9.0 AIR QUALITY

9.1 Introduction

This chapter assesses the likely air quality impacts associated with historical quarrying extraction activities 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 and was registered by a previous owner in 2005. Historical excavation has removed materials over an area of approximately 8.66 hectares. The site 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.

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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 have occurred due to operational activities such as extraction of materials; screening, crushing, and processing of materials; 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 through the release of nitrogen dioxide (NO_2) and particulate matter (as PM_{10} and $PM_{2.5}$) emissions.

The baseline environment has been prepared with reference to published air quality data from the Environmental Protection Agency (EPA) and Met Éireann. For the purposes of this assessment, while the activities assessed have occurred over the past decades, until quarrying ceased in 2014, impacts have been assessed against the most recently published air quality guidance and policies which are likely more stringent than historical policies from previous years. Therefore if it can be determined that, based on the most recent standards, no significant effects occurred as a result of the development then it is unlikely that significant impacts occurred based on historical standards.

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

In 1996, the Air Quality Framework Directive (96/62/EC) was published. This Directive was transposed into Irish law by the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999. The Directive was followed by four Daughter Directives, which set out limit values for specific pollutants:

- The first Daughter Directive (1999/30/EC) addresses sulphur dioxide, oxides of nitrogen, particulate matter and lead;
- The second Daughter Directive (2000/69/EC) addresses carbon monoxide and benzene. The first two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations 2002 (SI No. 271 of 2002);

- The third Daughter Directive, Council Directive (2002/3/EC) relating to ozone was published in 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations 2004 (SI No. 53 of 2004); and,
- The fourth Daughter Directive , published in 2004, relates to polyaromatic hydrocarbons (PAHs), arsenic, nickel, cadmium and mercury in ambient air and was transposed into Irish law by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations, 2009 (S.I. No. 58 of 2009).

The Air Quality Framework Directive and the first three Daughter Directives have been replaced by the Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), which encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives;
- New air quality objectives for particulate matter less than 2.5 micrometers (µm) referred to as $PM_{2.5}$ including the limit value and exposure concentration reduction target;
- The possibility to discount natural sources of pollution when assessing compliance against limit values; and,
- The possibility for time extensions of three years for particulate matter less than 10µm (PM_{10}) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

The CAFE Directive was transposed into Irish legislation by the Ambient Air Quality Standards Regulations 2022 (S.I. No. 739/2022). These regulations supersede the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011), which previously superseded the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), the Ozone in Ambient Air Regulations 2004 (S.I. No. 53 of 2004), and the Ambient Air Quality Assessment and Management Regulations 1999 (S.I. No. 33 of 1999).

The Air Quality Standards Regulations 2022, which incorporate EU Directive 2008/50/EC, set similar or more stringent limit values in relation to the air pollutants outlined in the previous directives and also set limit values in relation to $PM_{2.5}$.

In October 2024 the EU formally adopted 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 and sets out air quality standards for pollutants to be reached by 2026 and 2030 which are more closely aligned with the World Health Organisation (WHO) 2021 air quality guidelines.

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 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 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 can be implemented with regard to dust impacts from the operation of the 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.

Air dispersion modelling was undertaken 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. 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 the 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.

Historic quarrying activities have removed material over an approximate 8.75 ha area within an overall larger landholding. 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.

Historic permission allowed for extraction of up to a maximum of 200,000 tonnes per annum (tpa) of material. This figure has been used in the Substitute Consent 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 58 truck (HGV) movements in and out of the site per hour has been assumed, based on the information outlined in Chapter 13 Traffic & Transport (see Table 9-3).

The quarrying operational hours as previously permitted were: 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. Extraction activities were undertaken using mechanical methods only, no blasting operations were undertaken as part of the historic operation of the site.

The following operations were 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;
- 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 9-2. 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	-	-	-

Cumulative % ≤ Stated Size	Particle Size, µm	Minimum Value	Maximum Value	Standard Deviation
30	5.0	-	-	-
34	6.0	15	65	13
51	10.0	23	81	14

Table 9-2: 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 historic quarrying activities. As per Chapter 13 and Table 9-3, the development resulted in a maximum of 3 no. one-way staff trips and 58 no. one way HGV trips per day. This resulted in a maximum change of 122 AADT on the L7130 and a maximum change of 117 HDV AADT on the L7130. Therefore, the development did 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	58	116
Total	61	122

Table 9-3: Development Traffic (Source: Table 13.5 of Chapter 13 Traffic & Transport)

9.3 Baseline Environment

The site was first registered in 2005, with quarrying activities taking place up until 2014. A small gravel pit is indicated on historic maps dated 1913, and evidence of a quarry is shown on a map dated 1906 which accompanied the registration application. This indicates that quarrying activities may have been occurring at the site as far back as 1906.

Historical data for air quality was investigated in order to establish the relevant baseline for the purposes of the assessment. Data for the full likely extraction period was not available, however data from as far back as possible has been used in establishing the baseline.

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. A full long-term data set for the station at Oak Park is not available, however, 30-year average data over the period 1981 – 2010 for the meteorological station at Kilkenny (c. 23 km south-west of the site) has also been reviewed and the data is considered representative of the weather conditions at the site location. Over the 1980 – 2010 period at the Kilkenny meteorological station there were on average 193 "wet" days (Met Eireann, 2025).

