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Introduction

Background

8.1 This Chapter of the Environmental Impact Assessment Report (EIAR), prepared by SLR Consulting Ireland, describes the scope, relevant legislation, assessment methodology and the baseline conditions currently existing in the area. It then presents the potential impacts of the Proposed Development and an evaluation of the significance of effects. Further mitigation methods to ameliorate any potential effects are proposed, where appropriate, and residual effects assessed.

8.2 Further details on the proposed development, site activities, environmental management systems and controls at the application sites are provided in the Chapter 2 of this EIAR.

8.3 This Chapter uses data and information presented within the full technical assessment Appendix; Air Quality Assessment[1].

Scope of Work

8.4 The assessment scope has been informed by both national and local planning policy and guidance, established best practice and experience, as well as via the consultation process from consultees.

8.5 The assessment scope is consistent with the approach proposed within the Scoping Report, considering consultation comments received to date.

8.6 The objective of the assessment is to consider the potential air quality effects arising from the construction and operation of the proposed development on the surrounding environment

8.7 The principal air quality impact associated with the proposed development are:

- Road traffic trip generation and dust emissions associated with the construction phase;
- Road traffic trip generation associated with the site operations;
- Odour and dust emissions associated with the site operations;
- Emissions to air associated with the on-site combustion of bio-methane; and
- Ammonia emissions associated with the site operations.

8.8 With respect to the potential for air quality impacts, the key objective at the application site is to manage activities to ensure that air emissions are prevented where possible, and the effects of any residual releases are minimised.

Contributors / Author(s)

The air quality impact assessment presented in this Chapter was prepared by SLR Consulting Ltd. The lead consultant for the study was Richard Johnson (Associate Air Quality Consultant), with support from Matthew Mitchell (Principal Air Quality Consultant). Both consultants are Members of the Institute of Air Quality Management (MIAQM). Further review

[1] SLR report: Killough Quarry Bio-renewables Facility: Air Quality Assessment_v1.0

of document was carried out by Shane McDermott (Technical Director of Environmental & Social Impact Assessment).

Limitations / Difficulties Encountered

8.9 This assessment is compiled based on published regional and local data, guidance documents, and site-specific field surveys. No difficulties were encountered in compiling the required information.

Regulatory Background

8.10 The following sections describe the main legislative policy requirements in respect of air quality associated with the proposed development.

Legislation

Air Quality Standards

8.11 The Ambient Air Quality Standards Regulations 2022[2] (AAQRS) in Ireland set out the framework for monitoring and managing air quality in accordance with European Ambient Air Quality Directive (2008/50/EC) and its daughter directives, which aim to protect human health and the environment.

8.12 The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in Ireland.

8.13 The AQS sets standards and objectives for ten priority pollutants. Standards establish concentrations of pollutants in the atmosphere which can broadly be taken to provide a certain level of environmental quality. Objectives are policy targets, often expressed as maximum concentrations, not to be exceeded (either without exception, or with a limited number of exceedances within a specified timescale).

8.14 Monitoring stations across the country assess air quality, ensuring compliance with EU directives and providing public access to data.

8.15 The standards applied in this assessment for the protection of human health are provided in Error! Reference source not found.[3].

8.16 The AQALs should be assessed at locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. The AQALs should be assessed at locations where members of the public are likely to be regularly present and are likely to be exposed for a period appropriate to the averaging period of the AQAL. Thus, short-term standards, such as the 1-hour mean standard, should only apply to footpaths and other areas which may be regularly frequented by the public. Longer term standards, such as annual means, should apply at houses or other locations which the public can be expected to occupy on a continuous basis.

[2] https://www.irishstatutebook.ie/eli/2022/si/739/made/en/print

[3] Of the five key pollutants with emission ceilings (limits) for which Ireland has compliance commitments under the National Emissions Ceiling Directive (Directive (EU) 2016/22843.[Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Ammonia (NH_3), Non-Methane Volatile Organic Compounds(NMVOCs) and Fine Particulate Matter ($PM_{2.5}$), those listed in Table 8-1 are likely to be associated with the Proposed Development.

Table 8-1 Applied Air Quality Assessment Levels (AQALs)

Human Health	Limit, Target Value or Objective			
Pollutant	Averaging Period	Value	Maximum Number of Allowed Occurrences	Source
Nitrogen Dioxide (NO_2)	1-hour	200 µg/m^3	18	AAQSR
	Annual	40 µg/m^3	0	AAQSR
Sulphur Dioxide (SO_2)	15-minute	266 µg/m^3	35	AAQSR
	1-hour	350 µg/m^3	24	AAQSR
	24-hour	125 µg/m^3	3	AAQSR
Particulate matter with aerodynamic diameter of less than 10 µm (PM_{10})	24-hour	50 µg/m^3	35	AAQSR
	Annual	40 µg/m^3	0	AAQSR
Ammonia (NH_3)	1-hour	2,500	0	Proposed EAL (A)
	Annual	180	0	Proposed EAL (A)

Table notes:

(A) Proposed Environmental Assessment Level (EAL), derived in reference to exposure limits outlined by the Health and Safety Authority[4].

8.17 Regarding ecological receptors sites of nature conservation importance at a European, national and local level are provided environmental protection with respect to air quality. Standards for the protection of ecological receptors are known as C_{Le} for airborne concentrations and C_{Lo} for deposition to land from air.

8.18 EPA guidance[5] on consideration of designated ecological sites defers to methodology outlined in the UK publication "AQTAG06 – Technical Guidance On Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air".

8.19 C_{Le} are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. C_{Lo} are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. C_{Lo} are set for the deposition of various substances to sensitive ecosystems.

8.20 Air quality limit values in relation to vegetation protection are presented separately in Error! Reference source not found..

[4] 2021-code-of-practice-for-the-chemical-agents-and-carcinogens-regulations.pdf

[5] Environmental Protection Agency Office of Environmental Enforcement (OEE) (2019) Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)

Table 8-2 Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	C_{Le} (µg/m^3)	Habitat and Averaging Period
Oxides of Nitrogen (NO_x)	30	Annual mean (all ecosystems)
	75	Daily mean (all ecosystems)
Sulphur dioxide (SO_2)	10	Annual mean (where lichens or bryophytes are present)
Sulphur dioxide (SO_2)	20	Annual mean (all ecosystems)
Ammonia (NH_3)	3.0 (A)	Annual mean
Table note: (A) A more stringent level (1.0 µg/m^3) applies where lichens and bryophytes form a key part of the ecosystem integrity.		

Planning Policy and Development Control

National Spatial Strategy (NSS) / National Planning Framework – Project Ireland 2040

8.21 The National Planning Framework 2040[6] (published in February 2018) is a national planning framework for Ireland. The framework provides the policies for all regional and local plans. The site is within the Southern regional assembly area. In the framework, anaerobic digestion is mentioned within National Strategic Outcome 9 but not in relation to emissions or air quality issues. The general objective is to facilitate development and to protect the environment at the same time.

8.22 Air Quality is referenced in National Policy Objective 64 where it is stated:

8.23 *"Improve air quality and help prevent people being exposed to unacceptable levels of pollution in our urban and rural areas through integrated land use and spatial planning that supports public transport, walking and cycling as more favourable modes of transport to the private car, the promotion of energy efficient buildings and homes, heating systems with zero local emissions, green infrastructure planning and innovative design solutions"*

8.24 The air quality objectives assessed according to industry accepted methodology for EIA are identified in Error! Reference source not found..

Local Planning Policy – Co. Tipperary

8.25 The current Co. Tipperary County Development Plan (CDP)[7] addresses air quality within the planning policy in relation to air quality, where:

"11-1 In assessing proposals for new development to balance the need for new development with the protection and enhancement of the natural environment and human health. In line with the provisions of Article 6(3) and Article 6 (4) of the Habitats Directive, no plans, programmes, etc. or projects giving rise to significant cumulative, direct, indirect or secondary impacts on European sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air),transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this Plan (either individually or in combination with other plans, programmes, etc. or projects)."

[6] Draft First Revision to the National Planning Framework (issued July 2024)
[7] Tipperary County Council (2022) Tipperary County Development Plan 2022 – 2028 Written Statement

Assessment Guidance

8.26 The air quality assessment has been carried out with reference to the principles contained within the following guidance documents:

- EPA Air Dispersion Modelling Guidance Note (AG4)[8];
- EPA Odour Emissions Guidance Note (AG9)[9];
- EPA Odour Impact Assessment Guidance for EPA Licensed Sites (AG5)[10];
- Environment Agency Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air (AQTAG06)[Error! Bookmark not defined.];
- Environmental Protection UK (EPUK) and the Institute of Air Quality Management Guidance (IAQM): Land-Use Planning and Development Control: Planning for Air Quality[11];
- IAQM: Guidance on the Assessment of Dust from Demolition and Construction[12];
- IAQM: Guidance on the assessment of odour for planning[13];
- IAQM: Guidance on the Assessment of Mineral Dust Impacts for Planning[14]; and
- EA: Air emissions risk assessment for your environmental permit [15] ('EA AERA guidance').

Receiving Environment

Study Area

8.27 The application site is located at Killough Hill, situated wholly within the townland of Gaile, Holycross, Co. Tipperary, and within the existing footprint of the Killough quarry development, owned and operated by Roadstone Limited.

8.28 Killough Hill is located approximately 3.5km south of Holycross and 6.5km south of Thurles. The landscape surrounding Killough Hill is almost exclusively made up from agricultural land (mostly pasture interspersed with some arable fields).

8.29 The land immediately surrounding Killough Hill lies at levels of between 110 and 120m Above Ordnance Datum (AOD). Over a distance of 3.5km to the west of the hill the land falls gently towards the River Suir to levels just under 80m AOD. Killough Hill which reaches a maximum height of approximately 215m is the only noticeable highpoint within the general area.

8.30 The existing main extraction void of the quarry at Killough Hill covers approximately the southern three quarters of the hill. To the immediate northwest, north and east of the void, the land slopes towards the surrounding plain, covering a height difference of between 50-80m over a distance of less than 200m. To the immediate southwest of the void the quarry processing facilities are located at levels between 140m AOD and 170m AOD.

[8] EPA Air Dispersion Modelling Guidance Note (AG4) 2020 | Environmental Protection Agency
[9] Odour Emissions Guidance Note (Air Guidance Note AG9) | Environmental Protection Agency
[10] Odour Impact Assessment Guidance for EPA Licensed Sites (AG5) | Environmental Protection Agency
[11] EPUK and IAQM, Land-Use Planning and Development Control: Planning for Air Quality, 2017.
[12] IAQM, Guidance on the Assessment of Dust from Demolition and Construction, v1.1, 2016.
[13] IAQM, Guidance on the assessment of odour for planning, Version 1.1, July 2018.
[14] IAQM, Guidance on the Assessment of Mineral Dust Impacts for Planning, v2.2, 2024.
[15] Air emissions risk assessment for your environmental permit - GOV.UK

8.31 Sensitive receptors within the surrounding rural landscape consists of isolated residential properties and agriculture farms, predominantly along the local road network. There are 22 residences located within 1km of the red line application boundary, of which 12 residences are located within 500m. Gaile National School is located 1.4km west of the Site.

Background Air Quality

8.32 A desk study has been carried out to examine all relevant information relating to air quality conditions around the application site.

8.33 The EPA website was examined to note information on baseline air monitoring data around the application site. The EPA co-ordinates and manages a nationwide network of over 110 monitoring stations which measures the levels of air pollutants and delivers this information to the public as part of the National Ambient Air Quality Monitoring Programme (AAMP), which involved a greatly expanded national monitoring network providing enhanced real-time information to the public, as well as an increased local authority capacity to conduct indicative air monitoring. The results of the monitoring are compared to limit values set out in EU and national legislation on ambient air quality.

8.34 The closest national air quality monitoring location to the Site is 'Kilkenny Seville Lodge' on Callan Road. This is in a Zone C area located ~38 km to the east of the Site. This site is classified as a background site and monitors background levels of NO_2 and NO_X.

8.35 Additional monitoring stations are located within Co. Tipperary, at Clonmel and Tipperary Town, are 'tier 2' monitoring stations which only monitor for PM_{10} and $PM_{2.5}$. The closest stations are in Clonmel ~29km southeast to the site.

8.36 The nearest monitoring station to the Site which monitors SO_2 is located within Co. Laois in Portlaoise, located ~50km northeast of the site.

8.37 The latest year of ratified data from these stations (2023) is presented in Table 8-3, Table 8-4 and **Table 8-5**.

Table 8-3 Monitoring data at Kilkenny Seville Lodge (2023)

Monitoring Station	Annual Mean NO_2 Concentration (µg/m^3)	Number of Hours NO_2 >200µg/m^3	Annual Mean NO_X Concentration (µg/m^3)
Kilkenny Seville Lodge	4.4	0	6.0

Table 8-4 Monitoring data at Portlaoise (2023)

Monitoring Station	Annual Mean SO_2 Concentration (µg/m^3)	Number of Hours SO_2 >266µg/m^3	Number of Hours SO_2 >350µg/m^3	Number of Hours SO_2 >125µg/m^3
Portlaoise	4.11	0	0	0

Table 8-5 Monitoring data at Tipperary. Clonmel and Tipperary Town (2023)

Monitoring Station	Annual Mean PM_{10} Concentration (µg/m^3)	Annual Mean $PM_{2.5}$ Concentration (µg/m^3)
Clonmel	9.2	6.0
Tipperary Town	10.7	6.7

8.38 The tables above indicate that NO_2 and SO_2 concentrations monitored are below the annual mean AQALs and there are no exceedances of the of the 1-hour NO_2 or the 1-hour and 24-hour SO_2 limits. In addition, concentrations of PM_{10} are likely to comply with the requirement that a 24-hour mean of 50 µg/m^3 should not be exceeded more than 35 times in a calendar year.

8.39 For rural areas, such as those surrounding the application site, it is anticipated that background concentrations would be no greater than the measured data presented.

8.40 A Regional-to-local (street) scale air pollutant concentration modelling for Ireland has been undertaken for 2018 and 2019. As published within by the EPA in their 2022 report[16]. These models have been subsequently updated and now provide daily forecast, hourly updated and annual high-resolution maps for air quality in Ireland. These data sets were not however available at the time of writing and the 2019 maps have been sources for reference as presented in **Table 8-6**.

Table 8-6: EPA Background Modelled Data

Pollutant	Mapped Background Concentration within Study Area (µg/m^3)
NO_2	< 5
PM_{10}	7-10
$PM_{2.5}$	5-6
Ammonia (NH_3) (A)	1.1-2.2
Table note: (A) Background maps as published by The Ambient Atmospheric Ammonia Network[17].	

Meteorology: Dispersion of Emissions

8.41 The most important climatic parameters governing the release and dispersal of fugitive emissions from the Site are:

- wind direction which determines the broad direction of dispersal; and
- wind speed will affect ground level emissions by increasing the initial dilution of pollutants in the emission.

Local Wind Speed and Direction Data

8.42 There are no meteorological recording stations located in proximity of the Site; the nearest station (Gurteen) is located at a distance of more than 47km. As such, Numerical Weather Prediction (NWP) data has been utilised for the study. Five consecutive years of hourly-sequential NWP data covering the period 2019 to 2023 (inclusive) was acquired based on the Site location and has been applied in the assessment.

8.43 A windrose, showing the frequency of wind speed and direction used in the assessment is provided in **Figure 8-1**. The windrose shows that winds from the southern and eastern sectors are most frequent, with winds from the northern and eastern sectors least frequent.

[16] Environmental Protection Agency (2022) Air Quality in Ireland Report 2022

[17] Ammonia - Ambient Atmospheric Ammonia in Ireland (ucd.ie)

Rainfall Data

8.44 Relevant rainfall data applicable to the site has been obtained from the Irish Meteorological Service website for the Birr station[18], located approximately 20km west of the application site. Birr Synoptic station was closed in January 2009 and was replaced with Gurteen Recording Station. The annual average days with rainfall greater than 0.2 mm are 206 days per year (56%).

Sensitive Receptors

Human Receptors

8.64 Sensitive locations are those where people may be exposed to emissions to air from the proposed construction or operational phases of the Proposed Development. The closest receptors identified in each direction from the application site boundary are presented in **Table 8-7**. The relative sensitivity of receptors to odour and dust has been defined in reference to guidance published by the IAQM.

Table 8-7: Discrete Human Receptors Identified

Ref.	Description	NGR-x	NGR-y	Sensitivity to Odours and Dust	Distance and Direction from Site Boundary
R1	Residential	610458	650160	High	20m west
R2	Residential	610439	650136	High	10m west
R3	Residential	610353	650225	High	135m west
R4	Residential	610224	650234	High	230m west
R5	Residential	610508	650068	High	40m east
R6	Residential	610473	649955	High	125m south
R7	Residential	610656	649888	High	265m southeast
R8	Residential	610666	649859	High	300m southeast
R9	Residential	610617	649841	High	280m southeast
R10	Residential	610043	650191	High	380m west
R11	Residential	609994	650113	High	425m west
R12	Residential	609924	650089	High	495m west
R13	Residential	610710	649465	High	660m southeast
R14	Residential	610717	649386	High	735m southeast
R15	Residential	609780	649874	High	695m southwest
R16	Residential	610091	651415	High	700m northwest
R17	Residential	610180	651723	High	960m northwest
R18	Residential	609482	650283	High	965m west
R19	Residential	611157	649627	High	820m southeast
R20	Residential	611215	649608	High	880m southeast

[18] Birr synoptic weather station 1979–2008 averages (met.ie)

R21	Residential	611334	649578	High	1000m southeast
R22	Residential	611232	649454	High	985m southeast
R23	Residential	610896	651806	High	1120m north
R24	Residential	611650	651341	High	1170m northeast
R25	Residential	611769	651101	High	1180m northeast
R26	Residential	612295	650332	High	1570m east
R27	Residential	612069	650001	High	1410m east
R28	Residential	611849	649673	High	1400m southeast

Ecological Receptors

8.45 Ecological receptors have been identified in reference to the screening distances presented within the EA AERA guidance. There is one European designated ecological site located within 15km of the Proposed Development; the Lower River Sur SAC, located approximately 3.3 km to the west. There is one local ecological designation located within 2km of the Site; an area of woodlands on Killough Hill, designated as a proposed Natural Heritage Area (pNHA), which bounds the Site at the northern extent.

Table 8-8: Designated Ecological Sites

Designation	Site Name	Approx. Distance and Direction from Site Boundary
SAC	Lower River Suir SAC	3.3km west
pNHA	Killough Hill Woodlands	At northern boundary

Impact Assessment Methodology

Construction Dust

8.46 A construction dust assessment has been undertaken with reference to IAQM guidance. The assessment of risk is determined by considering the risk of dust effects arising from four activities in the absence of mitigation:

- Demolition;
- Earthworks;
- Construction; and
- Construction vehicle track-out.

8.47 The assessment methodology considers three separate dust impacts with account being taken of the sensitivity of the area that may experience these effects:

- Annoyance due to dust soiling;
- The risk of health effects due to an increase in exposure to PM10; and
- Harm to ecological receptors.

8.48 The first stage of the assessment involves a screening to determine if there are sensitive receptors within threshold distances of the site activities associated with the construction phase of the scheme. A detailed assessment is required where a:

- Human receptor is located within 350m of the Site, and/or within 50m of routes used by construction vehicles, up to 500m from the site entrance(s); and/or
- Ecological receptor is located within 50m of the Site, and/or within 50m of routes used by construction vehicles, up to 500m from the site entrance(s).

8.49 The dust emission class (or magnitude) for each activity is determined on the basis of the guidance, indicative thresholds and professional judgement. The risk of dust effects arising is based upon the relationship between the dust emission magnitude and the sensitivity of the area. The risk of impact is then used to determine the appropriate mitigation requirements, whereby through effective application, residual effects are considered to be 'not significant'.

Road Traffic Emissions

8.65 The assessment of air quality effects in relation to traffic generated during the construction and operational phases of the Proposed Development has been screened in accordance with the IAQM guidance to identify whether further assessment is required. If the Proposed Development does not exceed the screening criteria, then effects are considered insignificant.

8.66 The applied screening procedure is as follows:

- Comparison of road traffic trips generated by the Proposed Development with reference to EPUK-IAQM thresholds to determine the extent of the affected road network:
  - Within or adjacent to an AQMA:
    - a change of Light Goods Vehicle (LGV)[19] flows of more than 100 Annual Average Daily Traffic (AADT); and/or
    - a change of Heavy Goods Vehicle (HGV) flows of more than 25 AADT.
  - Outside of an AQMA:
    - a change of LGV flows of more than 500 AADT; and/or
    - a change of HGV flows of more than 100 AADT.

Operational Dust

8.67 The assessment of fugitive dust emissions from the Proposed Development has been undertaken on the basis of a conceptual model that takes into consideration the potential sources, surrounding receptors and the pathway between source and receptor in order to assess the magnitude of risk.

8.68 Specifically, the following aspects are considered:

- The type of activities proposed on site including designed-in mitigation measures to determine:
  - The potential magnitude of releases in general terms; and
  - The nature of that release.

[19] Whilst it is noted that the IAQM refers to Light-duty Vehicles (LDVs) and Heavy-duty Vehicles (HDVs), this assessment has applied the synonymous terms LGV and HGV throughput.

- The location of receptors in the surrounding area with specific consideration of the type of receptor and therefore their potential sensitivity to dust.

Odours

8.69 Prediction of off-site odour concentrations has been undertaken utilising the AERMOD atmospheric dispersion modelling software, utilising 5 years of recent meteorological data in combination with building elevations and local topographical data. Odour modelling assessments are undertaken using the concept of the European Odour Unit (ou_E), as defined in EN13725:2022[20].

8.70 The emission parameters for the extraction and abatement system have been determined in reference to the anticipated specification for the unit.

8.71 The magnitude of the predicted odour effect has been determined in reference to the AG9 Odour Emissions Guidance Note and IAQM Odour Guidance and with specific consideration of the likely offensiveness of odours from the Site as well as the sensitivity of the nearby receptors.

Combustion Emissions

8.72 The emission parameters for the CHP plant have been supplied by the client and have been defined in consideration of the anticipated heat and electrical power requirements of the Proposed Development. The pollutants assessed and emission concentrations applied have been defined in reference to the Medium Combustion Plant Directive (MCPD)[21].

8.73 The emission parameters for the flaring of biogas have been defined in consideration of the anticipated composition of the combusted gas, as well as the flow rate of gas to the flare.

8.74 In accordance with the EPA's EIAR guidance and EPA guidance AG4 (therein deferring to AQTAG06), a detailed dispersion modelling assessment has been undertaken to assess the impact of combustion emissions from the Proposed Development. The model has been used to predict ground level concentrations for comparison against AQALs, Critical Loads and Critical Levels.

Ammonia Emissions

8.75 The emission parameters for the extraction and abatement system have been determined in reference to the anticipated specification for the unit.

8.76 In accordance with the EPA's EIAR guidance and EPA guidance AG4, a detailed dispersion modelling assessment has been undertaken to assess the impact of NH_3 emissions from the Proposed Development. The model has been used to predict ground level concentrations for comparison against AQALs, Critical Loads and Critical Levels.

Assessment of Air Quality Impacts at Ecological Sites

8.77 In addition to EPA guidance AG4, and EA AERA guidance, the EA's Operational Instruction 66_12[22] details how air quality impacts on ecological sites should be assessed. This guidance is considered suitable for this assessment providing a risk-based screening criteria

[20] EN13725:2022 stationary source emissions – determination of odour concentration by dynamic olfactometry and odour emission rate.
[21] Directive (EU) 2015/2193, Limitation of emissions of certain pollutants into the air from medium combustion plants, European Parliament, November 2015.
[22] EA Operational Instruction 66_12 - Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation. Issued 08/05/2012.

to determine whether impacts will have 'no likely significant effects' for European sites, 'no likely damage' for ASSIs, or 'no significant pollution' for other sites, as follows:

- PC does not exceed 1% of the long-term C_{Le} and/or C_{Lo} or that the PEC does not exceed 70% long-term C_{Le} and/or C_{Lo} for European sites and ASSIs;
- PC does not exceed 10% of the short-term C_{Le} for NO_X for European sites and ASSIs; and
- PC does not exceed 100% of the short- or long-term C_{Le} and/or C_{Lo} for other conservation sites.

Assessment of Impacts

8.78 A summary of the assessment of impacts is presented below, full details are presented within the full technical assessment Appendix; Air Quality Assessment.

Construction Stage

Construction Dust

8.79 There are no statutory ecological designations (SAC, SPA or ASSI) located within the relevant screening distances of the Site. As such, assessment of construction dust upon ecological receptors is not required.

8.80 There are human receptors located within 250m of the Site boundary. As such, assessment of the impact significance of construction dust has been undertaken in application of the conceptual model outlined within IAQM guidance.

8.81 The findings of the conceptual model conclude that nearby human receptors are classified as (at worst) 'medium risk' in relation to dust soiling effects on people and property and 'low risk' in relation to human health impacts. However, potential dust effects during the construction phase are considered to be temporary in nature and may only arise at particular times (i.e. certain activities and/or meteorological conditions).

