9.0 AIR QUALITY

9.1 Introduction

This chapter assesses the likely air quality impacts associated with the continuation of an existing quarry and a proposed extension of that quarry at a site in the townland of Clogrennan, Bilboa, Co. Carlow. A full description of the development can be found in Chapter 3.

The subject site encompasses a total area of approximately c. 41.86 hectares, under ownership of the applicant, Milford Quarries Ltd. The land is located within the townland of Clogrennane, Co. Carlow and sits directly along the Co. Laois/Co. Carlow border. The site is approximately 6 km south west of Carlow town and approximately 3 km north-west of Ballinabranna.

Within the overall landholding is the subject site, which consists of a sandstone rock quarry, Redrock. The site is bounded by a private rural road that is connected to the L7129 Road to the west and the L7134 Road to the east. The M9 motorway can be accessed via junction 6 approximately 5.5km to the south east of the site. There has been no commercial extraction taking place at the quarry since 2014, see Chapter 2 for further details.

This chapter was completed by Ciara Nolan. Ciara is a Principal Environmental Consultant in the Air Quality & Climate section of AWN Consulting. She holds a BSc in Energy Systems Engineering from University College Dublin and has also completed an MSc in Applied Environmental Science at UCD. She is a Member of the Institute of Air Quality Management (MIAQM) and the Institution of Environmental Sciences (MIEnvSc). She has over 8 years of experience in undertaking air quality and climate assessments. She has prepared air quality and climate impact assessments as part of EIARs for residential developments including Woodbrook, Shankill (Planning Application Ref. ABP30584419), Ballygossan Park, Skerries (Planning Application Ref. LRD0010/S3), SHD Ratoath (Planning Application Ref. SH305196), SHD Rathmullen, Drogheda (Planning Application Ref. SH305552), commercial and industrial developments by Dublin Airport Authority, Abbvie, Mountpark, Pfizer, Takeda, as well as renewable energy developments such as Crockahenny Windfarm, Upperchurch Windfarm, Knocknamona Windfarm and Keerglen Windfarm. She also specialises in conducting air dispersion modelling assessments of emissions from data centres, energy centres and the chemical industry as part of EPA Industrial Emissions Licences for Echelon DC, AWS, Takeda, MSD and Regeneron. She has undertaken air quality and climate impact assessments for transportation schemes, primarily regional and national road schemes, from constraints, through to route selection and EIAR stage.

9.1.1 Aspects Relevant to this Assessment

Due to the nature of the proposed development as a quarry, there are no specific significant construction works required. The primary impacts to air quality will occur from operational activities such as extraction of materials; screening, crushing, and processing of materials; blasting operations; and movement of vehicles on site which have the potential to release dust and particulate matter (PM_{10} and $PM_{2.5}$) emissions.

Engine emissions from vehicles accessing the site have the potential to impact air quality during the operational phase of the development through the release of nitrogen dioxide (NO_2) and particulate matter (as PM_{10} and $PM_{2.5}$) emissions.

9.1.2 Legislative & Policy Context

The principal guidance and best practice documents used to inform the assessment of potential impacts on air quality are summarised below.

- PE-ENV-01106: Air Quality Assessment of Specified Infrastructure Projects (Transport Infrastructure Ireland [TII], 2022);
- Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) (EPA, 2020); and
- Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition (Periodically Updated) (USEPA, 1986).

In addition to specific air quality guidance documents, the following guidelines were considered and consulted in the preparation of this chapter:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (hereafter referred to as the Environmental Protection Agency (EPA) Guidelines) (EPA, 2022);
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Planning & Local Government, 2018); and
- Environmental Impact Assessment (EIA) Directive Guidance on the Preparation of the Environmental Impact Assessment Report (European Commission, 2017).

9.2 Methodology

9.2.1 Criteria for Rating of Impacts

The rating of potential environmental effects of the development on air quality is based on the criteria presented in Table 3.3 of the EPA (2022) document titled *Guidelines on the Information to Be Contained in Environmental Impact Assessment Reports*. These criteria consider the quality, significance, duration and types of effect characteristics identified.

9.2.1.1 Ambient Air Quality Standards

National and European statutory bodies, the Department of the Environment, Heritage and Local Government in Ireland and the European Parliament and Council of the European Union, have set limit values in ambient air for a range of air pollutants to reduce the risk to health from poor air quality. These limit values or *"Air Quality Standards"* are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set.

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland are set out in Directive (EU) 2024/2881 *of the European Parliament and of the Council of 23 October 2024 on ambient air quality and cleaner air for Europe (recast)*. This directive supersedes EU 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* (CAFE Directive). It sets out new air quality standards for pollutants to be reached by 2030 which are more closely aligned with the World Health Organisation (WHO) air quality guidelines and also includes limit values applicable until 2030.

The Ambient Air Quality Standards Regulations 2022 (S.I. 739 of 2022) (the Air Quality Standards Regulations 2022) further transposed the CAFE Directive and revoked the Air Quality Standards Regulations

2011, as amended. With the adoption of Directive (EU) 2024/2881, Ireland must similarly transpose this directive into national law, i.e. update the Air Quality Standards Regulations, before December 2026.

The ambient air quality limit values for pollutants are set out in Annex I of Directive (EU) 2024/2881. Table 1 of Annex I in Directive (EU) 2024/2881 sets out the updated air quality limit values for pollutants to be achieved by 1 January 2030, these are more closely aligned with the WHO air quality guidelines. Table 2 of Annex I in Directive (EU) 2024/2881 sets out the limit values for air pollutants which are to be achieved by 11 December 2026 and are also applicable up to 2030. The limit values in Table 2 of Annex I are the same as the limits set under Directive 2008/50/EC and the Air Quality Standards Regulations 2022.

In relation to the proposed development, the applicable limit values are for nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). Table 9.1 outlines the limit values pre-2030 and post-2030 for the specified pollutants.

Pollutant	Directive (EU) 2024/2881 Annex I Table 2		Directive (EU) 2024/2881 Annex I Table 1	
	Limit Type	Limit Value (to be attained by 2026 and applicable until 2030)	Limit Type	Limit Value (to be attained by 2030)
Particulate Matter (as PM_{10})	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3	24-hour limit for protection of human health - not to be exceeded more than 18 times/year	45 µg/m^3
	Annual limit for protection of human health	40 µg/m^3	Annual limit for protection of human health	20 µg/m^3
Particulate Matter (as $PM_{2.5}$)	N/A	N/A	24-hour limit for protection of human health - not to be exceeded more than 18 times/year	25 µg/m^3
	Annual limit for protection of human health	25 µg/m^3	Annual limit for protection of human health	10 µg/m^3

Table 9.1: Air Quality Limit Values

9.2.1.2 WHO Air Quality Guidelines and Cleaner Air Strategy

In April 2023, the Government of Ireland published the *Clean Air Strategy for Ireland* (Government of Ireland, 2023), which provides a high-level strategic policy framework needed to reduce air pollution. The strategy commits Ireland to achieving the 2021 WHO Air Quality Guidelines Interim Target 3 (IT3) by 2026 (Table 9.2), the IT4 targets by 2030 and the final targets by 2040 (Table 9.2). The strategy notes that a significant number of EPA monitoring stations observed air pollution levels in 2021 above the WHO targets; 80% of these stations would fail to meet the final $PM_{2.5}$ target of 5 µg/m^3. The strategy also acknowledges that "*meeting the WHO targets will be challenging and will require legislative and societal change, especially with regard to both $PM_{2.5}$ and NO_2*".

