water-based recreation, in the southeast of the site, while the study areas numerous rivers gives rise to fishing/angling opportunities. Lough Cutra loop walk is an approximately 20km circular

trail starting and finishing in Gort. Gort GAA Club, Gort Rugby Club and Gort Golf Club are other well-known public amenities in the locality.

10.3.2 Designations (Plans)

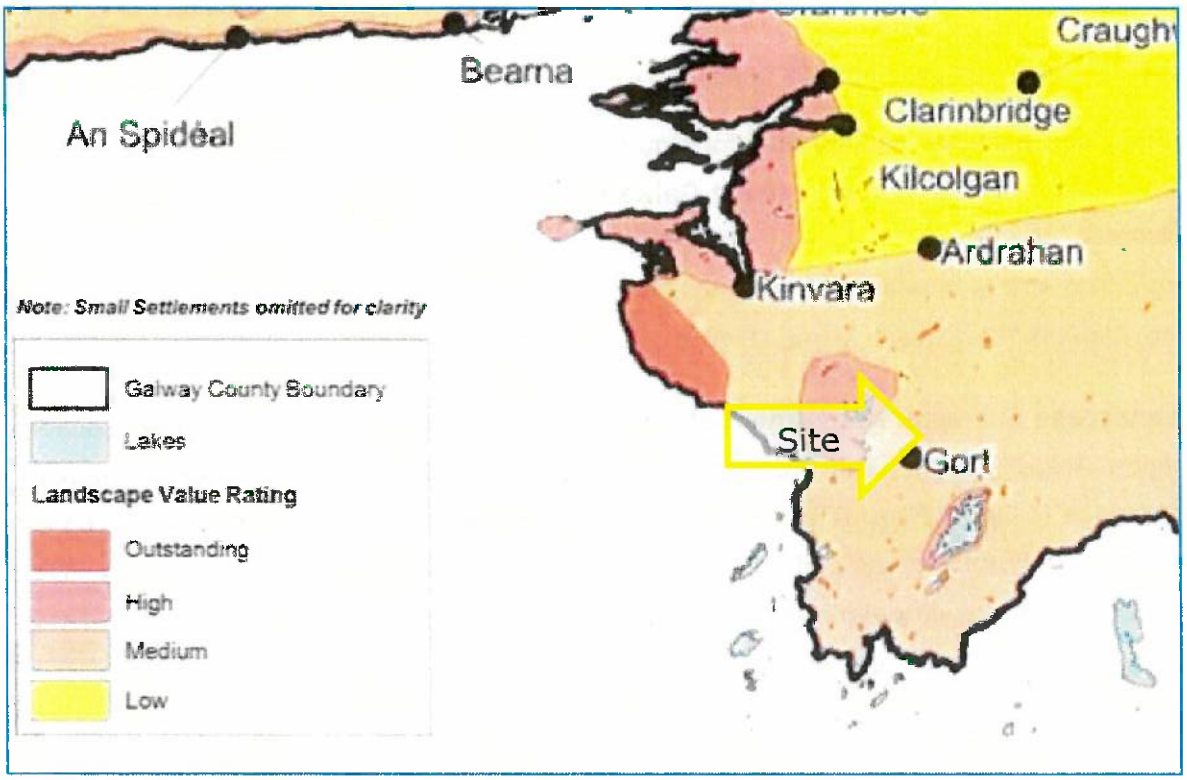
GALWAY COUNTY DEVELOPMENT PLAN 2015-2021

A Landscape Character Assessment for County Galway was undertaken in 2003 and this has been incorporated into the current Galway County Development Plan. As part of this assessment, the county has been divided up into areas with different Landscape Value Ratings. The site is located within a localised area of County Galway that is classified as having *'Medium'* Landscape Value (Figure 10.9 refers).

The Landscape Character Assessment also identifies 25 geographically distinct Landscape Character Areas (LCAs). The proposed site is situated within LCA 4 'Southeast Galway (Clarinbridge to Gort)' (Figure 10.10 refers). The landscape within this LCA is described as "...undulating scrubby grassland, bound by field hedgerows without mature trees. The landscape is scenic without being remarkable and there are long distance views of the Slieve Aughty Mountains to the east."

The landscape sensitivity of this LCA is rated as 'Medium sensitivity' (Class 3), with some pockets of 'Special sensitivity' (Class 4) within 2km west of the application site, and a broad expanse of 'Moderate Sensitivity' (Class 2) within 5km east of the site. LCA 4 is also ascribed as having 'Medium' cultural, socio-economic and environmental landscape values. However, these are wide-ranging, generic classifications of the LCAs within County Galway; LCAs that, in some instances, are more sizeable than the smaller counties elsewhere in Ireland. Such broad-stroke assessments, therefore, do not account for more localised, let alone site-specific, landscape values or sensitivities and are not intended to.

Figure 10.9 Excerpt from the Galway County Development Plan, showing approximate location of site in relation to landscape Value Ratings.



A number of recommendations have been provided in respect of proposed development within these LCAs and the most relevant of these to the proposed biogas plant include;

LCA 4 - 'Southeast Galway (Clarinbridge to Gort)'

- Development is prohibited in the areas that carry a nature designation. Development is permitted in the Class 2 area. Due to the undulating nature of the landscape, development of small-scale buildings will be easily accommodated and naturally screened in the natural hollows. Larger development may require earthworks (cut and fill) and the associated flattening of areas may alter the intimate character in existence.
- There is little coniferous or deciduous forestry in this area therefore large-scale screening by forestry is not appropriate, screening should be achieved using the natural topography. Development should not block important long distant views of the Burren or Slieve Aughty Mountains or local focal points as these views are of regional landscape value.
- New development should be surrounded by hedgerow etc. sections lost during construction and to continue the ecological corridor effect.

The Galway County Development Plan (2015-2021) provides a number of policies and objectives relating to landscape conservation and management. Those that are most relevant to the proposed development include:

- **Policy LCM1 - Preservation of Landscape Character -** Preserve and enhance the character of the landscape where, and to the extent that, in the opinion of the Planning Authority, the proper planning and sustainable development of the area requires it, including the preservation and enhancement, where possible of views and prospects and the amenities of places and features of natural beauty or interest.
- **Objective LCM1 - Landscape Sensitivity Classification** - The Planning Authority shall have regard to the landscape sensitivity classification of sites in the consideration of any significant development proposals and, where necessary, require a Landscape/Visual Impact Assessment to accompany such proposals. This shall be balanced against the need to develop key strategic infrastructure to meet the strategic aims of the plan and having regard to the zoning objectives of serviced development land within the Galway Metropolitan Areas.
- **Objective LCM2 – Landscape Sensitivity Ratings** - Consideration of landscape sensitivity ratings shall be an important factor in determining development uses in areas of the County. In areas of high landscape sensitivity, the design and the choice of location of proposed development in the landscape will also be critical considerations.
- **Objective LCM3 – Open/Unfenced Landscape** - Preserve the status of traditionally open/unfenced landscape. The merits of each case will be considered in light of landscape sensitivity ratings and views of amenity importance.
- **Objective LCM4 – Review of the Landscape Character Assessment** - On adoption of the National Landscape Strategy for Ireland 2015-2025, the Planning Authority shall facilitate the development of the National Landscape Character Assessment prior to reviewing the County Landscape Character Assessment.

Figure 10.10 Excerpt from the Galway County Development Plan, LCM1 - showing approximate location of site in relation to landscape Value Ratings.