8.82 Nonetheless, commensurate with the above designation of dust risk, mitigation measures, as identified by the IAQM guidance, are required to ensure that any potential impacts arising during the construction phase are reduced and, where possible, completely removed. In accordance with the guidance, providing effective mitigation measures are implemented, (such as those outlined in under the header 'Mitigation Measures' below) construction dust impacts are considered to be 'not significant'.

Construction Road Traffic

8.83 It is anticipated that the construction phase of the Proposed Development would result in the following approximate daily trip generation (as AADT):

- 60 LGV movements (in consideration of the temporary employment of contractors at the Site, as well as deliveries); and
- 6 HGV movements (in consideration of the size and nature of the construction operations).

8.84 The Proposed Development is located within air quality zone D, therefore the screening criteria for a site located outside of (and not in proximity of) an Air Quality Management Area has been applied: 100 HGV and 500 LGV movements (as AADT).

8.85 Based upon the anticipated trip generation details outlined above, the predicted number of additional journeys are well below the relevant screening criteria. Therefore, in accordance

with the EPUK & IAQM Guidance, the 'impacts [on air quality from construction phase trips] can be considered as having an insignificant effect'.

Operational Stage

Fugitive Dust

8.86 There are no statutory ecological designations (SAC, SPA or ASSI) located within the relevant screening distances of the Site. There are human receptors located within 400m of the Site boundary. As such, assessment of the impact significance of operational fugitive dust has been undertaken in application of the conceptual model outlined within IAQM guidance for human receptors only.

8.87 The findings of the conceptual model conclude that nearby human receptors are classified as 'slight adverse' at two receptors (R1 and R2) and 'negligible' at all other sensitive receptors identified.

8.88 The likely significance of effects as a result of dust generation from the proposed operations is therefore considered to be 'not significant' at all identified receptor locations in accordance with the IAQM guidance.

8.89 Furthermore, in consideration of predicted background PM_{10} concentrations, a significant increase in PM concentrations in the local area as a result of the operations at the Proposed Development would not be anticipated. It is therefore considered that in the absence of designed-in or additional mitigation, the impact and effect of the Proposed Development operations on human health from emissions of PM_{10} (and $PM_{2.5}$) would be negligible.

Operational Road Traffic

8.90 It is anticipated that the Proposed Development would result in the following approximate daily trip generation (as AADT):

- 40 LGV movements (in consideration of the employment of up to 20 staff at the Site); and
- 76 HGV movements (in consideration of import/export operations at the Site).

8.91 The Proposed Development is located within air quality zone D, therefore the screening criteria for a site located outside of (and not in proximity of) an Air Quality Management Area has been applied: 100 HGV and 500 LGV movements (as AADT).

8.92 Based upon the anticipated trip generation details outlined above, the predicted number of additional journeys are below the relevant screening criteria. Therefore, in accordance with the EPUK & IAQM Guidance, the 'impacts [on air quality from operational phase trips] can be considered as having an insignificant effect'.

Odours

8.93 Air from the areas within which potentially odorous processes will be undertaken will be extracted to and treated by an onsite odour abatement system (which will be in operation 24 hours per day, 7 days a week), or captured by the gas capture system.

8.94 The airflow rate from the odour abatement system has been defined in consideration of the volumes of the areas to be served by the system and the anticipated number of air changes from those areas. The proposed performance criteria (i.e. odour concentration following abatement) for the system was defined in reference to the Best Available Techniques Reference (BAT) reference document for the Waste Treatment sector.

8.95 In consideration of the offensiveness of odours and receptor sensitivities, and in adoption of a precautionary approach, the most stringent $C_{98,\ 1\text{-hour}}$ 1.5 ou_E/m^3 odour criterion has been applied to present the point at which the adverse effect of odours might be observed at the existing residential receptors identified.

8.96 The odour exposures predicted as a result of emissions from the Site at the identified sensitive receptors are below the relevant impact criterion ($C_{98,\ 1\text{-hour}}$ 1.5 ou_E/m^3). Therefore in reference to the IAQM guidance, the likely significance of effects as a result of potential odours from the Proposed Development is considered 'not significant'.

Combustion Plant Emissions

8.97 The CHP plant would be fuelled on biogas produced at the Site, and would have an anticipated thermal input of 2.1 MW_{th} and electrical output of 0.9MW_e. The emission parameters have been defined in consideration of such a unit. In reference to the MCPD the assessment of combustion emissions is limited to NO_X and SO_2.

8.98 The findings of the assessment in relation to human receptors are as follows:

- The impact (magnitude of change) can be described as 'negligible' at all receptors identified;
- AQALs are not exceeded at any of the receptor locations; and
- The maximum Ground Level Concentration (GLC) does not exceed short-term AQALs.

8.99 Therefore the effect on air quality at human receptors as a result of emissions from the CHP plant is considered 'not significant'.

Ammonia Emissions

8.100 Air from the areas within which the significant sources of ammonia are located will be extracted to and treated by an onsite odour abatement system (which will be in operation 24 hours per day, 7 days a week), or captured by the gas capture system.

8.101 The airflow rate from the odour abatement system has been defined in consideration of the volumes of the areas to be served by the system and the anticipated number of air changes from those areas. The proposed performance criteria (i.e. ammonia concentration following abatement) for the system was defined in reference to the BAT reference document for the Waste Treatment sector.

8.102 The findings of the assessment in relation to human receptors are as follows:

- The impact can be described as 'negligible' at all receptors identified;
- AQALs are not exceeded at any of the receptor locations; and
- The maximum GLC does not exceed the short-term AQAL.

8.103 Therefore the effect on air quality at human receptors as a result of ammonia emissions from the Site is considered 'not significant'.

Assessment of Critical Levels and Loads

8.104 The results of the assessment of impacts at ecological receptors on C_{Le} (as a result of NO_X, SO_2 and NH_3 emissions) and critical loads (as a result of NO_X, SO_2 and NH_3 emissions) are follows:

- the PC is below 1% of the long-term C_{Le} at the SAC;
- the PC is below 10% of the short-term C_{Le} at the SAC;
- the PC is below 100% of the short- and long-term C_{Le} at the pNHA;

- the nitrogen deposition PC exceeds 1% of the C_{Lo} at the SAC; however the PEC is less than 70% of the C_{Lo};
- the acid deposition PC does not exceed 1% of the C_{Lo} at the SAC; and
- the nitrogen and acid deposition PC does not exceed 100% of the C_{Lo} at the pNHA.

8.105 Therefore it is determined that the Proposed Development will cause 'no likely significant effects' at the Lower River Suir SAC and 'no significant pollution' at the Killough Hill Woodlands pNHA.

Unplanned Events

8.106 The proposed gas flare would be utilised in an emergency situation to dispose of excess biogas, if necessary. The gas flare would have the capacity to combust up to 2,500 m^3/hr of biogas. Due to the short-term nature of potential emissions, the scope of assessment is limited to the consideration of short-term impacts at human receptors only.

8.107 Emission parameters have been defined based on the anticipated composition of the biogas, the maximum flow to the flare (as outlined above) and application of the calculations outlined within the Guidance on Landfill Gas Flaring.

8.108 The findings of the assessment in relation to human receptors are as follows:

- The short-term impacts can be described as 'negligible' at all receptors identified;
- AQALs are not exceeded at any of the receptor locations; and
- The maximum GLC does not exceed the short-term AQAL.

8.109 Therefore the effect on air quality at human receptors as a result of emergency flaring of biogas is considered 'not significant'.

Cumulative / Synergistic Impacts

8.110 In essence, cumulative impacts are those which result from incremental changes caused by other past, present, or reasonably foreseeable actions or developments together with those generated by the proposed development. Therefore, the potential impacts of the proposed development cannot be considered in isolation but must be considered in addition to impacts already arising from existing or planned development.

8.111 This air quality impact assessment herein indicates that the proposed development is predicted to result in a 'not significant' effect on local air quality. There are no other significant sources of air emissions approved or planned within 2 km of the application site. Therefore, no potential for significant cumulative impacts has been identified and the cumulative impact of the proposed development is classified as insignificant.

Interaction with Other Impacts

8.112 The potential impact on air quality by the project on sensitive receptors including sensitive ecological receptors and people living in the area has been fully assessed in this chapter. The overall impact of the project on these receptors is further considered in Chapter 4 Population and Human Health and Chapter 5 Biodiversity.

Mitigation Measures

8.113 A wide range of mitigation and management measures are recommended for implementation during the construction phase of the Proposed Development, as outlined in Table 7-1 of the Air Quality Assessment within **Appendix 8-A**.

8.114 The operational/containment measures proposed, which have been considered within this assessment, are outlined below:

- the chicken litter and brewery residue siloes, cattle slurry tanks, pretreatment and equalization building, bio rest tanks and digestate handling building would be enclosed structures, with air extracted to the odour abatement system;
- the odour abatement system would treat the air extracted from these areas prior to discharge to atmosphere via a dispersion stack at a height of 17.5m;
- the anaerobic digestion process would be undertaken within sealed reactors located within the bioconversion building. These sealed reactors would be connected to the gas capture system, ensuring complete containment;
- a site management system would be in place to ensure routine cleaning measures are undertaken;
- Implementation of a speed restriction (25 km/hr) within and around the quarry;
- The existing road surfaces will be maintained;
- Water-assisted dust sweeper(s) will be utilised on the access road and local roads, as necessary, to remove material tracked out of the site; and
- Vehicles leaving the site will use the existing wheel wash.

Residual Impact Assessment

Human Receptors

8.115 With the effective implementation of the mitigation measures identified, the residual impacts at human receptors are considered 'not significant'. Furthermore, the potential residual impacts from the construction phase would be short-term (i.e. for the duration of the construction phase only) and local in extent.

Ecological Receptors

8.116 With the effective implementation of the mitigation measures identified, the residual impacts at ecological receptors are considered to cause 'no likely significant effects' (at the Lower River Suir SAC) and 'no significant pollution' (at the Killough Hill Woodlands pNHA).

Monitoring

Construction Stage

8.117 Ongoing dust deposition monitoring is carried out by Roadstone at the existing quarry site at selected locations along the extent of the site boundary, with the locations shown on **Figure 17-1** (Chapter 17 Mitigation and Monitoring). The German Standard VDI 2119 (Bergerhoff Method) is employed where dust gauges consisting of a collection vessel and dust stand are positioned at representatively important dust locations. The applicable limit value is the TA Luft limit value of 350 mg/m2/day for a 1 month monitoring period. Review of the dust monitoring results from these locations will be used to ensure the mitigation measures are effective for the duration of the construction phase.

Operational Stage

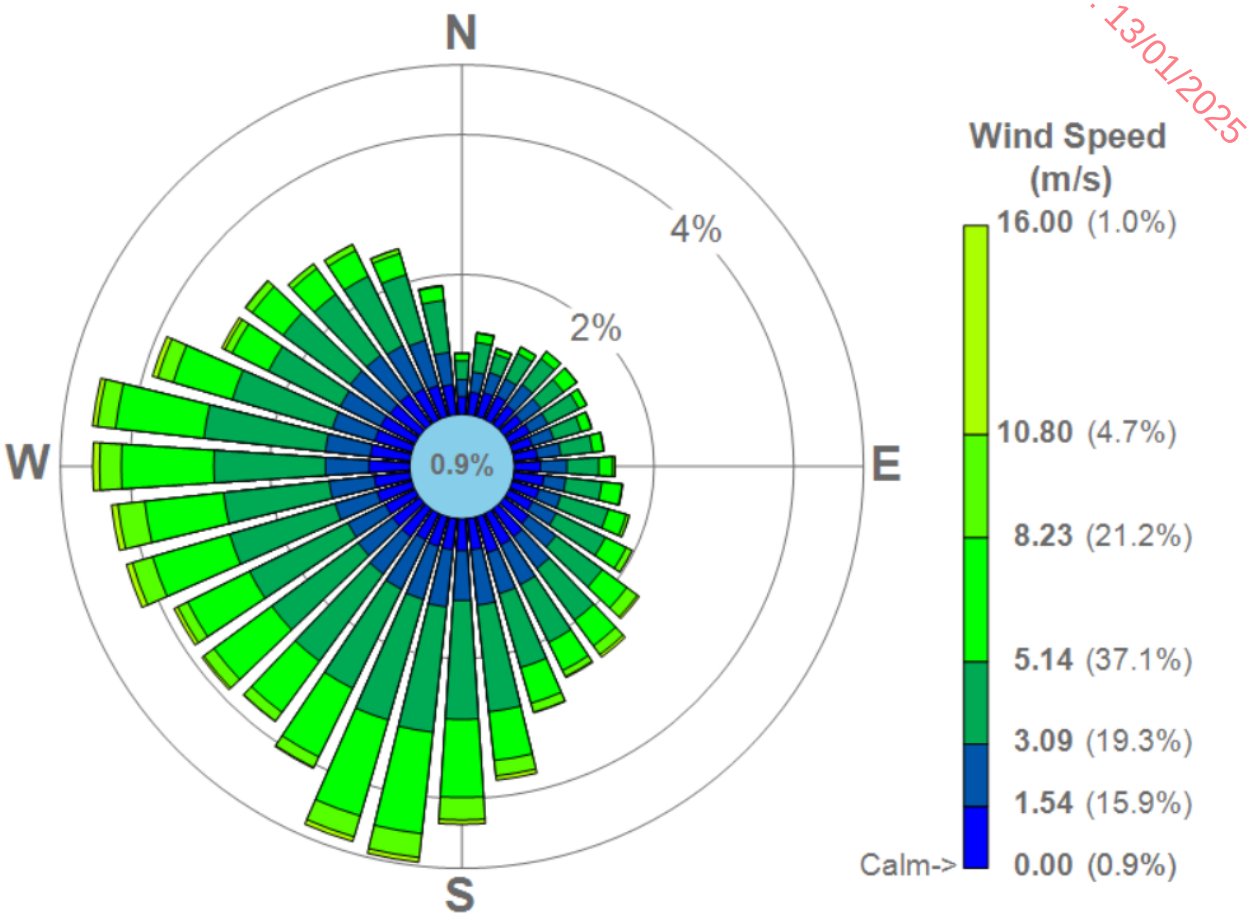
8.118 The proposed development will be a licenced facility under the Industrial Emissions Directive and will therefore be required to conduct "sniff surveys" in accordance with AG5 at regular intervals to demonstrate that mitigation measures are sufficient to prevent odour

nuisance at sensitive off-site locations. Stack monitoring of the odour abatement system exhaust may also be required at regular intervals under the conditions of the IE Licence.

8.119 Emissions monitoring of selected point sources will also be carried out in accordance with conditions of the future IE license. Typically, this monitoring would be carried out for the linear generator and odour abatement stacks due to their continuous nature and being the primary point sources onsite.

Figures

Figure 8-1: Windrose for NWP Meteorological Data (2019-2023)



Appendices

Appendix 8-A: Air Quality Assessment

Air Quality Assessment

Killough Quarry Bio-renewables Facility

Roadstone Ltd

Prepared by:

SLR Consulting Limited

SLR Project No.: 501.065577.00001

6 January 2025

Revision: v1.0

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
v1.0	6 January 2025	RJ	MM	SM

Basis of Report

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1.0 Introduction

SLR Consulting Limited (SLR) has been instructed by Roadstone Ltd (hereafter referred to as Roadstone) ('the client') to undertake an Air Quality Assessment (AQA) in support of their planning application for a bio-renewables production facility (the 'Proposed Development') incorporating Anaerobic Digestion (AD) at their existing Killough Quarry facility in Gaile townland, Holycross, Co. Tipperary.

The assessment describes the scope, relevant legislation, assessment methodology and the baseline conditions currently existing in the area. It then presents the potential impacts of the Proposed Development and an evaluation of the significance of effects.

1.1 Background

The overall planning application area (red line boundary) covers approximately 6.3 hectares (c. 15.6 acres) located within the southwest corner of the existing permitted Killough hard rock quarry.

The area is currently occupied by processed aggregate stockpiles which will be relocated elsewhere within the quarry site prior to any development works associated with the proposed bio-renewables facility being carried out.

The proposed bio-renewables production facility (incorporating anaerobic digestion) will utilise agricultural feedstocks to produce:

- bio-methane (gas);
- compressed bio-methane;
- carbon dioxide (CO_2);
- electricity (green); and
- organic fertilisers (pelleted).

The AD facility would have the capacity to produce approximately 12,170 m³ of biomethane per annum. Pelleted fertiliser will be available for supply to local agriculture and traders off-site. Further details of the proposed operations are presented in section 6.1.

1.2 Objective and Scope

The assessment scope has been informed by both national and local planning policy and guidance, established best practice and experience, as well as via the consultation process from consultees.

The objective of the assessment is to consider the potential air quality effects arising from the construction and operation of the Proposed Development on the surrounding environment.

The principal air quality impact associated with the Proposed Development are:

- Road traffic trip generation and dust emissions associated with the construction phase;
- Road traffic trip generation associated with the site operations;
- Odour and dust emissions associated with the site operations;
- Emissions to air associated with the on-site combustion of bio-methane; and
- Ammonia emissions associated with the site operations.

With respect to the potential for air quality impacts, the key objective at the application site is to manage activities to ensure that air emissions are prevented where possible, and the effects of any residual releases are minimised.

2.0 Legislation and Relevant Guidance

This assessment has been informed by the Environmental Protection Agency's (EPAs) 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' [1] (the 'EIAR guidance').

2.1 Air Quality Standards

The Ambient Air Quality Standards Regulations (AAQSR) 2022[2] in Ireland set out the framework for monitoring and managing air quality in accordance with European Ambient Air Quality Directive (2008/50/EC) and its daughter directives, which aim to protect human health and the environment.

The AAQSR sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in Ireland.

The AAQSR sets standards and objectives for ten priority pollutants. Standards establish concentrations of pollutants in the atmosphere which can broadly be taken to provide a certain level of environmental quality. Objectives are policy targets, often expressed as maximum concentrations, not to be exceeded (either without exception, or with a limited number of exceedances within a specified timescale).

Monitoring stations across the country assess air quality, ensuring compliance with EU directives and providing public access to data.

The standards applied in this assessment for the protection of human health are provided in Table 2-1, these are collectively termed Air Quality Assessment Levels (AQALs) throughout this report.

Table 2-1: Applied Air Quality Assessment Levels (AQALs)

Human Health	Limit, Target Value or Objective			
Pollutant	**Averaging Period**	**Value**	**Maximum Number of Allowed Occurrences**	**Source**
Nitrogen Dioxide (NO_2)	1-hour	200 µg/m^3	18	AAQSR
	Annual	40 µg/m^3	0	AAQSR
Sulphur Dioxide (SO_2)	15-minute	266 µg/m^3	35	AAQSR
	1-hour	350 µg/m^3	24	AAQSR
	24-hour	125 µg/m^3	3	AAQSR
Particulate matter with aerodynamic diameter of less than 10 µm (PM_{10})	24-hour	50 µg/m^3	35	AAQSR
	Annual	40 µg/m^3	0	AAQSR
Ammonia (NH_3)	1-hour	2,500	0	Proposed EAL (A)

[1] Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)

[2] https://www.irishstatutebook.ie/eli/2022/si/739/made/en/print

Human Health	Limit, Target Value or Objective			
	Annual	180	0	Proposed EAL (A)

Table notes:
(A) Proposed Environmental Assessment Level (EAL), derived in reference to exposure limits outlined by the Health and Safety Authority[3].

The AQALs should be assessed at locations where members of the public are likely to be regularly present and are likely to be exposed for a period appropriate to the averaging period of the AQAL. Thus, short-term standards, such as the 1-hour mean standard, should only apply to footpaths and other areas which may be regularly frequented by the public. Longer term standards, such as annual means, should apply at houses or other locations which the public can be expected to occupy on a continuous basis (examples are presented in Table 2-2).

Table 2-2: Relevant Public Exposure

Averaging Period	Relevant Locations	Standards should apply at:	Standards don't apply at:
Annual mean	Where individuals are exposed for a cumulative period of six months in a year	Building facades of residential properties, schools, hospitals etc.	Facades of offices Hotels Gardens of residences Kerbside sites
24-hour mean	Where individuals may be exposed for eight hours or more in a day	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure is expected to be short term
1-hour mean	Where individuals might reasonably be expected to spend one hour or longer	As above together with kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access
15-minute mean	Where individuals might reasonably be expected to spend 15-minutes or longer	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	-

2.2 Protection of Ecological Receptors

Sites of nature conservation importance at a European, national and local level are provided environmental protection with respect to air quality. Standards for the protection of ecological receptors are known as critical levels (C_{Le}) for airborne concentrations and critical loads (C_{Lo}) for deposition to land from air.

EPA guidance[4] on consideration of designated ecological sites defers to methodology outlined in the UK publication 'AQTAG06 – Technical Guidance on Detailed Modelling

[3] 2021-code-of-practice-for-the-chemical-agents-and-carcinogens-regulations.pdf

[4] Environmental Protection Agency Office of Environmental Enforcement (OEE) (2019) Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)

Approach for an Appropriate Assessment for Emissions to Air'[5]. Reference has also been made to the Environment Agency's 'Air emissions risk assessment for your environmental permit' guidance[6].

Ecological designations have been considered within the following distances of the Site:

- Within 15km of the Site:
  - Special Protection Areas (SPAs)
  - Special Areas of Conservation (SACs)
  - Ramsar sites (protected wetlands)
  - Areas of Special Scientific Interest (ASSIs)
- Within 2km of the Site:
  - local nature sites (Natural Heritage Areas (NHA), ancient woodlands, local wildlife sites and national and local nature reserves).

2.2.1 Critical Levels (C_{Le})

C_{Le} are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. The relevant C_{Le}'s for the protection of vegetation and ecosystems are presented in Table 2-3.

Table 2-3: Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	C_{Le} (µg/m^3)	Habitat and Averaging Period
Oxides of Nitrogen (NO_x)	30	Annual mean (all ecosystems)
	75	Daily mean (all ecosystems)
Sulphur dioxide (SO_2)	10	Annual mean (where lichens or bryophytes are present)
Sulphur dioxide (SO_2)	20	Annual mean (all ecosystems)
Ammonia (NH_3)	3.0 (A)	Annual mean
Table note: (A) A more stringent level (1.0 µg/m^3) applies where lichens and bryophytes form a key part of the ecosystem integrity.		

2.2.2 Critical Loads (C_{Lo})

C_{Lo} are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. C_{Lo} are set for the deposition of various substances to sensitive ecosystems. In relation to combustion emissions C_{Lo} for acidification are relevant which can occur via both wet and dry deposition; however, on a local scale only dry (direct deposition) is considered significant. Deposition of nitrogen can cause eutrophication and acidification; the relevant C_{Lo} are presented in Section 4.1.2.

[5] Environment Agency (2014) AQTAG06 – Technical Guidance On Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air

[6] Air emissions risk assessment for your environmental permit - GOV.UK

2.3 National Spatial Strategy (NSS) / National Planning Framework – Project Ireland 2040

The National Planning Framework 2040[7] (published in February 2018) is a national planning framework for Ireland. The framework provides the policies for all regional and local plans.

The site is within the Southern regional assembly area. In the framework, anaerobic digestion is mentioned within National Strategic Outcome 9 but not in relation to emissions or air quality issues. The general objective is to facilitate development and to protect the environment at the same time.

Air Quality is referenced in National Policy Objective 64 where it is stated:

> *"Improve air quality and help prevent people being exposed to unacceptable levels of pollution in our urban and rural areas through integrated land use and spatial planning that supports public transport, walking and cycling as more favourable modes of transport to the private car, the promotion of energy efficient buildings and homes, heating systems with zero local emissions, green infrastructure planning and innovative design solutions".*

2.3.1 Local Planning Policy – Co. Tipperary

The current Co. Tipperary County Development Plan (CDP)[8] addresses air quality within the planning policy in relation to air quality, where:

> *"11-1 In assessing proposals for new development to balance the need for new development with the protection and enhancement of the natural environment and human health. In line with the provisions of Article 6(3) and Article 6 (4) of the Habitats Directive, no plans, programmes, etc. or projects giving rise to significant cumulative, direct, indirect or secondary impacts on European sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air),transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this Plan (either individually or in combination with other plans, programmes, etc. or projects)."*

2.4 Assessment Guidance

The air quality assessment has been carried out with reference to the principles contained within the following guidance documents:

- EPA Air Dispersion Modelling Guidance Note (AG4)[9];
- EPA Odour Emissions Guidance Note (AG9)[10];
- EPA Odour Impact Assessment Guidance for EPA Licensed Sites (AG5)[11];
- Environment Agency Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air (AQTAG06)[5];

[7] Draft First Revision to the National Planning Framework (issued July 2024)

[8] Comhairle Contae Thiobriad Arann / Tipperary County Council (2022) Tipperary County Development Plan 2022 – 2028 Written Statement

[9] EPA Air Dispersion Modelling Guidance Note (AG4) 2020 | Environmental Protection Agency

[10] Odour Emissions Guidance Note (Air Guidance Note AG9) | Environmental Protection Agency

[11] Odour Impact Assessment Guidance for EPA Licensed Sites (AG5) | Environmental Protection Agency

- Environmental Protection UK (EPUK) and the Institute of Air Quality Management Guidance (IAQM): Land-Use Planning and Development Control: Planning for Air Quality[12];
- IAQM: Guidance on the Assessment of Dust from Demolition and Construction[13];
- IAQM: Guidance on the assessment of odour for planning[14];
- IAQM: Guidance on the Assessment of Mineral Dust Impacts for Planning[15]; and
- EA: Air emissions risk assessment for your environmental permit[16].