Annex II of Directive (EU) 2024/2881 gives assessment thresholds which align with the clean air strategy final 2040 WHO targets. Directive (EU) 2024/2881 states that "*Member States shall endeavour to achieve and preserve the best ambient air quality and a high level of protection of human health and the* *environment, with the aim of achieving a zero-pollution objective as referred to in Article 1(1), in line with WHO recommendations, and below the assessment thresholds laid down in Annex II.*"

These assessment thresholds relate to monitoring of ambient air quality by Member States, where "*exceedances of the assessment thresholds specified in Annex II shall be determined on the basis of concentrations during the previous 5 years where sufficient data are available. An assessment threshold shall be deemed to have been exceeded if it has been exceeded during at least 3 separate years out of those previous 5 years*."

Pollutant	Limit Type	IT3 (2026)	IT4 (2030)	Final Target (2040)
NO_2	24-hour limit for protection of human health	-	-	25 µg/m^3
	Annual limit for protection of human health	20 µg/m^3	-	10 µg/m^3
PM (as PM_{10})	24-hour limit for protection of human health	75 µg/m^3	50 µg/m^3	45 µg/m^3
	Annual limit for protection of human health	30 µg/m^3	20 µg/m^3	15 µg/m^3
PM (as $PM_{2.5}$)	24-hour limit for protection of human health	37.5 µg/m^3	25 µg/m^3	15 µg/m^3
	Annual limit for protection of human health	15 µg/m^3	10 µg/m^3	5 µg/m^3

Table 9.2: WHO Air Quality Guidelines

The applicable air quality limit values for the purposes of this assessment are those set out in Table 9.1. The limit values stipulated in Table 2 of Annex I of Directive (EU) 2024/2881 and the Air Quality Standards Regulations 2022 are applicable to the proposed development as it will be operational pre-2030.

9.2.1.3 Dust Deposition Guidelines

The concern from a health perspective is focused on particles of dust that are less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$). The EU ambient air quality standards outlined in Table 9.1 have set ambient air quality limit values for PM_{10} and $PM_{2.5}$.

With regard to larger dust particles that can give rise to nuisance dust through dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/m^2/day averaged over a one-year period at any receptors outside the site boundary. The TA-Luft standard has been applied for the purpose of this assessment based on recommendations from the EPA in Ireland in the document titled *Environmental Management Guidelines - Environmental Management in the Extractive Industry (Non-Scheduled Minerals)* (EPA, 2006). The document recommends that the TA-Luft limit of 350 mg/m^2/day be applied to the site boundary of quarries. This limit value is currently in place at the subject site and can be implemented with regard to dust impacts from the operation of the proposed development.

9.2.2 Dispersion Modelling Methodology for Quarrying Operations

The methodology used as part of this assessment involved undertaking a desk-based study to examine all relevant information relating to air quality conditions in the vicinity of the application site.

The air quality assessment has been carried out following procedures described in the publications by the EPA (EPA, 2015, 2020, 2022) and using the methodology outlined in the guidance documents published by the USEPA (USEPA, 2017, 2024). The air dispersion modelling input data consisted of information on the physical environment, design details from all emission sources on-site and five full years of meteorological data. Using this input data the model predicted ambient ground level concentrations and deposition rates beyond the land ownership boundary for each hour of the modelled meteorological years. The model post-processed the data to identify the location and maximum of the worst-case ground level concentration. This worst-case concentration and deposition rate was then added to the background concentration and deposition rate to give the worst-case predicted environmental concentration (PEC) and deposition flux. The PEC was then compared with the relevant ambient air quality standard to assess the significance of the releases from the site.

In order to assess the dust deposition flux at the land ownership boundary, and the PM_{10} and $PM_{2.5}$ concentrations associated with the quarrying activities at sensitive locations beyond the land ownership boundary, air dispersion modelling was undertaken. Modelling using the United States Environmental Protection Agency (USEPA) new generation dispersion model AERMOD (USEPA, 2024) (version 24142) was used as recommended by the USEPA (2017) and Irish EPA (2020). The model is a steady-state Gaussian plume model used to assess pollutant concentrations associated with industrial sources. The model has been designated the regulatory model by the USEPA for modelling emissions from industrial sources in both flat and rolling terrain (USEPA, 2017). The AERMET meteorological pre-processor (USEPA, 2018) was used to generate hourly boundary layer parameters for use by AERMOD. Dust generation rates were calculated from factors derived from empirical assessment and detailed in the USEPA database entitled *Compilation of Air Pollution Emission Factor*s, Volume 2, AP-42 (1986, updated periodically) (USEPA, 1986). The emission factors have been presented in Appendix 9.1.

9.2.2.1 Process Emissions

Quarrying activities typically emit dust. Dust is characterised as encompassing particulate matter with a particle size of between 1 and 75 microns (1 - 75µm). Deposition typically occurs in close proximity to each site and potential impacts generally occur within 500 metres of the dust generating activity as dust particles fall out of suspension in the air. Larger particles deposit closer to the generating source and deposition rates will decrease with distance from the source. Sensitivity to dust depends on the duration of the dust deposition, the dust generating activity, and the nature of the deposit. Therefore, a higher tolerance of dust deposition is likely to be shown if only short periods of dust deposition are expected and the dust generating activity is either expected to stop or move on.

The potential for dust to be emitted will depend on the type of activity being carried out in conjunction with environmental factors including levels of rainfall, wind speed, wind direction and dust prevention measures in place. This chapter identifies and quantifies the dust sources from the quarry.

The total extraction area will comprise c. 15.52 ha and is part of an overall larger landholding in the ownership of the Applicant. The site is currently accessed via 2 no. locations from an internal access road. The existing established access road connects the L7130 to the east of the subject site. The site is an existing sandstone rock quarry.

Permission is being sought to extract up to a maximum of 200,000 tonnes per annum (tpa) of material, and this figure has been used in the Proposed Operations scenario modelling assessment. Full details of the processes involved are set out in Chapter 3 of this EIAR.

For the purposes of this assessment 29 truck (HGV) movements in and out of the site per hour has been assumed, based on the information outlined in Chapter 13 Traffic & Transport.

The quarrying operational hours are assumed to be the same as previously permitted: 07:00 – 18:00 Monday to Friday, 07:00 – 13:00 Saturday with no operations on Sundays or bank holidays. The site is assumed to operate for 275 days per year. Blasting operations are proposed as part of the proposed extraction activities and these have been assumed to occur over the same operational hours as the general quarrying activities as a worst-case assessment.

The following operations are the main dust generating sources or activities at the quarry:

- Topsoil removal of proposed extension area;
- Movement of trucks along paved public roads;
- Movement of trucks along unpaved haul roads;
- Extraction of material;
- Blasting activities;
- Crushing of material;
- Screening of material;
- Transfer of material along conveyors;
- Stockpiling of material;
- Loading of material;
- Wind erosion at dump areas, stockpiles and exposed quarry surface;

The formulae and emission rates for the onsite activities are outlined in Appendix 9.1.

9.2.2.2 Dust Generation Rates

Dust generation rates depend on the site activity, particle size, the moisture content of the material and weather conditions. Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume no dust is generated under “wet day” conditions where rainfall greater than 0.2mm has fallen.

Large particle sizes (greater than 75 microns) fall rapidly out of atmospheric suspension and are subsequently deposited in close proximity to the source. Particle sizes of less than 75 microns are of interest as they can remain airborne for greater distances and give rise to the potential dust nuisance at the sensitive receptors. This size range would broadly be described as silt. Emission rates are normally predicted on a site-specific particle size distribution for each dust emission source. In the absence of such information, the particle size distribution outlined in AP-42 Appendix B.2.2 for Category 3 (mechanically generated aggregate) (USEPA, 1986) has been used and is outlined in Table 9.3. The moisture content of the extracted rock has been estimated at 2% based on sandstone as the rock type.