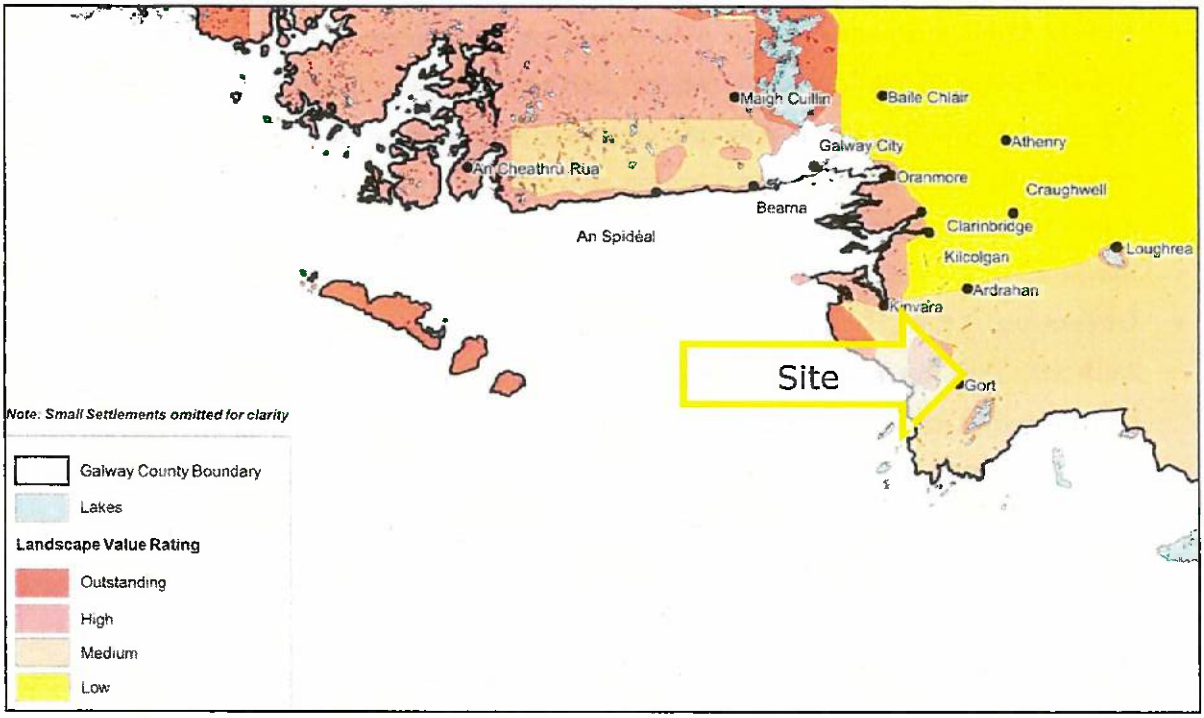
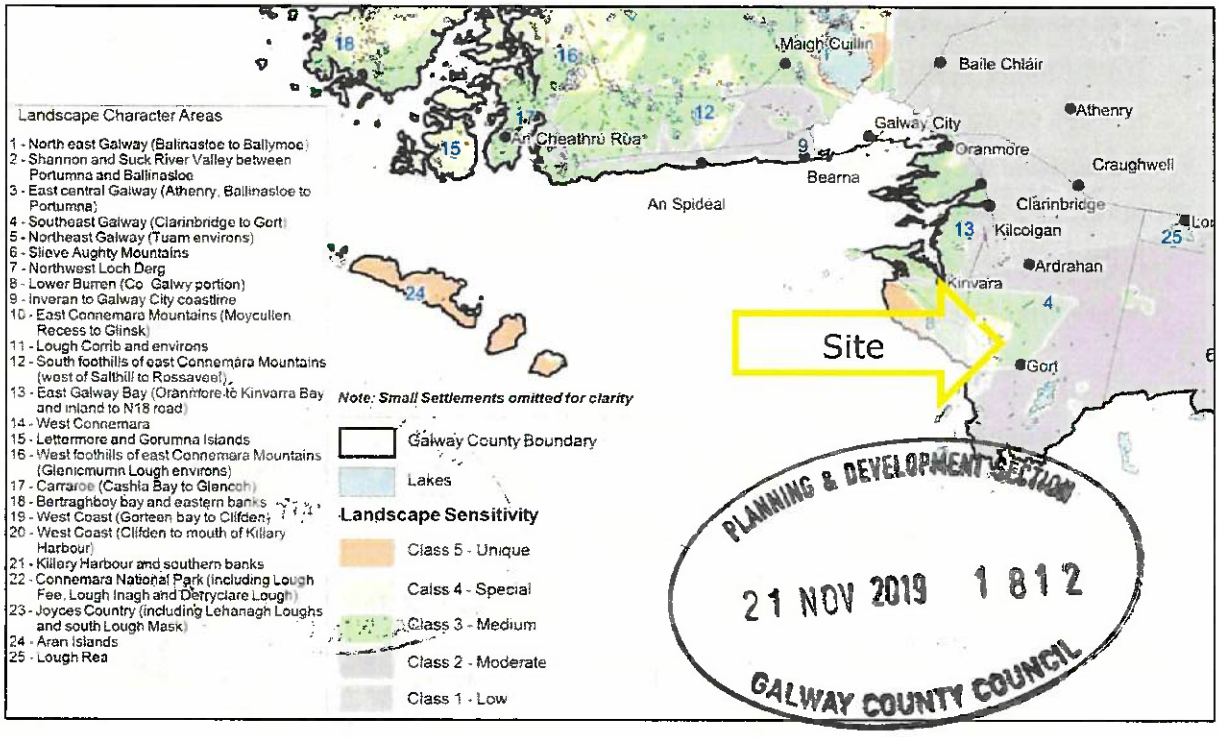


Figure 10.11 Excerpt from Galway County Development Plan, LCM2 – showing approximate location of proposed biogas plant site in relation to Landscape Character Areas (and Landscape Sensitivity).



RENEWABLE ENERGY POLICY

The Galway County Development Plan (2015-2021) also has a number of *Energy and Renewable Energy Objectives*, one of which is particularly relevant to the proposed biogas development and implies that landscape sensitivity alone is not likely to be an impediment to renewable energy development in this area;

- Objective ER 8 – Promoting Energy Hubs
  Galway County Council shall promote Tuam Hub Town, Athenry and Gort and their environs as energy hubs, to take account of opportunities to develop suitable sustainable enterprises due to their proximity to electricity and gas transmission networks and minimizing environmental impact.

VIEWS OF RECOGNISED SCENIC VALUE

Views of recognised scenic value are primarily indicated within the current development plan in the context of scenic views/routes designations, but they might also be indicated on touring maps, guide books, road side rest stops or on post cards that represent the area. With regards to Galway County council, while there is three designated "focal points/views" within the study area, none are of relevance to the application site, as they are not located near to it, or oriented towards it.

10.3.3 Visual Baseline

Only those parts of the receiving environment that potentially afford views of the proposed Development are of concern to this section of the assessment. A computer-generated Zone of Theoretical Visibility (ZTV) map has been prepared to illustrate where the proposed Development is potentially visible from. The ZTV map (Figure 10.12) is based solely on terrain data (bare ground visibility), and ignores features such as trees, hedges or buildings, which may screen views. Given the complex vegetation patterns within this landscape, the main value of this form of ZTV mapping is to determine those parts of the landscape from which the proposed Development will definitely not be visible, due to terrain screening within the 5km study area.