[12] EPUK and IAQM, Land-Use Planning and Development Control: Planning for Air Quality, 2017.
[13] IAQM, Guidance on the Assessment of Dust from Demolition and Construction, v1.1, 2016.
[14] IAQM, Guidance on the assessment of odour for planning, Version 1.1, July 2018.
[15] IAQM, Guidance on the Assessment of Mineral Dust Impacts for Planning, v2.2, 2024.
[16] Air emissions risk assessment for your environmental permit - GOV.UK

3.0 Assessment Methodology

3.1 Construction Dust

A construction dust assessment has been undertaken with reference to IAQM guidance. The assessment of risk is determined by considering the risk of dust effects arising from four activities in the absence of mitigation:

- Demolition;
- Earthworks;
- Construction; and
- Construction vehicle track-out.

The assessment methodology considers three separate dust impacts with account being taken of the sensitivity of the area that may experience these effects:

- Annoyance due to dust soiling;
- The risk of health effects due to an increase in exposure to PM_{10}; and
- Harm to ecological receptors.

The first stage of the assessment involves a screening to determine if there are sensitive receptors within threshold distances of the site activities associated with the construction phase of the scheme. A detailed assessment is required where a:

- Human receptor is located within 350m of the Site, and/or within 50m of routes used by construction vehicles, up to 500m from the site entrance(s); and/or
- Ecological receptor is located within 50m of the Site, and/or within 50m of routes used by construction vehicles, up to 500m from the site entrance(s).

The dust emission class (or magnitude) for each activity is determined on the basis of the guidance, indicative thresholds and professional judgement. The risk of dust effects arising is based upon the relationship between the dust emission magnitude and the sensitivity of the area. The risk of impact is then used to determine the appropriate mitigation requirements, whereby through effective application, residual effects are considered to be 'not significant'.

3.2 Road Traffic Emissions

The assessment of air quality effects in relation to traffic generated during the construction and operational phases of the Proposed Development has been screened in accordance with the IAQM guidance to identify whether further assessment is required. If the Proposed Development does not meet exceed the screening criteria, then effects are considered insignificant.

The applied screening procedure is as follows:

- Comparison of road traffic trips generated by the Proposed Development with reference to EPUK-IAQM thresholds to determine the extent of the affected road network:
    - Within or adjacent to an AQMA:
        - a change of Light Goods Vehicle (LGV)[17] flows of more than 100 Annual Average Daily Traffic (AADT); and/or
        - a change of Heavy Goods Vehicle (HGV)[17] flows of more than 25 AADT.

[17] Whilst it is noted that the IAQM refers to Light-duty Vehicles (LDVs) and Heavy-duty Vehicles (HDVs), this assessment has applied the synonymous terms LGV and HGV throughput.

- Outside of an AQMA:
  - a change of LGV flows of more than 500 AADT; and/or
  - a change of HGV flows of more than 100 AADT.

3.3 Operational Dust

The assessment of fugitive dust emissions from the Proposed Development has been undertaken on the basis of a conceptual model that takes into consideration the potential sources, surrounding receptors and the pathway between source and receptor in order to assess the magnitude of risk.

Specifically, the following aspects are considered:

- The type of activities proposed on site including designed-in mitigation measures to determine:
  - The potential magnitude of releases in general terms; and
  - The nature of that release.
- The location of receptors in the surrounding area with specific consideration of the type of receptor and therefore their potential sensitivity to dust.

3.4 Assessment of Odour

Prediction of off-site odour concentrations has been undertaken utilising the AERMOD atmospheric dispersion modelling software, utilising 5 years of recent meteorological data in combination with building elevations and local topographical data. Odour modelling assessments are undertaken using the concept of the European Odour Unit (ou_E), as defined in EN13725:2022[18].

The emission parameters for the extraction and abatement system have been determined in reference to the anticipated specification for the unit.

The magnitude of the predicted odour effect has been determined in reference to the AG9 Odour Emissions Guidance Note and IAQM Odour Guidance and with specific consideration of the likely offensiveness of odours from the Site as well as the sensitivity of the nearby receptors.

3.5 Assessment of Combustion Plant Emissions

The emission parameters for the CHP plant have been supplied by the client and have been defined in consideration of the anticipated heat and electrical power requirements of the Proposed Development. The pollutants assessed and emission concentrations applied have been defined in reference to the Medium Combustion Plant Directive (MCPD)[19].

The emission parameters for the flaring of biogas have been defined in consideration of the anticipated composition of the combusted gas, as well as the flow rate of gas to the flare.

In accordance with the EPA's EIAR guidance and EPA guidance AG4 (therein deferring to AQTAG06), a detailed dispersion modelling assessment has been undertaken to assess the impact of combustion emissions from the Proposed Development. The model has been used to predict ground level concentrations for comparison against AQALs, Critical Loads and Critical Levels.

[18] EN13725:2022 stationary source emissions – determination of odour concentration by dynamic olfactometry and odour emission rate.

[19] Directive (EU) 2015/2193, Limitation of emissions of certain pollutants into the air from medium combustion plants, European Parliament, November 2015.

3.6 Assessment of Ammonia

The emission parameters for the extraction and abatement system have been determined in reference to the anticipated specification for the unit.

In accordance with the EPA's EIAR guidance and EPA guidance AG4, a detailed dispersion modelling assessment has been undertaken to assess the impact of NH_3 emissions from the Proposed Development. The model has been used to predict ground level concentrations for comparison against AQALs, Critical Loads and Critical Levels.

3.7 Assessment of Air Quality Impacts at Ecological Sites

In addition to EPA guidance AG4, and EA AERA guidance, the EA's Operational Instruction 66_12[20] details how air quality impacts on ecological sites should be assessed. This guidance is considered suitable for this assessment providing a risk-based screening criteria to determine whether impacts will have 'no likely significant effects' for European sites, 'no likely damage' for ASSIs, or 'no significant pollution' for other sites, as follows:

- PC does not exceed 1% of the long-term C_{Le} and/or C_{Lo} or that the PEC does not exceed 70% long-term C_{Le} and/or C_{Lo} for European sites and ASSIs;
- PC does not exceed 10% of the short-term C_{Le} for NO_x for European sites and ASSIs; and
- PC does not exceed 100% of the short- or long-term C_{Le} and/or C_{Lo} for other conservation sites.

[20] EA Operational Instruction 66_12 - Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation. Issued 08/05/2012.

4.0 Baseline Environment

4.1 Site Setting and Sensitive Receptors

The application site is located at Killough Hill, situated wholly within the townland of Gaile, Holycross, Co. Tipperary, and within the existing footprint of the Killough quarry development, owned and operated by Roadstone Limited.

Killough Hill is located approximately 3.5km south of Holycross and 6.5km south of Thurles. The landscape surrounding Killough Hill is almost exclusively made up from agricultural land (mostly pasture interspersed with some arable fields).

Sensitive receptors within the surrounding rural landscape consists of isolated residential properties and agriculture farms, predominantly along the local road network. There are 22 residences located within 1km of the red line application boundary, of which 12 residences are located within 500m. Gaile National School is located 1.4km west of the Site.

Further information is illustrated in Figure 4-1 and tabulated in Table 4-1 and Table 4-2 below.

4.1.1 Human Receptors

Sensitive locations are those where people may be exposed to emissions to air from the proposed construction or operational phases of the Proposed Development. The closest receptors identified in each direction from the application site boundary are presented in Figure 4-1 and Table 4-1. The relative sensitivity of receptors to odour and dust has been defined in reference to guidance published by the IAQM.

Figure 4-1: Site Setting and Modelled Human Receptors

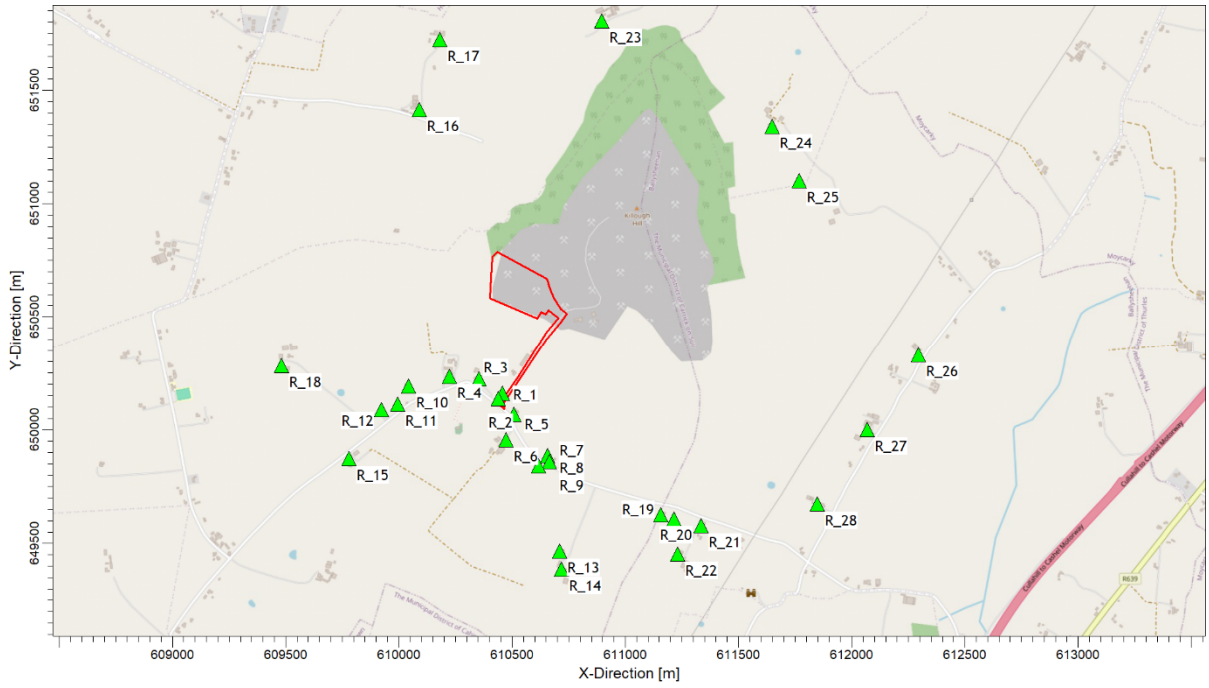


Table 4-1: Discrete Human Receptors Identified

Ref.	Description	NGR-x	NGR-y	Sensitivity to Odours and Dust	Distance and Direction from Site Boundary
R1	Residential	610458	650160	High	20m west
R2	Residential	610439	650136	High	10m west
R3	Residential	610353	650225	High	135m west
R4	Residential	610224	650234	High	230m west
R5	Residential	610508	650068	High	40m east
R6	Residential	610473	649955	High	125m south
R7	Residential	610656	649888	High	265m southeast
R8	Residential	610666	649859	High	300m southeast
R9	Residential	610617	649841	High	280m southeast
R10	Residential	610043	650191	High	380m west
R11	Residential	609994	650113	High	425m west
R12	Residential	609924	650089	High	495m west
R13	Residential	610710	649465	High	660m southeast
R14	Residential	610717	649386	High	735m southeast
R15	Residential	609780	649874	High	695m southwest
R16	Residential	610091	651415	High	700m northwest
R17	Residential	610180	651723	High	960m northwest
R18	Residential	609482	650283	High	965m west
R19	Residential	611157	649627	High	820m southeast
R20	Residential	611215	649608	High	880m southeast
R21	Residential	611334	649578	High	1000m southeast
R22	Residential	611232	649454	High	985m southeast
R23	Residential	610896	651806	High	1120m north
R24	Residential	611650	651341	High	1170m northeast
R25	Residential	611769	651101	High	1180m northeast
R26	Residential	612295	650332	High	1570m east
R27	Residential	612069	650001	High	1410m east
R28	Residential	611849	649673	High	1400m southeast

4.1.2 Ecological Receptors

Mapping data published by the National Parks and Wildlife Service (NPWS)[21] and the Air Pollution information System (APIS)[22] has been utilised to identify designated ecological sites and protected habitats within the Site locale.

There is one European designated ecological site located within 15km of the Proposed Development; the Lower River Sur SAC, located approximately 3.3 km to the west.

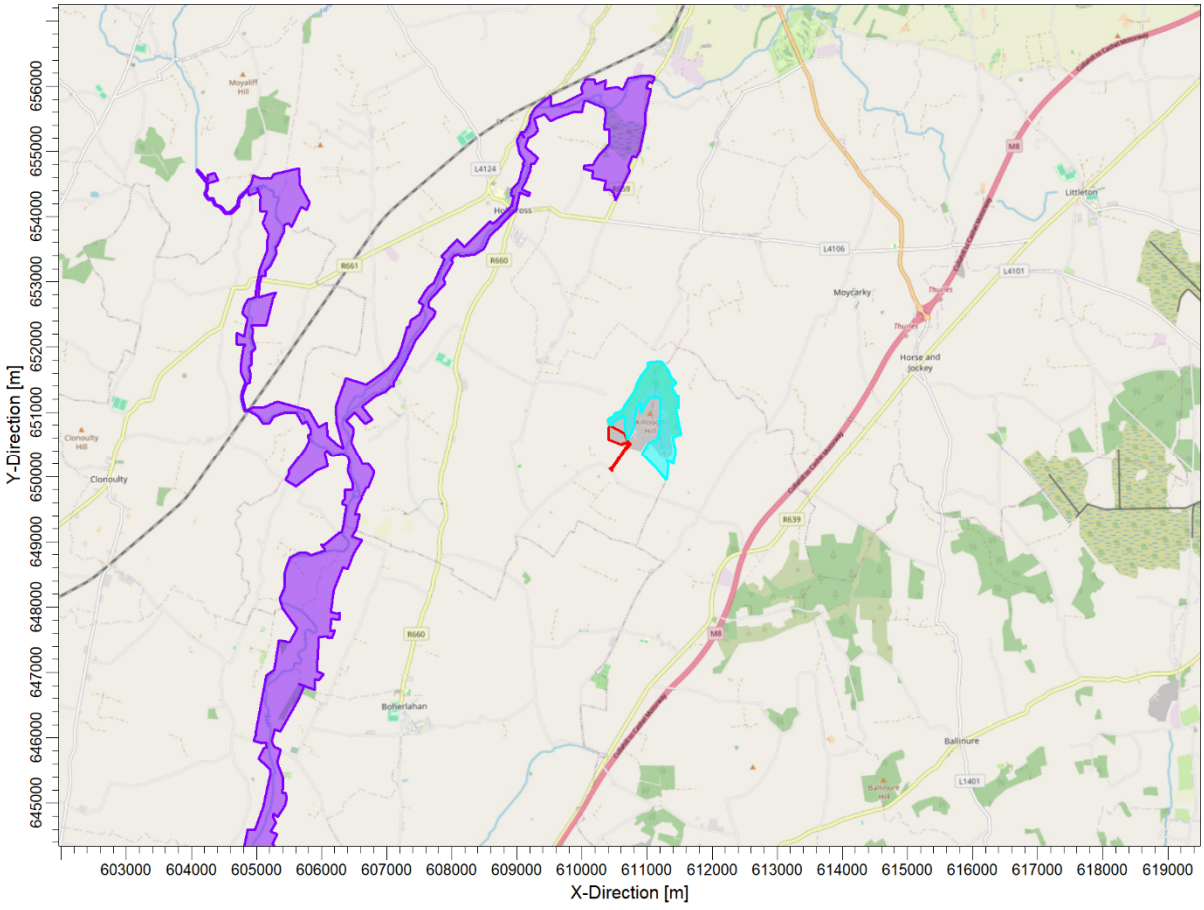
There is one local ecological designation located within 2km of the Site; an area of woodlands on Killough Hill, designated as a *proposed* Natural Heritage Area (pNHA), which bounds the Site at the northern extent.

Table 4-2: Designated Ecological Sites

Designation	Site Name	Approx. Distance and Direction from Site Boundary
SAC	Lower River Suir SAC	3.3km west
pNHA	Killough Hill Woodlands	At northern boundary

Figure 4-2 presents the location of the SAC (purple shaded area) and pNHA (blue shaded area) in relation to the Site boundary (red outline). The Lower River Suir SAC spans a vast area, therefore only the areas in proximity to the Site are presented.

Figure 4-2: Designated Ecological Receptors



[21] http://webgis.npws.ie/npwsviewer/ - Accessed November 2024.

[22] http://www.apis.ac.uk/ - Accessed November 2024.

4.2 Ambient Air Quality

The EPA report, *Air Quality in Ireland 2022*[23] details the main air quality trends based on monitoring from the national ambient air quality network. There are monitored exceedances of the WHO guideline values for NO_2, SO_2, PM_{10} and $PM_{2.5}$ at several sites across Ireland, though there are no current exceedances of the lower (less protective) EU standards at the existing monitoring locations in Ireland.

Ireland is designated into several air quality zones for the purpose of managing air quality, classified based on population density and the potential for air quality issues. The Site is located in 'Zone D': Rural Ireland (i.e. the remainder of the State excluding Zones A, B and C). Zone D typically experiences lower levels of air pollution compared to urban centres.

4.2.1 Local Air Quality Monitoring

A desk study has been carried out to examine all relevant information relating to air quality conditions around the application site. The EPA website was examined to note information on baseline air monitoring data around the application site. The EPA co-ordinates and manages a nationwide network of over 110 monitoring stations which measures the levels of air pollutants and delivers this information to the public as part of the National Ambient Air Quality Monitoring Programme (AAMP), which involved a greatly expanded national monitoring network providing enhanced real-time information to the public, as well as an increased local authority capacity to conduct indicative air monitoring. The results of the monitoring are compared to limit values set out in EU and national legislation on ambient air quality.

The closest national air quality monitoring location to the Site is 'Kilkenny Seville Lodge' on Callan Road. This is a, Kilkenny in a Zone C area located ~38 km to the east of the Site. This site is classified as a background site and monitors background levels of NO_2 and NO_X.

Additional monitoring stations are located within Co. Tipperary. Clonmel and Tipperary Town are 'tier 2' monitoring stations which only monitor for PM_{10} and $PM_{2.5}$. These stations are in Clonmel ~29km southeast to the site.

The nearest monitoring station to the Site which monitors SO_2 is located within Co. Laois in Portlaoise, located ~50km northeast of the site.

The latest year of ratified data from these stations (2023) is presented in Table 4-3, Table 4-4 and Table 4-5.

Table 4-3: Monitoring data at Kilkenny Seville Lodge (2023)

Monitoring Station	Annual Mean NO_2 Concentration (µg/m^3)	Number of Hours NO_2 >200µg/m^3	Annual Mean NO_X Concentration (µg/m^3)
Kilkenny Seville Lodge	4.4	0	6.0

Table 4-4: Monitoring data at Portlaoise (2023)

Monitoring Station	Annual Mean SO_2 Concentration (µg/m^3)	Number of Hours SO_2 >266µg/m^3	Number of Hours SO_2 >350µg/m^3	Number of Hours SO_2 >125µg/m^3
Portlaoise	4.11	0	0	0

[23] Environmental Protection Agency, Air Quality in Ireland 2022. Available at: https://www.epa.ie/publications/monitoring assessment/air/Air_Quality_Report_22_v8v2.pdf

Table 4-5: Monitoring data at Tipperary. Clonmel and Tipperary Town (2023)

Monitoring Station	Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)
Clonmel	9.2	6.0
Tipperary Town	10.7	6.7

The tables above indicate that NO_2 and SO_2 concentrations monitored are below the annual mean AQALs and there are no exceedances of the 1-hour NO_2 or the 1-hour and 24-hour SO_2 limits. In addition, concentrations of PM_{10} are likely to comply with the requirement that a 24-hour mean of 50 $\mu g/m^3$ should not be exceeded more than 35 times in a calendar year.

For rural areas, such as those surrounding the application site, it is anticipated that background concentrations would be no greater than the measured data presented.

4.2.2 Local Mapped Background Concentrations

A Regional-to-local (street) scale air pollutant concentration modelling for Ireland has been undertaken for 2018 and 2019. As published within the by the EPA in their 2022 report[24]. These models have been subsequently updated and now provide daily forecast, hourly updated and annual high-resolution maps for air quality in Ireland. These data sets were not however available at the time of writing and the 2019 maps have been sources for reference as presented in Table 4-6.

Table 4-6: EPA Background Modelled Data

Pollutant	Mapped Background Concentration within Study Area ($\mu g/m^3$)
NO_2	< 5
PM_{10}	7-10
$PM_{2.5}$	5-6
Ammonia (NH_3) (A)	1.1-2.2
Table note: (A) Background maps as published by The Ambient Atmospheric Ammonia Network[25].	

4.3 Baseline Conditions at Human receptors

The background concentrations at human receptors applied within this assessment have been determined in consideration of the measured data available using the highest data capture and most conservative values. These are presented within Table 4-7.

[24] Environmental Protection Agency (2022) Air Quality in Ireland Report 2022

[25] Ammonia - Ambient Atmospheric Ammonia in Ireland (ucd.ie)

Table 4-7: Baseline Conditions at Human Receptors

Pollutant	Averaging Period	Concentration (µg/m³)	Data Source
NO_2	Long-term	4.4	Kilkenny Seville Lodge recording station (2023 average).
	Short-term	8.8	2 x the long-term value above, as per the AERA guidance.
SO_2	Long-term	4.11	Portlaoise recording station (2023 average).
	Short-term	8.22	2 x the long-term value above, as per the AERA guidance.
PM_{10}	Long-term	10.7	Tipperary Town recording station (2023 average).
	Short-term	21.4	2 x the long-term value above, as per the AERA guidance.

4.4 Baseline Conditions at Ecological Receptors

The baseline conditions and appropriate C_{Lo} have been established on the basis of the APIS website[26] (a support tool for assessment of potential effects of air pollutants on habitats and species developed in partnership by the Centre for Ecology and Hydrology). The concentrations, deposition rates, and C_{Lo} for nutrient nitrogen and acid deposition are set out in Table 4-8 and Table 4-9.

Table 4-8: Nitrogen Concentration, Critical Loads and Current Load

Habitat (most sensitive Critical Load Class)	NO_x Annual Mean (µg/m³)	SO_2 Annual Mean (µg/m³)	NH_3 Annual Mean (µg/m³)	Critical Load Applied in Assessment (kg/ha/yr)	Current Load (kg/ha/yr)
Coniferous woodland	3.4 (A)	0.2 (A)	3.3 (A)	5	2.3 (A)
Broadleaved, Mixed and Yew Woodland	3.0	0.2	3.0	10	13.2
Table notes: (A) Maximum grid value across areas of designation within site locale (as per APIS).					

Table 4-9: Relevant Acid Critical Loads and Baseline Deposition

Habitat (most sensitive Critical Load Class)	Critical Level (k_{eq}/ha/yr)			Current Load (k_{eq}/ha/yr)
	CLmaxS	CLminN	CLmaxN	
Montane / freshwater	5.506	0.714	6.22	0.5 (A)
Unmanaged broadleaved / coniferous woodland	5.618	0.714	6.332	0.9
Table notes:				

[26] http://www.apis.ac.uk/app - Accessed November 2024

(A) Maximum grid value across areas of designation within site locale (as per APIS).