Cumulative % ≤ Stated Size	Particle Size, µm	Minimum Value	Maximum Value	Standard Deviation
4	1.0	-	-	-
11	2.0	-	-	-
15	2.5	3	35	7
18	3.0	-	-	-
25	4.0	-	-	-
30	5.0	-	-	-
34	6.0	15	65	13

Cumulative % ≤ Stated Size	Particle Size, µm	Minimum Value	Maximum Value	Standard Deviation
51	10.0	23	81	14

Table 9.3: Category 3 Mechanically Generated Aggregates. (Source: AP-42 (USEPA, 1986.)

9.2.3 Air Quality & Road Traffic Emissions

There is the potential for emissions from road vehicles accessing the site to impact air quality. Pollutants such as NO_2, PM_{10} and $PM_{2.5}$ are emitted from road vehicles.

The TII guidance *Air Quality Assessment of Specified Infrastructure Projects – PE-ENV-01106* (TII, 2022), states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and should be included in the local air quality assessment. While the guidance is specific to infrastructure projects, the approach can be applied to any development that causes a change in traffic.

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) AADT changes by 200 or more;
- Daily average speed change by 10 kph or more;
- Peak hour speed change by 20 kph or more;
- A change in road alignment by 5m or greater.

Chapter 13 Traffic & Transport has analysed the predicted increase in traffic volumes based on the proposed extraction of 200,000 tpa of material. As per Chapter 13 and Table 9-4, the proposed development results in a maximum of 3 no. one-way staff trips and 29 no. one way HGV trips per day. This results in a maximum change of 64 AADT on the L7130 and a maximum change of 58 HDV AADT on the L7130. Therefore, the development does not result in a greater than 1000 AADT change or greater than 200 HGV AADT change. Thus, a detailed assessment of operational phase traffic emissions has been scoped out and there is no potential for significant impacts to air quality from operational phase traffic emissions.

	One-way Flows	Two-way Flows
Staff (LVs)	3	6
HVs	29	58
Total	32	64

Table 9-4: Development Traffic (Source: Table 13.5 of Chapter 13 Traffic & Transport)

9.3 Baseline Environment

9.3.1 Meteorological Data

Meteorological conditions significantly affect the level of dust emissions and subsequent deposition downwind of the source. The most significant meteorological elements affecting dust deposition are rainfall and wind-speed. High levels of moisture either retained in soil or as a result of rainfall help suppress the generation of dust due to the cohesive nature of water between dust particles. Rain also assists in removing dust from the atmosphere through washout. Wind can lift particles up into the air and transport the dust downwind as well as drying out the surface. The worst dust deposition conditions typically occur, therefore, during dry conditions with strong winds.

The closest representative Met Éireann synoptic station to the quarry is at Oak Park meteorological station, which is approximately 8 km north-east of the site. Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume no dust is generated under "wet day" conditions where rainfall greater than 0.2 mm has fallen. Information collected from Oak Park Meteorological Station over the period 2020 – 2024 (Met Eireann, 2025) identified that on average 197 days per annum are "wet". Thus, approximately 54% of the time no significant dust generation will be likely due to natural meteorological conditions.

Wind frequency is also important as dust can only be dispersed by winds, and deposition of dust is a simple function of particle size, wind speed and distance. The closer the source of dust is to a receptor, the higher the potential risk of impact of dust blow. The prevailing winds in the area are southerly, thereby predominantly dispersing any potential dust emissions to the north of the site (see Figure 9.1). Wind speeds averaged 3.8 m/s over the period 2020 – 2024. Calm conditions account for only a small fraction of the time in any one year, peaking at 92 hours in 2021 (1.05% of the time).

All meteorological data referenced within this report is provided by Met Éireann (source www.met.ie) (Met Eireann, 2025).

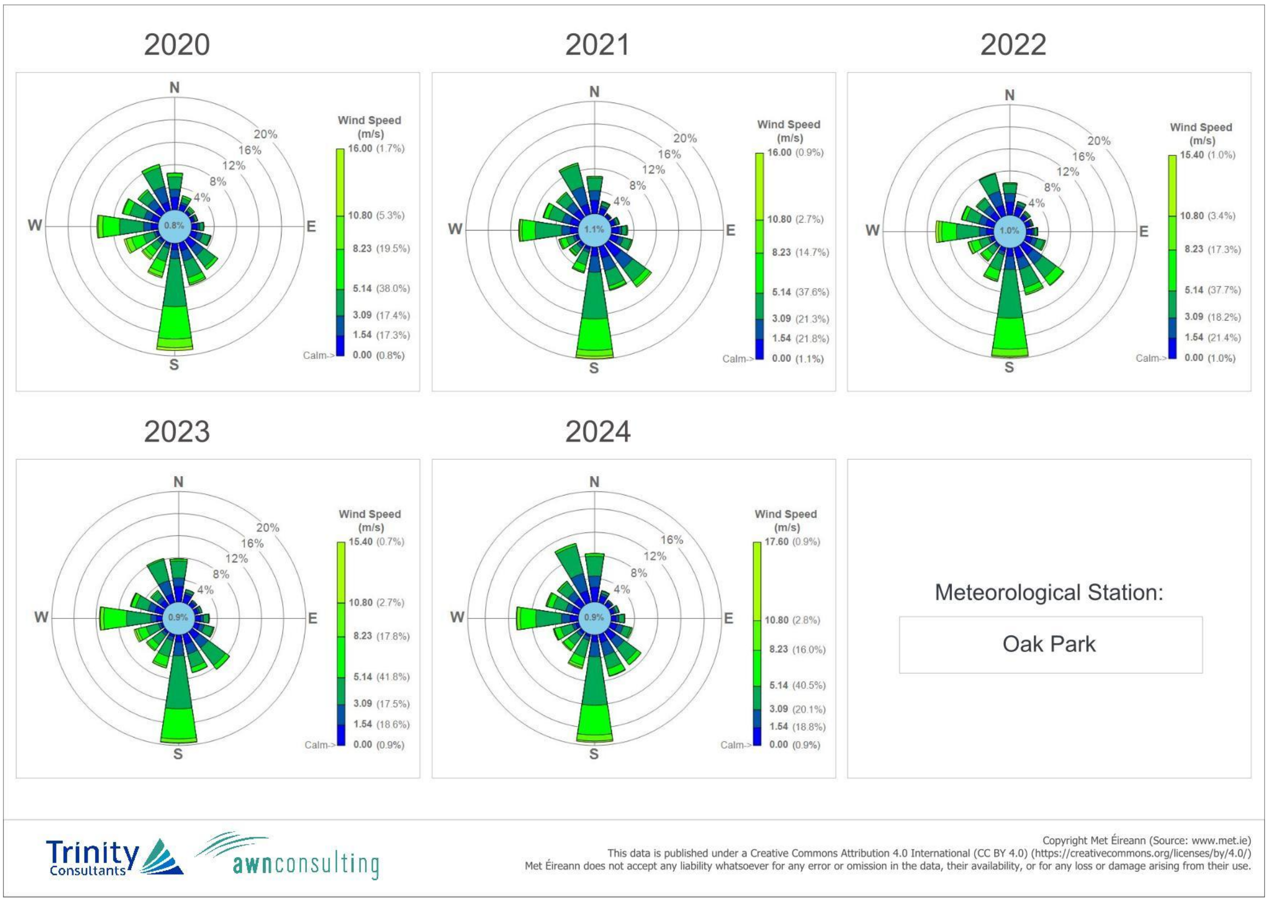

Figure 9.1: Wind Roses for Oak Park Meteorological Station

9.3.2 Background Sources of Dust

The sources of dust arising from the site contribute to background levels of dust. Dust is present naturally in the air from a number of sources including weathering of minerals, pick-up across open land and dust generated from fires.