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 from dust blow. According to the data from Oak Park 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). The average wind speed over the 1981 – 2010 period at the Kilkenny meteorological station was 3.5 m/s. Data from Oak Park and historical data from Kilkenny are relatively similar in relation to rainfall and windspeeds.

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

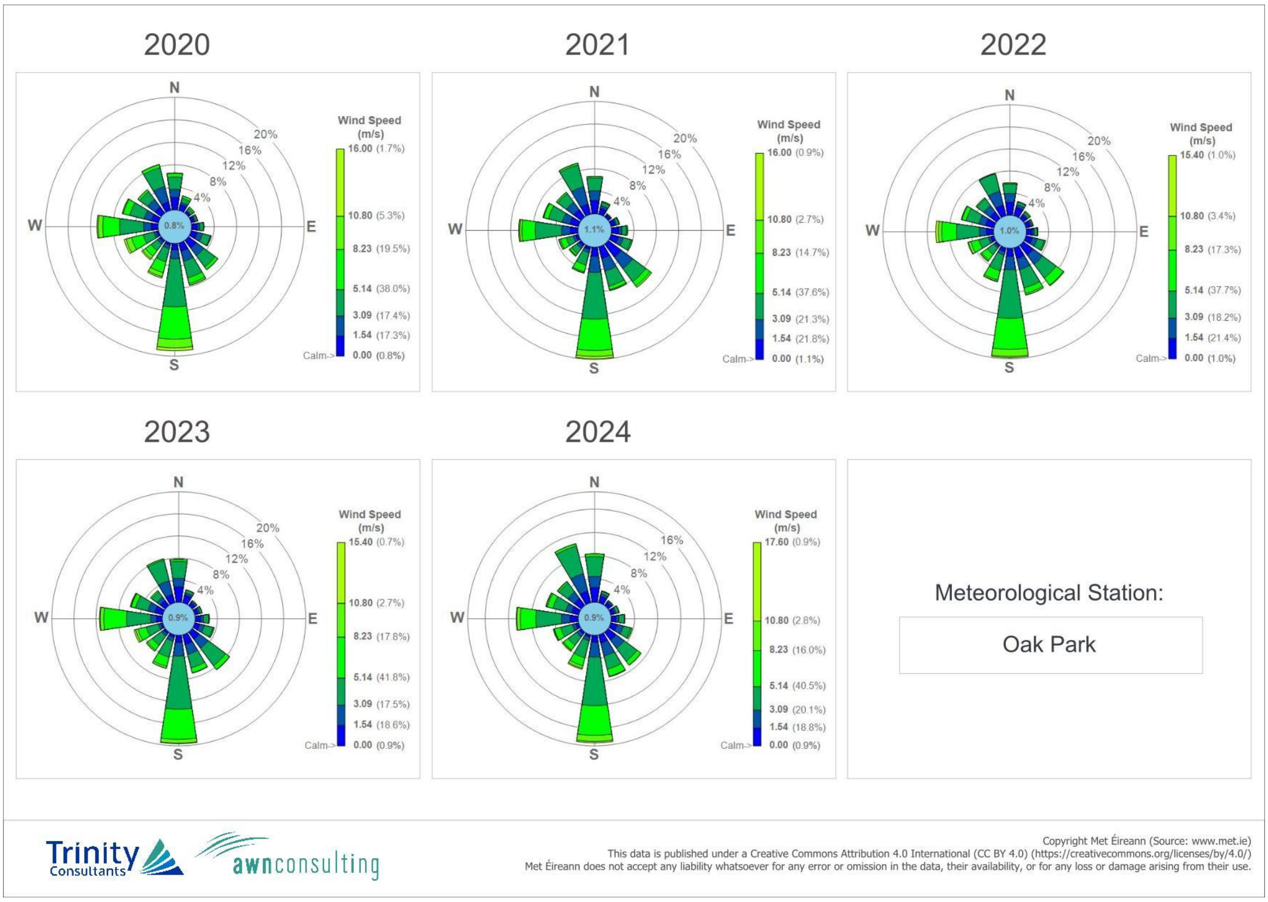

Figure 9.1: Wind Roses for Oak Park Meteorological Station

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 and Local Authorities. 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 (EPA, 2025). Monitoring data for the period 2006 – 2024 is available on the EPA website. The results of previous air quality monitoring are published in annual reports by the EPA (EPA, 2025).

As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), as amended, four air quality zones have been defined in Ireland for air quality management and assessment purposes. Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 no. 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 the development site is within the area categorised as Zone D (EPA, 2025). The long-term air monitoring data has been reviewed and used to determine background concentrations for the key pollutants of PM_{10} and $PM_{2.5}$ in the region of the development site. Representative rural Zone D sites have been reviewed as these are deemed the most appropriate in relation to the location of the development which is in a predominantly rural area. There are monitoring stations in closer proximity to the development however, these were not considered representative sites for background air quality purposes. The closer sites are not within the Zone D category, are suburban monitoring stations and background traffic monitoring stations which are not within a rural setting and therefore, do not represent the background air quality environment in proximity to the development site.

9.3.3.1 PM_{10}

Long-term PM_{10} monitoring has been carried out at the rural Zone D location of Kilkitt Co. Monaghan with data available for the period 2006 – 2024. Over the period 2006 – 2024 annual mean concentrations of PM_{10} ranged from a maximum of 11 µg/m^3 in 2013 to a low of 7 µg/m^3 in 2023 and 2024 (see Table 9-4) (EPA, 2025). The average annual mean concentration for the 2006 – 2024 period is 8.7 µg/m^3 which is significantly below the annual limit value of 40 µg/m^3. In addition, there were at most 3 exceedances of the daily limit value of 50 µg/m^3 (35 exceedances are allowed per year). Based on the above information an annual mean baseline concentration of 11 µg/m^3 has been used in this assessment.

