7.0 AIR QUALITY AND CLIMATE

7.1 Introduction

This chapter of the remedial Environmental Impact Assessment Report (rEIAR) presents a retrospective assessment of the potential effects that may have occurred, and may continue to occur, on the receiving environment (in particular dust and climate) as a result of activities at the existing quarry site at Ballinabarny North and Bolagh Lower, Redcross, Co. Wicklow (‘the Site’) between 1990 and the present day.

The choice of team members for each study has been informed by the experience of the relevant lead specialist in their area of technical interest. The air quality assessment has been prepared by Sophie Winters (BSc (Hons.)) and Rachel Lansley (BSc, MSc). Sophie is an Affiliate member of the Institute for Environmental Management and Assessment (IEMA) and has more than 3 years’ experience in air quality assessment. Rachel is a Chartered Scientist (CSci), a Member of the Institution of Environmental Sciences (IES), and a Member of the Institute of Air Quality Management (IAQM) and has more than 15 years’ experience in air quality and climate assessment.

A detailed description of the Site and the activities that have been undertaken (‘the Development’) can be found in Chapter 2 of this rEIAR (Project Description).

7.1.1 Background

This rEIAR has been prepared to accompany a substitute consent application for an existing quarry at Redcross Quarry, Ballinabarny, Co. Wicklow.

The lands comprising the subject of this rEIAR extend to ca. 23.7 ha and reflect the historic operational site area including the extractable area declared under S.261 quarry registration in 2007. The quarry extraction area that makes up the application for the substitute consent planning unit currently extends to ca. 20.16 ha, and lies centrally within the Site. The lands adjacent to the Site are used for agricultural purposes (including pasture and tillage), with plantations of trees located along the western, and eastern edges of the Site. An area of ‘heath’ and scrub occurs immediately adjacent to the south of the Site. Farmyards and one-off residential properties also occur in the vicinity of the Site.

The current quarry void is centrally located within the EIA unit and is roughly square in shape. The existing administration, maintenance, storage and welfare facilities are located at the southern edge of the Site, with the aggregate processing plant area located towards the centre of the Site. At baseline, in 1990, the quarried area has been determined to extend to approximately 0.75 ha with an average working depth of ca. 124 m AO and in 2022 to have expanded laterally to approximately 20.16 ha with an average working depth of ca. 114 m AOD where sand and gravel deposits have been worked out.

7.1.2 Scope & Methodology

This chapter presents an assessment of the potential air quality and climate effects associated with the historic operation of the Site. The effects have been assessed in the context of relevant national, regional and local air quality policies.

A qualitative assessment of dust impacts from the quarrying activities has been undertaken in line with Institute of Air Quality Management (IAQM); Guidance on the Assessment of Mineral Dust Impacts for Planning, 2016. The detailed assessment is included in Appendix 7.1.

A traffic screening for effects from road traffic emissions has been undertaken in accordance with the Environmental Protection UK/Institute of Air Quality Management guidance document ‘Land –Use Planning & Development Control: Planning for Air Quality’ (EPUK/IAQM 2017).

7.1.3 Sources of Emissions to Air

7.1.3.1 Particulates

The main potential impact on ambient air quality associated with extraction and processing activities is that associated with deposition of dust generated by the material extraction and transfer operations.

Potential dust emissions associated with quarry workings are:

- Earthmoving operations during the overburden stripping phase;
- Excavation of sand and gravel via excavators from the quarry floor;
- Transport of materials within the Site on haul routes via dump truck;
- Loading and unloading of materials via loading trucks;
- Temporary stockpiling of materials within the quarry floor;
- Haulage, where the weight of vehicles, their speed of passage and number of wheels in contact with the ground, and the nature and condition of road surfaces or haul routes all affect the amount of dust emitted; and
- Wind blow from material stockpiles, unsurfaced internal haul roads and the quarry floor.

7.1.3.2 Traffic Emissions

The historical daily traffic movements associated with the operation of the Site are approximately 40 HDV (trucks >3.5 tonnes) movements and 16 LDV (cars associated with staff/visitors) movements per day, with the Site operating 6 days a week (Monday to Saturday only). For conservatism these values are being used as the AADT, although if the AADT were calculated based on the working hours they would be approximately 34 AADT for HDVs and 14 LDVs.

The EPUK & IAQM Land Use Planning Control: Planning for Air Quality (2017) guidance specifies an LDV screening criteria of a change of 500 AADT, and a HDV screening criteria of a change of 100 AADT. Considering that the traffic flows associated with the historic operation of the Site falls below this screening criteria, no detailed assessment is required and therefore traffic emissions have been screened out of this assessment as **Not Significant**.

7.1.3.3 Odour

Inert natural materials have historically been excavated from the Site, which are not odorous. Therefore, odour is not considered any further in this assessment and is screened out as **Not Significant**.

7.2 Policy and Legislation Context

7.2.1 European Air Quality Directives

The European Union (EU) Directive on Ambient Air Quality Assessment and Management came into force in September 1996 (96/62/EC) and defines the policy framework for 12 air pollutants known to have harmful effects on human health and the environment. Air quality limit values (ambient pollutant concentrations not to be exceeded after a given date) for the pollutants are set through a series of Daughter Directives. The first Daughter Directive (1999/30/EC) sets limit values for NO_2 and PM_{10} (amongst other pollutants) in ambient air.

