9. AIR, DUST AND CLIMATIC FACTORS

9.1 Introduction

TMS Environment Ltd prepared this section of the Environmental Impact Assessment Report (EIAR). It considers the potential air quality and climate impacts associated with the proposed development. Impacts of site operations are considered by taking account of the existing baseline, the projected impacts and compliance with relevant standards.

The subject lands are located to the north of Clane town in the Townland of Capdoo in County Kildare and occupy an area of approximately 11.4ha. The proposed development for which planning permission is sought in this application comprises a residential development of approximately 366 residential units, a childcare facility, a new link road together with all associated and ancillary infrastructure and open space provision.

9.2 Methodology

9.2.1 Study Area

Air quality impacts of the proposed project on receptors which could potentially be affected by the proposed development are considered in this Chapter of the EIAR. The study area includes all areas that could potentially be affected by the emissions from the proposed project. The study area for the Construction Phase air quality impact assessment was defined according to the Institute of Air Quality Management's (IAQM's) *Guidance on the Assessment of Dust from Demolition and Construction* (IAQM 2014), and includes sensitive receptors (e.g. houses, schools and hospitals) that are located within 350m of construction activities.

The study area for the Operational Phase air quality assessment includes receptors and ecological designated sites that could be affected by the proposed project. The study area for the Operational Phase air quality assessment was determined using professional judgement and from a consideration of the potential impacts on receptors located near the proposed project. The potential impact on human receptors does not extend beyond a distance of 500m from the centre of the proposed development site.

9.2.2 Impact Assessment Methodology

Construction

The impact assessment methodology involves identification and characterisation of the air quality impacts that may be associated with the proposed project, characterisation of the baseline environment to benchmark the existing situation, quantitative prediction of air quality impacts and assessment of the impacts against recognised Air Quality Standards (AQS) and guidelines. From this assessment comes a definition of mitigation measures that are required to ensure that all aspects of the impacts of the proposed project, through the Construction Phase and the Operational Phase, are managed and controlled to protect human health, the environment and amenity.

The effects of the proposed project are described by considering the possible impacts that could occur as a result of the proposed project, the probability of their occurrence and the nature and significance of such impacts. The Environmental Protection Agency's (EPA's) draft *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA 2017a) (draft Guidelines) take account of Directive 2014/52/EU of 16 April 2014 on the assessment of the effects of certain public and private projects on the environment (EIA Directive) and have been considered in this assessment. Impacts are described in the draft Guidelines under various headings which are summarised as follows:

- Probability – likely, possible, unlikely;
- Quality – positive, neutral, negative;
- Significance – e.g. Imperceptible, Moderate, Profound; and
- Magnitude – duration, frequency, extent, context.

A description of the significance of effects is presented in Table 9.1, which shows the approach taken to quantifying the significance and magnitude of potential air quality impacts in this assessment.

In addition to considering the above guidance, the general approach adopted for the air quality impact assessment is summarised as follows:

- Describe the existing baseline air quality at the proposed project site and in the vicinity of receptors;
- Describe the potential impacts of the proposed project on air quality;
- Identify appropriate criteria against which to assess the significance of the impacts associated with the proposed project;
- Propose avoidance and mitigation measures where required; and
- Identify and assess all cumulative impacts with potential to impact upon the baseline environment.

Table 9.1 Describing the Significance and Magnitude of Environmental Effects (EPA 2017a)

Aspect	Description
Significance of Effects	
Imperceptible	An effect capable of measurement but without noticeable consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without noticeable consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends.
Significant	An effect which, by its character, magnitude, duration or intensity, alters most of a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics
Magnitude of Effects	
Extent	This is described by the size of the area, the number of sites and the proportion of the population affected by the effect.
Duration	**Momentary effects** last seconds to minutes.
	Brief effects last less than a day.
	Temporary effects last less than one year.
	Short-term effects last from one to seven years.
	Medium-term effects last from seven to 15 years.
	Long-term effects last from 15 to 60 years.
	Permanent effects last over 60 years.
Frequency	How often the effect will occur
Context	The contextual relationship between the effect and the existing baseline

The IAQM's (2014) *Guidance on the Assessment of Dust from Demolition and Construction* describes a five-step approach to the assessment which is summarised as follows:

- Screen the proposed project to determine if there is a requirement for a more detailed assessment;
- Assess the risk of dust impacts for each of the four activities (demolition, earthworks, construction and construction traffic) and take account of the scale and nature of the works, and the sensitivity of the area;
- Determine the site-specific mitigation for each potential activity;
- Examine the residual effects and determine whether these are significant; and
- Prepare the dust assessment report.

This approach has been applied to the proposed project. A detailed assessment is required when there are human receptors within 350m of the boundary of the project site, and since the closest human receptors to the proposed project site boundaries are within this distance, a detailed assessment was required.

There are no European or Designated Sites within 50m of the site boundary, which is the threshold distance for ecological sensitivity. Therefore, there are no significant Construction Phase air quality impacts predicted for ecological sites from the construction works, and this element is not assessed further.

The impacts on air quality from the Construction Phase will arise through the generation and subsequent deposition of dust and elevated local PM_{10} concentrations. The four construction activities have been assessed on the basis of the area sensitivity and the emission magnitude. The dust emission magnitude is based on the scale of the anticipated works and should be classified as Small, Medium, or Large. Dust emissions are defined according to the scale and nature of the work for each activity, as described in Table 9.2 below.