In relation to the maximum 24-hour averaging period (as a 90.4th%ile), a value of 14 µg/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 as percentile data was not available for the full 2006 – 2024 period.

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}].

9.3.3.2 $PM_{2.5}$

Monitoring of $PM_{2.5}$ is undertaken at the rural Zone D location of Claremorris Co. Mayo. Data is available for the period 2011 – 2024 on the EPA website (EPA, 2025). Annual mean concentrations of $PM_{2.5}$ ranged from 4 - 8 µg/m^3 over the period 2011 – 2024 which are significantly below the annual mean limit value of 25 µg/m^3 (see Table 9-5). The average annual mean concentration for the 2011 – 2024 period is 5.7 µg/m^3. Based on the EPA data, an annual mean baseline $PM_{2.5}$ concentration of 8 µg/m^3 was used in this assessment.

While specific pollutant concentrations prior to 2006 are not available it can generally be assumed that historical air quality was of a lesser quality than in more recent years. The EPA state that air quality is improving over time (EPA, 2025) as a result of the introduction of various policies and measures particularly in relation to road transport emissions and the use of cleaner fuels and the gradual introduction of hybrid and electric vehicles.

Station	Averaging Period	Year																		
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Kilkitt, Co. Monaghan	Annual Mean PM_{10} (µg/m^3)	10	10	10	8	10	9	9	11	9	9	8	8	9	7	8	8	9	7	7
	24-hr Mean > 50 µg/m^3	0	2	1	1	0	1	1	3	2	1	0	0	0	1	0	0	0	0	0

Table 9-4: Baseline Air Quality – PM_{10}

Station	Averaging Period	Year													
		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Claremorris, Co. Mayo	Annual Mean $PM_{2.5}$ (µg/m^3)	6	6	8	5	6	6	6	6	4	5	8	6	5	5

Table 9-5: Baseline 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.