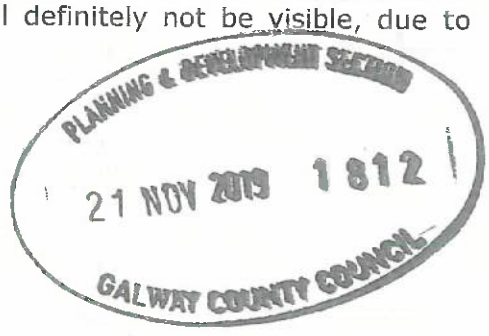
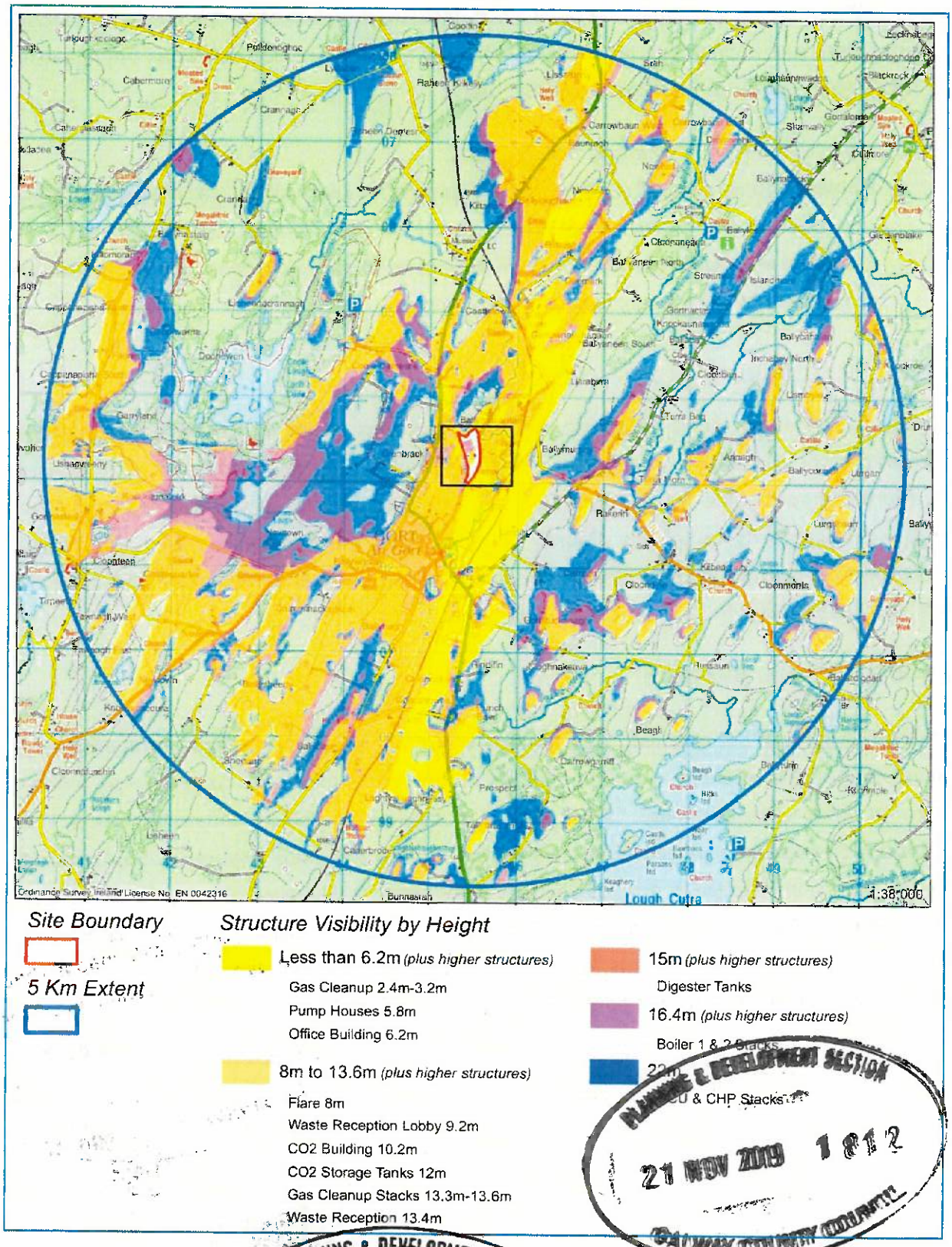


Figure 10.12 Standard (bare-ground) ZTV map (Please refer to Appendix 10.1 for more detailed, larger scale map)



The following key points are illustrated by the bare-ground' ZTV map (Figure 10.12 refers):

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GALWAY COUNTY COUNCIL

- Approximately half of the study area has no theoretical visibility of the proposed development;
- Theoretical visibility generally mirrors the landform of the study area, and its general northeast-southwest alignment;
- The yellow pattern indicates parts of the surrounding landscape that are most exposed to potential views of the development as they may see the ground-based elements such as the office building, pump houses as well as taller features. These areas occur in a narrow band within the low-lying flood plain of the Gort River to the east of the site and stretching northwards and southwards for approximately 3-4km. However, it should be noted that low-lying agricultural areas tend to be relatively enclosed by hedgerow vegetation such that theoretical viability (as indicated by a ZTV map) is seldom reflected by actual visibility of a development.
- The orange pattern indicates parts of the landscape that will be afforded theoretical views of structures between 8m and 13.6m in height, which includes many of the ancillary buildings and structures including the substantial Feedstock reception building. These areas expand beyond the flood plain of the Gort River to the west and southwest of the study area. Only hilltops to the east of the site are afforded this level of potential visibility.
- The remaining areas represented by red, purple and blue patterns are afforded views of only the tallest structures on the site, being the upper sections of the Digester tanks and the various stacks. Such areas are reasonably sporadic and expand downhill from more exposed areas indicated by the yellow and orange patterns. The main area of visibility of taller structures is c. 2km to the west of the site being low-lying land between the old N18 and Coole Lough.

The most important point to reiterate in respect of this 'bare-ground' ZTV is that it is theoretical and does not take account of the considerable vegetation screening in the area.

10.4 Mitigation Measures

Most of the mitigation measures are "embedded" into the siting and design of the proposed development, predominantly through the use of the existing large embankments defining the western and northern boundary of the site. It is for this reason that the mitigation element of this Section of the EIAR precedes the Impact Assessment section (10.5). Particularly because the photomontages used for the visual impact assessment incorporate many of the mitigation elements from the outset. Only the establishment of vegetative screening around the site distinguishes the 'pre-mitigation' and 'post-mitigation' photomontage views.

As previously mentioned, the site currently resembles a three-sided hollow enclosed by large embankments on two of those sides, leaving the east side topographically open. In order to countenance that, it is proposed to construct a similar berm down the east flank of the proposed buildings/structures. This will, in effect, enclose the proposed development on all three sides, just leaving a space of approx. 60m open for the entrance driveway and small car park to be accessed from the south. The material to construct the berm will be sourced from within the site allowing the base level of the tank farm area to be reduced below existing ground levels, thereby reducing the perceived height if these structures. The siting and alignment of this proposed berm will also create a buffer zone of approximately 400m length and 30-50m width from the Kinincha Road, which can be "returned to nature" with native riparian woodland and native calcareous grass seeding.

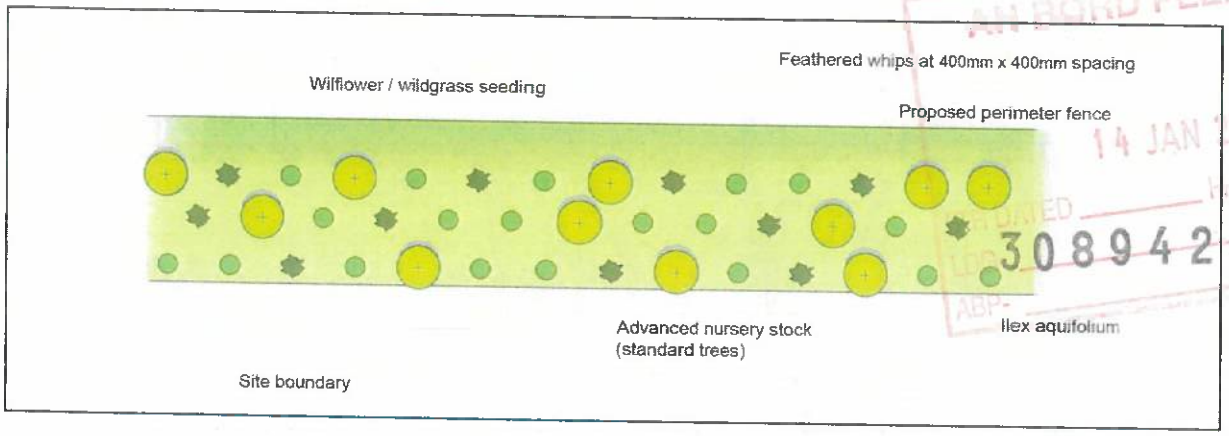
"Embedded mitigation" consideration has also been applied to the colour/tone of the buildings and tall structures within the proposed development. The multiple, 12-15m-high tanks proposed on site will alternate in light and dark tones, so as to reduce any potential distracting or domineering "block-like" appearance from beyond the site by generating a sense of solid and void. The numerous 5-13m-high buildings, such as the pump houses, office building, feedstock reception lobby and CO_2 building will have olive green exterior, similar to large agricultural buildings found regularly about the county. Meanwhile, the 16-22m-high stacks will have a light grey tone, to help the structures blend with the prevalent tone of Irish skies.