The two types of sensitive receptors that may be impacted by dust from construction activities, as defined by IAQM (2014), are human and ecological. These are defined as "*a location that may be affected by dust emissions during demolition and construction. Human receptors include locations where people spend time and where property may be impacted by dust. Ecological receptors are habitats that might be sensitive to dust*".

The guidance refers to human receptors as those properties that may be subject to adverse impacts of dust or PM_{10} over a time period relevant to the Air Quality Standard. Specific properties include, dwellings, cultural heritage collections, food manufactures, etc. According to IAQM (2014) a single dwelling is classified as one receptor, whereas a school counts as 100. In addition, relevant designated (ecological) sites and their sensitivity to dust impacts, have been also considered. Designated sites include nature sites that have special status as protected areas because of their natural importance.

Receptor sensitivity is defined by a number of factors including:

- specific sensitivities of those receptors;
- number of receptors;
- proximity to construction site;
- background PM_{10} concentrations; and
- site-specific factors.

The sensitivity of key receptors to each construction-related activity is determined for each of the following dust impacts:

- dust soiling;
- human health impacts; and
- impacts on ecological receptors.

The sensitivity of an area to the potential impacts of each activity is defined at various distances from the work site depending on the sensitivity and number of receptors. IAQM categorises these in several distance bands for different impacts at 20, 50, 100, 200 and 350 m. Receptor sensitivity to dust soiling is assessed for only four IAQM distance bands, whereas sensitivity to human health impacts is assessed for all five. Table 9.3 defines the levels of sensitivity of areas at different distances for each of the impacts listed above.

Table 9.2 Quantitative Determination of the Magnitude of Dust Emissions for Demolition and Construction Activities (IAQM 2014)

Activity	Dust Emission Magnitude	
Demolition	Large	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;
	Medium	Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
	Small	Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.
Earthworks	Large	Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes;
	Medium	Total site area 2,500 m^2 – 10,000 m^2, moderately, dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes; and
	Small	Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.
Construction	Large	Total building volume >100,000 m^3, on site concrete, batching, sandblasting;
	Medium	Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching; and
	Small	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).
Track-out	Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m;
	Medium	10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m; and
	Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

Table 9.3 Area Sensitivity to the Effects of Dust Soiling (IAQM 2014)

Receptor Sensitivity	Number of Receptors	Distance from the Source, m			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10 – 100	High	Medium	Low	Low
	1 – 10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

The estimated magnitudes of each construction activity (small, medium, large or negligible) are combined with the area sensitivity, which is determined by the number and proximity of receptors to the construction boundary and the background PM_{10} concentration. High sensitivity receptors include properties such as residences, care homes, hospitals and schools, and medium sensitivity receptors include hotels, offices and supermarkets. There are high sensitivity receptors close to the proposed project, and therefore as a worst-case approach, the assessment is based on a high sensitivity rating for all receptors. Since the potential emissions are predominantly in the 30µm to 75µm size range, PM_{10} impacts are screened out as insignificant for this assessment; the assessment therefore focuses on the larger particle sizes. This qualitative analysis provides the overall level of risk of impacts for dust soiling, human health and ecology. The level of risk of each impact is used to identify appropriate mitigation measures.

Climate

The potential climate impact of the proposed project is assessed by comparing the total emissions of Greenhouse Gases (GHG) with those that would occur if the site was left as it is. The Climate Action and Low-Carbon Development Act 2015, which provides for new arrangements aimed at achieving transition to a low-carbon, climate-resilient and environmentally sustainable economy by 2050, requires that the applicant considers and reduces its carbon footprint in all aspects of the proposed development. This assessment provides information on how the proposed project considers this objective in the selection of the preferred approaches for the proposed development.

The principal GHG emissions associated with the proposed development are methane and carbon dioxide (CO_2). For the purposes of this assessment the proposed development is compared with a *Do Nothing* scenario and evaluated. Therefore, 2 scenarios have been assessed as follows:

- Scenario 1 – Do Nothing, in this scenario, there will be no development at the site; and
- Scenario 2 – Do Something (proposed Project), in this scenario the proposed development is assessed.

The assessment estimates the total GHG emissions from direct and indirect activities associated with the proposed project. Overall emissions over the lifetime of the project are considered. The assessment is presented in terms of relative GHG emissions from the various sources and while there are some uncertainties, the assessment allows a reliable comparison of the Climate Impact of the proposed project relative to the Do Nothing scenario.

9.2.3 Impact Assessment Criteria

Air Quality Standards (AQS) in Ireland have been defined to ensure compliance with European Commission Directives; they are developed at different levels for different purposes. European legislation on air quality has been framed in terms of two categories: limit values and guide values. Limit values are concentrations that cannot be exceeded and are based on World Health Organisation (WHO) guidelines for the protection of human health. Guide values are set as a long-term precautionary measure for the protection of human health and the environment. The WHO Guidelines differ from the European Union Air Quality Standards (EU AQS) in that they are primarily set to protect public health from the effects of air pollution, whereas AQS are recommended by governments, and other factors, such as socio-economic factors, may be considered in setting the standards.

The AQS and guidelines referenced in this report are summarised in Table 9.4. These criteria have been chosen to ensure that the potential impacts of the proposed project during both the Construction Phase and the Operational Phase will be benchmarked against appropriate standards. Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (Clean Air for Europe Directive) is an amalgamation of Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management (Air Quality Framework Directive) and its subsequent daughter Directives and sets out limit and target values for named air quality parameters. The Clean Air for Europe Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air (Fourth Daughter Directive) was transposed into Irish legislation by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58 of 2009). These Directives and the Irish Regulations set out the main standards against which the potential impacts of the proposed project on air quality are assessed, as summarised in Table 9.4.