Following the Daughter Directives, EU Council Directive 2008/50/EC on ambient air quality and cleaner air for Europe (CAFE) came into force in June 2008, consolidating the existing air quality legislation, making provision for Member States to postpone attainment deadlines and allowing exemption from the obligation to limit values for certain pollutants, subject to strict conditions and assessment by the European Commission. Directive 2008/50/EC was transposed into Irish legislation in 2011 through The Air Quality Standards Regulations 2011.

The Directive merged the four daughter directives and EU Council decision into a single directive on air quality. The new Directive also introduced a new limit value for $PM_{2.5}$ but does not change the existing air quality standards.

7.2.2 National Air Quality Legislation

The Air Pollution Act (1987) is the primary legislation relating to air quality in Ireland and provides the means for local authorities to take the measures that they deem necessary to control air pollution.

The Air Quality Standards Regulations (2011) transpose the Directive on ambient air quality (2008/50/EC) into Irish law. These regulations establish limit values and thresholds for various pollutants in ambient air.

The Environmental Protection Agency (EPA) monitor the levels of various pollutants against the standards set out in EU and Irish legislation. The EPA are the competent authority for annual reporting to the Minister for the Environment, Heritage and Local Government and the European Commission.

7.2.3 Other Relevant Legislation

Legislative references considered specifically for the assessment of air quality from extraction activities, and relevant statutory instruments in a planning context include:

- European Communities (Environmental Impact Assessment Regulations) 1989 (S.I. No. 349 of 1989);
- Section 177F of the Planning & Development Act 2000 as amended;
- Directive 2014/52/EU of the European Parliament and of the Council, (amending Directive 2011/92/EU);
- European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018, S.I. 296 of 2018; and
- Planning and Development Regulations 2001 (as amended).

7.2.4 Relevant Guidance

This assessment has been undertaken with guidance from the ‘Guidelines on the information to be contained in Environmental Impact Assessment Reports’, published in - by the EPA in May 2022; ‘Environmental Impact Assessment of projects, and guidance on the preparation of the Environmental Impact Assessment Report’ published by the European Commission in 2017 Other guidance documents considered in this assessment include:

- IAQM; Guidance on the Assessment of Mineral Dust Impacts for Planning, 2016;
- IAQM; Guidance on the assessment of dust from demolition and construction, 2014;
- EPA; Guideline Document entitled Environmental Management in the Extractive Industries, 2006;
- EPUK & IAQM; Land-Use Planning and Development Control: Planning for Air Quality, 2017;
- Irish Concrete Federation – Environmental Code 2nd Edition, October 2005;
- Environmental Management in the Extractive Industry, EPA 2006;
- Quarries and Ancillary Activities – Guidelines for Planning Authorities – DOEHLG, April 2004;
- Process Guidance Note 3/16 (12) – Secretary of State’s Guidance for Mobile Crushing and Screening, DEFRA (UK), September 2012;
- Process Guidance Note 3/8 (12) – Secretary of State’s Guidance for Quarry Processes, DEFRA (UK), September 2012;

- Safe Quarry – Guidelines to the Safety, Health and Welfare at Work (Quarries) Regulations 2008 – Health and Safety Authority, 2020; and
- Environmental Protection Agency's Annual Air Quality in Ireland Report 2013.

7.2.5 Relevant Planning Objectives

The Wicklow County Development Plan (WCDP) (2016-2022) guides planning policy in the area and includes policies in relation to the protection of air quality from deposited dust and fine particulates. Polices included in the WCDP which are relevant to this assessment of population and human health include:

- "WE9 – To regulate and control activities likely to give rise to emissions to air (other than those activities which are regulated by the EPA);
- WE10 – To require proposals for new developments with the potential for the accidental release f chemicals or dust generation, to submit and have approved by the Local Authority construction and/or operation management plans to control such emissions;
- WE11 – To require activities likely to give rise to air emissions to implement measures to control such emissions, to undertake air quality monitoring and to provide an annual air quality audit."

The Draft Wicklow County Development Plan (2021-2027) is currently under assessment prior to publishing, however is publicly available online to view. The above objectives which are included in the current WCDP are carried across into the Draft 2021-2027 plan. There are no further objectives included in the Draft 2021-2027 plan which are relevant to air quality.

7.2.6 Air Quality Standards

Table 7.1 below shows the limit or target values, specified by the CAFE Directive 2008/50/EC, relevant to this assessment.