Landscape mitigation measures should be read in conjunction with the Landscape Management Plan (Appendix 10.2; Dwg. No. LD.GRTBIOG 01) produced by Macro Works in conjunction with the project Ecologists. Retention of existing boundaries, both within and around the site, maintains the current field pattern, as well as aiding visual screening from key receptors in the locality. In this respect the proposed biogas plant is not perceived to impose itself on the existing landscape pattern.

It is also proposed to bolster existing perimeter vegetation along the east side of the site (Area c) with sections of new hedgerow, composed of whip transplants interspersed with standard trees, in order to assist dense and consistent screening of the site in perpetuity. Plant species will be selected to complement the existing broadleaf hedgerow species mix around the site and will be of local provenance. In addition, a native woodland will be planted in the northeast corner of the site (Area E), between the proposed berm and the eastern site boundary. The proposed berm (Area B) will be planted with a hedgerow combining feathered whips with advanced nursery stock, further 5-6m to the screening effect of this proposed berm once established. Wild grass planting and three

proposed semi natural water bodies (Area D) around the site will also help mitigate the landscape of the site, aid stormwater drainage management and encourage biodiversity.

Figure 10.13 Indicative boundary planting detail showing the approach to proposed hedgerows.



IDENTIFICATION OF VIEWSHED REFERENCE POINTS AS A BASIS FOR ASSESSMENT

Viewshed Reference Points (VRP's) are the locations used to study the visual impacts of a proposal in detail. It is not warranted to include each and every location that provides a view of a development as this would result in an unwieldy report and make it extremely difficult to draw out the key impacts arising from the proposed Development. Instead, the selected viewpoints are intended to reflect a range of different receptor types, distances and angles. The visual impact of a proposed development is assessed by Macro Works using up to 6 no. categories of receptor type as listed below:

- Key Views (from features of national or international importance);
- Designated Scenic Routes and Views;
- Local Community views;
- Centres of Population;
- Major Routes;
- Amenity and heritage features.

VRP's might be relevant to more than one category and this makes them even more valid for inclusion in the assessment. The receptors that are intended to be represented by a particular VRP are listed at the beginning of each viewpoint appraisal. The Viewshed Reference Points selected in this instance are set out in the Table 10.5 and Figure 10.14 below.

Figure 10.14 Viewpoint location map.

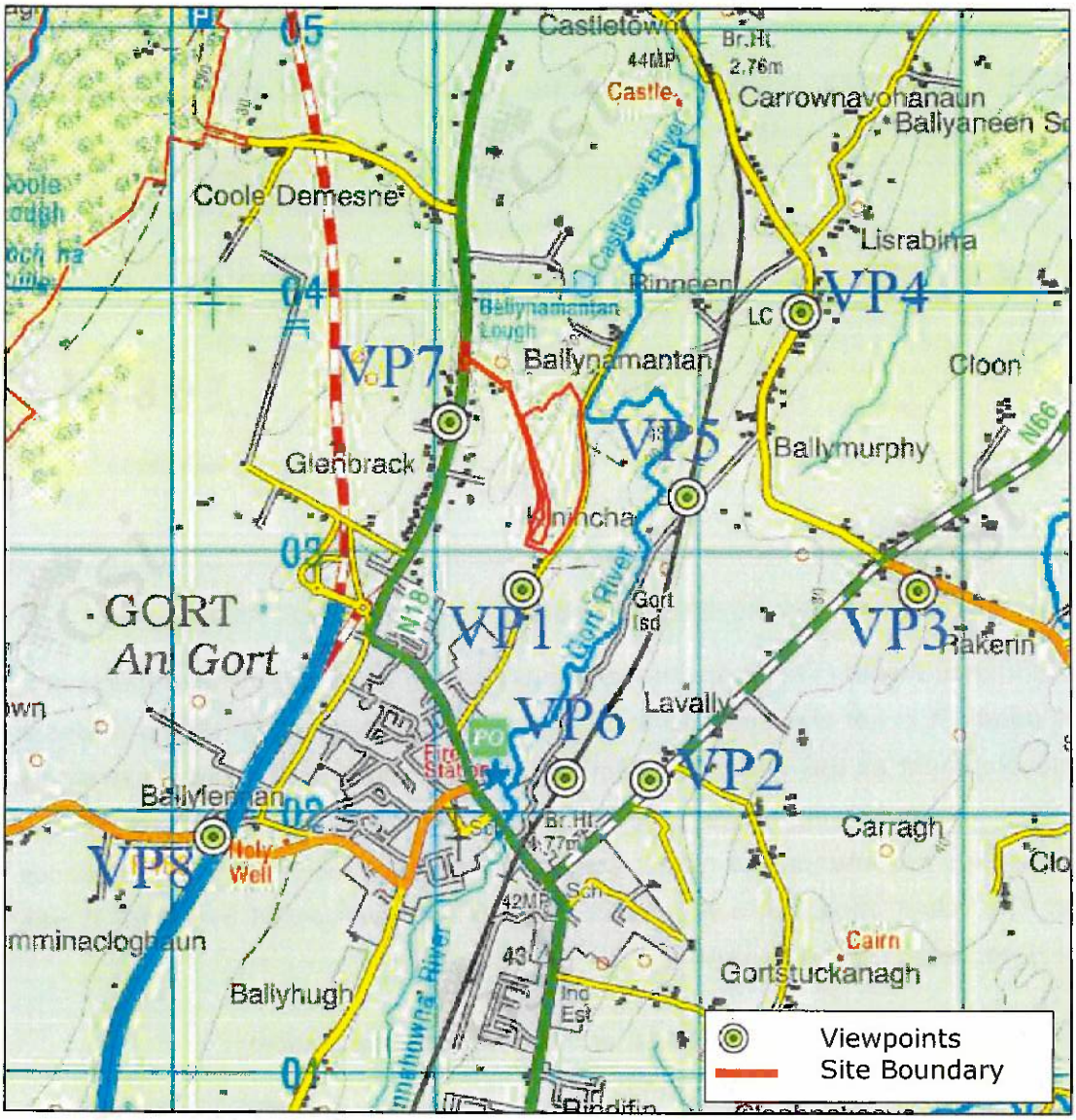


Table 10.5 Outline Description of Selected Viewshed Reference Points (VRPs)

VRP No.	Location	Direction of view
VP1	Kinincha Road, by the waste water treatment plant	N/NE
VP2	N66 east of Gort town centre	N/NW
VP3	Rakern Cemetery off R353 near N66 intersection	NW
VP4	Third class road between Ballymurphy and Castletown	SW
VP5	Vehicular overpass of rail line at quiet local third class road	W
VP6	Pedestrian overpass of rail line at Gort train station	N
VP7	Residences aligning N18 west of site	E/SE
VP8	Overpass of M18, southwest of Gort	NE

10.5 Impact Assessment

10.5.1 Landscape Impact Assessment

LANDSCAPE VALUE AND SENSITIVITY

Landscape value and sensitivity are considered in relation to a number of factors highlighted in the Guidelines for Landscape and Visual Impact Assessment 2013, which are set out below and discussed relative to the proposal site and wider study area.

Landscape quality (condition)

The landscape of the study area is dominated by managed pastoral agriculture, along with a sizeable degree of damp and/or scrubbing grassland, followed by small swathes of native woodland in isolated locations such as Coole Park. Unlike elsewhere in the county, there is little coniferous forestry or mountain terrain across this lowland area. Like the broader south Galway area, undulating scrubby grassland is common. Field boundaries are composed of the rustic dry stonewalls that are characteristic of the west of Ireland; in tandem with generally low hedgerows in which tall trees are prevalent.