There are no national or European AQS with which dust deposition can be compared. However, a figure of 350mg/m^2/day, based on the German Standard, Technical Instructions on Air Quality Control (TA Luft) Regulations, is commonly applied by Local Authorities and the Environmental Protection Agency (EPA) to ensure that no nuisance effects will result from specified industrial activities.

In addition to the Air Quality Standards Regulations 2011 and the Clean Air for Europe Directive standards, it is also appropriate to consider the WHO Guidelines. These Guidelines were developed by the WHO to provide appropriate air quality targets worldwide, based on the latest health information available. The air quality guidelines for PM_{10}, NO_2 and SO_2, and $PM_{2.5}$ are considered in this Chapter. While the WHO Guidelines are not mandatory, they represent the current informed opinion on the levels to which we should be aspiring in order to minimise the adverse health impacts of air pollution. The WHO guidelines referenced in this report are summarised in Table 9.5.

Table 9.4 Air Quality Standards Regulations 2011 (S.I. 180 of 2011; Based on Clean Air for Europe Directive 2008/50/EC)

Pollutant	EU Regulation	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	None	200 µg/m³ NO_2
		Annual limit for protection of human health	None	40 µg/m³ NO_2
		Annual limit for protection of vegetation	None	30 µg/m³ NO + NO_2
Sulphur Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	150 µg/m³	350 µg/m³
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 µg/m³
		Annual & Winter limit for the protection of human health and ecosystems	None	20 µg/m³
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50%	50 µg/m³
		Annual limit for protection of human health	20%	40 µg/m³
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health (Stage 1)	20% from June 2008. Decreasing linearly to 0% by 2015	25 µg/m³
		Annual limit for protection of human health (Stage 2)	None To be achieved by 2020	20 µg/m³
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	60%	10 mg/m³ (8.6 ppm)
Benzene	2008/50/EC	Annual limit for protection of human health	0% by 2010	5 µg/m³

Table 9.5 World health Organisation Air Quality Guidelines

Pollutant	Limit Type	Value
Nitrogen Dioxide	Hourly limit for protection of human health	200 µg/m^3
	Annual limit for protection of human health	40 µg/m^3
Sulphur Dioxide	Daily limit for protection of human health	20 µg/m^3
	10-minute limit for protection of human health	500 µg/m^3
Particulate matter (as PM_{10})	24-hour limit for protection of human health	50 µg/m^3
	Annual limit for protection of human health	20 µg/m^3
Particulate matter (as $PM_{2.5}$)	24-hour limit for protection of human health	25 µg/m^3
	Annual limit for protection of human health	10 µg/m^3

9.3 Receiving Environment

9.3.1 Meteorological Conditions

The magnitude of potential impacts of the proposed development on air and climate will largely be influenced by the local meteorological conditions, in particular by wind speed and direction and by precipitation rates. An evaluation of the climatic conditions at the site is therefore useful for an assessment of the type required for this study.

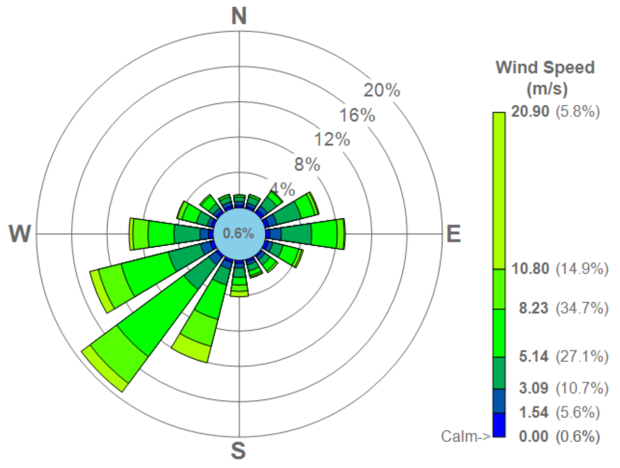
Met Éireann operate a Synoptic Network of weather stations at Belmullet, Malin Head, Rosslare (closed since 2008), Johnstown Castle, Birr, Clones, Kilkenny and Mullingar while the Aviation Division of Met Éireann maintains observing stations at Shannon Airport, Knock Airport, Casement Aerodrome, Dublin Airport and Cork Airport. There is no continuous meteorological monitoring on the subject site but the general guidance on selection of meteorological data for air quality impact assessments is to choose representative data, recently acquired, which best represents conditions at the site. At least three years of recently acquired data is preferred. Comprehensive monitoring data is available for Casement Aerodrome (located 15km east of the subject site) which would be indicative of the meteorological conditions that are experienced at the proposed site. Therefore, for the purpose of obtaining reliable information about the climatological conditions at the site of the proposed development, a full set of meteorological data for the period 2013 – 2015 recorded at Casement Aerodrome was analysed. This is considered an appropriate data set for the study because of the close proximity of the station to the site and the similarity in topography in the immediate area of both Casement Aerodrome and the site of the proposed development.

Wind speed and direction in particular is important in determining how emissions associated with the activity are dispersed. The prevailing wind direction determines which areas are most significantly affected by the emissions from the activity and wind speed determines in part the effectiveness of the dispersion of the emissions.