7.2.6.1 Gaseous Pollutants

Table 7.1: Air Quality Standards

Pollutant	Limit Value Objective	Averaging Period	Limit Value ug/m^3	Basis of application Limit
SO_2	Protection of human health	1 hour	350	Not to be exceeded more than 24 times in a calendar year
		24 hours	125	Not to be exceeded more than 3 times in a calendar year
	Protection of vegetation	Calendar year	20	Annual mean
		1 Oct to 31 Mar	20	Winter mean
NO_2	Protection of human health	1 hour	200	Not to be exceeded more than 18 times in a calendar year
		Calendar year	40	Annual mean
NO_2 + NO	Protection of ecosystems	Calendar year	30	Annual mean

Pollutant	Limit Value Objective	Averaging Period	Limit Value ug/m^3	Basis of application Limit
PM_{10}	Protection of human health	24 hours	50	Not to be exceeded more than 35 times in a calendar year
		Calendar year	25	Annual mean
PM2.5 Stage 1	Protection of human health	Calendar year	25	Annual mean
PM2.5 Stage 2		Calendar year	20	Annual mean

7.2.6.2 Coarse Particulates

The impact of dust is usually monitored by measuring rates of dust deposition. According to the Environmental Protection Agency (EPA) Guideline Document entitled Environmental Management in the Extractive Industries (April 2006), applicable during the assessment period for this rEIAR, there are no Irish statutory standards relating specifically to dust deposition thresholds for inert mineral dust. There are a number of methods to measure dust deposition but only the German TA Luft Air Quality Standards (TA Luft, 1986) specify a method of measuring dust deposition – the Bergerhoff Method (German Standard VDI 2119, 1972) – with dust nuisance.

On this basis, the EPA recommend a dust deposition limit value of 350 mg/m^2/day (Table 7.2)(when averaged over a 30-day period) be adopted at Site boundaries associated with quarrying related activities. This limit value has been applied in this assessment.

Table 7.2: Dust Limit Values

Procedures	Monitoring Frequency	Standard
Dust Emissions	Monthly	<350 mg/m^2/day; Bergerhoff Method

7.3 Existing Environment

7.3.1 Site Location

The Site is located in the townland areas of Ballinabarny North and Bolagh Lower, Redcross, Co. Wicklow, centered at coordinates 722164, 686418 (ITM95).

The lands comprising the subject of this rEIAR are roughly square in shape, and are bounded by agricultural lands, with a network of streams delineating the Site boundary on all sides. In this way, the immediate character of the lands is rural, with low density, isolated roadside housing and farmyards.

Access to the Site is via a gravel covered laneway from the L5155 road, linking to the L1152. The laneway is approximately 800 m long and is bounded by agricultural fields, plantation woodland and heath/scrub on either side.

A Site location plan is shown in Figure 7.1 below.

Figure 7.1: Site Location Plan

7.3.2 Study Area

It has been found that deposited dust does not generally travel beyond 400 m (IAQM, Appendix 2, 2016), therefore all receptors within 500 m of the Site boundary are conservatively considered. The guidance states that it is commonly accepted that the greatest impacts from particulates will occur within 100 m of the source, with the potential for travel up to 400 m.

For full consideration of the effects of particulates on the Site access road, in the absence of any methodology within the IAQM minerals guidance, the IAQM Guidance on the Assessment of Dust from Demolition and Construction (2014) has been considered.

This guidance states that human receptors within 50 m of routes used by vehicles for 350 m from a site exit point should be considered for mineral dust impacts. For this reason, the Site access road will be subject to a 50 m buffer, which will then extend 350 m out onto the L5155 main road in both directions to account for the possibility of trackout from exiting vehicles. For conservatism, a 350 m length buffer has been applied from the point at which the Site exits onto the L5155 public road. The full assessment in contained in Appendix 7.1 of this report.

7.3.3 Receptors

All receptors present during 1990 to the present day have been included in the assessment.

Historical and current receptors identified for the purpose of the assessment of particulates/ dust emissions previous operation of the quarry are shown below in Figure 7.2.