The Galway County Development Plan has classified most of study area as having 'Low Landscape Value', with landscape sensitivity rated as 'Medium sensitivity' (Class 3), with this Landscape Character Area having a 'Medium' cultural, socio-economic and environmental landscape values. The quality and condition of landscape on the site, however, is generally lower than that implied by the broader scale County landscape Character Assessment. It is, in fact, an environment that was extremely modified over the last century to the point where former field patterns are unrecognisable. Furthermore, the site's layout, land use, profile, soil and seed mix are at odds with much of the study area, and the county at large. Owing to significant alteration within the last 20 years, this somewhat degraded landscape has distinct crossovers with sites that were once subjected to industrial and/or extractive activities.

Scenic quality

The Galway County Development Plan has classified the Landscape Character Area containing the site as being *"scenic without being remarkable"*. Again, the scenic quality of the site and its immediate surrounds has a lower degree of scenic amenity than the majority of the Landscape Character Area in which it is contained. This is partly to do with the aforementioned modification the landscape on the site has experienced over the last quarter century, as well as the widespread dumping and fly-tipping of rubbish along Kinincha Road, but is also symptomatic of mere geography/topography.

Unless standing on the elevated western boundary of the site, views of the surrounding countryside are stymied from this *de facto* hollow, while views within the site are relatively uninviting. However, the benefit of this *de facto* hollow is that views of the site are also limited from the surrounding landscape, and those that are available focus upon the upper reaches of the large embankments along the western and northern boundaries of the site.

Rarity and Representativeness

The managed, low-lying agricultural landscape prevalent through the study area is representative of the broader south Galway landscape character, as is the frequency of loughs, turloughs and watercourses. The drystone walls, scrubby vegetation and ensuing sense of openness lend this area an equitable sense of place, while hinting at the underlying geology. However, this is not a particularly rare landscape setting in the broader regional context of south Galway. The rarity in the landscape of the study area is found at the wetland/woodland of Coole Park, approx. 2km west of the site: a complex wetland system of underground rivers, turloughs, springs and swallow holes, spread out across low-lying karstic limestone

Conservation interests

Most of the areas of conservation interest/designation are located on the outer realm of the 5km study area, and none are located with 1.5km of the site.

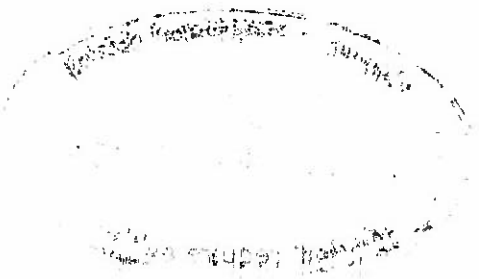
The Special Protection Areas include: Coole-Garryland (Site Code: 004107); Lough Cutra (Site Code: 004056) and Slieve Aughty Mountains (Site code: 004168). Special Areas of Conservation in the study area include: East Burren Complex SAC (Site code: 001926) Carrowbaun, Newhall and Ballylee Turloughs SAC (Site code: 002293); Lough Coy SAC (Site code 002117) and Lough Cutra SAC (Site code: 000299). There are no Natural Heritage Areas (NHAs) in the study are, but there are two proposed NHAs: Coole-Garryland Complex (Site code 000252) and Lough Cutra (Site Code: 000299).

Recreation Value

The landscape of the study area is not synonymous with recreation. However, there is a considerable recreational value associated with Coole Park, as well as the Lough Cutra loop walk, Gort GAA Club, Gort Rugby Club and Gort Golf Club.

Perceptual aspects

Within the study area, there are two locations that hold, to varying extents, recognisable perceptual aspects on the national level. The first is Coole Park for its deep and meaningful association with the Irish Literary Revival in the early 20th century, principally through WB Yeats, whose poem *The Wild Swans at Coole is* arguably one of the best known and



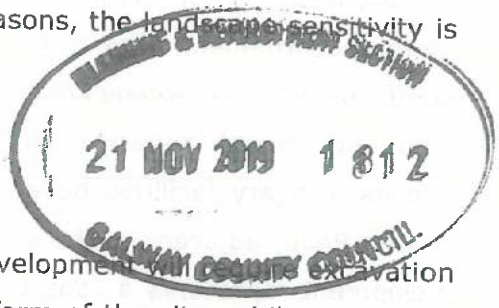
loved poems in Irish literature. In addition, his volume of poetry *In the Seven Woods* again gets its name from the landscape at Coole.

Beyond Coole Park, a minor degree of rural tranquilly can be found in some portions of the study area. However, the remainder of the study area encompasses a strong utilitarian character as a result of residential dwellings and major transport corridors.

Landscape Sensitivity Summary

The landscape within this LCA (Landscape Character Area) is described as having *"...undulating scrubby grassland, bound by field hedgerows without mature trees. The landscape is scenic without being remarkable..."* It has a landscape sensitivity rated by Galway County Council as *'Medium sensitivity'* (Class 3), with some pockets of *'Special sensitivity'* (Class 4) within 2km west of the application site, and a broad expanse of *'Moderate Sensitivity'* (Class 2) within 5km east of the site. In addition, this LCA 4 is also ascribed as having 'Medium' cultural, socio-economic and environmental landscape values.

However, as mentioned earlier, these classifications are wide-ranging, broad-stroke assessments that do not account for more localised, let alone site-specific, landscape values or sensitivities. Overall, it is considered that this is a low-lying, gently undulating rural landscape that is, with the exception of Coole Park, not rare or distinctive for Galway or Connaught. The vast majority of the study area offers only a modest degree of scenic amenity and there is limited sense of the naturalistic within the central study area. In addition, the landscape of the site is much-modified from its legacy of previous centuries. Consequently, the site is at odds with the landscape sensitivity of the wider study area and Landscape Character Area. On balance of these reasons, the landscape sensitivity is deemed to be Low.



MAGNITUDE OF LANDSCAPE EFFECTS

Physical Landform and Land Cover Disturbance

In terms of physical landscape effects, the proposed development will involve excavation that would continue to evolve the much-modified landform of the site, while its current pattern of field boundaries will be retained and enhanced where possible. In this respect the proposed biogas plant is not perceived to impose itself on the existing landscape pattern.

Intensive excavation works will be required to construct the foundations for the proposed settlement & storage tanks and digesters, but the depth and width of these excavations lessons considerably as one travels further south in the site. A large bund will be constructed down the eastside of the proposed works, similar to that existing on its

western and northern sides, as well as three proposed natural-looking water bodies around the site, similar to the turloughs found throughout the site area. In addition, several buildings up to 13.6m in height will be constructed, as will emission stacks ranging from 16.4m to 22m. A new site entrance from/to the N18/R458 will be constructed, as will new access tracks to access the site, which will be similar in nature to farm tracks that can be found throughout this rural context.

Duration, Intensity and Reversibility of Activities

There will be a much higher intensity of site activity during the construction and operational phases of the proposed development than there is at present on site, and likely ever has been other for the construction of the existing berms. Such activity will include the movement of construction machinery on-site as well as HGVs travelling to and from the site. It may also include temporary site lighting and the temporary storage of stripped earth and construction materials. The construction phase is likely to take in the order of 18 months to complete. Construction-related impacts will only result in temporary landscape and visual effects (i.e. effects lasting less than one year, according to the aforementioned Environmental Protection Agency publication *'Guidelines on the Information to be contained in Environmental Impact Assessment Reports'*. Operational-related effects are expected to be permanent (i.e. effects lasting over 60 year) and non-reversible.

In relation to landscape character, the proposal appears to seek the introduction of a relatively large Biogas facility into a rural/agricultural context. However, on closer analysis the more localised context is low-lying scrub pasture taking up from a peri-urban margin of semi-industrial land uses off Kinincha Road, which are within 500m of the site. In that regard, the likely landscape character of the proposed development will be little different to that of the town's municipal wastewater treatment plant located 150m south of the site, while its ancillary facilities have crossovers with the large council storage yard along Kinincha Road, adjacent to the eastern boundary of the site. So, although the proposed development represents a considerable increase in the intensity of built development in the immediate landscape context, the wider context is one that can be described as a utilitarian landscape with rural and peri-urban landscape values.