A study by the UK ODPM (UK ODPM, 2000) gives estimates of likely dust deposition levels in specific types of environments. In open country a level of 39 $mg/m^2/day$ is typical, rising to 59 $mg/m^2/day$ on the outskirts of town and peaking at 127 $mg/m^2/day$ for a purely industrial area. The subject site is located in a predominantly rural area, therefore a background dust deposition level of 39 $mg/m^2/day$ is appropriate for the region of the subject site at Clongrennan, Co. Carlow.

9.3.3 Background Sources of PM_{10} and $PM_{2.5}$

Air quality monitoring programs have been undertaken in recent years by the EPA. The most recent annual report on air quality in Ireland is '*Air Quality in Ireland 2024'* (EPA, 2025). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments.

As part of the implementation of the Air Quality Standards Regulations 2022 (S.I. No. 739 of 2022), as amended, four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2025). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

In terms of air monitoring and assessment, the proposed development site is within Zone D (EPA, 2025). The long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-site specific and non-traffic derived emissions (e.g. natural sources, industry, home heating etc.). Representative EPA monitoring stations have been used to determine an estimate of the background air quality in the region of the proposed development.

The subject site is located in a predominantly rural area which would indicate that rural background sites are most representative of the proposed development location.

9.3.3.1 PM_{10}

Continuous PM_{10} monitoring was carried out at a number of representative Zone D rural background locations from 2020 – 2024; Kilkitt, Claremorris and Askeaton. Annual average PM_{10} concentrations across the sites ranged from 7 – 10 $\mu g/m^3$ over the 2020 – 2024 period (Table 9.5). The overall annual average concentration for this 5-year period is 8 $\mu g/m^3$. There were no exceedances of the daily limit of 50 $\mu g/m^3$ over the 2020 – 2024 period. Based on the EPA data, a conservative estimate of the current annual mean background PM_{10} concentration in the region of the proposed development is 8 $\mu g/m^3$.

In relation to the maximum 24-hour averaging period (as a 90.4^{th}%ile), a value of 14 $\mu g/m^3$ was employed using the methodology outlined in Appendix E of AG4 (EPA, 2020) based on the 5-year average of the long-term PM_{10} monitoring at the identified Zone D locations over the period 2020 – 2024.

For the dispersion modelling assessment in order to calculate the predicted environmental concentration (PEC) a background concentration is added to the modelled process concentration (PC). In relation to the annual averages, the ambient background concentration is added directly to the process concentration. However, in relation to the short-term peak concentration, concentrations due to emissions from elevated sources cannot be combined in the same way. Guidance from the UK DEFRA (UK DEFRA, 2022) and the EPA (EPA, 2020) advises that for PM_{10} an estimate of the maximum combined pollutant concentration can be obtained as below:

PM_{10} – The 90.4th%ile of total 24-hour mean PM_{10} is equal to the maximum of either A or B below:

a) 90.4th%ile of 24-hour mean background PM_{10} + annual mean process contribution PM_{10}.
b) 90.4th%ile 24-hour mean process contribution PM_{10} + annual mean background PM_{10}.

Station	Averaging Period	Year				
		2020	2021	2022	2023	2024
Kilkitt, Co. Monaghan	Annual Mean PM_{10} (µg/m^3)	8	8	9	7	7
	24-hr Mean PM_{10} (as 90.4th%ile) (µg/m^3)	14	-	14	-	
	24-hr Mean > 50 µg/m^3 (days)	0	-	0	0	0
Claremorris, Co. Mayo	Annual Mean PM_{10} (µg/m^3)	10	10	8	8	8
	24-hr Mean PM_{10} (as 90.4th%ile) (µg/m^3)	16	13	13	-	
	24-hr Mean > 50 µg/m^3 (days)	0	0	0	0	0
Askeaton, Co. Limerick	Annual Mean PM_{10} (µg/m^3)	7	9	9	-	8
	24-hr Mean PM_{10} (as 90.4th%ile) (µg/m^3)	11	14	15	-	
	24-hr Mean > 50 µg/m^3 (days)	0	0	0	-	0

Table 9.5: Trends In Zone D Air Quality - PM_{10}

9.3.3.2 $PM_{2.5}$

Monitoring for $PM_{2.5}$ was conducted at the representative Zone D rural background sites of Claremorris and Shannon Estuary / Askeaton over the 2020 – 2024 period. Average $PM_{2.5}$ levels at these sites over the period 2020 - 2024 ranged from 4 – 8 µg/m^3 (Table 9.6) (EPA, 2025). The overall annual average concentration for this 5-year period is 5 µg/m^3. Based on this information, an estimate of the background $PM_{2.5}$ concentration in the region of the proposed development is 5 µg/m^3.

Station	Averaging Period	Year				
		2020	2021	2022	2023	2024
Claremorris, Co. Mayo	Annual Mean $PM_{2.5}$ (µg/ m^3)	5	8	6	5	5
Shannon Estuary / Askeaton, Co. Limerick	Annual Mean $PM_{2.5}$ (µg/ m^3)	4	6	5	5	5

Table 9.6: Trends In Zone D Air Quality - $PM_{2.5}$

9.3.4 Sensitive Receptors

9.3.4.1 Operational Phase Quarrying Activities Modelled Receptors

There are varying degrees of dust sensitivity depending on the receptor type. Those of highest sensitivity have the greatest risk of being adversely impacted by increases in ambient dust levels. However, this principle does not always apply and variation from the standard can occur depending on local factors such as rainfall and wind direction and receptor distance from the source.

Receptor sensitivity criteria for quarrying activities has been derived from the Institute of Air Quality Management (IAQM) guidance document *Guidelines on the Assessment of Dust from Demolition and Construction* (2024). The dust generation potential from quarrying activities is similar to construction activities. As per the IAQM guidance (2024) high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Commercial properties and places of work are regarded as medium sensitivity while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity. Additionally, The TII guidance (2022) defines sensitive receptor locations for the purposes of modelling annual mean pollutant concentrations as: residential housing, schools, hospitals, care homes and short term-accommodation such as hotels, i.e. locations where members of the public are likely to be regularly present for 24 hours.

The receptor types in the study area consist of high and low sensitivity receptors consisting mainly of residential areas and farms. There are a limited number of human receptors in the vicinity of the application site in the form of occupied dwellings. The nearest dwellings are located to the east of the site along the L7130 and the L3896. The closest receptor to the works area is located within c.445m to the direct east of the proposed development, opposite the site entrance.

The land ownership boundary and sensitive residential receptors used in the modelling assessment are shown in Figure 9.2.

Dust deposition typically occurs in close proximity to the dust-generating source. Generally, the potential for severe dust impacts is greatest within 100m of dust generating activities, though residual impacts can occur for distances beyond 100m. Vegetation, berms and the natural topography can act as breaks between the sources and the receptor. Tree lines can also act as an efficient dust filter and can be a useful dust control safeguard.

A receptor grid was created at which concentrations would be modelled. The receptor grid was based on a Cartesian grids with the site at the centre. The grid measured 10km x 10km with the site at the centre and concentrations calculated at 200 m intervals. Boundary receptor locations were also placed along the land ownership boundary of the site, at 50 m intervals. Nearby sensitive residential properties were also added to the model as discrete receptors giving a total of 2,763 calculation points for the model. The modelling has investigated the deposition and concentrations of dust, PM_{10} and $PM_{2.5}$ for the activities outlined above.