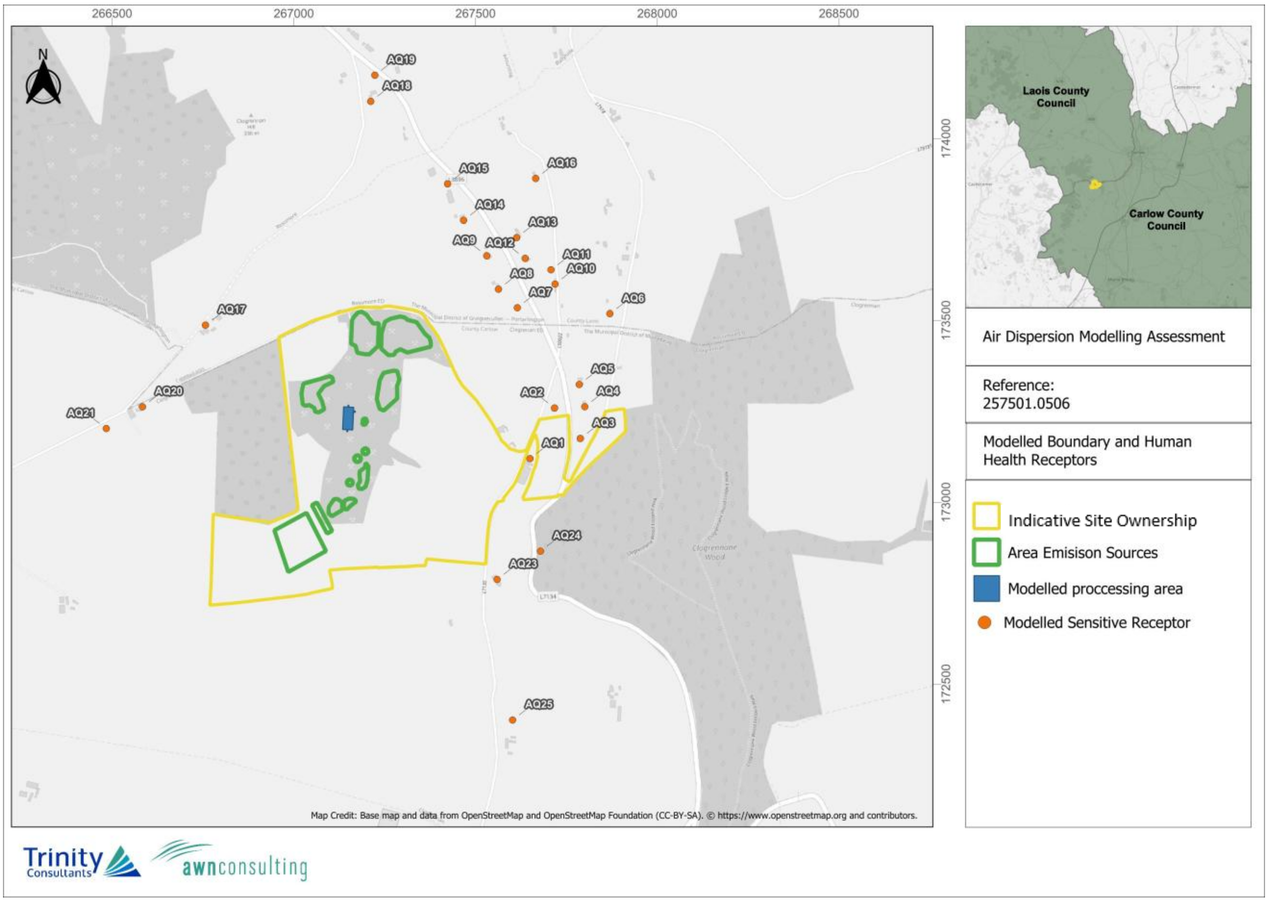

Figure 9.2: Modelled Boundary & Sensitive Receptors

9.4 Impact Assessment

9.4.1 Do Nothing Scenario

As outlined in the EPA Guidelines (2022), the description of 'Do-Nothing Effects' relates to the future environment as it would be, should the project not be carried out. Had quarrying activities at the site not taken place, the identified impacts to air quality would not have occurred. The Do Nothing scenario is considered neutral in relation to air quality.

9.4.2 Construction Phase

Full details of the historic development are not currently available, however given the land use, it is assumed that construction phase impacts would have been minimal. As a result significant impacts to air quality are not predicted and they have not been considered further. The primary impacts on air quality have occurred as part of the day-to-day operational activities on site.

9.4.3 Operational Phase

9.4.3.1 Quarrying Operations – Dispersion Modelling Results

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

The results of the dispersion modelling assessment show that dust deposition levels and annual mean concentrations of $PM_{2.5}$ from the historic quarrying operations are below the relevant limit values. In relation to PM_{10}, historic quarrying activities resulted in annual mean PM_{10} concentrations that are below the relevant limit value, however, the daily PM_{10} limit value of 50 µg/m^3 is exceeded in all assessment years. Exceedances are observed at a maximum of 7 no. of the 25 no. closest sensitive receptors to the site in the worst-case year assessed. These 7 no. receptors are located in closest proximity to the quarry.

The results indicate that the effect of the operational phase (i.e. Substitute Consent Operations Scenario) on air quality is ***localised, direct, long-term, negative*** and ***significant***.

Quarrying activities ceased on site by 2014 and there are no activities taking place on site at present, as a result, there are currently no impacts to air quality associated with the development site.

In relation to future air quality impacts from the development site, if the subject application is not approved, no activities on site will occur and therefore, there will be no effects on air quality. Should quarrying activities with the same historical practices recommence on site following grant of a relevant planning permission, impacts to air quality similar to those identified herein would likely occur.

9.4.3.1.1 Dust Deposition

Historic quarrying operations from the site lead to a dust deposition level, averaged over the full year, of at most 189 mg/m^2/day at the land ownership boundary to the quarry (see Table 9-6). 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 228 mg/m^2/day which is 65% 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/m²/day)	Background Concentration (mg/m²/day)	Predicted Environmental Concentration (PEC) (mg/m²/day)	Limit Value (mg/m²/day)	PEC as a % of Limit Value
		Type	X,Y (UTM Zone 29 N)					
Dust / 2020	Annual Mean	Boundary	634941, 5852381	174.1	39	213.1	350	61%
Dust / 2021	Annual Mean	Boundary	634941, 5852381	189.0	39	228.0	350	65%
Dust / 2022	Annual Mean	Boundary	634851, 5852344	145.2	39	184.2	350	53%
Dust / 2023	Annual Mean	Boundary	634941, 5852381	176.9	39	215.9	350	62%
Dust / 2024	Annual Mean	Boundary	634941, 5852381	176.3	39	215.3	350	62%

Table 9-6: Dispersion Modelling Results for Dust Deposition at Boundary – Substitute Consent Operations Scenario