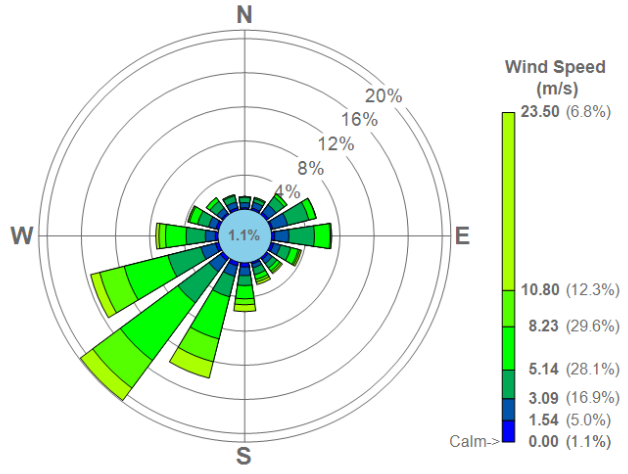
The windroses for Casement Aerodrome are presented in Figure 9.1 for each of the years 2013 – 2015. The dominant wind direction for Casement Aerodrome is from the southwest quadrant. The wind speed is below 5.14m/s for just under 50% of the time. The average long-term wind speed over the period 1985 – 2010 is 5.5m/s.

Figure 9.1 Windroses for Casement Aerodrome 2013 to 2015

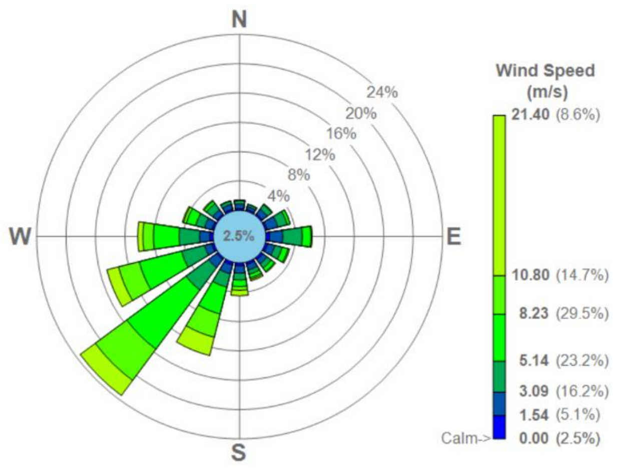
Casement Aerodrome 2013



Casement Aerodrome 2014



Casement Aerodrome 2015



Annual Average data for Casement Aerodrome 1981 - 2010	
Temperature, oC	9.7
Rainfall, mm	754
Mean num. of days with >= 0.2mm	183
Average wind speed, m/s	5.5

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Figure 9.1

Windroses for Casement Aerodrome 2013 - 2015

9.3.2 Influences on Ambient Air Quality

The existing activities at and in the vicinity of the proposed site have the potential to exert an influence on ambient air quality by release of emissions to atmosphere as follows:

- emissions of fine particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO) from domestic, commercial and industrial heating;
- emissions of particulate matter (PM_{10} and $PM_{2.5}$), SO_2, NO_x, CO and benzene from traffic on adjoining roads; and
- emissions of dust and PM from agricultural activities.

Overall, the contribution of traffic to air quality is considered to be the most significant influence on air quality in the immediate vicinity of the various Proposed Project site, but all other sources also exert significant influences on air quality.

The main substances which are of interest in terms of existing air quality are sulphur dioxide, nitrogen oxides, particulate dusts including PM_{10} and $PM_{2.5}$ which could originate from combustion sources and traffic. There are no new substances expected to be present in emissions released from the proposed development. A description of existing levels of the various substances in ambient air is required to allow completion of the evaluation of air quality impacts associated with the development and is presented in the following section.

9.3.3 Existing Ambient Air Quality

The main substances which are of interest in terms of existing air quality are sulphur dioxide, nitrogen oxides (nitric oxide, NO and nitrogen dioxide NO_2, collectively referred to as NO_x), fine particulate matter including PM_{10} and $PM_{2.5}$ which could originate from combustion sources, traffic and the existing commercial activities in the area. Carbon monoxide is also potentially of interest, and benzene may also be of interest from traffic sources. There are no significant new substances expected to be present in emissions released from the proposed development relative to the existing situation.

Particulate matter is made up of tiny particles in the atmosphere that can be solid or liquid and is produced by a wide variety of natural and manmade sources. Particulate matter includes dust, dirt, soot, smoke and tiny particles of pollutants. Particulate matter of 10 micrometers in aerodynamic diameter or less are also referred to as PM_{10} or more strictly, particles which pass through a size selective inlet with a 50% efficiency cut-off at 10 um aerodynamic diameter. Similarly, $PM_{2.5}$ refers to particulate matter of 2.5 micrometers or less in aerodynamic diameter. In the past domestic coal burning was a major source of particulate matter in Irish cities during winter months. Levels of particles have decreased significantly since then following the introduction of abatement strategies including Special Control Areas and other Regulations regarding the use, marketing, sale and distribution of certain fuels. The significance of particulate matter is predominantly related to human health and respiratory effects.

Nitrogen oxides (NO_x, which is the sum of NO and NO_2), are generated primarily by combustion processes. The main anthropogenic sources are mobile combustion sources (road, air and traffic) and stationary combustion sources (including industrial combustion). The main source of nitrogen oxides in the vicinity of the site is traffic. The significance is health-related for nitrogen dioxide (NO_2) and ecological for nitrogen oxides (NO_x).

Sulphur dioxide also originates from combustion but predominantly from heating sources and not traffic. The trend in ambient SO_2 concentrations in Ireland is very clearly downward and this pollutant is not a matter for concern in Ireland. This reduction can be attributed to fuel switching from high-sulphur fuels, such as coal and oil, to natural gas and to decreases in the sulphur content of oil.