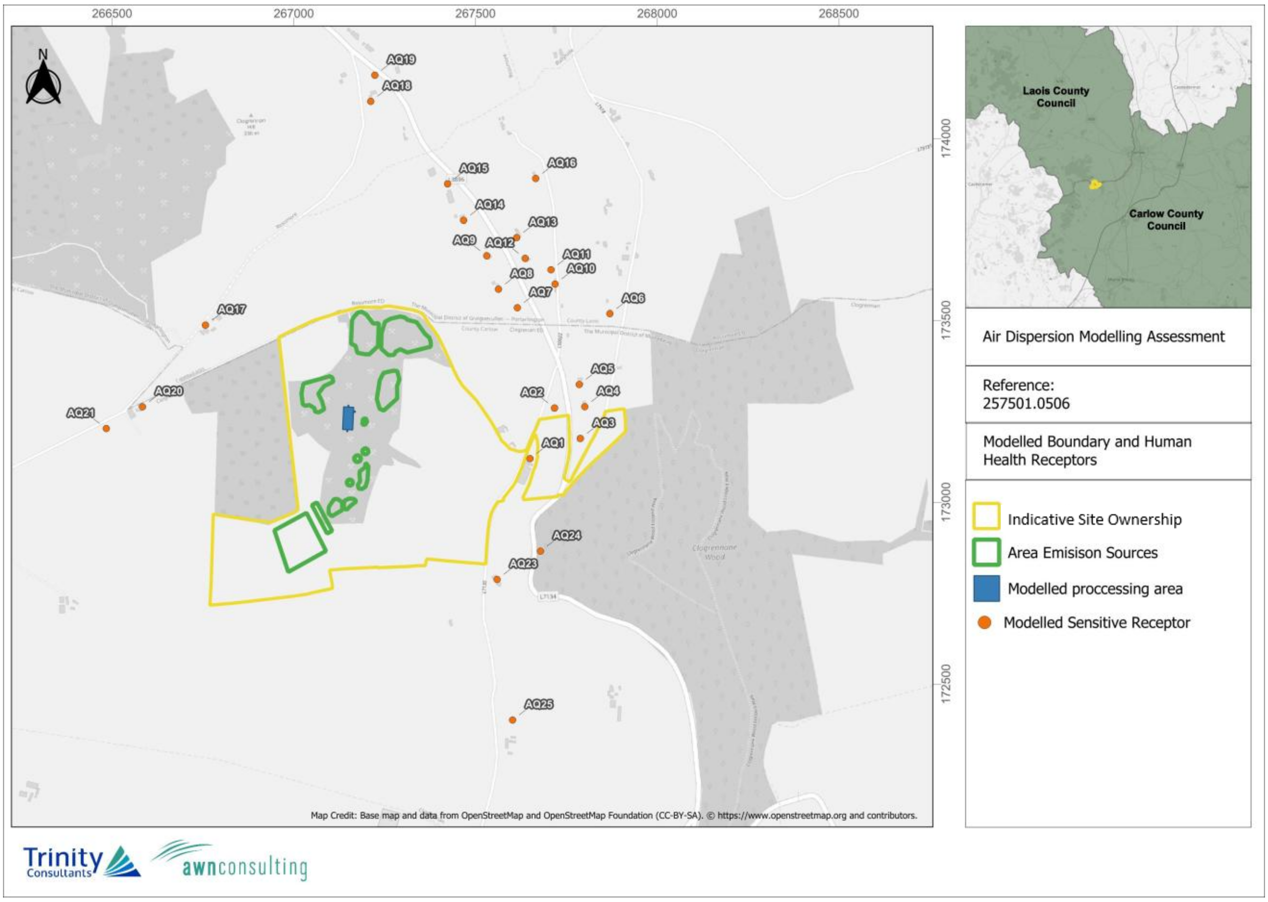

Figure 9.2: Modelled Boundary & Sensitive Receptors

9.4 Impact Assessment

9.4.1 Do Nothing Scenario

The Do Nothing scenario will see the site remain as is with no quarrying operations taking place. There are no predicted impacts to air quality under this scenario. The air quality baseline will continue to develop in line with current trends as per Section 9.3. The Do Nothing scenario is considered neutral in relation to air quality.

9.4.2 Construction Phase

There are no significant construction works associated with the proposed development. Due to the minimal nature of these works significant impacts to air quality are not predicted and they have not been considered further. Overburden for the proposed extension area will be stripped in phases and will be undertaken during the normal day to day operations at the site and has been considered within the operational phase assessment detailed in Section 9.4.3.1.

9.4.3 Operational Phase

9.4.3.1 Quarrying Operations – Dispersion Modelling Results

The primary sources of emissions to air will be associated with plant and machinery undertaking day to day activities such as extraction, onsite processing and transportation of material and dust blow generated during dry, windy conditions. Potential impacts associated with day to day activities have been separated into dust deposition, PM_{10} and $PM_{2.5}$ emissions.

The results of the dispersion modelling assessment show that dust deposition levels and concentrations of PM_{10} and $PM_{2.5}$ from the proposed quarrying operations are below the relevant limit values provided the mitigation measures outlined in Section 9.6 are in place. With proposed best practice mitigation in place the results indicate that the impact of the operational phase (i.e. Proposed Operations Scenario) is ***localised, direct, long-term, negative*** and **not significant**.

9.4.3.1.1 Dust Deposition

Emissions from the site under the proposed operations lead to a dust deposition level averaged over the full year of at most 70.7 mg/m^2/day at the land ownership boundary to the quarry (see Table 9.7). Based on a worst case background dust deposition of 39 mg/m^2/day in the region of the site, the combined dust deposition level peaks at 109.7 mg/m^2/day which is 31% of the TA Luft Limit Value of 350 mg/m^2/day.

Figure 9.3 shows the geographical variation in annual dust deposition levels in the region of development. The dust deposition level decreases with increasing distance from the site.

Pollutant/ Year	Averaging Period	Worst Case Receptor		Process Contribution (PC) (mg/m^2/day)	Background Concentration (mg/m^2/day)	Predicted Environmental Concentration (PEC) (mg/m^2/day)	Limit Value (mg/m^2/day)	PEC as a % of Limit Value
		Type	X,Y (UTM Zone 29 N)					
Dust / 2020	Annual Mean	Boundary	634323, 5852355	70.7	39	109.7	350	31%
Dust / 2021	Annual Mean	Boundary	634323, 5852355	69.0	39	108.0	350	31%
Dust / 2022	Annual Mean	Boundary	634286, 5852336	63.5	39	102.5	350	29%
Dust / 2023	Annual Mean	Boundary	634323, 5852355	61.5	39	100.5	350	29%
Dust / 2024	Annual Mean	Boundary	634323, 5852355	66.4	39	105.4	350	30%

Table 9.7: Dispersion Modelling Results for Dust Deposition at Boundary – Proposed Operations Scenario