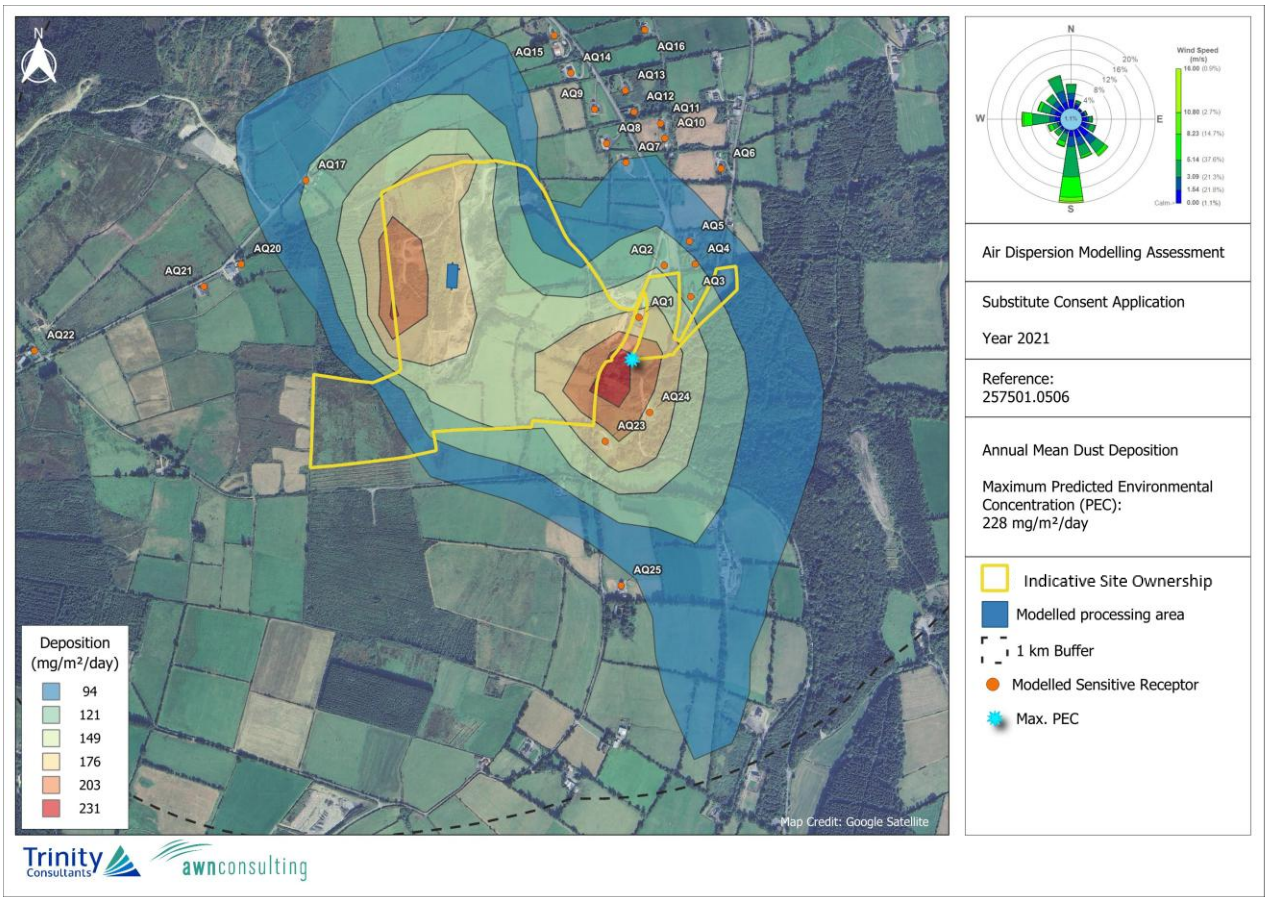

Figure 9.3: Annual Mean Dust Deposition Rate (g/m²/yr) – Substitute Consent Operations Scenario

9.4.3.1.2 PM_{10}

Predicted PM_{10} concentrations as a result of the historic quarrying operations are presented in Table 9-7.

Due to the emissions from the historic quarrying operations, the annual mean concentrations (including background concentration) at the worst-case receptor peak at 37.96 µg/m³. This equates to 95% of the annual PM_{10} limit value of 40 µg/m³.

The predicted 24-hour PM_{10} concentration (including background) peaks at 90.16 µg/m³ (based on Method B) which is 180% of the 24-hour limit value of 50 µg/m³ (measured as a 90.4th%ile).

Table 9-8 shows the predicted 24-hour mean PM_{10} concentrations (including background concentration) at each modelled sensitive receptor in the vicinity of the site. Receptors AQ1, AQ2, AQ3, AQ5, AQ23 and AQ24 experienced exceedances of the 24-hour limit value of 50 µg/m³ (measured as a 90.4th%ile) in the modelled assessment years. The majority of receptors experienced 24-hour PM_{10} concentrations the are in compliance with the 24-hour limit value of 50 µg/m³ (measured as a 90.4th%ile). Receptors AQ1, AQ2, AQ3, AQ5, AQ23 and AQ24 are located in closest proximity to the site along the L7130 and L7134, near the site entrance.

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 mean 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	24.509	11	35.51	35.51	40	89%
	24-hr Mean (as 90.4th%ile)	Sensitive	634869, 5852162	76.290	14	38.51	87.29	50	175%
PM_{10} / 2021	Annual Mean	Sensitive	634869, 5852162	26.964	11	37.96	37.96	40	95%
	24-hr Mean (as 90.4th%ile)	Sensitive	634869, 5852162	79.155	14	40.96	90.16	50	180%
PM_{10} / 2022	Annual Mean	Sensitive	634869, 5852162	22.439	11	33.44	33.44	40	84%
	24-hr Mean (as 90.4th%ile)	Sensitive	634869, 5852162	72.227	14	36.44	83.23	50	166%
PM_{10} / 2023	Annual Mean	Sensitive	634989, 5852240	23.813	11	34.81	34.81	40	87%
	24-hr Mean (as 90.4th%ile)	Sensitive	634869, 5852162	77.029	14	37.81	88.03	50	176%
PM_{10} / 2024	Annual Mean	Sensitive	634869, 5852162	25.342	11	36.34	36.34	40	91%
	24-hr Mean (as 90.4th%ile)	Sensitive	634869, 5852162	72.303	14	39.34	83.30	50	167%

Table 9-7: Dispersion Model Results for PM_{10} – Substitute Consent Operations Scenario