Carbon Monoxide (CO) is a colourless and odourless gas, formed when carbon in fuel is not burned completely. It is a component of motor-vehicle exhaust, which accounts for most of the CO emissions nationwide. Consequently, CO concentrations are generally higher in areas with heavy traffic congestion.

A description of existing levels of the various substances in ambient air is required to allow completion of the evaluation of air quality impacts associated with the development. The available data from the National Ambient Air Quality Network is a reliable data set for consideration in this study.

The Environmental Protection Agency (EPA) and local authorities maintain and operate a number of ambient air quality monitoring stations throughout Ireland in order to implement EU Directives and to assess the country's compliance with national air quality standards. Ireland's small population and generally good air quality means that a relatively small number of monitoring stations are sufficient across the country for the purposes of implementing the EU Air Directives. For ambient air quality management and monitoring in Ireland, four zones, A, B, C and D are defined in the Air Quality Standards (AQS) Regulations (S.I. No. 180 of 2011) and are defined as follows:

- Zone A: Dublin Conurbation.
- Zone B: Cork Conurbation.
- Zone C: 24 cities and large towns. Includes Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Newbridge, Mullingar, Letterkenny, Celbridge, Balbriggan, Portlaoise, Greystones and Leixlip.
- Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B &C.

The subject site is considered to be located in Zone D and is considered a rural site for assessment purposes. Air Quality Data from representative air monitoring stations in Zone D are therefore considered representative of air quality at the subject site. The EPA publishes Ambient Air Quality Reports every year which details the air quality in each of the four zones. The most recent report, published by the EPA in 2017, is the Air Quality in Ireland 2016 – Indicators of Air Quality, which contains monitoring data collected during 2016. Best practice requires that an average of at least three years of recent monitoring data is used for assessments of this type so data for 2014 to 2016 has been reviewed.

The EPA maintains monitoring stations in a number of rural locations including Emo, Enniscorthy, Castlebar, Kilkitt, Shannon Estuary, Claremorris and Portlaoise to monitor Zone D background air quality. Other monitoring stations have operated at various times and some new stations have been added to the network, but long-term data is available for the above stations.

Data from the Air Quality Monitoring Annual reports for 2014, 2015 and 2016 was reviewed and a summary of the data for representative stations for the three most recent years is presented for each parameter of interest in Table 9.6.

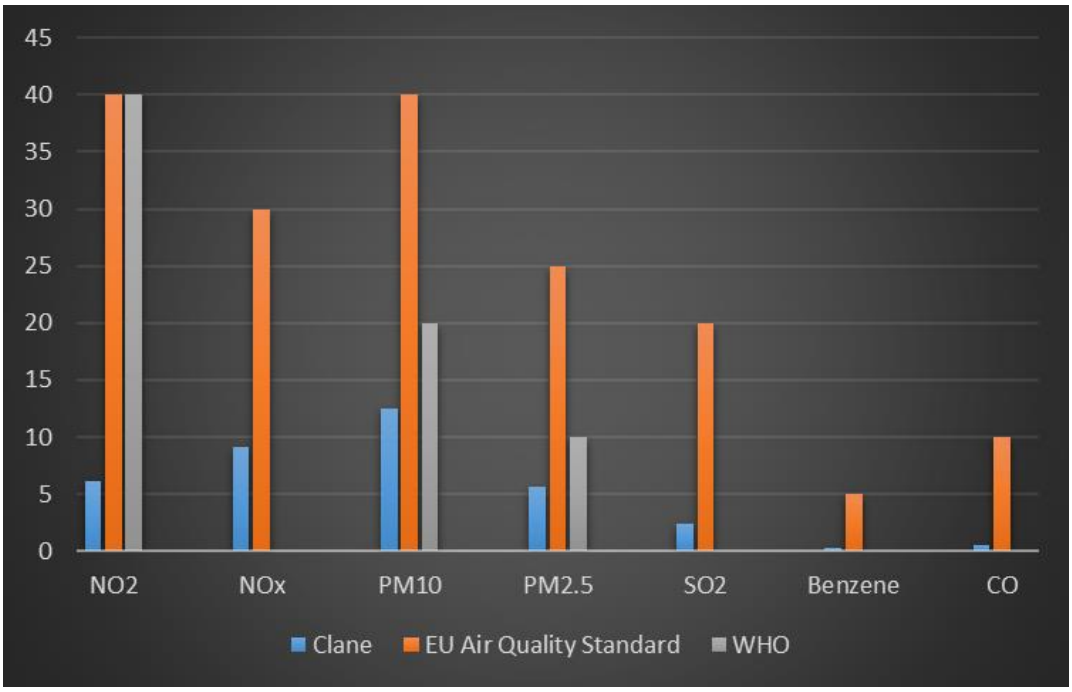
The approach taken is to take the average of the three most recent years (2014 – 2016) for each of the designated Zone D stations detailed above and the averages of the values for the stations are reported in Table 9.6. This is the data set which is used in the assessment of the potential impact of the proposed development on air quality. A graphical presentation comparing the data with the relevant Air Quality Standards (discussed further in Section 9.5 below) is presented in Figure 9.2.

It is noted from the data that existing ambient air quality is good for all health-related pollutants. All concentration levels are well within the EU Standards for all parameters of interest.