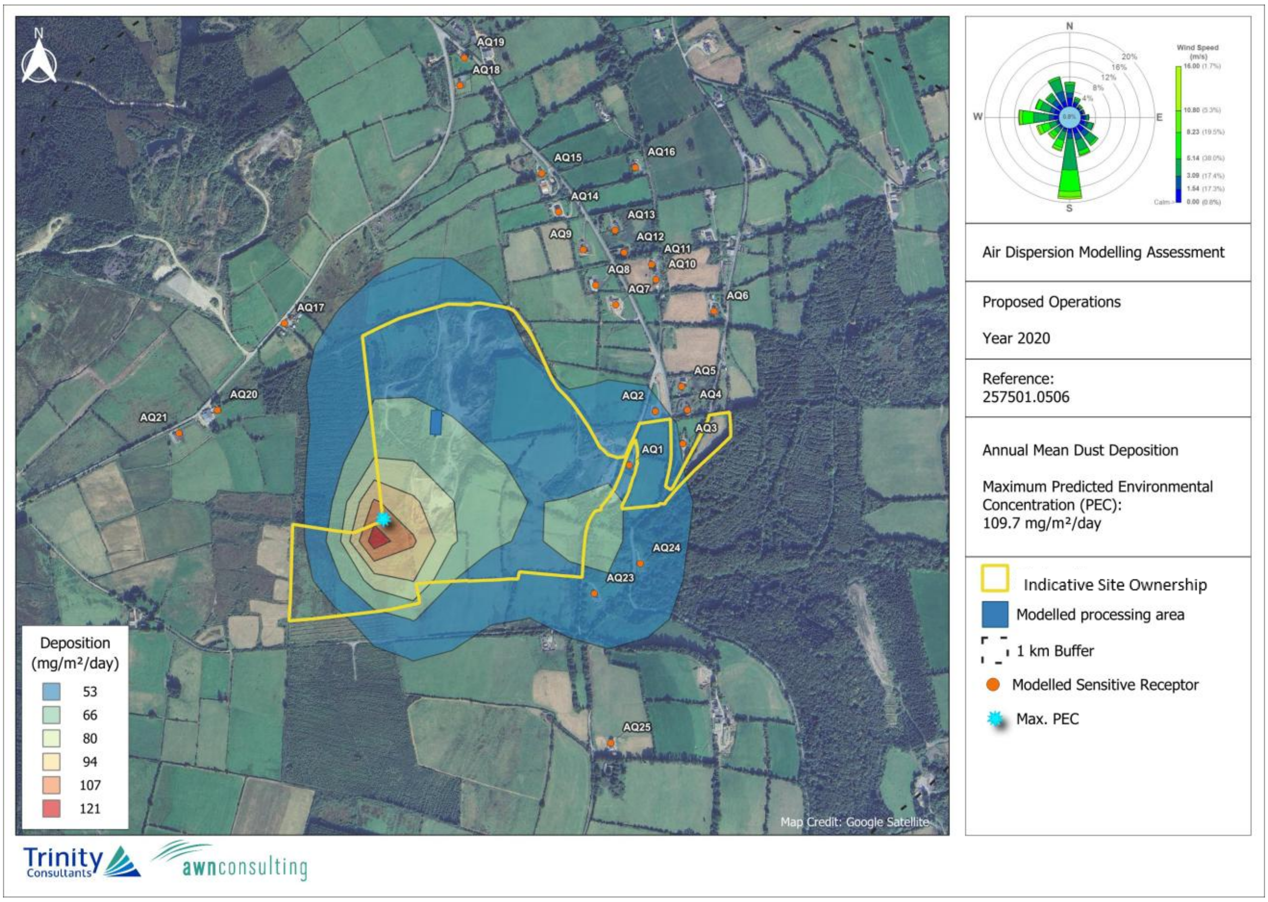

Figure 9.3: Annual Mean Dust Deposition Rate (mg/m^2/day) – Proposed Operations Scenario

9.4.3.1.2 PM_{10}

Predicted PM_{10} concentrations are significantly lower than the ambient air quality standards at the worst-case residential receptor due to background concentrations and the proposed operations (see Table 9.8). Emissions from the proposed operations result in an annual PM_{10} concentration of 11.18 µg/m^3 (Table 9.8). This predicted level equates to at most 28% of the annual limit value of 40 µg/m^3. The predicted 24-hour PM_{10} concentration (including background) peaks at 17.55 µg/m^3 (based on Method B) which is 35% of the 24-hour limit value of 50 µg/m^3 (measured as a 90.4th%ile).

The geographical variation in the 24-hour mean (90.4th%ile) PM_{10} ground level concentrations are illustrated as concentration contours in Figure 9.4. The geographical variation in annual PM_{10} ground level concentrations in the region of the development are illustrated as contours in Figure 9.5. The locations of the maximum concentrations for PM_{10} are close to the boundary of the site with concentrations decreasing with distance from the subject site.

Pollutant/ Year	Averaging Period	Worst Case Receptor		Process Contribution (PC) (µg/m³)	Background Concentration (µg/m³)	Predicted Environmental Concentration (PEC) (µg/m³) Method A	Predicted Environmental Concentration (PEC) (µg/m³) Method B	Limit Values (µg/Nm³)	PEC as a % of Limit Value
		Type	X,Y (UTM Zone 29 N)						
PM_{10} / 2020	Annual Mean	Sensitive	634869, 5852162	2.88	8	10.88	10.88	40	27%
	24-hr Mean (as 90.4th%ile)	Discrete	634869, 5852162	8.81	14	16.88	16.81	50	34%

Pollutant/ Year	Averaging Period	Worst Case Receptor		Process Contribution (PC) ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Predicted Environmental Concentration (PEC) ($\mu g/m^3$) Method A	Predicted Environmental Concentration (PEC) ($\mu g/m^3$) Method B	Limit Values ($\mu g/Nm^3$)	PEC as a % of Limit Value
		Type	X,Y (UTM Zone 29 N)						
PM_{10} / 2021	Annual Mean	Sensitive	634869, 5852162	3.18	8	11.18	11.18	40	28%
	24-hr Mean (as 90.4^{th}%ile)	Discrete	634869, 5852162	9.55	14	17.18	17.55	50	35%
PM_{10} / 2022	Annual Mean	Sensitive	634869, 5852162	2.50	8	10.50	10.50	40	26%
	24-hr Mean (as 90.4^{th}%ile)	Discrete	634869, 5852162	7.81	14	16.50	15.81	50	33%
PM_{10} / 2023	Annual Mean	Sensitive	634989, 5852240	2.68	8	10.68	10.68	40	27%
	24-hr Mean (as 90.4^{th}%ile)	Discrete	634989, 5852240	8.01	14	16.68	16.01	50	33%
PM_{10} / 2024	Annual Mean	Sensitive	634869, 5852162	2.93	8	10.93	10.93	40	27%
	24-hr Mean (as 90.4^{th}%ile)	Discrete	634869, 5852162	8.01	14	16.93	16.01	50	34%