4.5 Meteorological Conditions

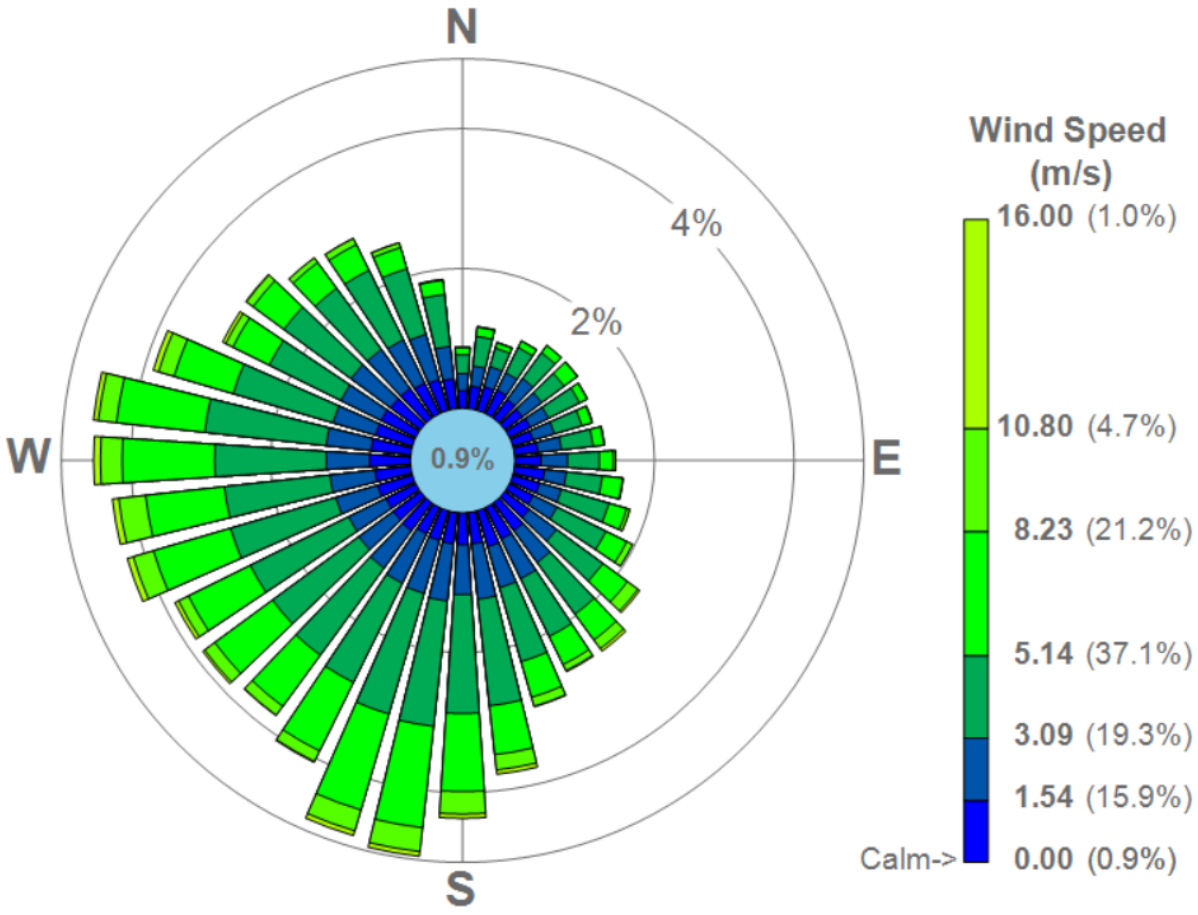
The most important climatic parameters governing the release and dispersal of fugitive emissions from the Site are:

- wind direction which determines the broad direction of dispersal; and
- wind speed will affect ground level emissions by increasing the initial dilution of pollutants in the emission.

There are no meteorological recording stations located in proximity of the Site; the nearest station (Gurteen) is located at a distance of more than 47km. As such, Numerical Weather Prediction (NWP) data has been utilised for the study. Five consecutive years of hourly-sequential NWP data covering the period 2019 to 2023 (inclusive) was acquired based on the Site location and has been applied in the assessment.

A windrose, showing the frequency of wind speed and direction used in the assessment is provided in Figure 4-3 below. The windrose shows that winds from the southern and eastern sectors are most frequent, with winds from the northern and eastern sectors least frequent.

Figure 4-3: Windrose for NWP Meteorological Data (2019-2023)



In addition to the NWP meteorological data acquired, reference has also been made to historic data published by Met Eireann for the Birr Synoptic station, to characterise rainfall

trends within the study area[27]. Birr Synoptic station was closed in January 2009 and was replaced with Gurteen Recording Station.

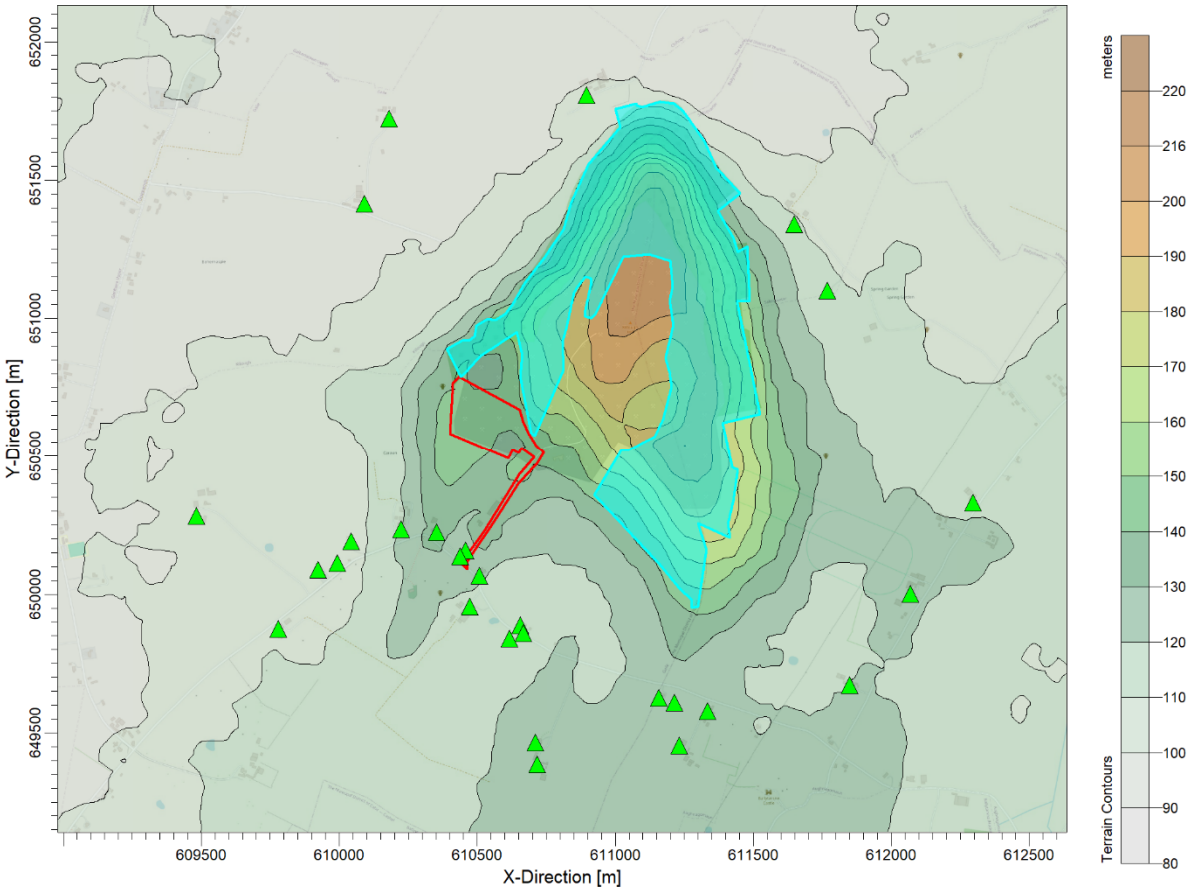
4.6 Topography

The land immediately surrounding Killough Hill lies at levels of between 110 and 120m Above Ordnance Datum (AOD). Over a distance of 3.5km to the west of the hill the land falls gently towards the River Suir to levels just under 80m AOD. Killough Hill which reaches a maximum height of approximately 215m is the only noticeable highpoint within the general area.

The existing main extraction void of the quarry at Killough Hill covers approximately the southern three quarters of the hill. To the immediate northwest, north and east of the void, the land slopes towards the surrounding plain, covering a height difference of between 50-80m over a distance of less than 200m. To the immediate southwest of the void the quarry processing facilities are located at levels between 140m AOD and 170m AOD.

The surrounding topography is illustrated in Figure 4-4 below. The Site boundary is outlined in red, with the pNHA in blue and human receptors pinned in green.

Figure 4-4: Surrounding Topography



4.7 Existing Sources of Emissions

A review of baseline conditions with respect to odours in the surrounding area has been undertaken by reviewing aerial imagery. Through review of aerial imagery, the only significant sources of odours and ammonia identified is the existing agricultural activity in the

[27] Birr synoptic weather station 1979–2008 averages (met.ie)

area (i.e. working of agricultural land). However, in consideration of the likely infrequent nature of these activities, this potential source has not been considered further within this assessment.

The existing quarry, which incorporates an existing asphalt production plant, has been in operation for over 20 years. It is therefore considered that any emissions (dust and combustion emissions) are already taken into consideration within the background measured and modelled pollutant concentrations (as presented in Section 4.2) and have not been included as an additional source(s) within the assessment.

5.0 Construction Phase Assessment

This section presents the potential air quality impacts associated with dust/PM_{10} emissions generated by Site construction activities on nearby sensitive receptor locations.

5.1 Description of Construction Phase

The proposed bio-renewables production facility will cover an area of approximately 4 hectares, with 16,821.5m² of new buildings. The buildings to be constructed will consist of; an administration building, a dry matter reception building, a workshop, a bio-conversion building, a pre-treatment, equalisation and gas upgrading building, a digestate handling building, a warehouse storage building, a bio-filling station building, an odour abatement and pumping station building, a linear generator building and a sub-station building. These buildings will predominately be prefabricated offsite made of commercial steel framing, similar to agricultural buildings.

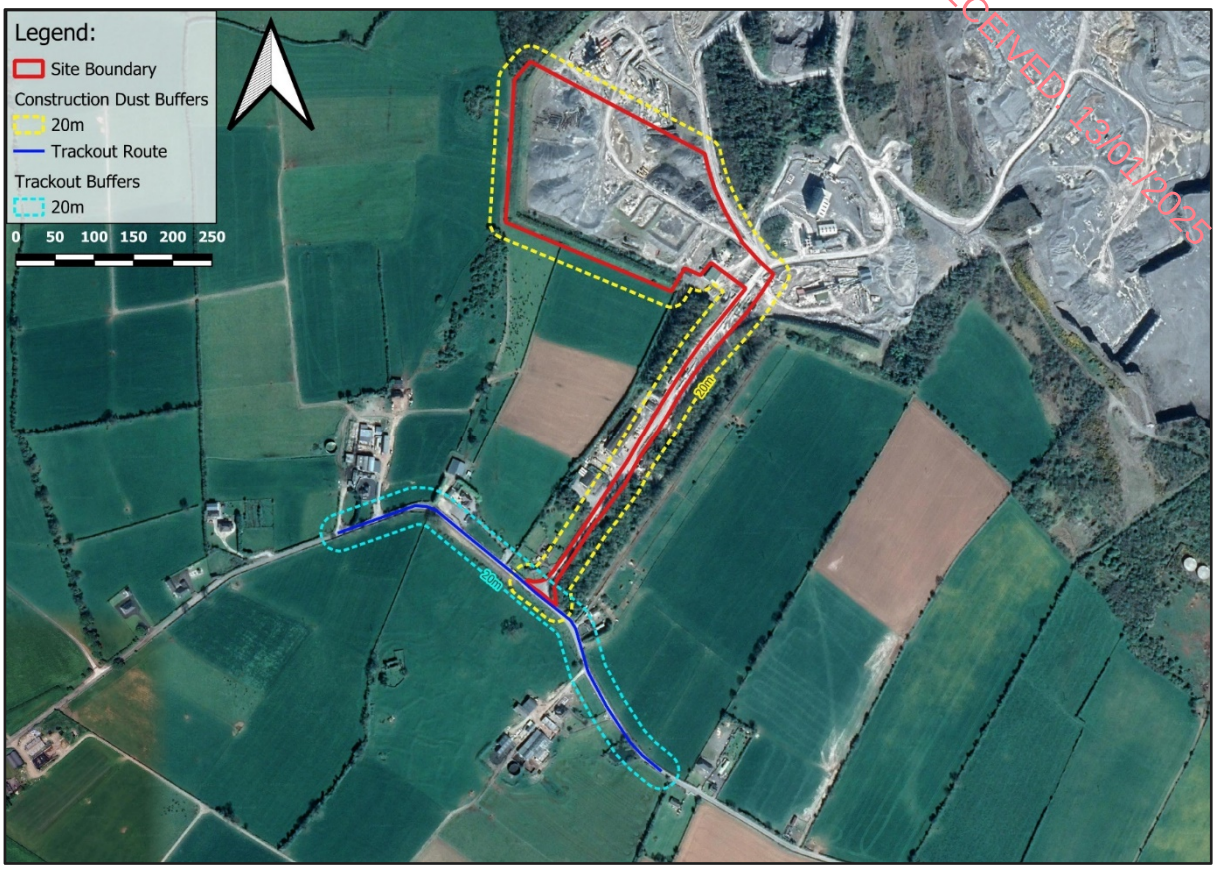
An existing single storey block constructed store building (of approximately 158m²) lies partially within the red line boundary, which will be demolished to facilitate the Proposed Development.

5.2 Construction Dust Assessment

Where figures relating to area of the Site, volume of the Site, approximate number of construction vehicles or distances to receptors are presented, these relate to thresholds as defined in the IAQM guidance to guide the assessor to define the dust emissions magnitude and sensitivity of the area.

There are human receptors located within 250m of the Site but no statutory ecological designations (SAC, SPA or ASSI) within 50m of the Site boundary or within 50m of the roads anticipated to witness construction traffic movements up to 250m of the Site entrance(s). As such, an assessment considering only human receptors is required (no assessment of ecological receptors is required).

Figure 5-1 Construction Dust Screening Distances



5.2.1 Potential Dust Emission Magnitude

Demolition

Demolition of an existing store will be required. The total building volume is less than 12,000m^3 commensurate of a 'small' operation. It is considered likely that material requiring removal will be primarily sheet metal cladding and steel frame which have a low dust potential. Therefore, the dust emission magnitude for demolition is considered to be 'small'.

Earthworks

Earthworks are required over an area of up to 40,000m^2, commensurate of a 'medium' sized site (i.e. 18,000m^2 – 110,000m^2). Rock extraction (comprising drilling and/or blasting) will be required for the water storage ponds which will be approximately 6m deep. The existing access road will remain in place and is fully paved; as such no significant earthwork activities are anticipated to be required on the access road. It is predicted that 5 – 10 heavy earth moving vehicles would be active at any one time. Therefore, the dust emission magnitude for earthworks is considered 'medium'.

Construction

The total building volume requiring construction is up to 100,000m^3, commensurate of a 'large' site. It is anticipated that the construction material will include primarily steel frame structures, sheet metal cladding and pre-constructed tanks for storage of feedstocks and byproducts. These construction materials have a low dust emission potential. In consideration of the scale of construction required, the dust emission magnitude for construction is considered 'large'.

Trackout

It has been assumed that construction vehicles will access the Site via the existing fully paved Site access road. It is anticipated that the construction phase would result in an additional 6 HGV movements in any one day (as AADT). Therefore, the dust emission magnitude for trackout is considered 'medium'.

Summary

A summary of the dust emission magnitude for each activity is presented within Table 5-1.

Table 5-1: Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	Small
Earthworks	Medium
Construction	Large
Trackout	Medium

5.2.2 Sensitivity of the Area

Dust Soiling Impacts

There are between 1 and 10 residential (high sensitivity) receptors within 20m of the Site boundary (red line boundary). Furthermore, there are between 1 and 10 residential (high sensitivity) receptors within 20m of the predicted Site access routes up to 250m from the Site entrances.

Therefore, the sensitivity of the area with respect to dust soiling effects on people and property in relation to earthworks, construction, and trackout is considered to be 'medium'.

Human Health Impacts

From inspection of the data from the Tipperary Town recording station, the 2023 background PM_{10} annual mean concentration is estimated to be 10.7µg/m³ (i.e. falls into the <24µg/m^3 class).

Given the above information regarding the number of high sensitivity receptors located within 20m of the Site and 20m of construction access routes up to 250m from the Site entrances, the sensitivity of the area with respect to human health impacts in relation to earthworks, construction and trackout is defined as 'low'.

Summary

A summary of the sensitivity of the area for each potential impact and activity is presented within Table 5-2.

Table 5-2: Sensitivity of the Surrounding Area

Potential Impact	Sensitivity of Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Medium	Medium
Human Health	Low	Low	Low	Low

5.2.3 Risk of Impacts

The outcome of the assessment of the potential 'magnitude of dust emissions', and the 'sensitivity of the area' are combined in Table 5-3 below to determine the risk of impact which is used to inform the selection of appropriate mitigation.

Table 5-3: Construction Phase Assessment Summary – Risk of Dust Impacts

Potential Impact	Activity			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low Risk	Medium Risk	Medium Risk	Medium Risk
Human Health	Negligible	Low Risk	Low Risk	Low Risk

Following the construction dust assessment, the Site is found to be at worst 'Medium Risk' in relation to dust soiling effects on people and property and 'Low Risk' in relation to human health impacts (Table 5-3). However, potential dust effects during the construction phase are considered to be temporary in nature and may only arise at particular times (i.e. certain activities and/or meteorological conditions).

Nonetheless, commensurate with the above designation of dust risk, mitigation measures, as identified by the IAQM guidance, are required to ensure that any potential impacts arising during the construction phase are reduced and, where possible, completely removed. In accordance with the guidance, providing effective mitigation measures are implemented, such as those outlined in Section 7.1, construction dust impacts are considered to be 'not significant'.

5.3 Construction Traffic Screening

5.3.1 Trip Generation

The construction phase of the Proposed Development would result in a temporary increase in road traffic arriving at and leaving the Site, and as such a screening assessment of the associated trip generation is required.

Construction of the Proposed Development would result in the temporary employment of contractors at the Site, as well as deliveries. In consideration of the size and nature of the construction operations, the anticipated number of LGV movements to/from the Site is 60 AADT.

The construction of the Proposed Development would result in import and exports of goods and materials to/from the Site via HGVs. In consideration of the size and nature of the construction operations, the anticipated number of HGVs movements to/from the Site is 6 AADT.

5.3.2 Screening Assessment – Consideration of Potential Impacts

The Proposed Development is located within air quality zone D, therefore the screening criteria for a site located outside of (and not in proximity of) an Air Quality Management Area has been applied.

Based upon the anticipated trip generation details outlined above, the predicted number of additional journeys are well below the relevant screening criteria of 100 HGV and 500 LGV movements (as AADT).

Therefore, in accordance with the EPUK & IAQM Guidance, the *'impacts* [on air quality from construction phase trips] *can be considered as having an insignificant effect*'.

6.0 Assessment of Operational Phase

6.1 Description of Proposed Operations

The total feedstock imported to the Site will be approximately 105,000 tonnes per annum (tpa) consisting:

- 60,000 tpa of grass silage;
- 20,000 tpa of cattle slurry;
- 15,000 tpa of poultry litter;
- 5,000 tpa of maize silage; and
- 5,000 tpa of brewery residues (potale and spent grain).

Silage feedstocks and brewery residues would arrive by road via tractors or lorries with open trailers. Cattle slurry would be received within sealed vacuum tankers, and poultry litter within enclosed trailers.

Grass silage, maize silage, brewery residues and poultry manure would be received and within the dry matter reception building within designated feedstock bays (on a hardstanding surface) prior to transfer to the dedicated siloes (maize silage silo, chicken litter silo or brewery residues tank/silo). The storage capacity within the dry matter reception building would be approximately 10,000 tonnes. The dry matter reception building will be an enclosed structure providing shelter from the wind.

Cattle slurry would be pumped directly from sealed vacuum tankers to the sealed slurry silo, with a storage capacity of approximately 400m^3. Air displaced from the slurry silo during filling operations would be routed to the odour abatement system.

Feedstocks would be conditioned within the pretreatment and equalization building to maximise biochemical methane potential. Feedstocks would undergo size reduction to ensure particle size of <5mm through high-pressure grinding, maceration and pulping. Conditioned feedstocks would subsequently be transfer to the mixing plant where feedstocks will be blended to create a standardised feedstock. Conditioned and standardised feedstocks would be stored within the three silage feed soil/mixing tanks, each with a storage capacity of approximately 400m^3. The pretreatment and equalization building would be enclosed and connected to the odour abatement system.

The anaerobic digestion process would be undertaken within sealed reactors located within the bioconversion building. These sealed reactors would be connected to the gas capture system, ensuring complete containment of the anaerobic digestion process. Standardised feedstock would be pumped from the silage feed soil/mixing tanks directly to the reactors as required.

The digestate resulting from the anaerobic digestion process (consisting of undigested inert material and water) would be stored within the three sealed bio rest tanks (each with a storage capacity of approximately 3,220m^3) which would be connected to the odour abatement system.

The digestate would subsequently be processed into pelleted (solid) fertiliser, and the removed liquids recirculated to the reactors. The pelleted fertiliser would be stored within the digestate handling building pending offsite export to local agriculture and traders. The digestate handling building would be an enclosed structure and would be connected to the odour abatement system.

The biogas resulting from the anaerobic digestion process is anticipated to consist of 55-70% methane (CH_4), 30-45% carbon dioxide (CO_2), with the remainder comprising traces of other gases (such as nitrogen, hydrogen, hydrogen sulphide (H_2S) and ammonia (NH_3)) and water vapour. The biogas would be processed at the gas upgrade plant, removing CO_2, H_2S, moisture and other trace gases to produce bio-methane. The removed CO_2 would be liquefied and exported offsite.

The facility would produce approximately 12,170 m³ of bio-methane per annum. A proportion of the bio-methane produced would be utilised via a Combined Heat and Power (CHP) plant, producing both electricity and heating power for the on-site operations. Excess electrical power would be utilised at the main Killough Quarry site. It is anticipated that the remaining bio-methane produced could be used as a fuel source for the Killough Quarry operations (however this lies outside the scope of this application), and any surplus will be tankered off-site for use at other Roadstone facilities.

The gas flare would only be operated under distinct scenarios to ensure safety and compliance. The flare is incorporated for emergency use only and is not anticipated to function during normal operating procedures.

The facility will operate 24 hours per day, 7 days a week, as anaerobic digestion is a continuous biological process. However, feedstock will only be accepted between the hours of 0800 and 1800 Monday to Saturday. There will be no deliveries on Sunday and on Bank Holidays.

6.2 Dust Impact Assessment

6.2.1 Assessment of Impacts – Screening Criteria

There are human receptors with a sensitivity to dust soiling within 400m of the Site (see Section 4.1). There are no designated habitat sites (SAC, SPA or ASSI) within 400m of the Site. Therefore, further assessment for the potential impact of deposited dust and PM_{10} on human receptors is required.

6.2.2 Dust Soiling Potential

6.2.2.1 Feedstock import and Fertiliser Export

Total feedstock imported to the Site will be approximately 105,000 tpa consisting of mostly grass silage and cattle slurry (approximately 75% of the total) with the remainder comprising poultry litter, maize silage and brewery residues (pot ale and spent grain). Grass silage, maize silage, poultry litter and a proportion of the brewery residues will comprise dry matter with a low-to-medium dust emission potential. Cattle slurry is wet matter with a negligible dust emissions potential, and therefore has not been considered further. Silage feedstocks and brewery residues would arrive by road via tractors or lorries with open trailers and offloading operations would take place within the covered dry matter reception building.

Following AD of feedstocks, the resulting digestate would be processed into pelleted (solid) fertiliser. This pelleted fertiliser would have a low moisture content, and therefore a medium-to-high dust potential. Pelleted fertiliser would be either be individually bagged or loaded loose into enclosed trailers within the digestate handling building pending offsite export. The digestate handling building would be an enclosed structure, with air extracted to the abatement system.

In consideration of the throughput of the Site, the associated dust potential of the materials and the level of containment provided, the residual source emission in relation to feedstock imports is considered ‘small’.

6.2.2.2 Feedstock and Digestate Storage

Grass silage, maize silage, brewery residues and poultry manure would be stored within designated feedstock bays (on a hardstanding surface) and siloes within the dry matter reception building. The storage capacity within the dry matter reception building would be approximately 10,000 tonnes. The dry matter reception building will be an enclosed structure providing shelter from the wind.

Pelleted fertiliser would be stored within the digestate handling building on a hardstanding surface. The digestate handling building would be an enclosed structure, with air extracted to the abatement system.

In consideration of the volume of materials stored, the associated dust potential of the materials stored and the level of containment provided, the residual source emission in relation to feedstock storage is considered ‘small’.

6.2.2.3 Feedstock Handling

The feedstock handling operations would comprise the following:

- feedstocks received within the designated feedstock bays (within the dry matter reception building) would be transferred to the dedicated siloes (within the same building); and
- feedstocks would later undergo conditioning within the pre-treatment and equalization building. Feedstocks would undergo size reduction to ensure particle

size of <5mm through high-pressure grinding, maceration and pulping. The pre-treatment and equalization building would be enclosed, with air extracted to the abatement system prior to release to atmosphere via the stack.

The remainder of the conditioning activities would be 'wet', and as such would have a negligible dust potential.

In consideration of the volume of feedstocks handled, the associated dust potential of those feedstocks and the level of containment provided, the residual source emission in relation to feedstock handling is considered 'Small'.

6.2.2.4 Vehicle Movements

It is anticipated that the Proposed Development would generate an additional 40 LGV and 76 HGV movements. It is proposed that the existing (fully paved) access route to the south of the Site will be utilised. The site access roads will all be of a hardstanding surface.

Silage feedstocks and brewery residues would arrive within tractors or lorries with open trailers. Cattle slurry would be received within sealed vacuum tankers, and poultry litter within enclosed trailers. Pelleted (solid) fertiliser would be exported within covered trailers. Wheel washing facilities will be provisioned as part of the Sites embedded mitigation strategy for the Site.