Table 9.6 Summary Background Air Quality Data for Stations in Zone D

Data Set	Parameter and Averaging Interval		Concentration μg/m³
Rural Background (Zone D)	Nitrogen dioxide NO_2	Annual Mean, μg/m³	6.2
Rural Background (Zone D)	Nitrogen oxides, NO_x	Annual Mean, μg/m³	9.2
Rural Background (Zone D)	Particulate Matter PM_{10}	Annual Mean, μg/m³	12.5
Rural Background (Zone D)	Particulate Matter $PM_{2.5}$	Annual Mean, μg/m³	5.7
Rural Background (Zone D)	Sulphur dioxide, SO_2	Annual Mean, μg/m³	2.4
Rural Background (Zone D)	Carbon Monoxide CO	Annual Mean 8-hour, mg/m³	0.5
Rural Background (Zone D)	Benzene	Annual Mean, μg/m³	0.3

Figure 9.2 Comparison of Background Air Quality Data with Air Quality Standards



9.4 Air Quality Impact Identification

9.4.1 Existing Activities

The existing activity at the site of the proposed development has the potential to exert an influence on air quality by release of emissions associated with the activity as follows:

- emissions of particulate matter (PM_{10} and $PM_{2.5}$), Sulphur dioxide (SO_2), nitrogen oxides (NO_x) and carbon monoxide CO from heating sources in the area;
- emissions of particulate matter (PM_{10} and $PM_{2.5}$), SO_2, NO_x, CO from traffic

The magnitude of the emissions from the existing activity is small relative to the dominant influence on air quality in the surrounding area which is traffic from the adjoining road network.

9.4.2 Construction Phase Impacts

The potential air quality impacts during Construction are summarised as follows:

a) Dust Emissions Associated with Excavations and Demolition Works

The most significant of the potential air quality impacts associated with the construction site is dust. Dust can be generated as a result of disturbance of materials, as a result of wind blowing across exposed surfaces and as a result of construction vehicle movements across exposed surfaces.

There are three potential impacts on air quality of the dust / particulate matter emissions. Dust deposition on surfaces is the main potential impact associated with the larger particles, nuisance effects such as reduced visibility could be associated with excessively high levels of suspended particulate matter and respiratory effects could occur as a result of excessive levels of fine particles such as PM_{10} and $PM_{2.5}$.

Dust emissions associated with the Construction Phase of the proposed development are expected to be predominantly in the 30 – 75µm particle size range so these particles, because of their size, will generally be deposited within 100m of the emission source. Only under exceptional meteorological conditions would the dusts be carried further downwind.

Suspended particulate matter (SPM) may also be released and this matter may remain suspended in the air. The main effect would be on visibility but this type of material could also be a respiratory nuisance if present at excessive levels. Emissions of dust in the form of fine particulate matter, PM_{10} and $PM_{2.5}$, may also occur, primarily as a result of materials handling and storage since the dominant particle size of the main construction materials is in the lower size ranges. There may also be some emissions of particles in these size ranges from the general site activities.

b) Construction Transport Emissions

Emissions of dust raised by vehicle movement on the roads near the site and also on site are considered under the general construction phase emissions in section (a) above. Emissions from the construction vehicles as a result of fuel combustion are considered here. The emissions include PM_{10} and $PM_{2.5}$, NO_2 and NO_x and CO and benzene.

c) Aspergillus Emissions from Excavation and Earthmoving Activity

There is concern about a fungal disease, "invasive Aspergillosis" which may be contracted as result of disturbance of materials that release fungal spores into the atmosphere. Fungal spores (the Aspergillus moulds) are found everywhere but are of particular concern when large scale demolition, excavation and earth-moving activity takes place.

9.4.3 Operation Phase Impacts

The most significant potential impacts remain the same as those associated with existing activities at and in the vicinity of the proposed site, namely emissions of particulate matter and combustion gases such as CO, SO_2 and NO_2 from heating and traffic.

Sulphur dioxide emissions originate from the sulphur in the fuel used in the combustion process. Since natural gas (heating) is the fuel to be used sulphur dioxide emissions will be negligible. Nitrogen oxides are present in the emission stream as a result of the combustion process. Much of the emissions are in the form of nitrogen oxide (NO) which is expected to be substantially oxidised to nitrogen dioxide in the atmosphere. Nitrogen oxide emissions from boilers using natural gas as fuel are significantly lower than the emissions associated with other fuels.

Particulate matter and carbon monoxide may also arise from the combustion process in the emission stream but only in minor amounts. Again, natural gas is a very clean fuel and particulate emissions from the boilers are predicted to be very low.

There is the potential for a number of greenhouse gas emissions to atmosphere from the boilers which may give rise to CO_2 emissions. However, the level of emissions will be insignificant compared to national greenhouse gas emissions, and the levels will be the same as the existing situation.

9.4.4 Traffic Impacts

There will be an insignificant change in traffic movements and this will not result in a quantifiable change in the emissions. These emissions will remain the same as the current situation. The principal substances that are associated with transport activity are particulate matter, nitrogen oxides and carbon monoxide. Dust emissions associated with construction traffic is also possible.

9.4.5 Do Nothing Impact

There will be no change in air quality impacts if no change takes place. In the absence of the development proposal, the air quality is unlikely to change.

9.5 Air Quality Impact Assessment

9.5.1 Construction Phase Impact

The construction of the proposed development will involve general construction activities. Site clearance will require the use of heavy earth-moving machinery and equipment that will be used for soil stripping, excavation, importation of materials to site and foundation laying equipment. Conventional construction work will then be required to build up the individual units that will be required on-site.