On the basis of the factors discussed above it is considered that the magnitude of landscape impact is **High-medium** in the direct, immediate vicinity of the site, being those lands contained within approximately 400m of the proposed Development, where it is contained within the same visual context. The magnitude of impact is likely to reduce rapidly with increasing distance thereafter (i.e. **Medium**, **Low** and then **Imperceptible**),

as the proposed Development becomes a proportionally smaller component of the overall rural hinterland landscape fabric.

With reference to the significance matrix (Table 10.3) above, the **Low** landscape sensitivity judgement attributed to the study area coupled with a **High-medium** magnitude of landscape impact in the immediate vicinity (<400m) of the proposed Development is considered to result in an overall significance of no greater than **Moderate-Slight,** with most of the 5km radius study area likely to experience **Imperceptible** landscape impacts.

10.5.2 Visual Impact Assessment

SENSITIVITY OF VISUAL RECEPTORS

Table 10.6 Analysis of Visual Receptor Sensitivity at Viewshed Reference Points

Strong association	Moderate association	Mild association	Negligible association

Scale of value for each criterion

Values associated with the view	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8
Susceptibility of viewers to changes in views								
Recognised scenic value of the view								
Views from within highly sensitive landscape areas								
Primary views from residences								
Intensity of use, popularity (number of viewers)								
Viewer connection with the landscape								
Provision of vast, elevated panoramic views								
Sense of remoteness / tranquillity at the viewing location								
Degree of perceived naturalness								
Presence of striking or noteworthy features								
Sense of Historical, cultural and / or spiritual significance								

Values associated with the view	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8
Rarity or uniqueness of the view								
Integrity of the landscape character within the view								
Sense of place at the viewing location								
Sense of awe								
Overall sensitivity assessment	**L**	**ML**	**M**	**M**	**ML**	**L**	**ML**	**L**

N = Negligible; L = low sensitivity; ML = medium-low sensitivity M = medium sensitivity; HM = High-medium sensitivity; H = high sensitivity; VH = very high sensitivity

MAGNITUDE OF VISUAL EFFECTS

The assessment of visual impacts at each of the selected viewpoints is aided by photomontages of the Proposed Development. Photomontages are a 'photo-real' depiction of the scheme within the view utilising a rendered three-dimensional model of the development, which has been geo-referenced to allow accurate placement and scale. For each viewpoint, the following images have been produced:

1. Existing view;
2. Outline view (yellow outline showing the extent of the proposed buildings and structures, overlaid on the photograph);
3. Montage view pre-mitigation (proposed Development upon completion of construction, prior to maturing of the landscaping);
4. Montage view post-mitigation (proposed Development with landscaping established).

Please note, a fundamental aspect of the aforementioned *"embedded mitigation"* of the proposed development is a berm running for approximately 400m length down the east flank of the proposed buildings and structures. This will not feature in the outline view (i.e. yellow outline) but will be assessed in the following Viewshed Reference Points as part of the Montage view pre-mitigation.

Viewshed Reference Point		Viewing distance	Direction of View
VP1	Kinincha Road, by the waste water treatment plant	191m	N/NE

Representative of:

- Views along Kinincha Road when approaching site from Gort

Receptor Sensitivity

Low

Existing View

Unless approaching the site from the two residences located north of the site on the *cul de sac* local Kinincha Road, this is a view nearly all observers – pedestrians or road users – will experience when approaching the site. A view of two halves, to the west (i.e. left) is a rough pastoral field degenerating to scrub. Bramble chokes the low roadside stonewall, from which a 110kv power line utility pole emanates. The altered, incongruous landform of the site is evident at this distance of nearly 200m: a timber post and rail fence running along the crest of the modified embankment – a lay of the land out of synch with the landform in the foreground.

To the east (i.e. right) of Kinincha Road, the town peri-urban mark has left its legacy, as, behind concrete bollards, a thick belt of Leylandii trees screens Gort's municipal wastewater treatment plant.

Pre-mitigation Visual Impact

As can be determined from the outline view (yellow outline showing the extent of the proposed buildings and structures, overlaid on the photograph), no element of the proposed development is visible from this location. Consequently, the magnitude of visual impact is considered to be **Negligible** prior to the full establishment of screen planting.

Post-mitigation Visual Impact

Again, no element of the proposed development is visible from this location. Consequently, the magnitude of visual impact is considered to be **Negligible** following the full establishment of screen planting.

Summary

Based on the assessment criteria and matrices outlined at **Section 10.1.3** the significance of residual visual impact is summarised below.

	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Low	Negligible	**Imperceptible**
Post-mitigation	Low	Negligible	**Imperceptible**

Viewshed Reference Point		Viewing distance	Direction of View
VP2	N66 east of Gort town centre	978m	N/NW

Representative of:

- Views of residents, pedestrians and road users along this stretch of the N66

Receptor Sensitivity

Medium low

Existing View

From a slightly elevated location east of Gort, the landform and land use context in which the town is set becomes more apparent. That is, in what is a generally low-lying domain, undulating pastoral fields with thick, if not tall, vegetated field boundaries are plentiful, with the exception of one stonewalled field.

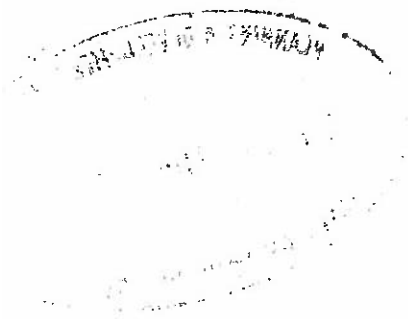
The semi-industrial legacy of Gort's peri-urban northern realm is evident, as is the site's proximity to it. The existing site is noticeable because of its variant topography, which is not a natural bedfellow to the more natural, undulating terrain to all sides of it. In addition, the timber post and rail fence running along the crest of the modified embankment reinforces this incongruity, as do the linear strands of vegetation colonising parts of the embankment. Furthermore, the legacy of energy transmission is clear in this scene, with a number of power lines crisscrossing the landscape, as is the regularity with which more modern, detached "one-off" housing populates this area.

Pre-mitigation Visual Impact

Within the spectrum of elements visible within this vista, the proposed development is not a dominant feature, but it is a noticeable one in terms of its scale and the considerable massing of the combined structures which are closely aligned from this angle with the blocky feedstock reception building to the fore. The complementary and variant colour tones of the structures helps to assimilate it within the scene and overall the scheme is deemed to have a sub-dominant visual presence.

Aesthetically, the bulk and massing of the structures is slightly at odds with surrounding buildings. However, this is clearly a rural hinterland scene in which a transitional form of development such as this industrial/rural biogas plant is not unexpected or out of keeping. Despite their bulk, the buildings appear nestled within the landscape context due to the enclosed nature of the site and the selected colour tones. Indeed the dark olive green of the feedstock reception building ties into several bands of conifers that run along the base of the valley to the left of the site.

On balance of the reasons outlined above, the magnitude of visual impact is considered to be **Medium low** prior to the establishment of screen planting.



Post-mitigation Visual Impact

Once mitigation screen planting along the top of the proposed eastern berm becomes established to a height of around 6m, the scheme will be substantially screened behind it. Only the rooflines of the tank farm and reception building and the upper portions of the stacks will remain visible. These will be subtle elements within this peri-urban scheme and there will be very little detraction from visual amenity. Thus, the magnitude of visual impact is deemed to reduce to Low.

On the basis of these reasons, the magnitude of visual impact is considered to reduce to **Low** following the establishment of planting.

Summary

Based on the assessment criteria and matrices outlined at **Section 10.1.3** the significance of residual visual impact is summarised below.