In consideration of the digestate processing methods and export (i.e. within enclosed buildings). The residual source emission in relation to solid digestate storage and export is considered to be 'Small'

In consideration of the number of vehicular movements at the Site, types of vehicles and the level of containment provided to the materials transported, the residual source emission in relation to vehicular movements is considered to be 'medium'.

6.2.3 Existing Sources of Dust

As outlined in Section 4.7, the client operates an existing quarry which has been in operation for over 20 years.

6.2.4 Overall Residual Source Emission

In consideration of the above, the overall residual source emission is considered 'medium'.

6.2.5 Likely Magnitude of Dust Risk

The likely magnitude of dust effects has been determined by consideration of the residual source emission and the pathway effectiveness. The results are summarised in Table 6-1 and Table 6-2 below.

Table 6-1 Determination of Pathway Effectiveness

Receptor [A]	Distance from Site Boundary (m) [B]	Wind Sectors Affecting Receptor [C]	Frequency of Winds (%) <5m/s and Dry	Frequency Category	Pathway Effectiveness
R1	15	350-220	7.2	Moderately Frequent	Moderately Effective
R2	15	0-200	5.9	Moderately Frequent	Moderately Effective
R3	140	10-150	2.1	Infrequent	Ineffective
R4	230	20-130	1.6	Infrequent	Ineffective
R5	45	290-30	2.4	Infrequent	Ineffective
R6	135	350-20	0.6	Infrequent	Ineffective

Receptor (A)	Distance from Site Boundary (m) (B)	Wind Sectors Affecting Receptor (C)	Frequency of Winds (%) <5m/s and Dry	Frequency Category	Pathway Effectiveness
R7	275	310-350	1.2	Infrequent	Ineffective
R8	305	310-350	1.2	Infrequent	Ineffective
R9	290	320-350	0.9	Infrequent	Ineffective
R10	390	100-110	0.3	Infrequent	Ineffective

Table note:
(A) Sensitive receptors within 250m of the Site have been considered.
(B) As a precautionary approach, the distance between the receptors and the Red Line Boundary has been utilised. This represents a conservative assessment approach.
(C) Maximum result from the affecting sectors has been considered.

Table 6-2 Determination of Likely Dust Effects

Receptor (A)	Residual Source Emissions	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust Effects
R1	Medium	Moderately Effective	Low Risk	High	Slight Adverse Effect
R2	Medium	Moderately Effective	Low Risk	High	Slight Adverse Effect
R3	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R4	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R5	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R6	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R7	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R8	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R9	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R10	Medium	Ineffective	Negligible Risk	High	Negligible Effect

Table note:
(A) Sensitive receptors within 250m of the Site have been considered.

The likely dust effect is predicted to be ‘slight adverse’ at R1 and R2. Furthermore, the likely dust effect at all other considered receptors is predicted to be ‘negligible’.

The likely significance of effects as a result of dust generation from the proposed operations is therefore considered to be ‘not significant’ at all identified receptor locations in accordance with the IAQM guidance.

6.2.6 PM_{10} Generation Potential

The existing air quality, in terms of annual PM_{10}, has been taken from the Defra background maps to represent conditions at the Site. The maximum background PM_{10} concentration for the grid square of the Site as well as surrounding receptors is 10.7µg/m³, representing approximately 26% of the corresponding AQAL for PM_{10}. Moreover, concentrations are predicted to decrease year on year. On this basis, a significant increase in PM concentrations in the local area as a result of the operations at the Proposed Development would not be anticipated.

It is therefore considered that in the absence of designed-in or additional mitigation, the impact and effect of the Proposed Development operations on human health from emissions of PM_{10} (and $PM_{2.5}$) would be negligible.

6.3 Traffic Screening Assessment

It is anticipated that the Proposed Development would result in the following approximate daily trip generation (as AADT):

- 40 LGV movements – due to the employment of up to 20 staff at the Site; and
- 76 HGV movements – daily average calculated from the total anticipated number of HGVs arriving/departing based on annual tonnages processed – daily trips would fluctuate on a seasonal basis (i.e., during the harvest season when silage is brought in from the fields).

Based upon the trip generation details outlined above, the predicted number of additional development trips are below the relevant criteria for a site situated within Air Quality Zone D (i.e. a site located outside of and not in proximity of an Air Quality Management Area) for both LGVs and HGVs (500 LGVs and 100 HGVs AADT). Therefore, in accordance with the EPUK & IAQM Guidance, the *'impacts* [on air quality from operational phase trips] *can be considered as having an insignificant effect*'.

6.4 Odour Impact Assessment

In order to predict potential odour impacts within the vicinity of the Site a quantitative assessment utilising the AERMOD dispersion model[28] was undertaken.

The odour unit is a Standard Unit in the same way as gram or milligram, therefore the notation used in odour assessment follows the conventions of any mass emission unit as follows:

- Concentration: ou_E/m^3; and
- Emission: ou_E/s.

As per air quality standards for individual pollutants, exposure to odour is given in terms of a percentile of averages over the course of a year. The exposure criteria most accepted in Europe at present is given in terms of (concentration) European Odour Units as a 98th percentile (C_{98}) of hourly averages. This allows 2% of the year when the impact may be above the limit criterion (175 hours). The notation for impact is therefore: $C_{98,\ 1\ hour}$ X ou_E/m^3.

The key model inputs and results of the dispersion modelling assessment are summarised within the sections below. Further details on the methodology and inputs for the dispersion modelling study are presented in Appendix C.

6.4.1 Odour Sources

The significant potential sources of odours associated with the proposed site operations are as follows:

- Import and storage of manure/slurry and brewery residue feedstocks;
- Feedstock conditioning and pre-treatment;
- Anaerobic digestion;
- Storage of digestate;
- Production of pelleted (solid) fertiliser; and
- Storage and export of pelleted fertiliser.

The anaerobic digestion process would be undertaken within sealed reactors located within the bioconversion building. These sealed reactors would be connected to the gas capture system, ensuring complete containment of the anaerobic digestion process. As such, in consideration of the containment provided, the anaerobic digestion process is not considered a significant source of odours.

The chicken litter and brewery residue siloes, cattle slurry tanks, pretreatment and equalization building (i.e. feedstock conditioning and pre-treatment), bio rest tanks (i.e. digestate storage) and digestate handling building (i.e. production, storage and export of pelleted fertiliser) would be enclosed structures, with air extracted from these areas to the odour abatement system.

As such, the treated air discharged from the odour abatement system (which will be in operation 24 hours per day, 7 days a week) is the only significant source of odour emissions identified at the Site.

[28] Aermod model executable 23132.

6.4.2 Emission Parameters

The odour abatement system is represented within the dispersion modelling assessment as a single point source. The emission parameters for the odour abatement system have been defined by the client, in consideration of the volumes of the areas to be served by the system and the anticipated number of air changes from those areas.

The proposed performance criteria for the system was defined in reference to the Best Available Techniques Reference (BAT) reference document for the Waste Treatment sector[29] (Section 6.3.1.2 contained therein). The higher range of that outlined within the BAT reference document[30] has been adopted, reflecting a precautionary approach.

The emission parameters for the odour abatement system, as applied within the dispersion modelling assessment, are outlined in Table 6-3 below.

Table 6-3: Odour Abatement System – Odour Emission Parameters

Parameter / Source	Odour Abatement System
Stack Location (NGR x,y)	610605, 650595
Stack Height (m)	17.5
Internal Stack diameter (m)	2.5
Emission temperature (°C)	Ambient (A)
Design Air Extraction Rate (m^3/hr)	445,000
Design Air Extraction Rate (m^3/s)	123.6
Efflux velocity (m/s)	25.2
Odour Concentration Following Abatement (ou_E/m^3)	1,000
Odour Emission Rate (ou_E/s)	123,600

Table note:
(A) The 'ambient' option within Aermod has been selected. This equates the emission temperature with the ambient temperature within the meteorological data file.

6.4.3 Receptors

The discrete sensitive receptors considered within the dispersion modelling were as outlined in Section 4.1.1. All identified receptors comprise residential uses and therefore have been assessed in consideration of a high sensitivity to odours, in reference to the EPA AG9 and IAQM Odour Guidance.

Furthermore, the dispersion modelling has been completed using a nested receptor grid (as outlined in Appendix C) to allow potential short-term exposure to be assessed at all locations surrounding the Site.

6.4.4 Impact Criterion

The magnitude of the predicted odour effect (i.e., impact significance) has been determined in reference to EPA guidance AG9, as well as consideration of the IAQM Odour Guidance,

[29] Best Available Techniques (BAT) Reference Document for Waste Treatment, Directive 2010/75/EU (Integrated Pollution Prevention and Control), European Commission, 2018.

[30] 200 – 1,000 ou_E/m^3.

with specific consideration given to the likely offensiveness of odours from the Site as well as the sensitivity of the nearby receptors.

In consideration of the offensiveness of odours and receptor sensitivities, and in adoption of a precautionary approach, the most stringent $C_{98,\ 1\text{-hour}}$ 1.5 ou_E/m^3 odour criterion has been applied to present the point at which the adverse effect of odours might be observed at the existing residential receptors identified.

6.4.5 Prediction of Impact

The odour exposures predicted as a result of emissions from the Site are presented below. The dispersion modelling assessment has been undertaken in consideration of the continuous (24 hours per day, 365 days per year) operations at the site.

The predicted concentrations may be compared against the relevant benchmark criterion of $C_{98,\ 1\text{-hour}}$ 1.5 ou_E/m^3 for 'high sensitivity' (residential) receptors.

The odour exposures predicted as a result of emissions from the Site at the identified sensitive receptors are below the impact criterion, as presented in Table 6-4 below. As such, the associated impact descriptor can be described as 'slight' or 'negligible' at all sensitive receptors.

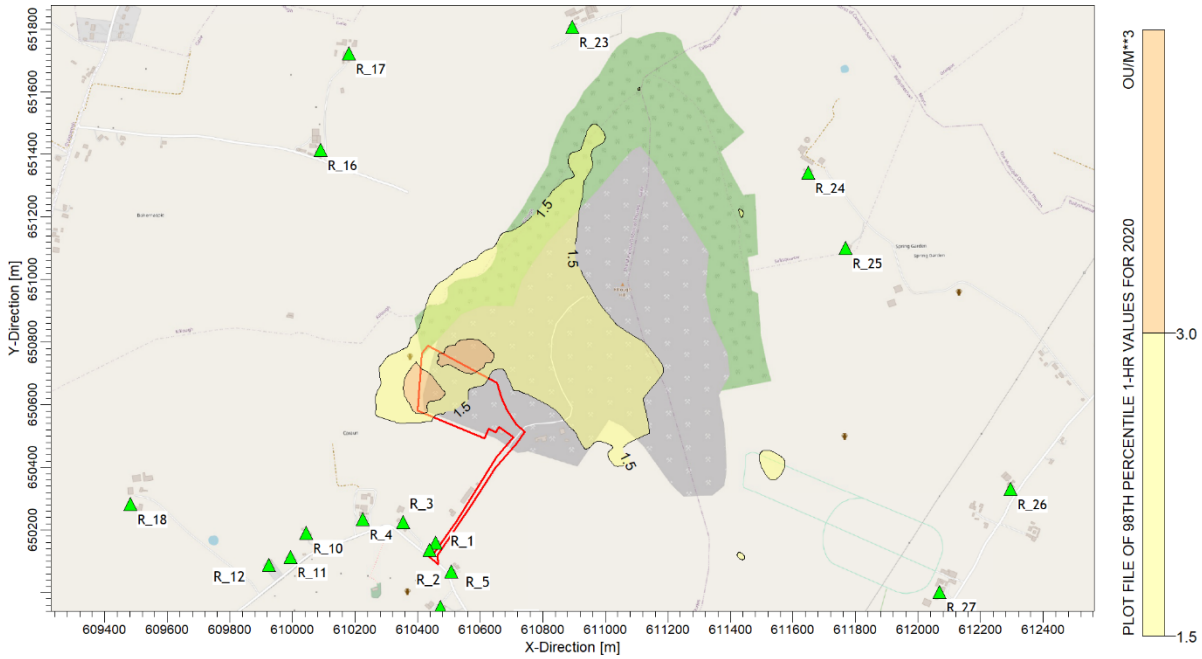
Table 6-4: Predicted Odour Concentrations at Sensitive Receptors

Receptor	Receptor Sensitivity	Predicted Odour Concentration ($C_{98,\ 1\text{-hour}}$ ou_E/m^3)						Associated Impact Descriptor
		2019	2020	2021	2022	2023	Maximum	
R1	High	0.2	0.5	0.3	0.3	0.4	0.5	Slight
R2	High	0.2	0.4	0.3	0.3	0.4	0.4	Negligible
R3	High	0.3	0.6	0.5	0.5	0.6	0.6	Slight
R4	High	0.4	0.7	0.5	0.6	0.5	0.7	Slight
R5	High	0.2	0.4	0.3	0.3	0.4	0.4	Negligible
R6	High	0.2	0.4	0.3	0.2	0.3	0.4	Negligible
R7	High	0.4	0.4	0.4	0.3	0.3	0.4	Negligible
R8	High	0.4	0.4	0.4	0.3	0.3	0.4	Negligible
R9	High	0.3	0.3	0.3	0.2	0.3	0.3	Negligible
R10	High	0.3	0.4	0.3	0.4	0.3	0.4	Negligible
R11	High	0.2	0.4	0.2	0.3	0.3	0.4	Negligible
R12	High	0.2	0.3	0.2	0.3	0.3	0.3	Negligible
R13	High	0.3	0.2	0.3	0.2	0.2	0.3	Negligible
R14	High	0.2	0.2	0.2	0.2	0.2	0.2	Negligible
R15	High	0.1	0.2	0.2	0.2	0.2	0.2	Negligible
R16	High	0.9	0.5	0.7	0.6	0.7	0.9	Slight
R17	High	0.6	0.6	0.8	0.7	0.5	0.8	Slight
R18	High	0.1	0.2	0.2	0.1	0.2	0.2	Negligible
R19	High	0.6	0.6	0.6	0.3	0.6	0.6	Slight
R20	High	0.5	0.6	0.6	0.4	0.6	0.6	Slight
R21	High	0.5	0.6	0.5	0.4	0.5	0.6	Slight

Receptor	Receptor Sensitivity	Predicted Odour Concentration ($C_{98, 1\text{-hour}}$ ou_E/m^3)						Associated Impact Descriptor
		2019	2020	2021	2022	2023	Maximum	
R22	High	0.5	0.4	0.5	0.3	0.5	0.5	Slight
R23	High	0.8	0.7	0.9	0.8	0.8	0.9	Slight
R24	High	0.7	0.8	0.7	0.8	0.6	0.8	Slight
R25	High	0.8	0.8	0.7	0.7	0.7	0.8	Slight
R26	High	0.5	0.5	0.6	0.5	0.4	0.6	Slight
R27	High	0.5	0.4	0.5	0.5	0.4	0.5	Slight
R28	High	0.5	0.5	0.5	0.5	0.3	0.5	Slight

The results of the dispersion modelling are presented as isopleths of 98th percentile of 1-hour mean concentrations for each year of meteorological data investigated. An isopleth plot for the 'worst-case' metrological year identified[31] (2020) is presented below. The remaining meteorological years investigated are presented within Appendix A.

Figure 6-1: Modelled $C_{98\ 1\text{-hour}}$ Odour Concentrations - 2020 Meteorological Data



6.4.6 Interpretation of Results

In accordance with the IAQM guidance, the likely significance of effects as a result of odours is considered 'not significant' where a 'slight' or 'negligible' odour effect is observed at sensitive receptors. This aligns with the indicative criteria outlined within the AG9 guidance.

The odour assessment concludes that the likely odour effect is predicted to be either 'slight' (i.e. predicted concentrations $C_{98, 1\text{-hour}}$ 0.5-<1.5) or 'negligible' (i.e. predicted concentrations $C_{98, 1\text{-hour}}$ <0.5) at all sensitive receptors identified.

[31] Defined in consideration of the maximum odour concentration predicted at sensitive receptors.

Therefore in reference to the IAQM guidance, the likely significance of effects as a result of potential odours from the Proposed Development is considered ‘not significant’.

6.5 Combustion Plant Emissions Assessment

In order to predict potential odour impacts within the vicinity of the Site a quantitative assessment utilising the AERMOD dispersion model[28] was undertaken.

A proportion of the bio-methane produced at the Site would be utilised via a CHP plant, producing both electricity and heating power for the site operations for 24 hours per day, 7 days a week.

6.5.1 Emission Parameters

The CHP plant would have an anticipated thermal input of 2.1 MW_{th} and electrical output of 0.9MW_e. The emission parameters have been defined by the client in consideration of such a unit.

The modelling input parameters are detailed in Table 6-5 below. Further modelling assessment details and relevant significance criteria are presented within Appendix C.

Table 6-5: CHP Plant – Emission Parameters

Parameter / Source	CHP Plant
Fuel	Biogas
Stack Location (NGR x,y)	610690, 650550
Stack Height (m)	16.5
Emission temperature (°C)	200 (A)
Stack diameter (m)	0.4
Efflux velocity (m/s)	15.4
Flow (Am^3/s)	1.93
Flow (Nm^3/s)	1.94 (B)
NO_X Concentration (mg/Nm^3)	190
NO_X emission (g/s)	0.37
SO_2 Concentration (mg/Nm^3)	15
SO_2 emission (g/s)	0.029

Table note:

(A) Defined in consideration of an exhaust gas heat recovery system.

(B) Normalised to 273K, dry, 101.3kPa, 15% O_2 assuming in-stack oxygen concentration of 9.1% (dry) and moisture content of 12.0%.

6.5.2 NO_2 Emissions at Human Receptors

The maximum predicted NO_2 impacts at the modelled relevant receptor locations are presented in Table 6-6 and Table 6-7. Isopleth plots are presented in Appendix A.

The findings are as follows:

- The impact (magnitude of change) can be described as ‘negligible’ at all receptors identified;
- The AQAL is not exceeded at any of the receptor locations; and
- The maximum Ground Level Concentration (GLC) is presented and does not exceed the AQAL.

The short- and long-term impacts are described as 'negligible', therefore the effect on air quality at human receptors as a result of emissions from the CHP plant is considered 'not significant'.

Table 6-6: Predicted NO_2 Annual Mean Impacts

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
R1	0.1	0.2%	4.5	11.2%	Negligible
R2	0.1	0.2%	4.5	11.2%	Negligible
R3	0.1	0.2%	4.5	11.2%	Negligible
R4	0.1	0.2%	4.5	11.2%	Negligible
R5	0.1	0.1%	4.5	11.1%	Negligible
R6	0.0	0.1%	4.4	11.1%	Negligible
R7	0.0	0.1%	4.4	11.1%	Negligible
R8	0.0	0.1%	4.4	11.1%	Negligible
R9	0.0	0.1%	4.4	11.1%	Negligible
R10	0.0	0.1%	4.4	11.1%	Negligible
R11	0.0	0.1%	4.4	11.1%	Negligible
R12	0.0	<0.1%	4.4	11.1%	Negligible
R13	0.0	<0.1%	4.4	11.1%	Negligible
R14	0.0	<0.1%	4.4	11.1%	Negligible
R15	0.0	<0.1%	4.4	11.1%	Negligible
R16	0.1	0.2%	4.5	11.2%	Negligible
R17	0.1	0.1%	4.5	11.1%	Negligible
R18	0.0	<0.1%	4.4	11.1%	Negligible
R19	0.1	0.2%	4.5	11.2%	Negligible
R20	0.1	0.1%	4.5	11.1%	Negligible
R21	0.1	0.1%	4.5	11.1%	Negligible
R22	0.1	0.1%	4.5	11.1%	Negligible
R23	0.1	0.2%	4.5	11.2%	Negligible
R24	0.1	0.2%	4.5	11.2%	Negligible
R25	0.1	0.2%	4.5	11.2%	Negligible
R26	0.1	0.2%	4.5	11.2%	Negligible
R27	0.1	0.1%	4.5	11.1%	Negligible
R28	0.1	0.1%	4.5	11.1%	Negligible

Table 6-7: Predicted NO_2 1-hour Mean (99.79%ile) Impacts

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
Max GLC	**31.5**	**15.7%**	**35.9**	**17.9%**	**n/a**
R1	2.0	1.0%	6.4	3.2%	Negligible
R2	2.0	1.0%	6.4	3.2%	Negligible
R3	2.0	1.0%	6.4	3.2%	Negligible
R4	1.8	0.9%	6.2	3.1%	Negligible
R5	1.5	0.7%	5.9	2.9%	Negligible
R6	1.3	0.7%	5.7	2.9%	Negligible
R7	1.4	0.7%	5.8	2.9%	Negligible

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
R8	1.3	0.7%	5.7	2.9%	Negligible
R9	1.5	0.7%	5.9	2.9%	Negligible
R10	1.6	0.8%	6.0	3.0%	Negligible
R11	1.6	0.8%	6.0	3.0%	Negligible
R12	1.4	0.7%	5.8	2.9%	Negligible
R13	1.0	0.5%	5.4	2.7%	Negligible
R14	1.0	0.5%	5.4	2.7%	Negligible
R15	1.1	0.6%	5.5	2.8%	Negligible
R16	1.5	0.8%	5.9	3.0%	Negligible
R17	1.3	0.7%	5.7	2.9%	Negligible
R18	1.3	0.6%	5.7	2.8%	Negligible
R19	1.4	0.7%	5.8	2.9%	Negligible
R20	1.4	0.7%	5.8	2.9%	Negligible
R21	1.4	0.7%	5.8	2.9%	Negligible
R22	1.3	0.7%	5.7	2.9%	Negligible
R23	1.4	0.7%	5.8	2.9%	Negligible
R24	1.3	0.7%	5.7	2.9%	Negligible
R25	1.4	0.7%	5.8	2.9%	Negligible
R26	1.2	0.6%	5.6	2.8%	Negligible
R27	1.2	0.6%	5.6	2.8%	Negligible
R28	1.3	0.6%	5.7	2.8%	Negligible

6.5.3 SO_2 Emissions at Human Receptors

The maximum predicted SO_2 impacts at the modelled relevant receptor locations are presented in Table 6-8, Table 6-9 and Table 6-10. Isopleth plots are presented in Appendix A.

The findings are as follows:

- The impact can be described as 'negligible' at all receptors identified;
- The AQAL is not exceeded at any of the receptor locations; and
- The maximum GLC is presented and does not exceed the AQAL.

The short-term impacts are described as 'negligible', therefore the effect on air quality at human receptors as a result of SO_2 emissions is considered 'not significant'.