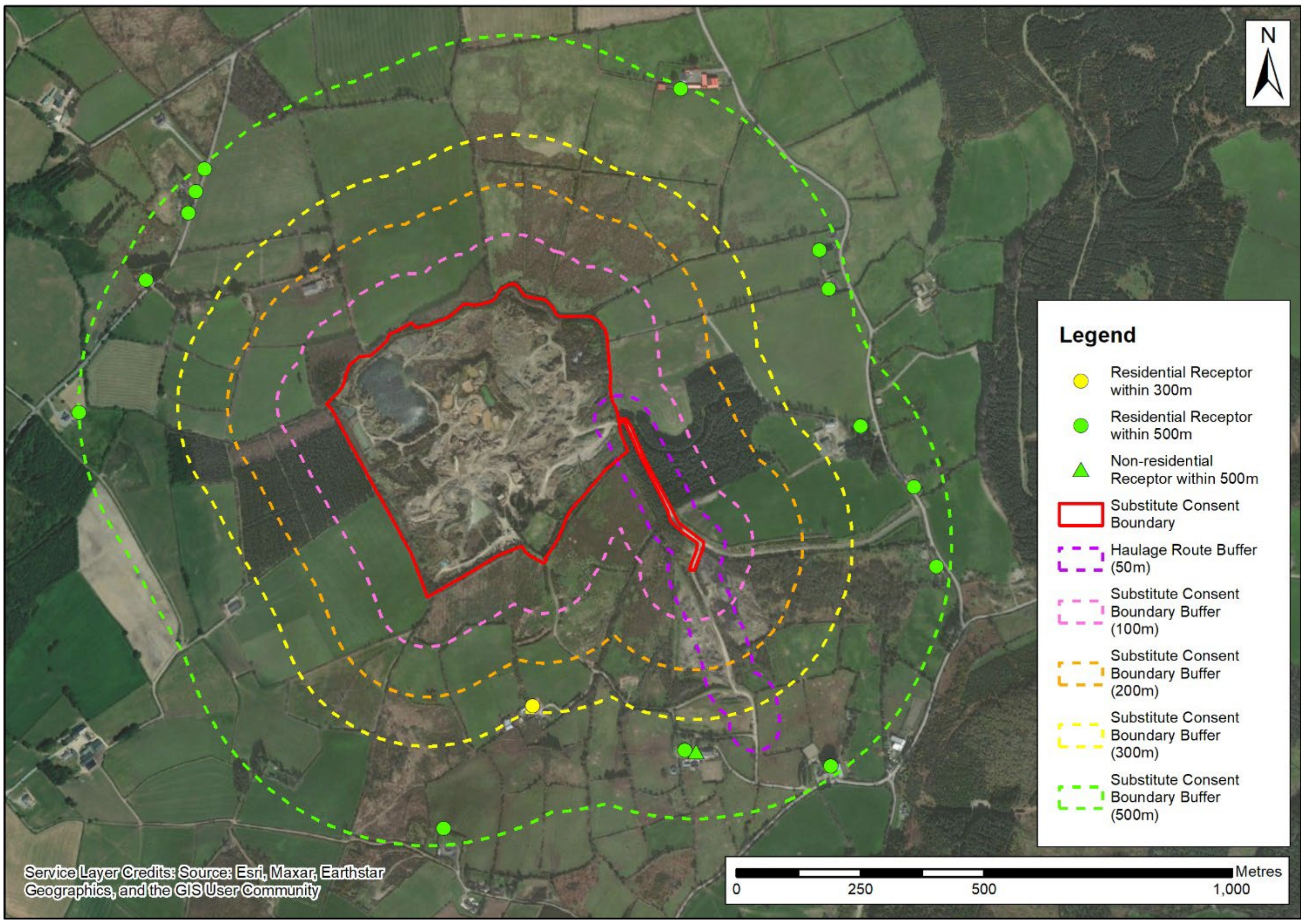

Figure 7.2: Location of receptors within 500 m of the Site (including Site Boundary) and within 50 m of the Site Access Haulage Route (extending 350 m from the point of exit of the Site Boundary).

7.3.4 Climate at the Site

The Irish climate is subject to strong maritime influences, the effects decreasing with increasing distance from the Atlantic coast. The climate in the area of the Site is typical of the Irish climate, which is temperate maritime.

The closest and most representative Met Éireann station recording multiple meteorological parameters is located at Carlow Oak Park, Co. Carlow, ca. 55 km west of the Site. Data is available for this station from 2004 onwards. Monthly historical data between 2004 and 2022 have been averaged and are presented in Table 7.3.

Table 7.3: Carlow Oak Park, Co. Carlow Monthly Averaged Monthly Climate Information 2004 to 2022

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Air Temperature (°C)	5.2	5.5	6.6	8.8	11.4	14.2	16.0	15.5	13.6	10.7	7.3	5.6
Maximum Air Temperature (°C)	12.9	13.2	15.4	18.2	21.9	24.8	25.5	24.0	22.5	18.1	15.1	13.3
Minimum Air Temperature (°C)	-4.4	-3.5	-2.7	-0.8	1.5	4.7	6.9	6.5	3.3	0.5	-2.7	-3.7
Mean Maximum Temperature (°C)	8.2	8.7	10.6	13.3	16.0	18.8	20.5	19.8	17.8	14.3	10.5	8.6
Mean Minimum Temperature (°C)	2.3	2.2	2.6	4.3	6.8	9.6	11.5	11.2	9.4	7.1	4.2	2.7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Precipitation (mm)	76.7	68.3	61.9	44.4	53.3	60.4	69.1	81.0	64.7	95.0	88.2	93.4
Grass Minimum Temperature (°C)	-9.3	-8.4	-7.9	-5.8	-3.3	0.6	2.5	1.9	-1.1	-3.6	-6.8	-8.3
Mean Wind Speed (knots)	8.2	8.5	8.0	7.1	7.1	6.6	6.5	7.1	6.9	7.2	7.4	8.2
Highest Gust (knots)	47.0	44.9	43.7	39.6	37.6	32.4	32.1	32.6	35.9	39.6	41.8	43.6

The information presented in Table 7.3 above provides an overview of the climatic conditions at the Site. Over the time period for which data is provided, the wettest months in terms of total rainfall for the period are October and December. High rainfall in these months provides natural dampening for potential dust emissions. The opposite impact occurs in dry and windy months, when there is increased potential for dust to be mobilised. The months with the highest mean wind speed are December to March and the driest months in the Site area are April and May.

An important meteorological parameter with regard to the dilution and dispersal of air pollutants is wind speed and direction. A full annual wind-rose for the Carlow Oak Park station is presented in Figure 7.3 for the period 01 January 2004 to 31 December 2021. The prevailing winds are from a southerly direction, with some north-westerlies.