	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Medium low	Medium low	Moderate slight
Post-mitigation	Medium low	Low	**Slight**

Viewshed Reference Point		**Viewing distance**	**Direction of View**
VP3	Rakern Cemetery off R353 near N66 intersection	1.31km	NW

Representative of:

- West-facing roads users and select residents on R353
- Visitors to Rakern Cemetery

Receptor Sensitivity

Medium

Existing View

An undulating, productive pastoral spread, punctuated by more modern, detached "one-off" housing, populates this scene from an elevated location approx. 1.8km northeast of Gort. It is a locale in which a relatively high level of built intensity - for the rural context - is in existence, including large agricultural buildings. The R353/N66 crossroads is evident in the mid-ground, as is the mountains of east Clare on the horizon. Once more, the legacy of energy transmission on the landscape is palpable, with a number of power lines crisscrossing the landscape.

Pre-mitigation Visual Impact

The proposed development is substantially screened beyond a dense cluster of farmstead buildings and a stand of tall conifers in the lower fore-to-middle ground. A low ridge just beyond these also contributes to the screening of the development, which presents as glimpses of distant buildings between trees that the viewer is likely to associate as farm sheds. If noticed at all by a casual observer, the proposed development will not have any material consequence of the visual amenity of the scene. Consequently, the magnitude of visual impact

is deemed to be **Negligible** even prior to the establishment of mitigation screen planting.

Post-mitigation Visual Impact

Mitigation screen planting along the eastern berm of the site will reduce the visible extent of proposed structures further confirming the Negligible impact.

Summary

Based on the assessment criteria and matrices outlined at **Section 10.1.3** the significance of residual visual impact is summarised below.

	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Medium	Negligible	Imperceptible
Post-mitigation	Medium	Negligible	**Imperceptible**

Viewshed Reference Point		**Viewing distance**	**Direction of View**
VP4	Third class road between Ballymurphy and Castletown	900m	SW

Representative of:

- 10 no. west-facing, adjacent residences along this third-class road
- South-facing cyclists and pedestrians along this third-class road

Receptor Sensitivity

Medium

Existing View

Over a medium-height, fairly broad sweeping view of the south Galway rural setting is evidenced, similar to that in VP3. Owing to the lack of tall vegetation along the roadside, views southwest, west and northwest are open from the series of dwellings that line the eastern side of the road. The semi-secluded "hollow" carved out by the Gort River valley is well-captured from this location, as is the rich degree of visual absorption in the low-lying valley.

Energy transmission and *"one-off"* housing are again present in this view, as is Slieve Carran mountains of the Burren in Clare on the horizon. Lastly, the rail line leading to/from Gort can be made out over a low section of the roadside wall.

Pre-mitigation Visual Impact

The proposed development is a noticeable feature within the middle ground context of this vista, to the fore of residential development associated with the north-eastern fringe of Gort. Although the tank farm and reception building structures are nestled within the enclosed setting of the site, they still present with considerable bulk and massing. It is considered they will have a visual presence in the order of co-dominant to sub-dominant in the overall context of the vista.

The proposed development will increase the scale and intensity of built development within this predominantly rural scene and give the impression of Gort's urban fringe advancing in the direction of the viewer. However, this is already an urban fringe view so this form of development is not incongruous within the setting. The contained siting of the scheme and its dispersed colour scheme that blends with familiar and surrounding tones also aids the sense of visual assimilation. The scheme will not obstruct or unduly intrude on the distant views of the Burren, which is a key asset of this vista.

On balance of the reasons outlined above, the magnitude of visual impact is considered to be **Medium low** prior to the establishment of screen planting.

Post-mitigation Visual Impact

Once established, the planting to the new eastern perimeter berm and the woodland in north-eastern corner of the site will screen all but the roofline profile of the reception building and tank farm with the taller stacks also remaining in view. The scheme will be less prominent and appear more consolidated within the Gort fringe section of the view.

On the basis of these reasons, the magnitude of visual impact is considered to reduce to **Low** following the establishment of planting.

Summary

Based on the assessment criteria and matrices outlined at **Section 10.1.3** the significance of residual visual impact is summarised below.

	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Medium	Medium low	Moderate slight
Post-mitigation	Medium	Low	**Slight**

Viewshed Reference Point		**Viewing distance**	**Direction of View**
VP5	Vehicular overpass of rail line at quiet local third class road	369m	W

Representative of:

- Road users of quiet local third class road

Receptor Sensitivity

ML

Existing View

It should be firstly noted that this view is from an elevated overpass over the aforementioned rail line, along an otherwise narrow, quiet third-class road with just one residence along its 1.5km span; a residence located approx. 60m north of this location, and therefore further from the site.

Similar to VP4, the semi-secluded "hollow" carved out by the Gort River (visible to the south) is again evident from this location, as is the rich degree of visual absorption in the low-lying valley.

Similar to VP2, the semi-industrial legacy of Gort's peri-urban northern realm is again clear to the south (i.e. left) of the view, as is the site's proximity to it, including the large and brightly coloured council storage building and yard immediately east of the site. The existing site is noticeable because of its modified topography, which, much like the vegetation on site, is slightly at odds with the more natural, undulating terrain north, south and east of it. The built intensity of detached urban fringe housing can be traced along the N18, nearing the horizon to the west.

Pre-mitigation Visual Impact

The proposed development will be a prominent feature in the fore-to-middle ground of this view across the river though it joins a complex horizontal band of modified ground, dense vegetation and built development that stretches across the view between a more tranquil rural foreground and the distant mountains beyond. The bulk and massing of the proposed buildings stands in slight contrast to the more modest scale residential dwellings that lie further beyond and in this respect the scheme adds considerably to the intensity and scale of built development within the view. However, it is less out of place in a thematic sense within this rural hinterland scene.

On balance of the reasons outlined above, the magnitude of visual impact is considered to be **Medium** prior to the establishment of screen planting.

Post-mitigation Visual Impact

This view will benefit considerably from the establishment of screen planting atop the proposed eastern berm and the new patch of woodland in the north-eastern corner of the site. Though the upper sections of stacks, the tank farm and the reception building will still remain visible, they are more strongly consolidated within the middle ground 'built development band'. Thus, the magnitude of impact is deemed to reduce to Medium low.

Summary

Based on the assessment criteria and matrices outlined at **Section 10.1.3** the significance of residual visual impact is summarised below.

	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Medium low	Medium	Moderate
Post-mitigation	Medium low	Medium low	**Moderate slight**

Viewshed Reference Point		**Viewing distance**	**Direction of View**
VP6	Pedestrian overpass of rail line at Gort train station	892m	N

Representative of:	• Irish Rail passengers and staff
Receptor Sensitivity	**Low**
Existing View	Set within Gort's peri-urban, semi-industrial northern realm, Gort train station doesn't typically offer elevated or vast views of the surrounding landscape and/or townscape. However, a pedestrian overpass has allowed that in this location. Elements of the existing view have several crossovers with that of VP2, 4 & 5, especially the modified landform within the site, and the scrub vegetation colonising it. In this instance, the propensity of damp areas/pools in the vicinity of the Gort River, is revealed, along with the council storage building, which is located adjacent to the site.
Pre-mitigation Visual Impact	The proposed development will be a noticeable feature of the view due to its considerable bulk and massing of structures within an immediately surrounding agricultural context. However, it is not a prominent feature of the view as it is seen beyond a complex foreground of railway buildings and infrastructure. It also incorporates subdued tones that reflect the surrounding landscape patterns. Parts of the development are also screened by existing and proposed embankments as well as intervening vegetation. Aesthetically, the proposed biogas plant nestles into the surrounding landform and land cover context in a visual sense. Although it represents the northward progression of the urban fringe of Gort, this is a logical sequence that does not appear incongruous in the peri-urban setting. Overall, the magnitude of visual impact is considered to be **Low** prior to the establishment of screen planting measures.
Post-mitigation Visual Impact	Following the establishment of mitigation screen planting along the top of the new eastern perimeter berm, the visible extent of the development will be noticeably reduced. Indeed, only the tops of buildings tanks and stacks will remain discernible, but with little consequence for visual amenity. On the basis of these reasons, the magnitude of visual impact is considered to reduce to **Low negligible** following the establishment of planting.
Summary	Based on the assessment criteria and matrices outlined at **Section 10.1.3** the significance of residual visual impact is summarised below.