Receptor	Coordinates (UTM Zone 29N)		24-hr Mean PM_{10} (as 90.4th%ile) Predicted Environmental Concentration (PEC) (µg/m³)				
	X Coord	Y Coord	2020	2021	2022	2023	2024
AQ1	634960	5852494	**66.52**	**69.95**	**58.40**	**67.00**	**64.56**
AQ2	635027	5852633	**61.66**	**58.90**	44.61	**57.64**	**66.76**
AQ3	635099	5852550	**52.68**	**58.61**	45.05	**52.83**	**55.95**
AQ4	635110	5852637	48.17	48.72	38.79	47.90	**53.75**
AQ5	635095	5852698	**50.58**	46.66	36.02	48.12	**52.06**
AQ6	635179	5852893	29.29	30.78	25.89	32.38	32.87
AQ7	634925	5852909	37.19	35.42	30.86	40.07	41.66
AQ8	634873	5852960	32.45	28.65	27.45	33.08	32.70
AQ9	634841	5853052	32.43	29.29	27.07	30.46	32.02
AQ10	635029	5852974	37.46	37.69	27.73	43.78	41.69
AQ11	635018	5853013	37.64	34.03	26.64	41.90	41.17
AQ12	634946	5853045	36.68	31.75	27.48	38.33	39.50
AQ13	634923	5853102	37.03	32.13	28.74	35.50	36.62
AQ14	634777	5853149	31.42	28.38	26.33	28.32	28.24
AQ15	634733	5853249	27.20	30.03	26.54	28.59	27.98
AQ16	634975	5853264	32.77	30.15	26.06	32.26	31.53

Receptor	Coordinates (UTM Zone 29N)		24-hr Mean PM_{10} (as 90.4th%ile) Predicted Environmental Concentration (PEC) (µg/m³)				
	X Coord	Y Coord	2020	2021	2022	2023	2024
AQ17	634067	5852861	19.30	21.07	23.05	20.57	18.93
AQ18	634522	5853476	25.68	26.14	22.37	26.68	25.04
AQ19	634533	5853548	25.39	25.79	21.89	25.62	24.95
AQ20	633894	5852637	14.98	15.57	14.62	15.12	15.55
AQ21	633794	5852577	14.39	14.28	12.63	14.10	14.47
AQ22	633340	5852405	13.41	13.85	13.07	13.39	12.77
AQ23	634869	5852162	**87.29**	**90.16**	**83.23**	**88.03**	**83.30**
AQ24	634989	5852240	**77.47**	**84.97**	**67.10**	**82.15**	**77.13**
AQ25	634912	5851775	31.36	34.28	25.16	29.73	31.82
Values > 50 µg/m³			6	5	3	5	7

Table 9-8: 24-Hour Mean PM_{10} Concentrations at Nearby Sensitive Receptors

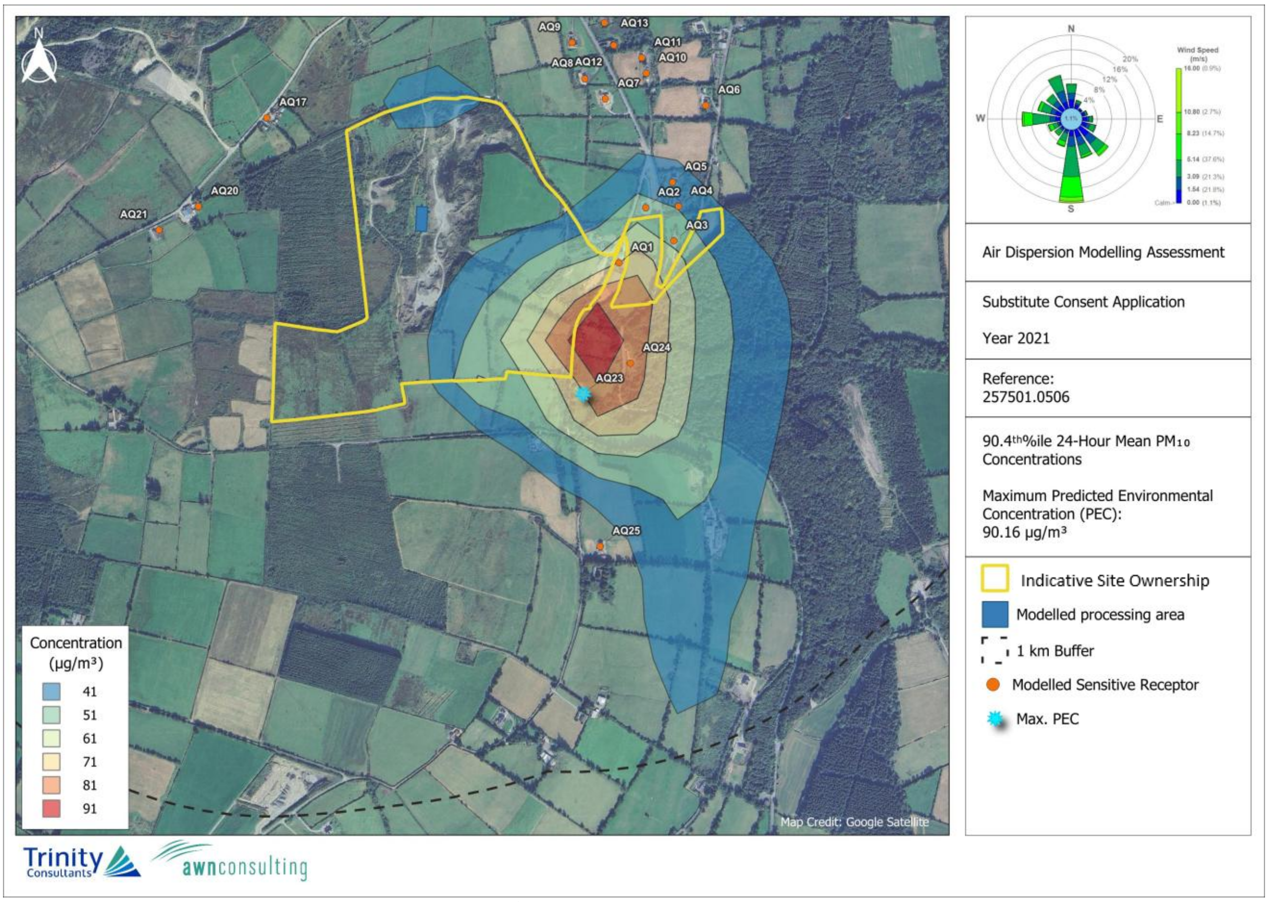

Figure 9.4: Maximum 24-Hr PM_{10} Concentration (as a 90.4th%ile) (µg/m³) – Substitute Consent Operations Scenario