The risk of dust being emitted in sufficient quantities to cause a nuisance or health impacts is evaluated by considering the scale of the works programme. The IAQM's (2014) *Guidance on the Assessment of Dust from Demolition and Construction* gives advice on classifying the magnitude of the potential dust impacts and using the advice and information derived from the Construction Plan for the site, the magnitude of the dust emissions is estimated as shown in Table 9.7. The assessment is based on the closest receptors to any section of the proposed site and therefore represents a worst-case assessment scenario whereby the maximum potential impact is assessed.

Table 9.7 Assessment of Magnitude of Dust Emissions and Receptor Sensitivity for the Construction Programme for the Proposed Development

Activity	Magnitude of Dust Emissions	Sensitivity of Receptors and Surrounding Areas		
		Dust Soiling	Human Health	Ecological
Demolition	Small	Low	Low	Low
Excavations	Medium	Medium to High	Medium to High	Low
Construction	Low to Medium	Medium	Medium	Low
Construction Traffic	Medium	Medium	Medium	Low

The proposed development consists of a construction programme and very minor demolition works for the existing farmhouse and buildings. Excavation work is required as the site is a greenfield site with by far the majority of excavated materials being soils (grassed topsoil, topsoil and subsoil). The Construction programme is significant and therefore significant emissions could be expected.

The significance of the dust emissions and impacts is evaluated in terms of the sensitivity of the receptors in the area that could be affected by the emissions. In general, receptors located close to the construction site boundary are considered high sensitivity with sensitivity decreasing with increasing distance from the source reflecting the exponential decrease in dust levels as distance increases. The highest receptor sensitivity in the immediate vicinity of the proposed site is medium to high for any potential excavation works less than 20m from the nearest receptors and is medium for the vast majority of the construction activity.

The potential air quality impact arises from emissions of particulate matter and may result in deposition of dust around the site and trackout onto the roads in the vicinity of the site. The magnitude of the potential emissions associated with Construction is assessed as medium using the above criteria. The Construction Phase Environmental Management Plan will include a specific Dust Minimisation Plan which will ensure that dust impacts are prevented or minimized during the Construction Phase of the development.

Using the alternative assessment approach outlined in the Draft Guidelines on Environmental Impact Assessment as outlined in Section 9.2, the significance of potential dust emissions during construction is summarised in Table 9.8.

Table 9.8 Assessment of Significance of the Dust Emissions for the Construction Phase

Activity	Significance of Dust Emission	Duration of Dust Emission
Demolition	Imperceptible	Brief
Excavations	Slight	Temporary
Construction	Not Significant	Temporary
Construction Traffic	Slight	Short-term

This assessment shows that the most significant potential impacts are those associated with excavation work and construction traffic both of which are very dependent on weather conditions. Damp weather and low wind speeds will reduce the level of impact experienced at the receptor locations. There will be a temporary, slight impact on the closest receptors during the excavation programme and a temporary, not significant impact on the closest receptors during the construction works. Construction traffic impacts will be slight and experienced in the short-term. In an overall context, there will be no lasting impact and the temporary impacts can be effectively managed by means of a Construction Management Plan incorporating the mitigation measures outlined in section 9.7.

As noted above, there is concern about a fungal disease, "invasive Aspergillosis" which may be contracted as result of disturbance of materials that release fungal spores into the atmosphere. This is a disease which is detrimental to persons with suppressed immune systems, such as hospital patients. The "*National Guidelines for the prevention of Nosocomial Invasive Aspergillosis during construction/renovation activities*" deals specifically with construction works occurring within or adjacent to hospitals. The report states that the fungal spores responsible for invasive Aspergillosis can originate from a number of sources such as construction, demolition, renovation, disturbance of soil, removal of fibrous insulation material, removal of suspended ceiling tiles and from poorly maintained air ventilation systems. The potential sources of the fungal spores associated with invasive Aspergillosis, as detailed above, are related to the occurrence of these operations either within or in very close proximity to the hospital buildings.

Fungal spores (the *Aspergillus* moulds) are found everywhere but are of particular concern when large scale demolition, excavation and earth-moving activity takes place and especially in close proximity to areas where vulnerable individuals are located. The dispersion of spores (or indeed dust or any other substance) which are released at a particular location depends on a significant number of factors which include the rate and temperature of the release, the release height, the wind speed, rainfall, wind direction, topography, local meteorological conditions, the nature of the substances released, the potential for physical or chemical interactions and the concentrations of the substances released and other factors. The dispersion of fungal spores will depend on all of the above factors and this dispersion is evaluated by considering the factors noted above and the distances from the source at which the predicted impacts are to be assessed. In the first instance, the key factors are the concentration of the spores released and the distance to sensitive receptors. Dispersion of fungal spores released as a result of any activity is a function of time and distance and would be completely dispersed i.e. no measurable concentration at approximately 250m from the source of the release.

The National Guidelines report referred to above notes that the fundamental requirement in respect of eliminating *Aspergillus* infection from construction works is first to minimise the dust generated during construction and second to prevent dust infiltration into patient care areas. All construction works will be carried out in a way that minimizes dust emissions and in accordance with the requirements of the National Guidelines.

Raw materials required for the construction will be delivered to the sites using conventional Heavy Goods Vehicles (HGVs) and any wastes requiring removal from the site will be removed using HGVs.

The principal substances that are emitted from the vehicles are fine particulate matter, nitrogen oxides and carbon monoxide. Dust and particulate matter impacts associated with the passage of vehicles on roads has already been assessed as part of the dust and particulate matter impacts. The level of traffic movements has been reviewed in the context of potential contributions to air quality in the area. Potential emissions from traffic using the local road network linking onto the M4 were taken into consideration in this assessment. Using the guidance from the National Roads Authority (NRA) "Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes, NRA 2011" it was concluded that the additional transport will not generate significant emissions in terms of local air quality and no measurable change in air quality relative to the existing situation is predicted.