	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Low	Low	Slight imperceptible
Post-mitigation	Low	Low negligible	**Imperceptible**

Viewshed Reference Point		Viewing distance	Direction of View
VP7	Residences aligning N18 west of site	279m	E/SE

Representative of:

- Select residences aligning N18, north of Gort.
- South-facing pedestrians and road users on N18, north of Gort.

Receptor Sensitivity

Medium-low

Existing View

Between a hedgerow and a private residence to the southeast, a wave-like pastoral field anchors the foreground, within which utility poles support a 38kV power line. Although less than 300m from the site's western boundary, there is little in this view to suggest the existence of the site. This is because of the semi-secluded "hollow" carved out by the low-lying Gort River valley is effectively invisible, as the topography takes-up east of the site in a similar elevation and undulation as it does west of it (i.e. fluctuating loosely to either side of the 30mAOD contour - approx. 10m higher than Kinincha Road, for example).

The timber post and rail fence aligning the site's western boundary can be made out at the end of the foreground field. Interestingly, the high-pitched roof of the new-looking residence above the fence is, in fact, located on Pound Road, approx. 490m east of the site (i.e. almost 800m from this location), with no indication of the Gort River valley between it and the aforementioned post and rail fence.

Pre-mitigation Visual Impact

The proposed development is substantially contained below the lip of the escarpment at the end of the foreground field. Indeed, only the roofline profile of the reception building and tank farm as well as the upper sections of the tallest stacks can be seen. The nearest and most exposed tanks at the northern end of the site are the most prominent features to the left of the foreground hedgerow.

The same deliberate relationship between the height of the proposed structures and the lowered site levels that allow for the substantial screening of the development from here also server to consolidate it within the surrounding landform and land cover context. There is a sense of a reasonable scale industrial development below the middle ground ridge, but also that it has been tucked out of site to reduce the impact on visual amenity.

On balance of the reasons outlined above, the magnitude of visual impact is considered to be **Low** prior to the establishment of screen planting.

Post-mitigation Visual Impact

Screen planting is predominantly focussed on the eastern (opposite) side of the development, which is also its most exposed side. There will be no consequential change to the visual impact from this side

of the development once the mitigation planting becomes established.

Summary

Based on the assessment criteria and matrices outlined at **Section 10.1.3** the significance of residual visual impact is summarised below.

	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Medium low	Low	Slight
Post-mitigation	Medium low	Low	Slight

Viewshed Reference Point		**Viewing distance**	**Direction of View**
VP8	Overpass of M18, southwest of Gort	1.68km	NE

Representative of:

- Road users of M18 overpass, southwest of Gort.

Receptor Sensitivity

Low

Existing View

This is an elevated view likely to be most experienced by motorists crossing the M18 crossover southwest of Gort. As the town's development has been almost wholly confined to the east of the M18, while west of the motorway is largely an agricultural/rural milieu, it is unlikely there will be very many pedestrians crossing this overpass: those very people who are only capable of fully taking in this view.

We see a large motorway leading away from the overpass; like so many other motorways in this country and overseas, it is in-cut through the landscape at and near this location, thereby greatly limiting views beyond it for its road users. Little can be discerned from the landscape west of the motorway, while a marked density of settlement is evident east of the road. The town centre of Gort can be deduced from the tall church steeple, beyond which the Slieve Aughty Mountains are visible upon the eastern horizon.

Pre-mitigation Visual Impact

The proposed development will not be visible from here due to intervening screening from landform and vegetation and therefore, the magnitude of visual impact is Negligible by default.

Post-mitigation Visual Impact

Mitigation measures will not be visible from here.

Summary

Based on the assessment criteria and matrices outlined at **Section 10.1.3** the significance of residual visual impact is summarised below.

	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Low	Negligible	Imperceptible
Post-mitigation	Low	Negligible	Imperceptible

10.5.3 Cumulative Impacts

It is not considered that the proposed biogas development will have any discernible landscape or visual impacts in-combination with other existing or permitted developments in the vicinity. The nearest developments include an existing municipal water treatment plant (150m south) and County Council storage facility (immediately east of the site). These are typical urban fringe developments and it is considered that any other such developments that occur between the built fringe of Gort and the proposed biogas facility will only serve to consolidate Gort's northern fringe.

10.5.4 Residual Impacts

As discussed above, the landscape and visual impact assessments consider many of the mitigation measures including the siting and design of buildings, eastern perimeter berm, reduction of site levels and the colour scheme to be 'embedded mitigation' (an integral part of the scheme design). Indeed, only the establishment of proposed screen planting measures has been considered as additional mitigation and the pre-planting and post-planting establishment scenarios are assessed in sequence for each of the selected viewpoints (section 10.5.2 above). Thus, the presented scheme has already been assessed in terms of residual impacts. In nearly all instances, the proposed mitigation screen planting successfully reduced predicted visual impacts by at least one assessment category.

10.5.5 Summary of Impacts

In terms of landscape impacts the proposed development is considered to result in substantial physical disturbance and permanent change to the landform and land cover of the site itself. However, this is in the context of already much-modified land form within the site over the last 25 years, which contributes to the site and its immediate surrounds being considered a *'Low'* sensitivity landscape.

There will be noticeable impacts on landscape character as a result of the introduction of the propose biogas plant. These will be most apparent in the localised environs of the site, which are predominantly rural in character. However, when considered in the slightly broader context of the northern urban fringe of Gort the scheme, although considerable in

scale, is consistent with the gradual progression of peri-urban development and is not incongruous in terms of form of function within this landscape setting. These effects are aided by the siting and design of the development which takes advantage of an existing enclosed setting, which can be readily modified to reduce the floor levels of structures and enclose the only open side of the site using excavated material from the site.

For these reasons, a Moderate-slight significance of landscape impact is predicted for the Application Site and its immediate surrounds. This will reduce quickly to Slight and Imperceptible impact significance with increasing distance and as the proposed development becomes a proportionately smaller feature of the broader hinterland land use mix and landscape fabric.

Visual impacts were assessed at 8 No. viewpoints representing a variety of distances, angles and viewing contexts. These viewpoints are considered to range in sensitivity between Medium and Low depending mainly on the extent of the view in question and whether it takes in a predominantly rural or mixed peri-urban landscape context. No designated scenic views will be affected by the proposed development.

When combined with the judgments relating to the magnitude of visual effects the highest level of impact significance was considered to be 'Moderate' (VP5) and 'Moderate-slight' (VP2 and VP4) prior to the establishment of mitigation screen planting. In each instance, the level of impact significance is deemed to reduce by one assessment category once mitigation screen planting become established (4-5 growing seasons) – i.e. VP 5 reduces to 'Moderate-slight' and VP2 and VP4 reduce to 'Slight'.

The most impacted viewpoint (VP5) occurs directly across the Gort River to the east of the site from an elevated railway overpass. It is important to recognise that the overpass in question serves a very quiet farm lane and does not represent views that might be afforded to the nearest residential receptors. Indeed, it was selected mainly to provide an open contextual view of the development form close quarters – something of a rare opportunity given the perimeter berm that will line the eastern side of the development obscuring views from the Kinincha Road. Even from this location the scheme appears strongly contained within the landscape context in view, which is that of Gort's urban fringe. Mitigation screen planting further enhances the sense of consolidation within the landscape. Similar effects occur for both VP2 to the south of the site and VP4 to the northeast albeit at longer viewing distances such that the initial and post-mitigation impacts are lesser.

10.5.6 Statement of Significance

Based on the landscape and visual impact judgements provided throughout this LVIA, the proposed biogas development north of Gort is not considered to give rise to any significant landscape or visual impacts. Instead, landscape and visual impacts are likely to be no greater than Moderate-Slight from select locations within the immediate vicinity of the scheme and generally lower at increasing distances. Though not considered critical in terms of reducing otherwise significant impacts, the proposed planted perimeter berm along the eastern side of the site is considered to be highly successful at reducing potential levels of landscape and visual impact as a 'best-practice' mitigation measure.