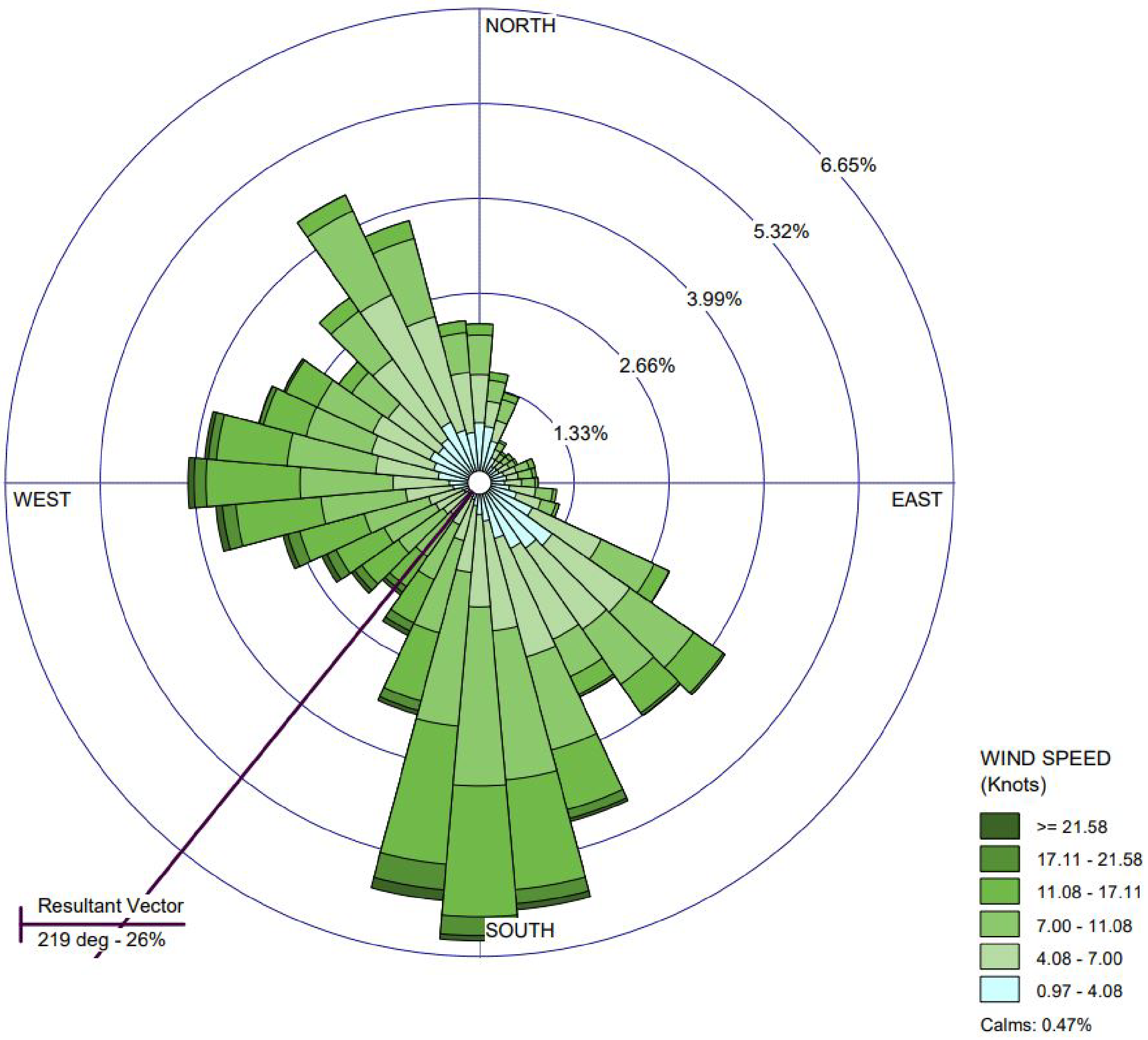

Figure 7.3: Annual dominant wind direction at Carlow Oak Park using Hourly Wind Data (Assessment Period 1 January 2004 to 31 December 2021)

7.3.5 Background Air Quality

7.3.5.1 Primary Data – Site Monitoring Data

Dust monitoring has been undertaken historically at the Site between 2008 and 2014, and more recently over a six month period from October 2021 to April 2022, using the Bergerhoff method. Monitoring was undertaken between 2008 and 2014 at 4 different monitoring locations, and in 2021/2022 at 3 different monitoring locations. Descriptions of the dust monitoring locations are presented in Table 7.4 and their locations are shown in Figure 7.4.

Table 7.4: Description of Dust Monitoring Locations

Location	Description
D1 (Historic)	Located adjacent to the southern boundary of the Site in a field.
D2 (Historic)	Located along the L1152, adjacent to an isolated residential dwelling.

Location	Description
D3 (Historic)	Located adjacent to the eastern boundary of the Site in a field, north of the Site entrance.
D4 (Historic)	Located adjacent to the northwest boundary of the Site in a field.
D1	Located in the northeast corner of the Site.
D2	Located to the south of the Site in a field, and adjacent to a haul road.
D3	Located adjacent to the western boundary of the Site in a field.