Table 6-8: Predicted SO_2 24-hr Mean (99.18%ile) Impacts

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
R1	0.2	0.1%	4.6	3.6%	Negligible
R2	0.1	0.1%	4.5	3.6%	Negligible
R3	0.2	0.2%	4.6	3.7%	Negligible
R4	0.2	0.1%	4.6	3.7%	Negligible
R5	0.1	<0.1%	4.5	3.6%	Negligible
R6	<0.1	<0.1%	4.5	3.6%	Negligible
R7	<0.1	<0.1%	4.5	3.6%	Negligible
R8	<0.1	<0.1%	4.5	3.6%	Negligible

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
R9	<0.1	<0.1%	4.5	3.6%	Negligible
R10	0.2	0.1%	4.6	3.6%	Negligible
R11	0.1	0.1%	4.5	3.6%	Negligible
R12	0.1	0.1%	4.5	3.6%	Negligible
R13	<0.1	<0.1%	4.5	3.6%	Negligible
R14	<0.1	<0.1%	4.5	3.6%	Negligible
R15	0.1	<0.1%	4.5	3.6%	Negligible
R16	0.1	<0.1%	4.5	3.6%	Negligible
R17	<0.1	<0.1%	4.5	3.6%	Negligible
R18	<0.1	<0.1%	4.5	3.6%	Negligible
R19	0.1	<0.1%	4.5	3.6%	Negligible
R20	0.1	<0.1%	4.5	3.6%	Negligible
R21	<0.1	<0.1%	4.5	3.6%	Negligible
R22	<0.1	<0.1%	4.5	3.6%	Negligible
R23	<0.1	<0.1%	4.5	3.6%	Negligible
R24	0.1	<0.1%	4.5	3.6%	Negligible
R25	<0.1	<0.1%	4.5	3.6%	Negligible
R26	<0.1	<0.1%	4.5	3.6%	Negligible
R27	<0.1	<0.1%	4.5	3.6%	Negligible
R28	<0.1	<0.1%	4.5	3.6%	Negligible

Table 6-9: Predicted SO_2 1-hr Mean (99.73%ile) Impacts

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
Max GLC	**6.4**	**1.8%**	**10.8**	**3.1%**	**n/a**
R1	0.4	0.1%	4.8	1.4%	Negligible
R2	0.4	0.1%	4.8	1.4%	Negligible
R3	0.4	0.1%	4.8	1.4%	Negligible
R4	0.4	0.1%	4.8	1.4%	Negligible
R5	0.3	<0.1%	4.7	1.3%	Negligible
R6	0.3	<0.1%	4.7	1.3%	Negligible
R7	0.3	<0.1%	4.7	1.3%	Negligible
R8	0.3	<0.1%	4.7	1.3%	Negligible
R9	0.3	<0.1%	4.7	1.3%	Negligible
R10	0.3	<0.1%	4.7	1.3%	Negligible
R11	0.3	<0.1%	4.7	1.4%	Negligible
R12	0.3	<0.1%	4.7	1.3%	Negligible
R13	0.2	<0.1%	4.6	1.3%	Negligible
R14	0.2	<0.1%	4.6	1.3%	Negligible
R15	0.2	<0.1%	4.6	1.3%	Negligible
R16	0.3	<0.1%	4.7	1.4%	Negligible
R17	0.3	<0.1%	4.7	1.3%	Negligible
R18	0.3	<0.1%	4.7	1.3%	Negligible
R19	0.3	<0.1%	4.7	1.3%	Negligible

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
R20	0.3	<0.1%	4.7	1.3%	Negligible
R21	0.3	<0.1%	4.7	1.3%	Negligible
R22	0.3	<0.1%	4.7	1.3%	Negligible
R23	0.3	<0.1%	4.7	1.3%	Negligible
R24	0.3	<0.1%	4.7	1.3%	Negligible
R25	0.3	<0.1%	4.7	1.3%	Negligible
R26	0.2	<0.1%	4.6	1.3%	Negligible
R27	0.3	<0.1%	4.7	1.3%	Negligible
R28	0.3	<0.1%	4.7	1.3%	Negligible

Table 6-10: Predicted SO_2 15-minute Mean (99.9%ile) Impacts

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
Max GLC	**12.0**	**4.5%**	**16.4**	**6.2%**	**n/a**
R1	0.7	0.3%	5.1	1.9%	Negligible
R2	0.7	0.2%	5.1	1.9%	Negligible
R3	0.7	0.3%	5.1	1.9%	Negligible
R4	0.6	0.2%	5.0	1.9%	Negligible
R5	0.5	0.2%	4.9	1.9%	Negligible
R6	0.5	0.2%	4.9	1.8%	Negligible
R7	0.5	0.2%	4.9	1.8%	Negligible
R8	0.5	0.2%	4.9	1.8%	Negligible
R9	0.5	0.2%	4.9	1.9%	Negligible
R10	0.5	0.2%	4.9	1.8%	Negligible
R11	0.5	0.2%	4.9	1.8%	Negligible
R12	0.5	0.2%	4.9	1.8%	Negligible
R13	0.4	0.2%	4.8	1.8%	Negligible
R14	0.4	0.2%	4.8	1.8%	Negligible
R15	0.4	0.1%	4.8	1.8%	Negligible
R16	0.5	0.2%	4.9	1.8%	Negligible
R17	0.5	0.2%	4.9	1.8%	Negligible
R18	0.4	0.2%	4.8	1.8%	Negligible
R19	0.5	0.2%	4.9	1.8%	Negligible
R20	0.5	0.2%	4.9	1.8%	Negligible
R21	0.5	0.2%	4.9	1.8%	Negligible
R22	0.4	0.2%	4.8	1.8%	Negligible
R23	0.5	0.2%	4.9	1.8%	Negligible
R24	0.4	0.2%	4.8	1.8%	Negligible
R25	0.4	0.2%	4.8	1.8%	Negligible
R26	0.4	0.1%	4.8	1.8%	Negligible
R27	0.4	0.2%	4.8	1.8%	Negligible
R28	0.4	0.2%	4.8	1.8%	Negligible

6.5.4 NO_X and SO_2 Emissions at Ecological Receptors

Assessment of critical loads and critical levels at the sensitive ecological receptors identified is presented in Section 6.7.

6.5.5 Gas Flare

The proposed gas flare would be utilised as an emergency measure to dispose of excess biogas via combustion. This would not form part of normal site operations. The potential short-term effect on air quality at human receptors as a result of flaring operations has been investigated in Appendix B.

6.6 Ammonia Impact Assessment

In order to predict potential odour impacts within the vicinity of the Site a quantitative assessment utilising the AERMOD dispersion model[28] was undertaken.

The key model inputs and results of the dispersion modelling assessment are summarised within the sections below. Further details on the methodology and inputs for the dispersion modelling study are presented in Appendix C.

6.6.1 Ammonia Emission Sources

The significant potential sources of ammonia associated with the proposed site operations are as follows:

- Import and storage of manure/slurry and brewery residue feedstocks;
- Feedstock conditioning and pre-treatment;
- Anaerobic digestion;
- Storage of digestate;
- Production of pelleted (solid) fertiliser; and
- Storage and export of pelleted fertiliser.

The anaerobic digestion process would be undertaken within sealed reactors located within the bioconversion building. These sealed reactors would be connected to the gas capture system, ensuring complete containment of the anaerobic digestion process. As such, in consideration of the containment provided, the anaerobic digestion process is not considered a significant source of ammonia emissions.

The chicken litter and brewery residue siloes, cattle slurry tanks, pretreatment and equalization building (i.e. feedstock conditioning and pre-treatment), bio rest tanks (i.e. digestate storage) and digestate handling building (i.e. production, storage and export of pelleted fertiliser) would be enclosed structures, with air extracted from these areas by the odour abatement system prior to discharge to atmosphere.

As such, the discharge stack of the odour abatement system is the only significant source of ammonia emissions identified at the Site.

The facility will operate 24 hours per day, 7 days a week.

6.6.2 Emission Parameters

The odour abatement system is represented within the dispersion modelling assessment as a single point source. The emission parameters for the odour abatement system have been defined by the client, in consideration of the volumes of the areas to be served by the system and the anticipated number of air changes from those areas.

The proposed performance criteria for the system was defined in reference to the BAT reference document for the Waste Treatment sector[29] (Section 6.3.1.2 contained therein).

The emission parameters for the odour abatement system, as applied within the dispersion modelling assessment, are outlined in Table 6-11 below.

Table 6-11: Odour Abatement System – NH_3 Emission Parameters

Parameter / Source	Odour Abatement System
Stack Location (NGR x,y)	610605, 650595
Stack Height (m)	17.5

Parameter / Source	Odour Abatement System
Internal Stack diameter (m)	2.5
Emission temperature (°C)	Ambient (A)
Design Air Extraction Rate (m^3/hr)	445,000
Design Air Extraction Rate (m^3/s)	123.6
Efflux velocity (m/s)	25.2
NH_3 Concentration Following Abatement (mg/m^3)	0.3
NH_3 Emission Rate (g/s)	0.037
Table note: (A) The 'ambient' option within Aermod has been selected. This equates the emission temperature with the ambient temperature within the meteorological data file.	

6.6.3 NH_3 Emissions at Human Receptors

The maximum predicted NH_3 impacts at the modelled relevant receptor locations are presented in Table 6-12 and Table 6-13. Isopleth plots are presented in Appendix A.

The findings are as follows:

- The impact can be described as 'negligible' at all receptors identified;
- The AQAL is not exceeded at any of the receptor locations; and
- The maximum GLC is presented and does not exceed the AQAL.

The short- and long-term impacts are described as 'negligible', therefore the effect on air quality at human receptors as a result of NH_3 emissions is considered 'not significant'.

Table 6-12 Predicted NH_3 Annual Mean Impacts

Receptor	PC (µg/m^3)	PC as % of EAL	PEC (µg/m^3)	PEC as % of EAL	Impact Descriptor
R1	0.01	<0.1%	4.41	2.5%	Negligible
R2	0.01	<0.1%	4.41	2.5%	Negligible
R3	0.01	<0.1%	4.41	2.5%	Negligible
R4	0.01	<0.1%	4.41	2.5%	Negligible
R5	0.01	<0.1%	4.41	2.5%	Negligible
R6	<0.01	<0.1%	4.41	2.4%	Negligible
R7	<0.01	<0.1%	4.41	2.4%	Negligible
R8	<0.01	<0.1%	4.41	2.4%	Negligible
R9	<0.01	<0.1%	4.41	2.4%	Negligible
R10	<0.01	<0.1%	4.41	2.4%	Negligible
R11	<0.01	<0.1%	4.41	2.4%	Negligible
R12	<0.01	<0.1%	4.41	2.4%	Negligible
R13	<0.01	<0.1%	4.41	2.4%	Negligible
R14	<0.01	<0.1%	4.41	2.4%	Negligible
R15	<0.01	<0.1%	4.41	2.4%	Negligible
R16	0.02	<0.1%	4.42	2.5%	Negligible
R17	0.01	<0.1%	4.41	2.5%	Negligible
R18	<0.01	<0.1%	4.41	2.4%	Negligible

Receptor	PC (µg/m³)	PC as % of EAL	PEC (µg/m³)	PEC as % of EAL	Impact Descriptor
R19	0.01	<0.1%	4.41	2.5%	Negligible
R20	0.01	<0.1%	4.41	2.5%	Negligible
R21	0.01	<0.1%	4.41	2.5%	Negligible
R22	0.01	<0.1%	4.41	2.5%	Negligible
R23	0.02	<0.1%	4.42	2.5%	Negligible
R24	0.02	<0.1%	4.42	2.5%	Negligible
R25	0.02	<0.1%	4.42	2.5%	Negligible
R26	0.01	<0.1%	4.41	2.5%	Negligible
R27	0.01	<0.1%	4.41	2.5%	Negligible
R28	0.01	<0.1%	4.41	2.5%	Negligible

Table 6-13: Predicted NH_3 1-hour Maximum Impacts

Receptor	PC (µg/m³)	PC as % of EAL	PEC (µg/m³)	PEC as % of EAL	Impact Descriptor
Max GLC	**335.4**	**13.4%**	339.8	**13.6%**	**n/a**
R1	4.3	0.2%	8.7	0.3%	Negligible
R2	4.4	0.2%	8.8	0.4%	Negligible
R3	4.0	0.2%	8.4	0.3%	Negligible
R4	2.3	<0.1%	6.7	0.3%	Negligible
R5	3.2	0.1%	7.6	0.3%	Negligible
R6	3.3	0.1%	7.7	0.3%	Negligible
R7	2.2	<0.1%	6.6	0.3%	Negligible
R8	2.1	<0.1%	6.5	0.3%	Negligible
R9	2.0	<0.1%	6.4	0.3%	Negligible
R10	3.0	0.1%	7.4	0.3%	Negligible
R11	2.5	0.1%	6.9	0.3%	Negligible
R12	2.5	0.1%	6.9	0.3%	Negligible
R13	1.7	<0.1%	6.1	0.2%	Negligible
R14	1.6	<0.1%	6.0	0.2%	Negligible
R15	1.4	<0.1%	5.8	0.2%	Negligible
R16	1.6	<0.1%	6.0	0.2%	Negligible
R17	1.1	<0.1%	5.5	0.2%	Negligible
R18	2.1	<0.1%	6.5	0.3%	Negligible
R19	2.1	<0.1%	6.5	0.3%	Negligible
R20	1.6	<0.1%	6.0	0.2%	Negligible
R21	1.7	<0.1%	6.1	0.2%	Negligible
R22	1.9	<0.1%	6.3	0.3%	Negligible
R23	1.3	<0.1%	5.7	0.2%	Negligible
R24	1.5	<0.1%	5.9	0.2%	Negligible
R25	1.8	<0.1%	6.2	0.2%	Negligible
R26	1.3	<0.1%	5.7	0.2%	Negligible
R27	1.2	<0.1%	5.6	0.2%	Negligible
R28	1.0	<0.1%	5.4	0.2%	Negligible

6.6.4 NH_3 Emissions at Ecological Receptors

Assessment of critical loads and critical levels at the sensitive ecological receptors identified is presented in Section 6.7.

6.7 Assessment of Critical Levels and Loads

6.7.1 Impacts on Critical Levels

The results of the assessment of impacts at ecological receptors on C_{Le} (as a result of NO_X, SO_2 and NH_3 emissions) are presented in Table 6-14 below. Isopleth plots are presented in Appendix A. Further modelling assessment details are presented within Appendix C.

The findings are as follows:

- the PC is below 1% of the long-term C_{Le} at the SAC;
- the PC is below 10% of the short-term C_{Le} at the SAC; and
- the PC is below 100% of the short- and long-term C_{Le} at the pNHA.

In consideration of impacts on the C_{Le}, it is determined that the Proposed Development will cause 'no likely significant effects' at the Lower River Suir SAC and 'no significant pollution' at the Killough Hill Woodlands pNHA.

Table 6-14: Impact on Critical Levels

Receptor	Averaging Period	Applied C_{Le} ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC as % of C_{Le}	PEC ($\mu g/m^3$)	PEC as % of C_{Le}
Lower River Suir SAC	NO_X Annual	30	<0.1	0.1%	3.4	11.4%
	NO_X 24-hour	200	0.8	1.0%	7.6	10.1%
	SO_2 Annual	10 (A)	<0.01	<0.1%	0.2	2.0%
	NH_3 Annual	1.0 (A)	0.008	0.8%	3.408	340.8%
Killough Hill Woodlands pNHA	NO_X Annual	30	1.9	6.2%	4.9	16.2%
	NO_X 24-hour	200	28.8	38.3%	34.8	46.3%
	SO_2 Annual	10 (A)	0.15	1.5%	0.35	3.5%
	NH_3 Annual	1.0 (A)	0.093	9.3%	3.093	309.3%

Table note:

(A) The lower SO_2 and NH_3 C_{Le} has been applied, reflecting a conservative approach (assuming the presence of lichens and/or bryophytes at all areas across both designations).

6.7.2 Impacts on Critical Loads

The results of the assessment of impacts on C_{Lo} (as a result of NO_X, SO_2 and NH_3 emissions) are presented in Table 6-15 and Table 6-16 below.

The findings are as follows:

- the nitrogen deposition PC exceeds 1% of the C_{Lo} at the SAC, however the PEC is less than 70% of the C_{Lo};
- the acid deposition PC does not exceed 1% of the C_{Lo} at the SAC; and
- the nitrogen and acid deposition PC does not exceed 100% of the C_{Lo} at the pNHA.

In consideration of impacts on the C_{Lo}, it is determined that the Proposed Development will cause 'no likely significant effects' at the Lower River Suir SAC and 'no significant pollution' at the Killough Hill Woodlands pNHA.

Table 6-15: Impact on Nitrogen Critical Load

Site	Applied C_{Lo} (kg N/ha/yr)	PC (A) (kg N/ha/yr)	PC as % of C_{Lo}	PEC (kg N/ha/yr)	PEC as % of C_{Lo}
Lower River Suir SAC	5	0.07	1.4%	2.3	46.1%
Killough Hill Woodlands pNHA	10	1.10	11.0%	13.6	135.8%

Table note:
(A) Process Contribution inclusive of contributions from NO_X and NH_3 from both combustion emissions and ammonia contribution.

Table 6-16: Impact on Acid Critical Load

Site	Applied C_{Lo} Max N (keq/ha/yr)	PC (A) (keq/ha/yr)	PC as % of C_{Lo}	PEC (keq/ha/yr)	PEC as % of C_{Lo}
Lower River Suir SAC	5.506	<0.001	<0.1%	0.501	9.1%
Killough Hill Woodlands pNHA	6.332	0.113	1.8%	1.013	16.0%

Table note:
(A) Process Contribution inclusive of contributions from N (NO_X and NH_3) and S (SO_2) from both combustion emissions and ammonia contribution.

7.0 MITIGATION MEASURES

The proposed mitigation measures (for the construction and operational phase of the development) considered within this assessment are summarised below.

7.1 Construction Phase

IAQM guidance outlines several site-specific mitigation measures based on the assessed site risk, as displayed in Table 7-1. The measures are grouped into those which are highly recommended and those which are desirable.

Table 7-1 Construction Dust Mitigation Measures

Site Application	Mitigation Measures
Highly Recommended	
Communications	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site and during the works.
	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
	Develop and implement a Dust Management Plan (DMP), which may include measures to control emissions, approved by the Local Authority.
	Provide training to Site personnel on dust mitigation measures to be implemented at the Site. Complete regular inspections of Site works to ensure compliance with the DMP. The frequency of these inspections should be increased to coincide with activities where the risk of impact is higher during dry and/or windy conditions.
Construction	Speed restrictions within and around the quarry (25 km/hr) and maintenance of existing road surfaces.
	During dry and/or windy conditions, dampening of surfaces, as required.
Monitoring	Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
	Agree dust deposition and PM_{10} monitoring locations (and duration) with the Local Authority. Commence baseline monitoring before work commences on site.
Operating Vehicle / Machinery and Sustainable Travel	Ensure all vehicles switch off engines when stationary - no idling vehicles.
	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
	Use covered skips.
	Minimise drop heights excavators, loading shovels and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
Preparing and Maintaining the Site	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.

Site Application	Mitigation Measures
Site Management	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
	Make the complaints log available to the local authority when asked. An electronic complaints log will be maintained at the Site, available for review as required.
	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the electronic recording system.
Trackout	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site.
	Avoid dry sweeping of large areas.
	Ensure vehicles carrying materials with a potential for dust entering and leaving sites are covered to prevent escape of materials during transport.
	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
	Record all inspections of haul routes and any subsequent action in the site log book, or electronically.
	Paved haul road to be regularly damped down (with fixed or mobile sprinkler systems, or mobile water bowsers) as required, and regularly cleaned.
	Vehicles leaving the site will use the existing wheel wash.
Waste Management	Avoid bonfires and burning of waste materials.
Desirable	
Construction	For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.

7.2 Operational Phase

The operational/containment measures proposed, which have been considered within this assessment, are outlined below:

- the chicken litter and brewery residue siloes, cattle slurry tanks, pretreatment and equalization building, bio rest tanks and digestate handling building will be enclosed structures, with air extracted to the odour abatement system;
- the odour abatement system will treat the air extracted from these areas prior to discharge to atmosphere via a dispersion stack at a height of 17.5m;
- the anaerobic digestion process will be undertaken within sealed reactors located within the bioconversion building. These sealed reactors would be connected to the gas capture system, ensuring complete containment;
- a site management system will be in place to ensure routine cleaning measures are undertaken;
- Implementation of a speed restriction (25 km/hr) within and around the quarry;
- The existing road surfaces will be maintained;
- Water-assisted dust sweeper(s) will be utilised on the access road and local roads, as necessary, to remove material tracked out of the site; and
- Vehicles leaving the site will use the existing and new additional wheel wash on existing the site.

In addition to the mitigation measures outlined above, the applicant will carry out additional environmental measures and good practices to include: monitoring of dust as per a Dust Management Plan (DMP) which may include measures to control emissions, approved by the Local Authority or/and the EPA licence; carry out regular site inspections; display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager; provide

training to Site personnel on dust mitigation measures to be implemented at the Site; and make the complaints log available to the local authority when requested with an electronic complaints log to be maintained at the Site, and available for review at any reasonable time.

8.0 CONCLUSIONS

The construction phase assessment has concluded that the construction of the Proposed Development would result in a ‘not significant’ effect, providing effective mitigation measures are implemented.

The operational phase assessment has concluded that the Proposed Development would result in a ‘not significant’ effect at human receptor locations with regard to dust, road traffic, odour, NO_2, SO_2 and NH_3 emissions. In consideration of the predicted impacts on the critical levels and loads at nearby ecological designations, it is determined that the Proposed Development would cause ‘no likely significant effects’ at the Lower River Suir SAC and ‘no significant pollution’ at the Killough Hill Woodlands pNHA.

The potential effect on air quality at human receptors as a result of emergency flaring of biogas is considered ‘not significant’.

Appendix A Contour Plots

Figure A-1: Modelled $C_{98\ 1\text{-hour}}$ Odour Concentrations - 2019 Meteorological Data

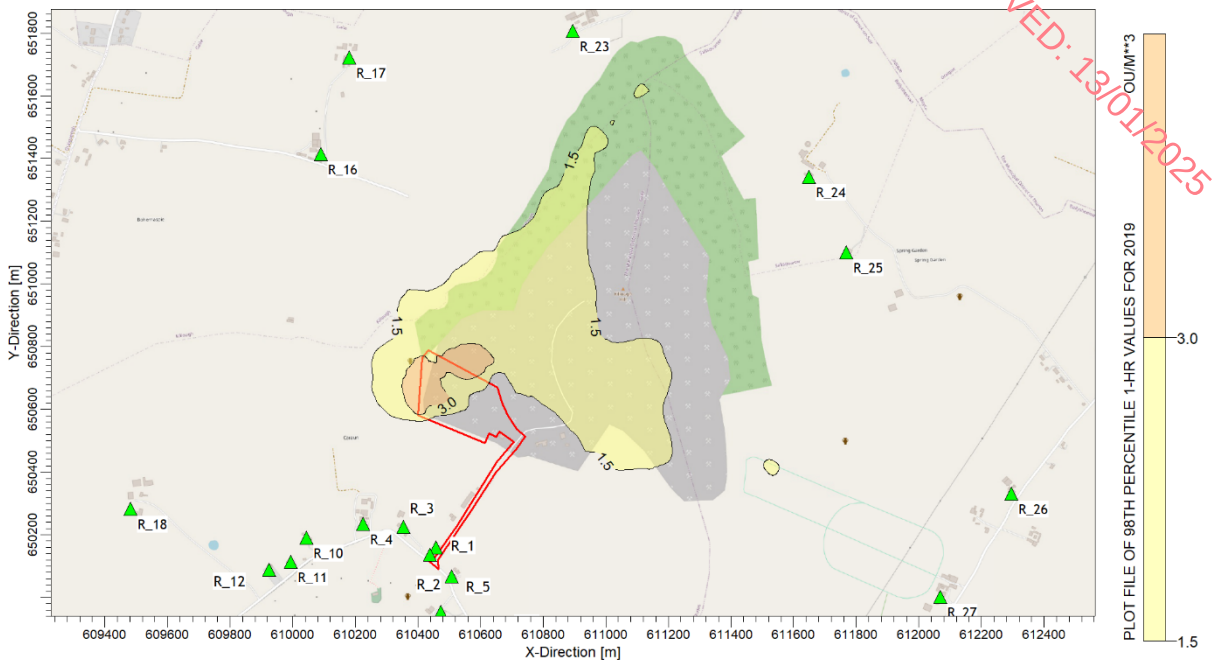


Figure A-2: Modelled $C_{98\ 1\text{-hour}}$ Odour Concentrations - 2021 Meteorological Data

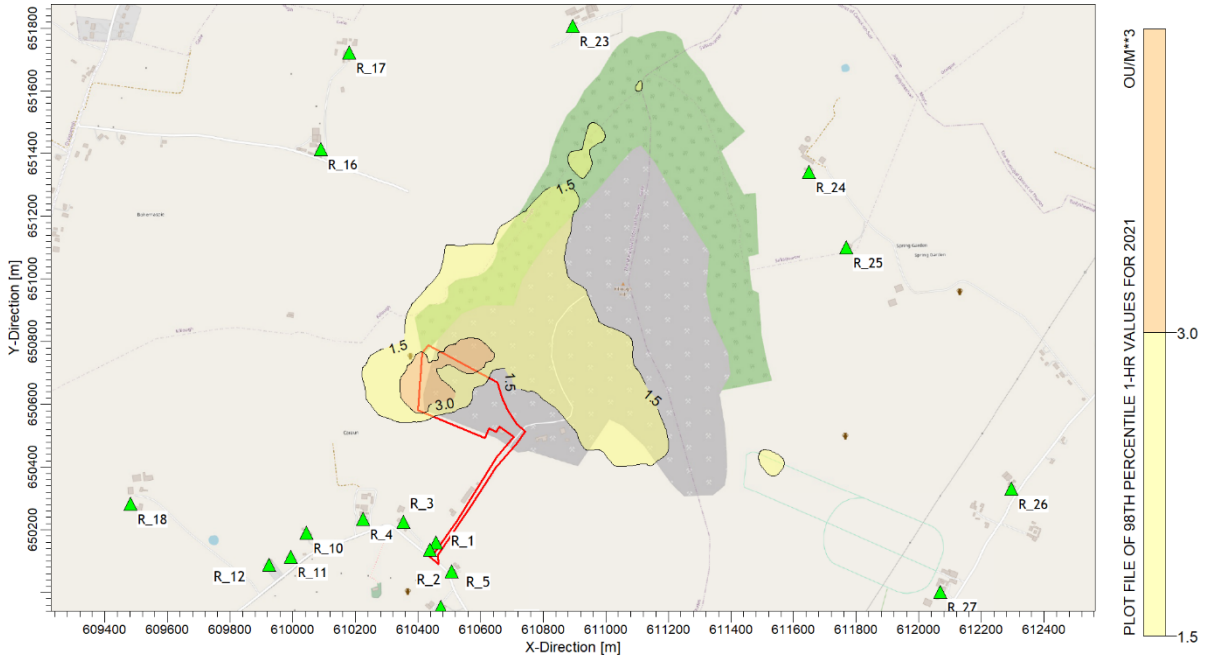


Figure A-3: Modelled $C_{98\ 1\text{-hour}}$ Odour Concentrations - 2022 Meteorological Data