Table 9.8: Dispersion Model Results for PM_{10} – Proposed Operations Scenario

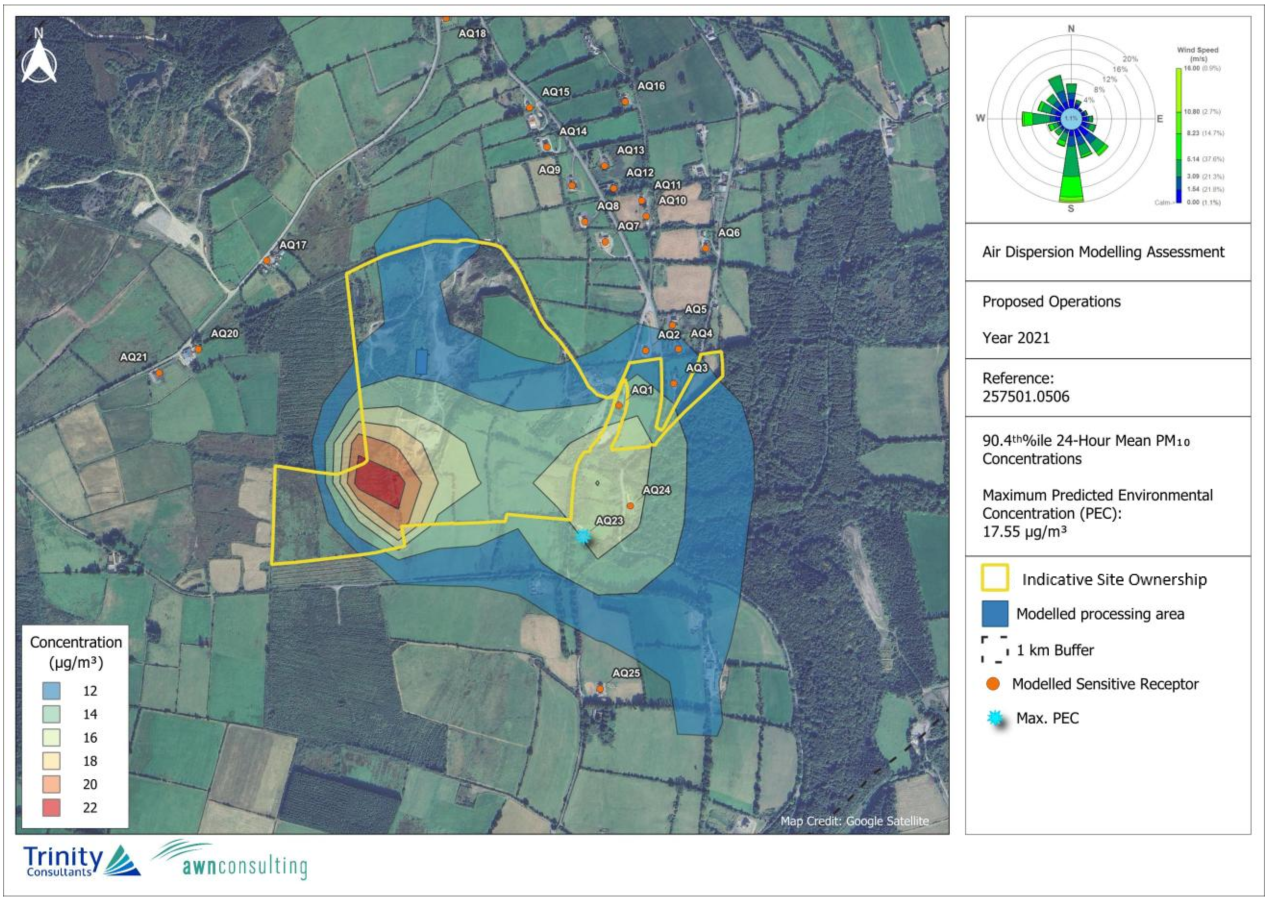

Figure 9.4: Maximum 24-Hr PM_{10} Concentration (as a 90.4^{th}%ile) ($\mu g/m^3$) – Proposed Operations Scenario

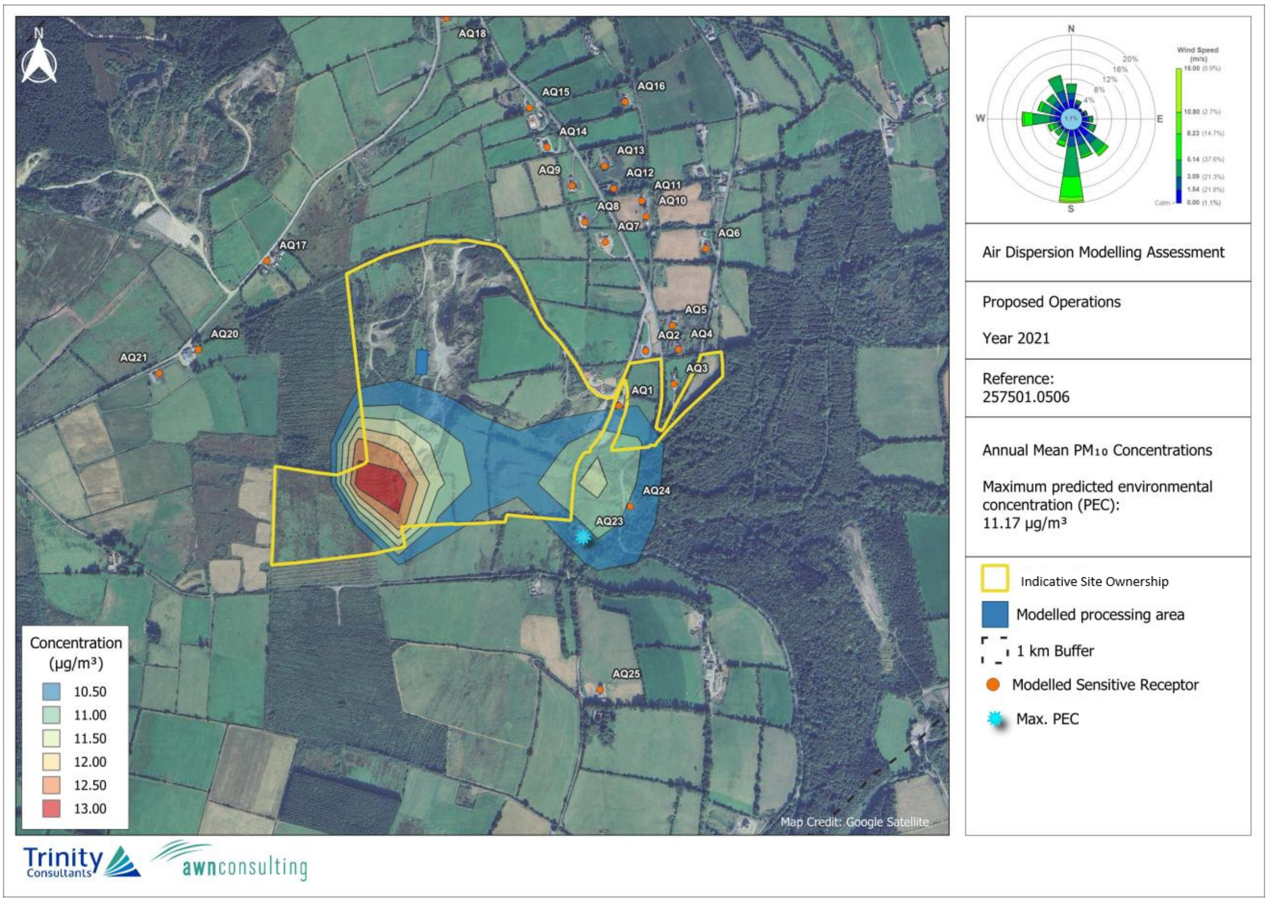

Figure 9.5: Annual Mean PM_{10} Concentration (µg/m³) – Proposed Operations Scenario

9.4.3.1.3 $PM_{2.5}$

Predicted $PM_{2.5}$ concentrations at the worst-case receptor are significantly lower than the limit value of 25 µg/m³ (see Table 9.9). The predicted annual mean concentration including the proposed operations (i.e. PEC) peaks at 6.14 µg/m³. This peak level equates to 25% of the annual limit value for $PM_{2.5}$.

The geographical variation in annual $PM_{2.5}$ ground level concentrations in the region of the development are illustrated as contours in Figure 9.6. The locations of the maximum concentrations for $PM_{2.5}$ are close to the boundary of the site with concentrations decreasing with distance from the subject site.