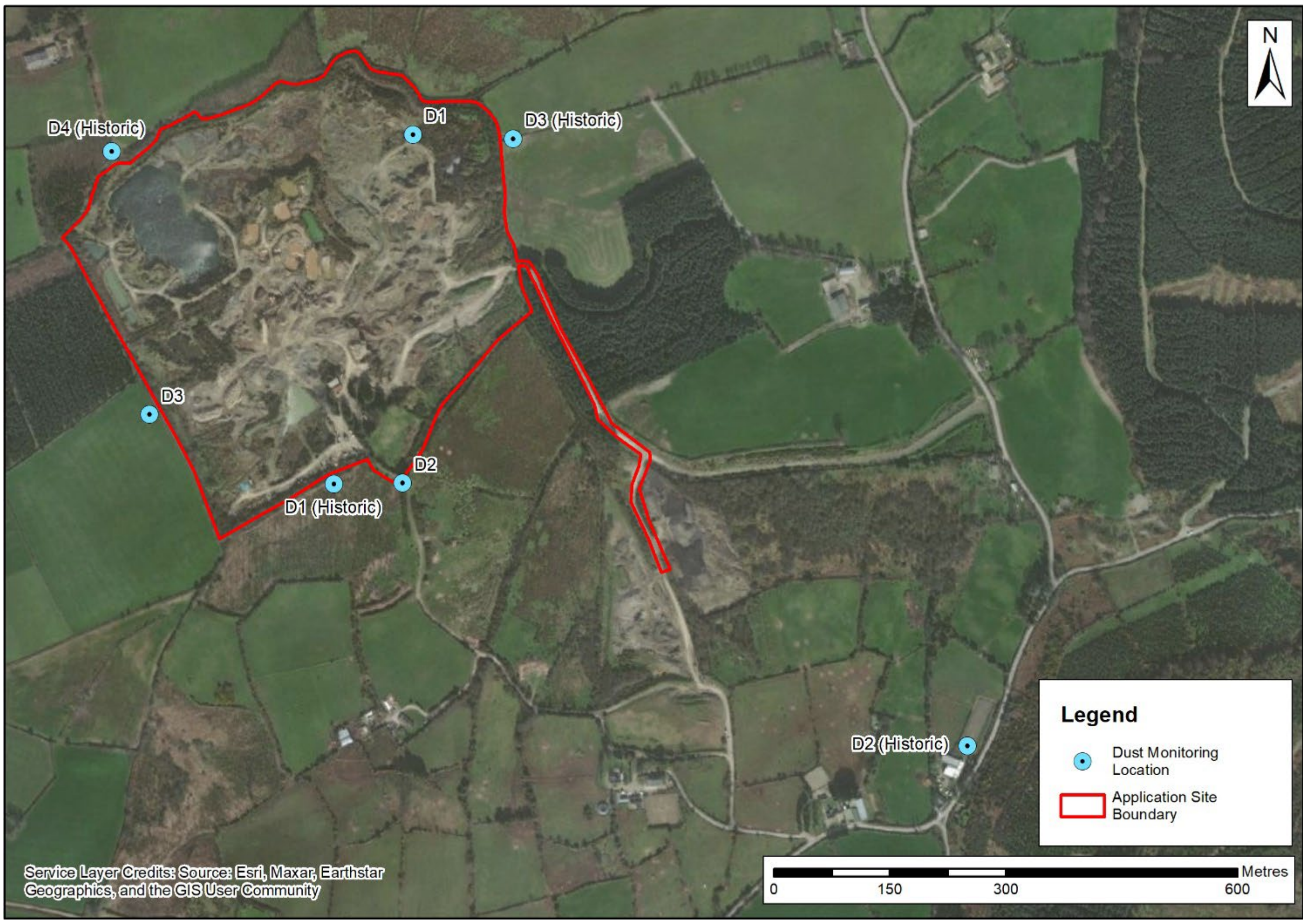

Figure 7.4: Plan Showing Dust Monitoring Locations

The historical dust deposition monitoring undertaken at the Site used Bergerhoff dust gauges. The recommended dust deposition limit value when using the Bergerhoff method is 350 mg/m^2/day, as specified in Table 7.2 of this assessment. This value is recommended by the EPA in their guidance - Environmental Management in the Extractive Industries (April 2006). The results of the monitoring from 2008 – 2014 are shown as a range in Table 7.5 and Figure 7.5 below. The monitoring undertaken more recently in 2021 and 2022 are shown in Table 7.6 and are also included in Figure 7.6.

Table 7.5: Recorded Deposited Dust (mg/m^2/day) at Monitoring Locations during 2008 - 2014

Date	Dust Deposition Rate Annual Range (mg/m^2/day)
March 2008	87 – 152
September 2008	175 – 289

Date	Dust Deposition Rate Annual Range (mg/m^2/day)
July 2009	156 – 265
June 2014	51 - 121