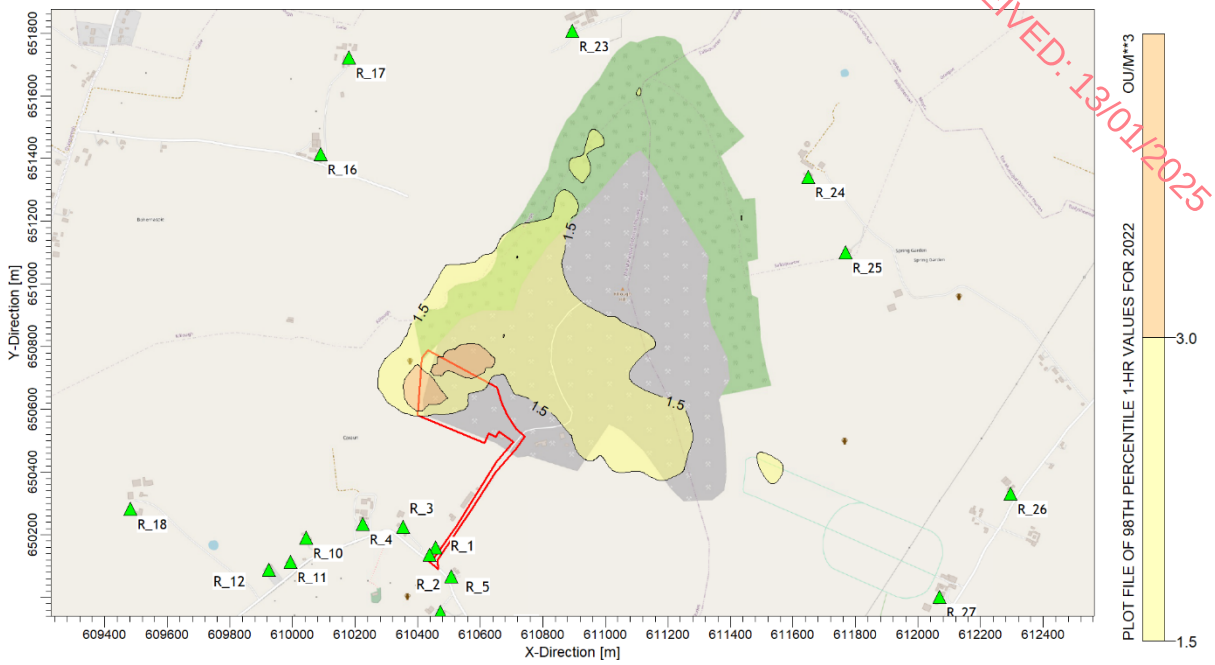


Figure A-4: Modelled C98 1-hour Odour Concentrations - 2023 Meteorological Data

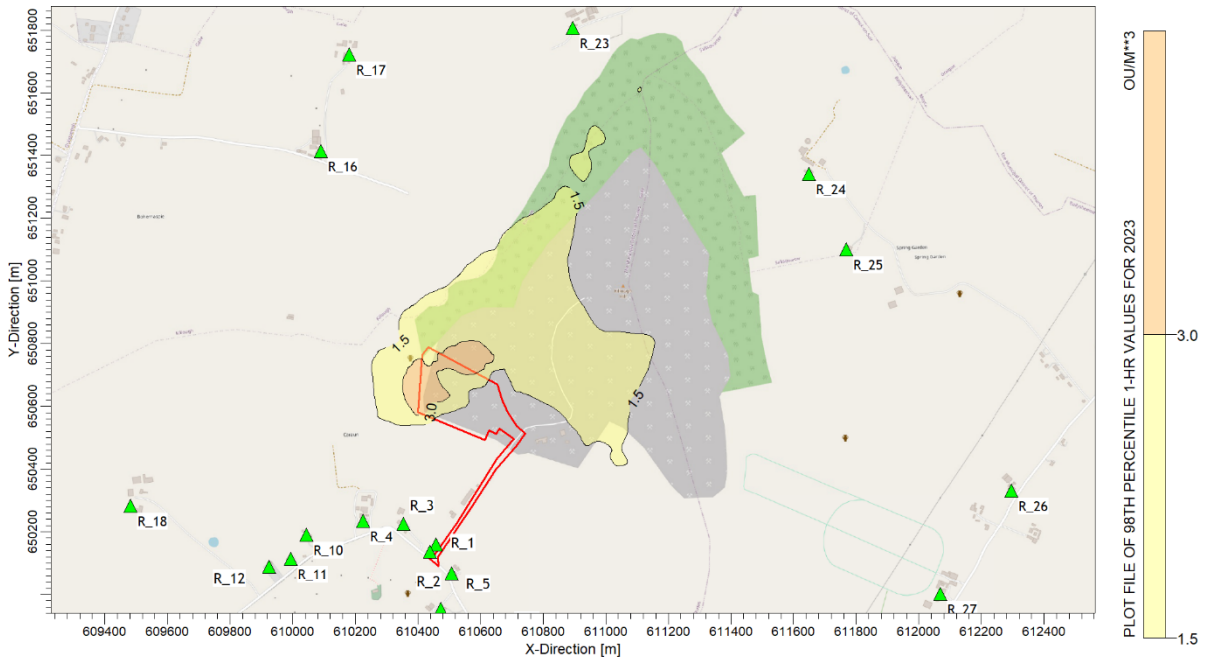


Figure A-5: Annual Mean NO_2 Process Contribution (2020)

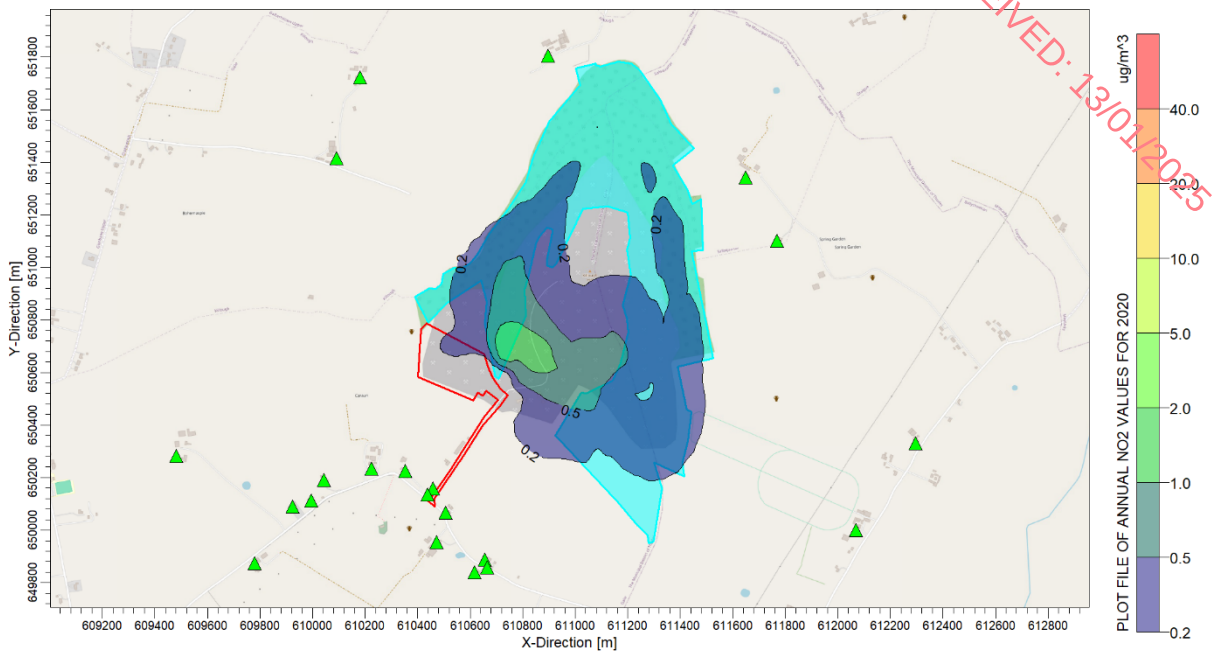


Figure A-6: 1-hour Mean (99.79%ile) NO_2 Process Contribution (2022)

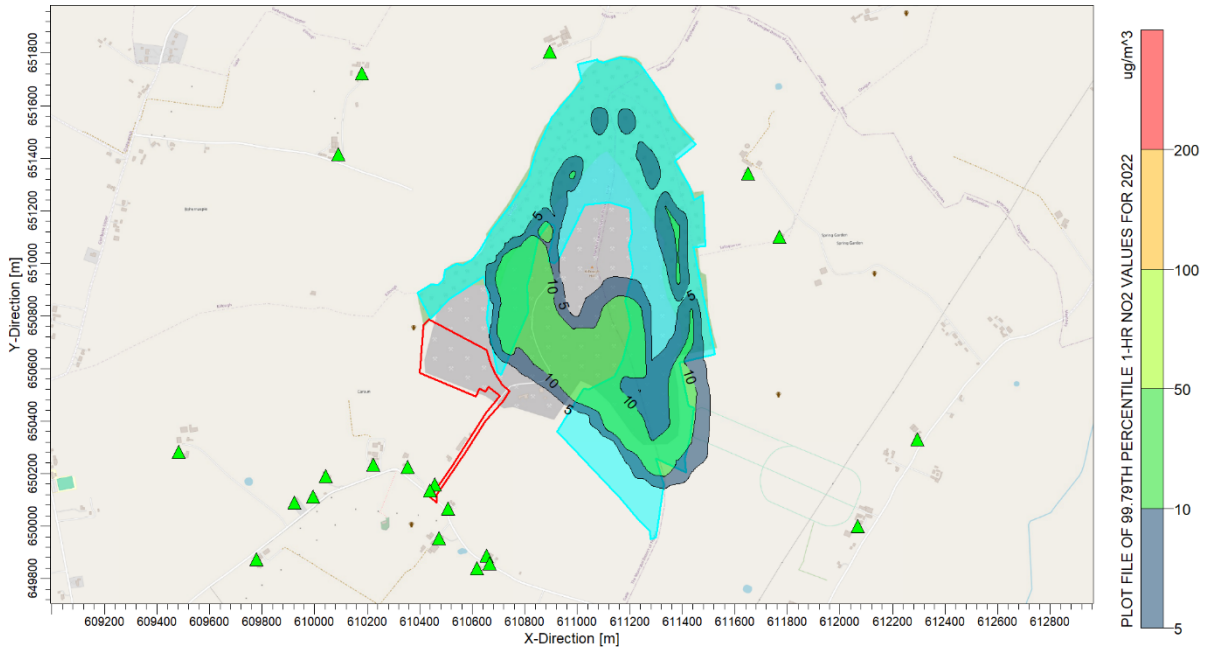


Figure A-7: 24-hour Mean (99.18%ile) SO_2 Process Contribution 2022)

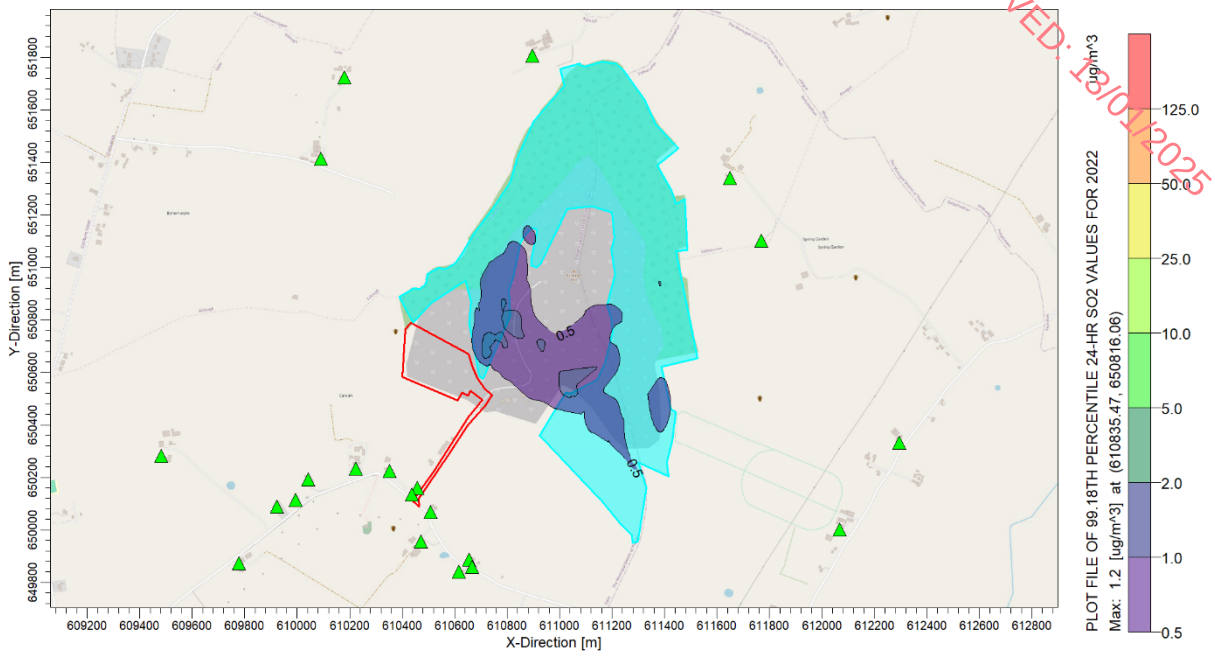


Figure A-8: 1-hour Mean (99.73%ile) SO_2 Process Contribution (2022)

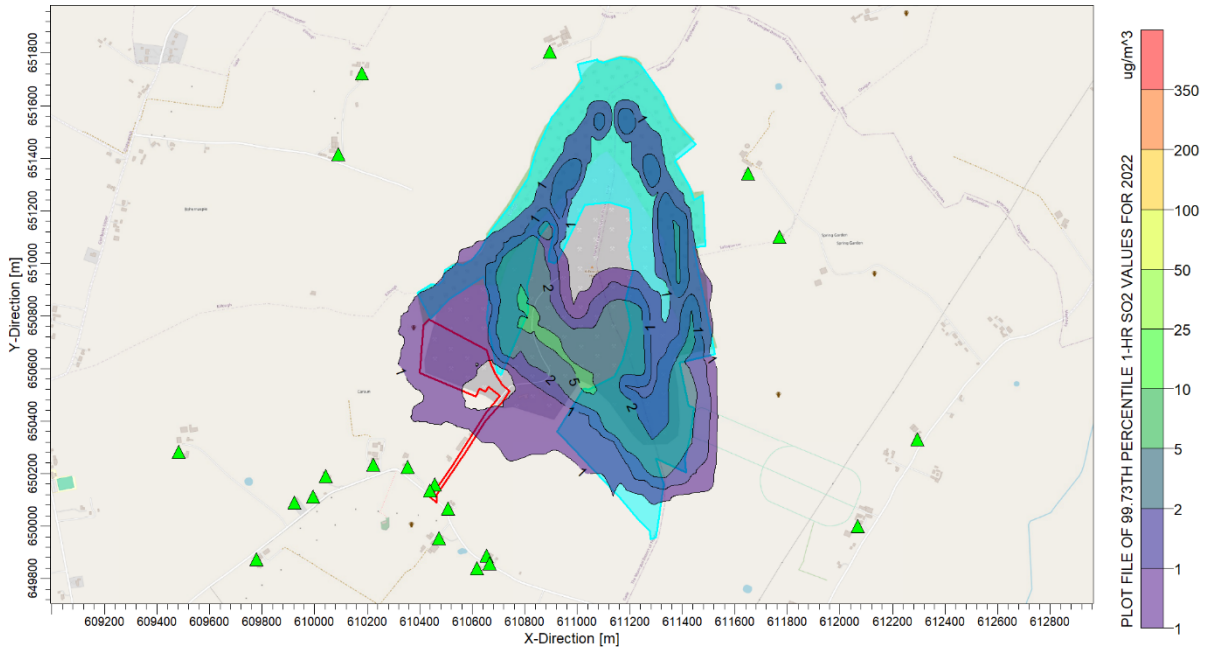


Figure A-9: 15-minute Mean (99.73%ile) SO_2 Process Contribution (2022)

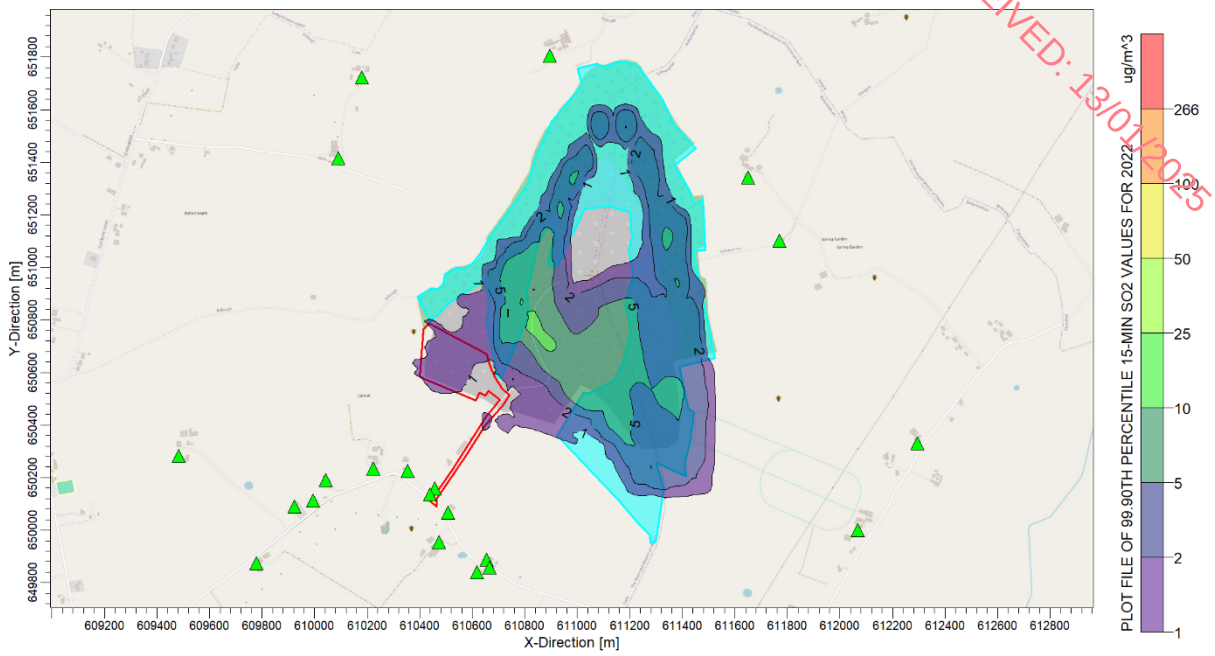


Figure A-10: Annual Mean NH_3 Process Contribution (2020)

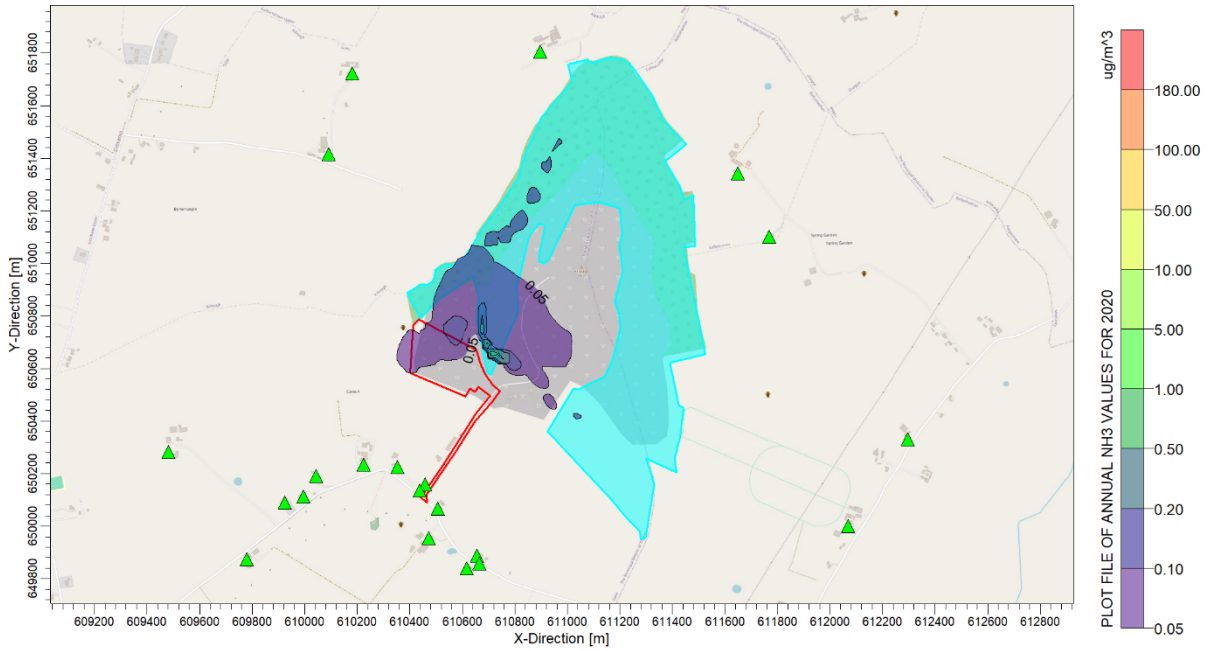
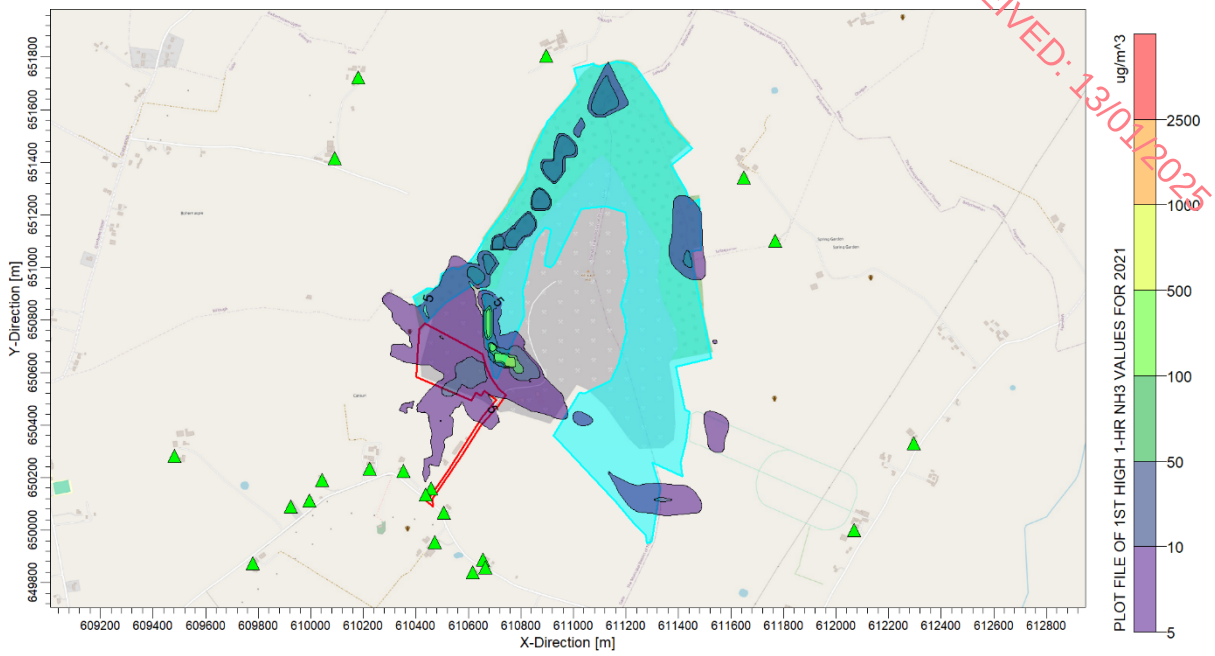


Figure A-11: 1-hour Mean NH_3 Process Contribution (2021)



Appendix B Flare Emissions

The proposed gas flare would be utilised as an emergency measure to dispose of excess biogas if necessary, with a maximum capacity of up to 2,500 m^3/hr of gas flow to the flare.

In order to predict potential impacts within the vicinity of the Site from the proposed enclosed ground flare, a quantitative assessment utilising the AERMOD dispersion model[28] has been undertaken. Further details on the methodology and inputs for the dispersion modelling study are presented in Appendix C.

Emission Parameters

Emission parameters have been input based on the client's design specifications, as well as application of the calculations outlined within the Guidance on Landfill Gas Flaring[32], which is considered appropriate of the type of enclosed bio-gas flare proposed.

The modelling input parameters are detailed in Table B-1.

Table B-1: Biogas Flare – Emission Parameters

Parameter / Source	Flare
Fuel	Biogas
Stack Location (NGR x,y)	610626 650564
Gas Composition	64% CH_4, 35% CO_2 and 0.01% H_2S
Stack Height (m)	10
Emission temperature (°C)	1000 (A)
Stack diameter (m)	2.5
Efflux velocity (m/s)	6.54
Flow (Am^3/s)	32.1 (B)
Actual O_2 % (dry)	9.13
Actual moisture %	6.60
Flow (Nm^3/s)	3.96 (C)
NO_X Concentration (mg/Nm^3)	150 (D)
NO_X emission (g/s)	0.59
SO_2 Concentration (mg/m^3)	139 (E)
SO_2 emission (g/s)	0.18

Table note:

(A) Default value for flare emission temperature.