Pollutant/ Year	Averaging Period	Worst Case Receptor		Process Contribution (PC) (µg/m³)	Background Concentration (µg/m³)	Predicted Environmental Concentration (PEC) (µg/m³)	Limit Values (µg/Nm³)	PEC as a % of Limit Value
		Type	X,Y (UTM Zone 29 N)					
$PM_{2.5}$ / 2020	Annual Mean	Sensitive	634869, 5852162	1.03	5	6.03	25	24%
$PM_{2.5}$/ 2021	Annual Mean	Sensitive	634869, 5852162	1.14	5	6.14	25	25%
$PM_{2.5}$/ 2022	Annual Mean	Sensitive	634869, 5852162	0.93	5	5.93	25	24%
$PM_{2.5}$/ 2023	Annual Mean	Sensitive	634869, 5852162	1.01	5	6.01	25	24%

Pollutant/ Year	Averaging Period	Worst Case Receptor		Process Contribution (PC) (µg/m³)	Background Concentration (µg/m³)	Predicted Environmental Concentration (PEC) (µg/m³)	Limit Values (µg/Nm³)	PEC as a % of Limit Value
		Type	X,Y (UTM Zone 29 N)					
$PM_{2.5}$/ 2024	Annual Mean	Sensitive	634869, 5852162	1.06	5	6.06	25	24%

Table 9.9: Dispersion Model Results for $PM_{2.5}$ – Proposed Operations Scenario

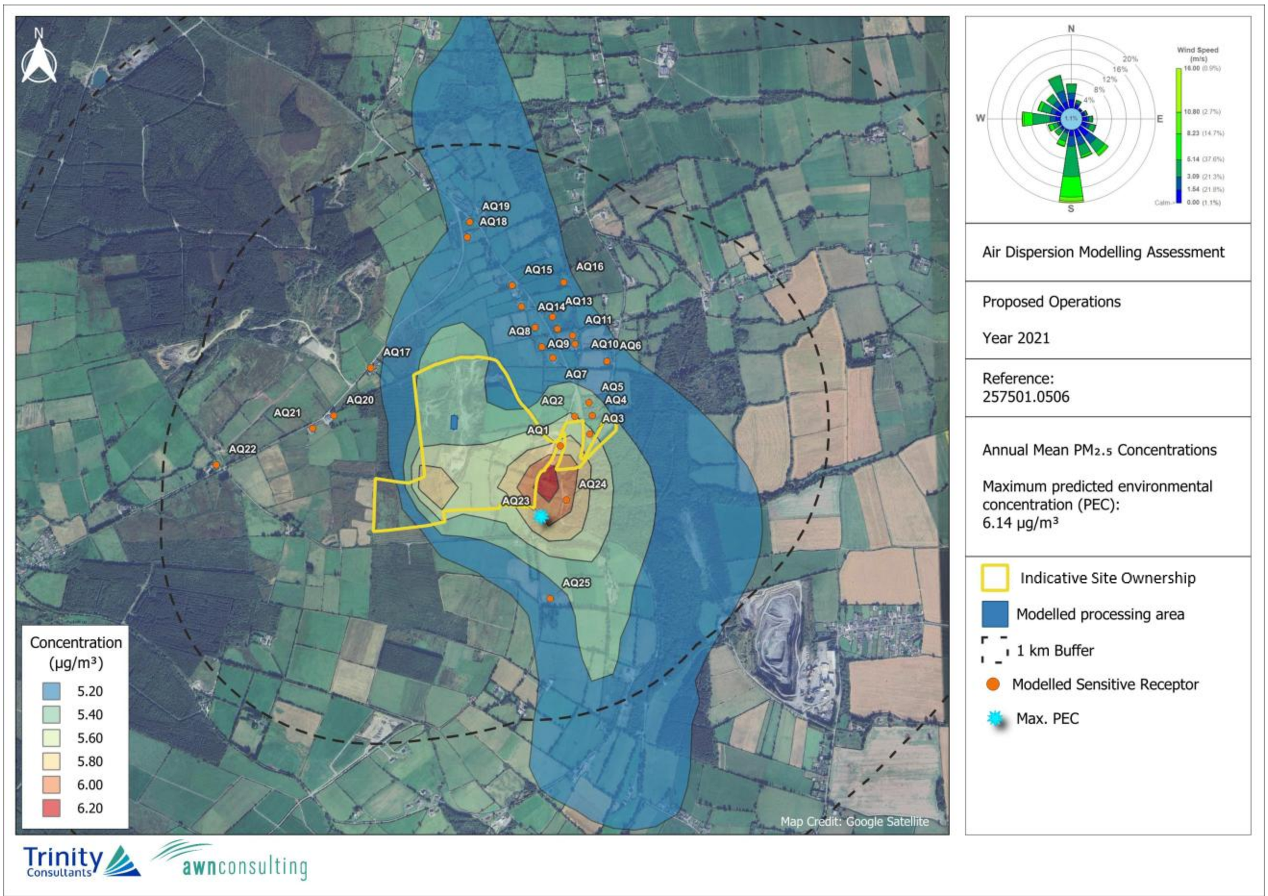

Figure 9.6: Annual Mean $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations Scenario

9.5 Cumulative Impacts

Cumulative effects have been assessed for the proposed development. Background concentrations have been included in the modelling study based on EPA data for PM_{10} and $PM_{2.5}$. These background concentrations account for non-localised sources of the pollutants of concern. Based on a review of satellite mapping there is a quarry operating over 1 km to the south-east of the site and another potential quarry c. 955 m to the direct north-west of the site. However, these operations are outside the area of impact for the application site. Impacts from the site are localised to the immediate vicinity of the site (see Figure 9.3 – Figure 9.6).

There are no other significant sources of dust, PM_{10}, or $PM_{2.5}$, within the area of impact from the quarry and therefore no further prediction of cumulative impact is required.

9.6 Mitigation Measures

There are a number of mitigation measures proposed to prevent significant dust emissions from on-site activities. These measures include:

- The site contains an existing wheel wash which will be maintained. All trucks must pass through the wheel wash prior to exiting onto the private site access road.
- Site roads will be dampened using wet methods during dry periods.
- Inspection, sweeping and cleaning of site roads and adjoining public roads will be undertaken on a regular basis, minimum every other day. A road sweeper will be utilized if required.
- All fine materials will be covered when leaving the site to prevent dust escaping.
- Speeds restrictions will in place on site. Speeds will be reduced to a maximum of 20 kmph.
- Drop heights will be minimised when handling material.
- The perimeter natural vegetation and screening mounds will be maintained to allow for natural screening of dust from nearby receptors.
- Idle times will be reduced by providing an efficient material handling plan that minimizes vehicle wait time.
- Regular maintenance of plant and equipment will be undertaken to ensure they will perform the most efficiently.
- Traffic management measures will be implemented.

Uncontrolled stockpiles are a significant source of dust emissions. Without adequate controls in place there is the potential for significant dust impacts from stockpiling activities. The following good practices in relation to stockpiles will be implemented:

- Where possible stockpiles will be sited to take advantage of shelter from wind. Stockpiles within the quarry void will be protected from significant dust blow due to the topography.
- All stockpiles will be kept damp using wet methods during dry periods.
- The bucket of the loading shovel will be kept low when tipping.
- Speeds will be reduced on the ramps to the stockpile.
- The destocking of a stockpile will be confined to a single discrete area.
- Regular toolbox talks will be held with the loading shovel drivers to ensure they employ best practice when working stockpiles.

These measures have been incorporated into the modelling assessment to determine the impact of the site on levels of dust deposition and ambient levels of particulate matter (PM_{10} / $PM_{2.5}$). Without the above mitigation in place there is the potential for significant dust impacts. With mitigation in place impacts to ambient air quality will be insignificant.

9.7 Monitoring

Monitoring for dust deposition is proposed using the Bergerhoff Method as per German Standard VDI 2119. This monitoring methodology is best practice for quarry sites. Monitoring is recommended to occur along the site boundary and compliance with the TA Luft limit value of 350 mg/m^2/day assessed over the monitoring period of 30 days (+/- 2 days). Monitoring will indicate whether dust mitigation measures are working satisfactorily and whether quarrying operations are leading to potential off-site dust impacts.

9.8 Residual Impacts

The assessment involved modelling emissions from the proposed quarrying operations. Predicted dust deposition rates, and PM_{10} and $PM_{2.5}$ concentrations from the quarrying operations are in compliance with the ambient air quality limit values which are set for the protection of human health and the environment. With proposed mitigation measures in place it can be concluded that the proposed development will have a ***long-term, localised, direct, negative*** and ***not significant*** effect on air quality.

9.9 References

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