9.5.2 Operation Phase Impact

The only predicted air quality impacts associated with operation of the development are emissions to atmosphere from heating sources and traffic associated with the development. The change in traffic movements will have no quantifiable impact on air quality. There are no adverse impacts on ambient air quality predicted as a result of the Operation Phase of the proposed development.

9.5.3 Climate Impact

The principal GHG emissions associated with construction are carbon dioxide from transport and machinery utilised in construction. For the *Do Nothing* Scenario, if the proposed development does not proceed then the emissions of GHGs in the area are projected to remain the same with some relatively minor increases as activity in the area develops. However, GHG emissions will still occur somewhere because the residential accommodation must be provided to cater for existing and future needs.

Although the overall impact of each of the potential scenarios assessed would be the same, opportunities for minimisation of GHG emissions during construction will arise and will be required to ensure that the overall objectives of enhanced energy efficiency and minimisation of GHG emission are achieved.

The operation of the proposed development will result in indirect emissions of GHGs including carbon dioxide (CO_2) and methane (CH_4) resulting from energy generation required for space heating and road traffic.

The CO_2 released due to energy usage is directly reduced by enhancing the energy efficiency of the proposed development. In this respect, the selection of natural gas as the heating source is the optimum strategy. The proposed design considers these factors and contributes to the overall objective of minimising GHG emissions.

Due to the size and nature of the development, greenhouse gas emissions resulting from the development will be imperceptible in the national context. There will therefore be no adverse impacts on climate and no significant contribution to Irelands greenhouse gas budget.

The size and nature of the development and the nature and volume of emissions will lead to an imperceptible change in atmospheric conditions. There will be no change to the heat balance in the immediate area.

9.6 Do Nothing Scenario

If the proposed project does not proceed there will be no significant change in air quality at the site location and surrounding areas. Traffic is a dominant influence on air quality in the study area as discussed above, and if the proposed project does not proceed, this will continue to be the case.

9.7 Mitigation Measures

A Dust Management Plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The principal objective of the Plan is to ensure that dust emissions do not cause significant nuisance at receptors in the vicinity of the site. The most important features of the Dust Management Plan are summarised as follows:

- A designated Site Agent will be assigned overall responsibility for Dust Management;
- The design of the site and Construction programme considers dust impact management and chooses design approaches to minimise dust emissions;
- An effective training programme for site personnel will be implemented for the duration of the Construction Programme;
- A strategy for ensuring effective communication with the local community will be developed and implemented;
- A programme of dust minimisation and control measures will be implemented and regularly reviewed;
- A monitoring programme will be implemented.

The design of the construction programme and the location and layout of the construction compound and the storage of materials will be carefully planned to ensure that air quality impacts are minimised. The following is a summary of the main mitigation features of the project and the specific mitigation measures which will be employed in order to minimise emissions from the activity and the associated impacts of such emissions:

- Activities with potential for significant emissions will wherever possible be located at a position as far as possible removed from the nearest residential and commercial receptors;
- The areas on site which vehicles will be travelling on will generally be hard-surfaced or compressed ground thus significantly reducing the potential for dust emissions from the vehicles;
- The construction compound area will have hard standing areas to minimise dust generation from wind-blow.
- In order to minimise the potential for wind-generated emissions from material storage bays, these bays will be oriented away from the dominant wind direction to minimise the effects of wind on release of dust and particulate.
- The relatively coarse particle size (30 – 75µm) associated with the activity means that the particles will generally be deposited close to the emission source and will not travel significant distances away from the site.
- Fixed and mobile water sprays will be used to control dust emissions from material stockpiles and road and yard surfaces as necessary in dry and/or windy weather.
- A daily inspection programme will be formulated and implemented in order to ensure that dust control measures are inspected to verify effective operation and management.
- A dust deposition monitoring programme will be implemented at the site boundaries for the duration of the construction phase in order to verify the continued compliance with relevant standards and limits.

9.8 Residual Impacts

The proposed mitigation measures have been shown to be effective in the management of air quality impacts associated with the proposed project. Construction will be managed so that there are no residual air quality impacts after completion. The comprehensive mitigation and management proposals for the proposed project will ensure that there are no significant residual impacts.

The mitigation measures that will be put in place during the construction phase will ensure that the impact of the development complies with the AQS limit values which are based on the protection of human health. Therefore, the impact of construction of the proposed project will be Temporary and Not Significant with respect to air quality and human health.

As shown by the impact assessment for the operational phase, the proposed project will not have a significant impact on ambient air pollutant concentrations. Pollutant concentrations with the proposed development in place are compliant with all AQS limit values and, therefore, will not result in a significant impact on human health.

9.9 Interactions Arising

The potential interactions between environmental aspects arising from the proposed project are considered and the assessment has considered both the Construction Phase and Operational Phase.

The main interactions involving Air Quality include:

- Population and Human Health – the impact on human health receptors from emissions, including aspergillus, dust and particulate matter and nuisance impacts associated with dust. This interaction is described as negative and quantified as Not Significant; and
- Traffic and Transport - impacts associated with creation of dust during construction and generation of vehicle emissions. This interaction is described as negative and quantified as Not Significant.

9.10 References

Environmental Protection Agency (2017a). Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.

Environmental Protection Agency (2017b). Air Quality in Ireland 2016: Indicators of Air Quality.

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