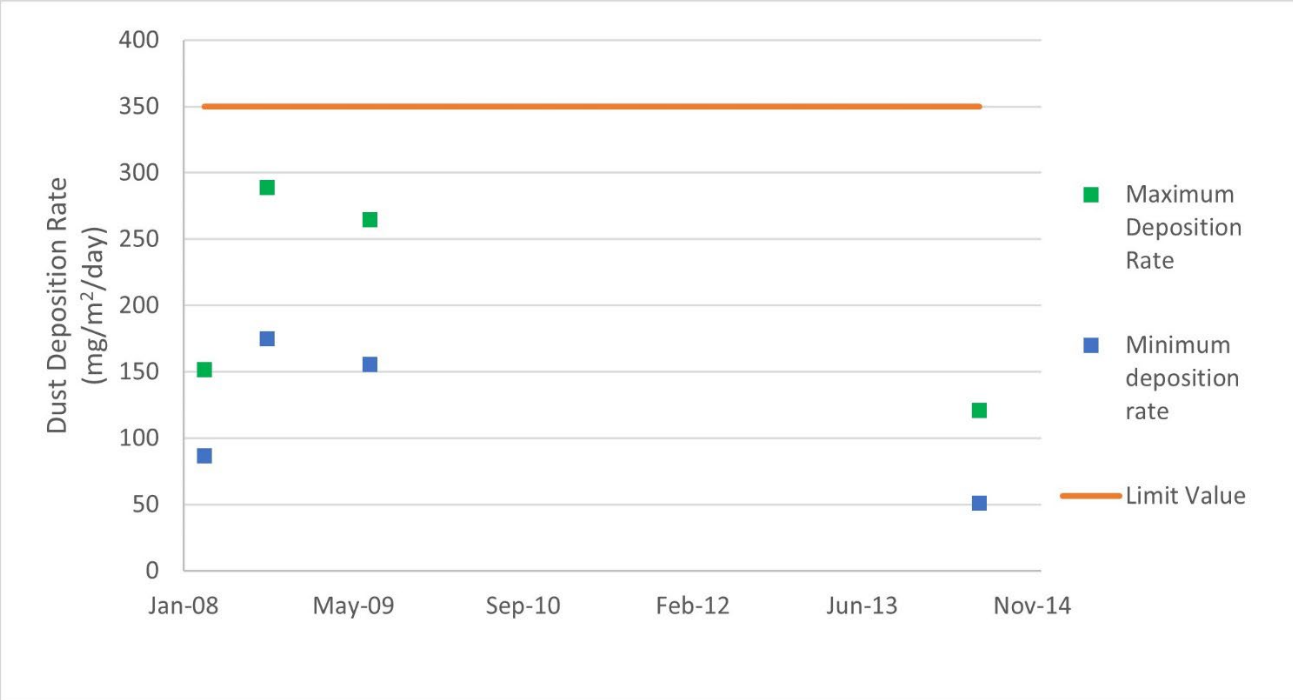

Figure 7.5: 2008-2014 dust deposition monitoring results

Table 7.6: Recorded Deposited Dust (mg/m^2/day) at Monitoring Locations during 2021/2022

Monitoring Period	Monitoring Location		
	D1	D2	D3
05/10/2021 – 04/11/2021	56.9	66.3	8.9
02/12/2021 – 07/01/2022	*	190.3	154.8
06/01/2022 – 04/02/2022	32.1	569.0	96.4
04/02/2022 – 04/03/2022	94.8	52.9	109.9
04/03/2022 – 01/04/2022	107.9	109.4	118.5

* No result available, sample jar dislodged by high winds during a storm.