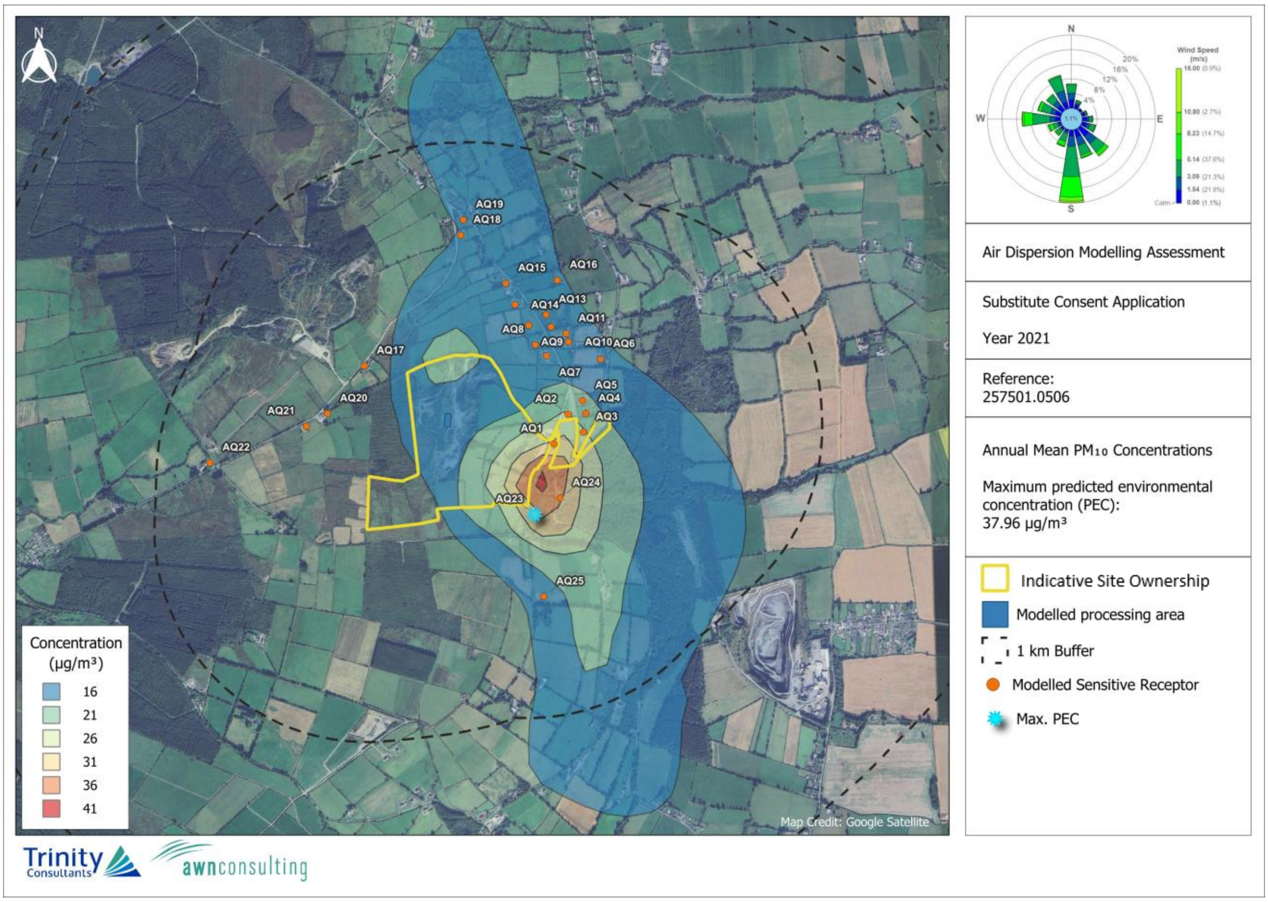

Figure 9.5: Annual Mean PM_{10} Concentration (µg/m³) – Substitute Consent Operations Scenario

9.4.3.1.3 $PM_{2.5}$

Predicted $PM_{2.5}$ concentrations at the worst-case receptor are below the limit value of 25 µg/m³ (see Table 9-9). Based on a background $PM_{2.5}$ concentration of 8 µg/m³ in the region of the site, the annual mean $PM_{2.5}$ concentration including the operations (i.e. PEC) peaks at 18.71 µg/m³. This peak level equates to 75% 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	9.73	8	17.73	25	71%
$PM_{2.5}$/ 2021	Annual Mean	Sensitive	634869, 5852162	10.71	8	18.71	25	75%
$PM_{2.5}$/ 2022	Annual Mean	Sensitive	634869, 5852162	8.92	8	16.92	25	68%
$PM_{2.5}$/ 2023	Annual Mean	Sensitive	634869, 634869	9.52	8	17.52	25	70%