(B) Combustion air calculated as Air/CH_4 ratio of 22.3, which is considered representative of AD Biogas scenarios.

(C) Normalised to 273K, dry, 101.3kPa, O_2 assuming in-stack oxygen concentration of 21% (dry) and moisture content of 9.7%.

(D) Emissions Standard for enclosed landfill gas flare.

(E) Calculated from the anticipated H_2S content (100 ppm), assuming complete conversion to SO_2 and 99% destruction and removal efficiency.

[32] Environment Agency (England) (2002) Guidance on Landfill Gas Flaring.

Emissions at Human Receptors

Flaring events would only occur during emergency scenarios, which would be short lived. Results are therefore presented against in consideration of short-term impacts at human receptors only.

The maximum predicted NO_2 and SO_2 impacts at the modelled relevant receptor locations are presented in Table B-2 to Table B-5 below.

The findings are as follows:

- The short-term impacts can be described as 'negligible' at all receptors identified;
- The AQAL is not exceeded at any of the receptor locations; and
- The maximum GLC is presented and does not exceed the AQAL.

Therefore the effect on air quality at human receptors as a result of emergency flaring of biogas is considered 'not significant'.

Table B-2: Predicted NO_2 1-hour Mean (99.79%ile) Impacts

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
Max GLC	17.0	8.5%	25.8	12.9%	n/a
Maximum at Residential Receptor	3.0	1.5%	11.8	5.9%	Negligible

Table B-3: Predicted SO_2 24-hr Mean (99.18%ile) Impacts

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
Max GLC	7.9	6.3%	16.1	12.9%	n/a
Maximum at Residential Receptor	0.5	0.4%	8.7	7.0%	Negligible

Table B-4: Predicted SO_2 1-hr Mean (99.73%ile) Impacts

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
Max GLC	13.7	3.9%	21.9	6.3%	n/a
Maximum at Residential Receptor	2.0	0.6%	10.2	2.9%	Negligible

Table B-5: Predicted SO_2 15-minute Mean (99.9%ile) Impacts

Receptor	PC (µg/m³)	PC as % of AQAL	PEC (µg/m³)	PEC as % of AQAL	Impact Descriptor
Max GLC	19.2	7.2%	27.4	10.3%	n/a
Maximum at Residential Receptor	4.4	1.6%	12.6	4.7%	Negligible

Appendix C Detailed Modelling Parameters

For this assessment the AERMOD model[28] has been applied; this model is widely used and accepted for undertaking such assessments and its predictions have been validated against real-time monitoring data by the United States (US) Environmental Protection Agency (EPA). It is therefore considered a suitable model for this assessment.

Model Domain / Receptors

The modelling has been undertaken using a receptor grid across a map of the study area. Pollutant exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the maximum ground level concentration outside the Site boundary to be assessed.

A nested receptor grid of 5km by 5km centred upon the Site was applied as follows:

- 200m x 200m at 20m grid resolution;
- 500m x 500m at 50m grid resolution;
- 1000m x 1000m at 100m grid resolution;
- 2000m x 2000m at 200m grid resolution; and
- 5000m x 5000m at 500m grid resolution.

In addition, the modelling of discrete sensitive receptor locations, as described in Section 4.1, was undertaken to assess the impact at relevant exposure locations for annual mean impact and facilitate the discussion of results.

Topography

The presence of elevated terrain can affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away.

AERMOD utilises digital elevation data to determine the impact of topography on dispersion from a source. Topography was incorporated within the modelling using 30m resolution Shuttle Radar Topography Mission (SRTM) terrain data files. Data was processed by the AERMAP function within AERMOD to calculate terrain heights.

Topography has been incorporated into the model and is illustrated in Section 4.6.

Building Downwash

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. Building downwash has been considered for buildings that have a maximum height equivalent to at least 40% of the emission height and which are within a distance defined as five times the lesser of the height or maximum projected width of the building.

The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Figure C-1 to Figure C-3 below present the buildings input to the model in blue and emission stacks in red.

Figure C-1: Modelled Buildings and Structures – Odour Abatement System Stack

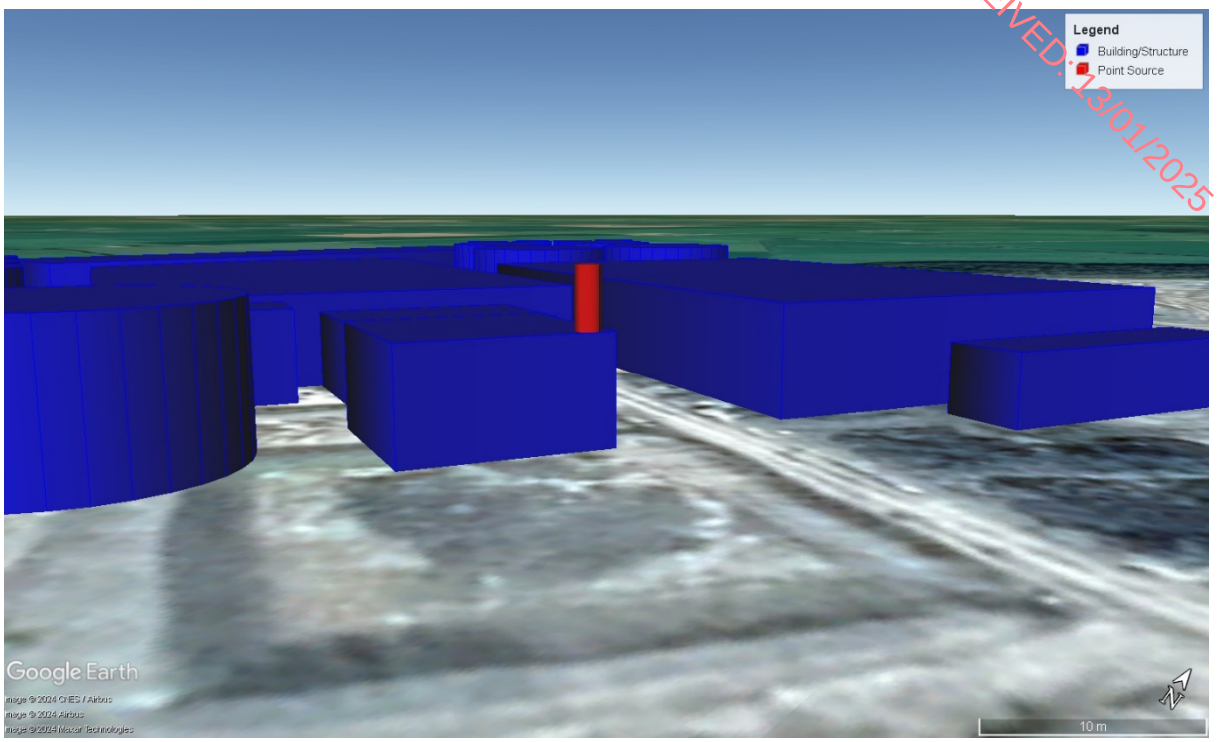


Figure C-2: Modelled Buildings and Structures – CHP Stack

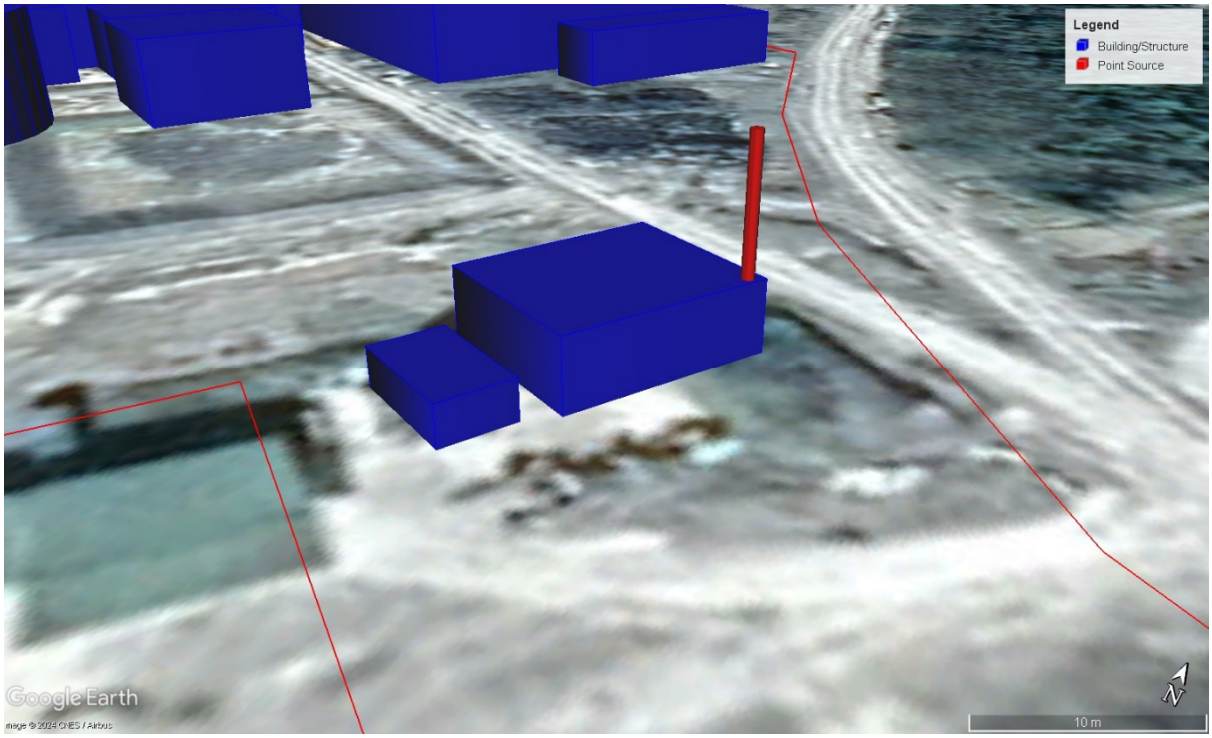
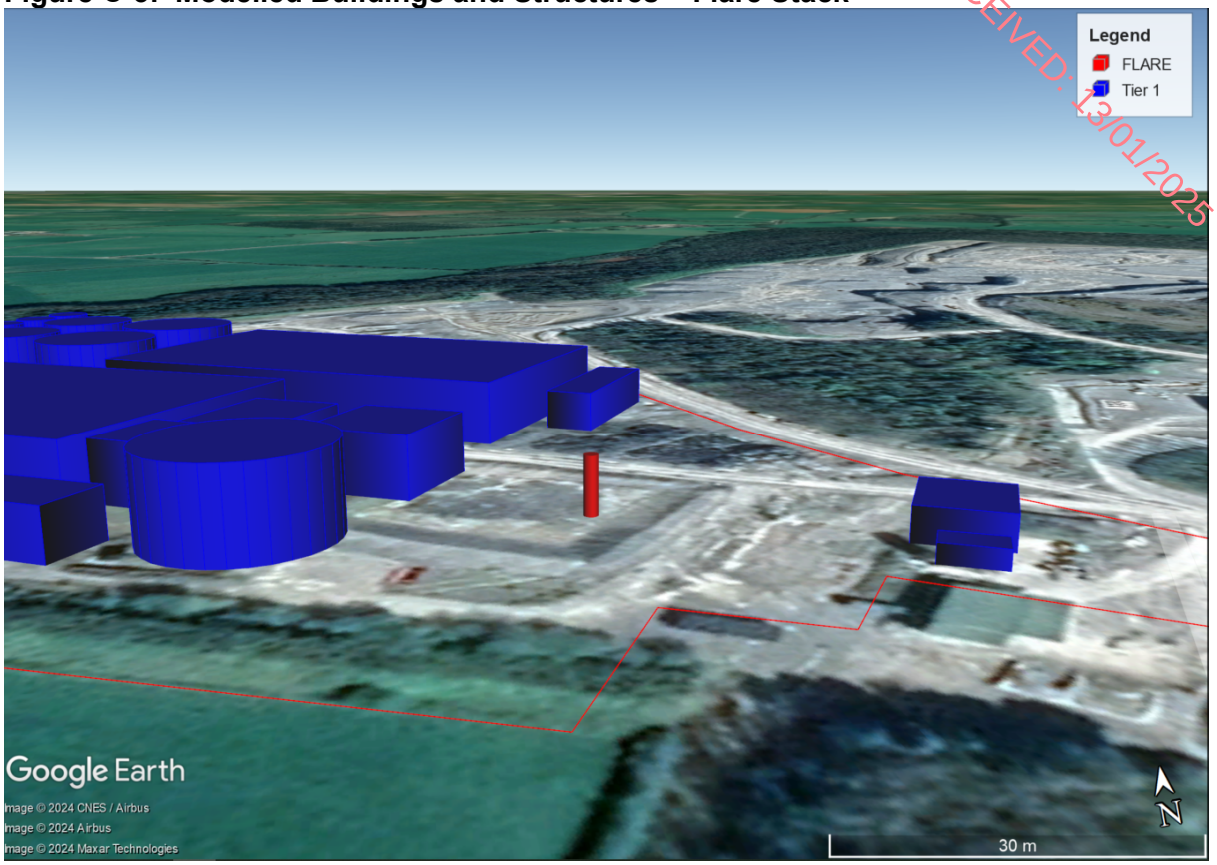


Figure C-3: Modelled Buildings and Structures – Flare Stack



Meteorological Data and Preparation

As there are no meteorological recording stations located in proximity of the Site, NWP data has been utilised for the study. Five consecutive years of hourly-sequential NWP data covering the period 2019 to 2023 (inclusive) was acquired based on the Site location and has been applied in the assessment.

The NWP meteorological data was obtained in '.met' format from the data supplier. The data was converted to the required surface and profile formats for use in AERMOD, in accordance with the latest guidance[33], using the AerMet View meteorological pre-processor. Details specific to the works location were used to define surface roughness, albedo and bowen ratio in the conversion using the AerSurface tool within AerMet. The applied values are presented in Table C-1 below.

[33] AERMOD Implementation guide. AERMOD implementation workgroup, USEPA. Last revised October 2023.

Table C-1: Meteorological Data Preparation – Applied Surface Characteristics

Zone (Start and End Sectors in °)	Albedo	Bowen	Surface Roughness
0 – 30	0.18	0.56	0.114
30 – 60	0.18	0.56	0.062
60 – 90	0.18	0.56	0.054
90 – 120	0.18	0.56	0.06
120 – 150	0.18	0.56	0.083
150 – 180	0.18	0.56	0.077
180 - 210	0.18	0.56	0.085
210 – 240	0.18	0.56	0.083
240 – 270	0.18	0.56	0.079
270 – 300	0.18	0.56	0.077
300 – 330	0.18	0.56	0.068
330 - 0	0.18	0.56	0.101

A windrose, showing the frequency of wind speed and direction used in the assessment is provided in Section 4.5. The windrose shows that winds from the southern and eastern sectors are most frequent, with winds from the northern and eastern sectors least frequent.

Dispersion Coefficients

The 'rural' option for dispersion coefficients was selected in accordance with AERMOD guidance.

Dispersion Model Uncertainty

Model validation studies[34] for AERMOD generally suggest that these dispersion models are for the vast majority of cases able to predict maximum short term high percentiles concentrations well within a factor of two and the latest evaluation study for AERMOD shows the composite (geometric mean) ratio of predicted to observed short-term averages from 'test sites' (where real-time monitoring data is available to validate model performance), to be between 0.96 and 1.2.

NO_X to NO_2 Conversion

NO_x emitted to atmosphere as a result of combustion will consist largely of nitric oxide (NO), a relatively innocuous substance. Once released into the atmosphere, NO is oxidised to NO_2. The proportion of NO converted to NO_2 depends on a number of factors including wind speed, distance from the source, solar radiation and the availability of oxidants, such as ozone (O_3).

[34] AERMOD: Latest Features and Evaluation Results, EPA-454/R-03-003, June 2003 (United States Environmental Protection Agency).

A worse-case scenario has been applied in that 35% of NO_x is presented as NO_2 in relation to short-term impacts and 70% of NO_x is present as NO_2 in relation to long-term impacts in accordance with the EA's AQMAU guidance[35] on the conversion ratio for NO_x and NO_2.

SO_2 15-minute Mean Averaging Period

As dispersion models utilise hourly average meteorological data, calculation of 15-minute averages, such as required for SO_2, requires the application of conversion factors. For the purposes of detailed modelling of SO_2, a conversion factor of 1.34 is applied to the hourly average data, as detailed in the AERA guidance.

Assessment of Impacts on Human Receptors

The significance of effects on human receptors will be assessed on the basis of the EPUK & IAQM guidance, which presents a matrix to establish the magnitude of impact on individual receptors based upon the percentage change relative to the AQAL. The impact at an individual receptor is identified as 'negligible', 'slight', 'moderate' or 'substantial'. The impact can be either 'adverse' (due to concentration increase) or 'beneficial' (due to concentration decrease).

The impact at individual receptors is dependent upon the long-term average pollutant concentration at the receptor in the assessment year and the percentage change relative to the AQAL.

Reference should be made to Table C-2 for presentation of the impact descriptors used within the assessment of long-term concentrations and Table C-3 for short-term concentrations.

Table C-2: Impact Descriptors – Assessment of Long-term Concentrations

Long-term Concentration with development at receptor location	Percentage Change in Long-term Concentration Relative to AQAL				
	<0.5	1	2 – 5	6 – 10	>10
<75% of the AQAL	Negligible	Negligible	Negligible	Slight	Moderate
75 – 95% of the AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95 – 103% of the AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103 – 110% of the AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
>110% of the AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

[35] Environment Agency, Air Quality Modelling and Assessment Unit, 'Conversion Ratios for NOx and NO_2' (no date).

Table C-3: Impact Descriptors – Assessment of Short-term Concentrations

Impact Descriptor	Maximum Predicted Short-term Concentration as % of AQAL
Substantial	>50
Moderate	20 – 50
Slight	10 – 20
Negligible	<10

The predicted impacts will be used to determine the significance of the overall effect; which is dependent on a number of factors. Therefore, professional judgement will be applied to determine the likely significance of effects, with the following factors considered:

- the existing and future air quality in the absence of the development, notably whether the AQALs are likely to be met or the scale of exceedances in the long-term and short-term mean concentrations;
- the extent of current and future population exposure to the predicted impacts, notably the number of properties and/or people present and the scale of impact (e.g. whether the majority of the local population is subject to substantial or slight magnitude impacts); and
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts, such as establishing a worst-case scenario for sensitive receptors.

If the overall impact is described as 'substantial', or there is a predicted exceedance of any considered AQAL at a location of relevant exposure, the predicted effect on air quality may be considered "significant".

Assessment of Impacts on Vegetation and Ecosystems

Calculation of Contribution to Critical Loads

Deposition rates were calculated using empirical methods recommended by the EA AQTAG06[36]. Dry deposition flux was calculated using the following equation:

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

Wet deposition occurs via the incorporation of the pollutant into water droplets which are then removed in rain or snow, and is not considered significant over short distances (AQTAG06) compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered.

The applied deposition velocities for the relevant chemical species are as presented in Table C-4.

[36] AQTAG06 – Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air. Environment Agency, March 2014 version.

Table C-4: Applied Deposition Velocities

Chemical Species	Recommended deposition velocity (m/s)	
NO_2	Grassland	0.0015
	Woodland	0.0030
SO_2	Grassland	0.0120
	Woodland	0.0240

Critical Loads

C_{Lo} for the habitats and species of relevance to this assessment have been obtained from the APIS website.

Critical Loads – Eutrophication / Nutrient Nitrogen

C_{Lo} for nitrogen deposition (N) are recorded in units of kgN/ha/yr. The deposition PC is converted from µg/m^2/s to units of kgN/ha/yr by multiplying the dry deposition flux by the standard conversion factor of 95.9 for NO_2.

Critical Loads – Acidification

The predicted deposition rates are converted to units of equivalents (keq/ha/year), which is a measure of how acidifying the chemical species can be, by multiplying by the dry deposition flux (µg/m^2/s) by the standard pollutant specific conversion factors presented within Table C-5.

Table C-5: Applied Acidification Conversion Factors

Chemical Species	Conversion factor to keq/ha/year
NO_2	6.84
SO_2	9.84

Calculation of PC as a percentage of Acid Critical Load Function

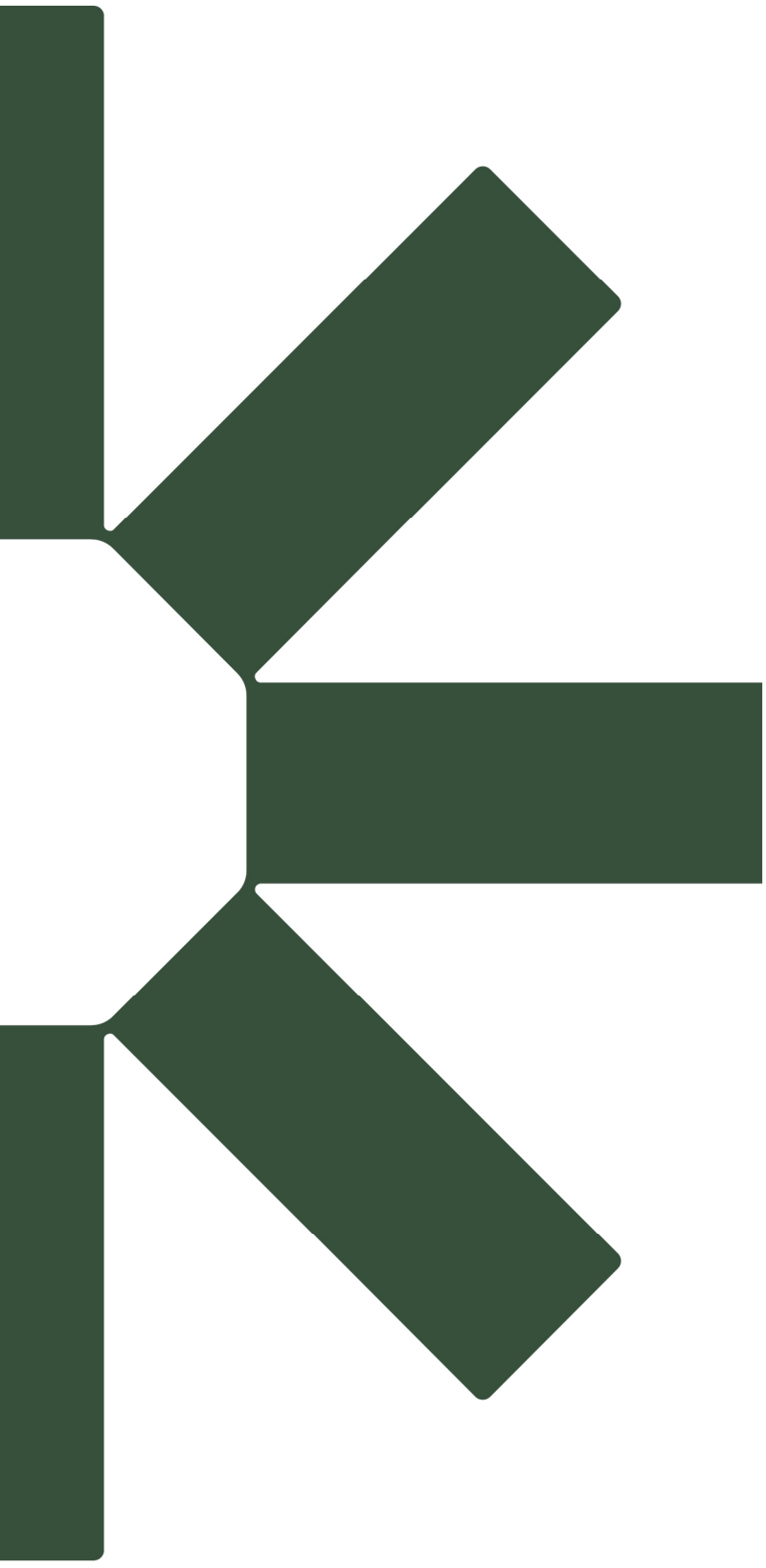
The calculation of the process contribution of N and S to the acid C_{Lo} function has been carried out according to the guidance on the APIS, which is as follows:

> *'The potential impacts of additional sulphur and/or nitrogen deposition from a source are partly determined by PEC, because only if PEC of nitrogen deposition is greater than CLminN will the additional nitrogen deposition from the source contribute to acidity. Consequently, if PEC is less that CLminN only the acidifying affects of sulphur from the process need to be considered:*
>
> *Where PEC N Deposition < CLminN*
>
> *PC as % CL function = (PC S deposition/CLmaxS)*100*
>
> *Where PEC is greater than CLminN (the majority of cases), the combined inputs of sulphur and nitrogen need to be considered. In such cases, the total acidity input should be calculated as a proportion of the CLmaxN.*
>
> *Where PEC N Deposition > CLminN*

*PC as %CL function = ((PC of S+N deposition)/CLmaxN)*100'*

Assessment of Impact and Significance

Air quality impacts on ecological sites have been assessed in consideration of the criteria outlined in Section 3.7.



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