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	10.06	8	18.06	25	72%

Table 9-9: Dispersion Model Results for $PM_{2.5}$ – Substitute Consent Operations Scenario

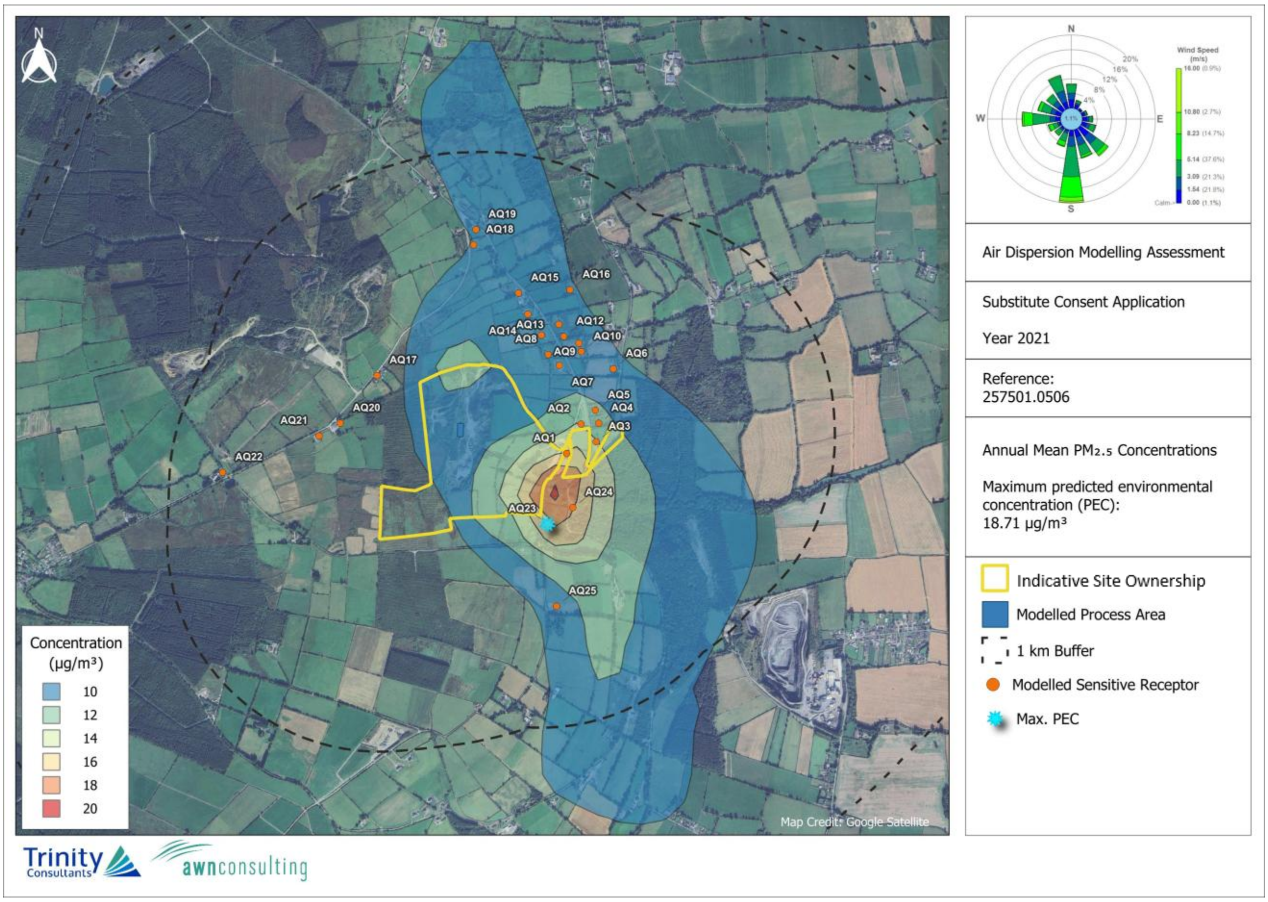

Figure 9.6: Annual Mean $PM_{2.5}$ Concentration (µg/m³) – Substitute Consent Operations Scenario

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 were a number of mitigation measures in place on site to prevent significant dust emissions from on-site activities. These measures include:

- A wheel wash was in place on site which trucks must pass through prior to exiting onto the private site access road.
- Site roads were dampened using wet methods during dry periods.
- Sweeping and cleaning of site roads and adjoining public roads was carried out.
- All fine materials were covered when leaving the site to prevent dust escaping.
- Speeds restrictions were in place on site.
- Perimeter natural vegetation and screening mounds were maintained.
- Plant and equipment was regularly maintained and inspected.
- Traffic management measures were implemented.

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} / $PM_{2.5}$).

9.7 Monitoring

Air quality monitoring was not undertaken on site.

9.8 Residual Impacts

The assessment involved modelling emissions from the historic quarrying operations. Predicted dust deposition rates, and annual mean concentrations of PM_{10} and $PM_{2.5}$ 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. Predicted 24-hour PM_{10} concentrations are above the daily limit value of 50 µg/m^3 for the protection of human health and the environment.

It can be concluded that the proposed development had a ***localised, direct, long-term, negative*** and ***significant*** effect on air quality.

9.9 References

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