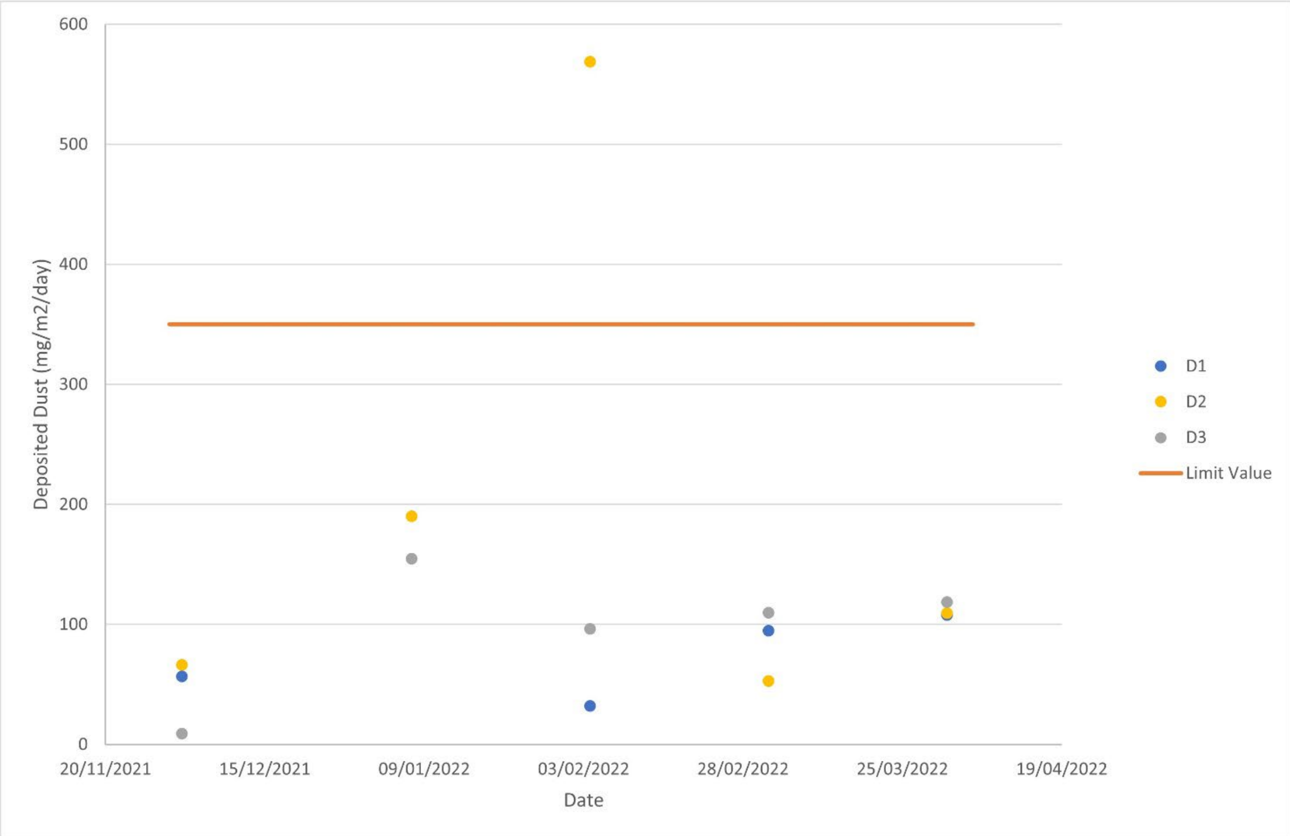

Figure 7.6: 2021/2022 dust deposition monitoring results

7.3.5.1.1 Commentary on Concentrations greater than the Limit Value

All of the historic monitoring results obtained between 2008 and 2014 were below the limit value of 350 mg/m^2/day.

Of the monitoring results for the sampling undertaken between October 2021 and April 2022, all values are below the limit value of 350 mg/m^2/day, apart from the result at location D2 from the 06/01/2022 – 04/02/2022 monitoring period where a value of 569 mg/m2/day was recorded.

The location of D2 adjacent to a haul road gives rise to a slightly greater dust concentration, as shown throughout the monitoring period with the D2 results being consistently higher than those recorded at D1 and D3. It is thought that this, coupled with an increase in extraction activity in the southern portion of the Site directly adjacent to D2, are the likely causes of the limit value exceedance seen during the 06/01/2022 – 04/02/2022 monitoring period.

7.3.5.1.2 Supplementary off-Site Monitoring Data

During 2014 and 2016, two rounds of dust deposition monitoring were undertaken by the Site in association with a planning application at the neighboring Bolagh recycling facility. There were two monitoring locations, both of which were south of the Site. The results of this monitoring are included in Table 7.7 below.

Table 7.7: Recorded Deposited Dust (mg/m^2/day) at off-Site Monitoring Locations during 2018

Monitoring Period	Monitoring Location	
	Location 1	Location 2
21/06/2014 – 20/07/2014	222	165

Monitoring Period	Monitoring Location	
	Location 1	Location 2
October 2016	<49	<49

This monitoring was undertaken using Bergerhoff dust gauges, and therefore the results are compared to the recommended dust deposition limit value of 350 mg/m²/day. All results obtained were below the limit value, with the 2016 results also falling below the limit of detection. The results obtained during 2014 represented 64% and 47% of the limit value at Location 1 and Location 2 respectively.

During 2018, a round of dust deposition monitoring was undertaken by the Site in association with a planning application for the neighboring Bolagh recycling facility. There were four monitoring locations, all located south of the Site. The closest location to the Site was D3, which was on the southwest boundary of the Site. It is noted that these monitoring locations were different to those used during the 2014 and 2016 monitoring described above. The results of this monitoring are included in Table 7.7 below.

Table 7.8: Recorded Deposited Dust (mg/m²/day) at off-Site Monitoring Locations during 2018

Monitoring Period	Monitoring Location			
	Location 1	Location 2	Location 3	Location 4
02/05/2018 – 01/06/2018	<52	<52	<52	<52

This monitoring was undertaken using Bergerhoff dust gauges, and therefore the results are compared to the recommended dust deposition limit value of 350 mg/m²/day. All results obtained were below the limit of detection, and therefore it is reasonable to assume that no measurable dust impact was present.

7.3.5.2 Secondary Data – EPA Monitoring

There are 4 air quality zones in Ireland, defined for the purposes of air quality management and assessment. Highly populated areas are classified as Zone A, with sparsely populated areas as Zone D. The Site is located in a rural area, and it is therefore deemed reasonable to characterise the area as a Zone D area. A review of publicly available information identifies that the Irish EPA do not operate background air quality monitoring within Ballinabarney or the immediate surrounds.

In the absence of local background data, the most recent annual mean data (2020) for NO_2, NOx, SO_2, PM_{10} and $PM_{2.5}$, and average historical data for NO_2, PM_{10} and $PM_{2.5}$ from monitoring locations in Zone D areas throughout Ireland are presented in Table 7.9 below. These locations are part of the EPA National Ambient Air Quality Monitoring Network and data is reported to Europe. The historical data is available as a Zone D average only.

Table 7.9: Annual Mean Monitoring Data for Zone D Stations (2020: Monitoring & Assessment: Air Publications | Environmental Protection Agency (epa.ie)) and historical data: Air | Environmental Protection Agency (epa.ie))

Pollutant	Year	Monitoring Location	Concentration µg/m³
NO_2	2020	Birr	9
		Carrick-on-shannon	17

Pollutant	Year	Monitoring Location	Concentration µg/m³
		Castlebarr	6
		Emo Court	4
		Kilkitt	2
	2005	Zone D	9
	Average		**7.8**
NO_x	2020	Birr	23.2
		Carrick-on-shannon	40.1
		Castlebarr	8.9
		Emo Court	4.7
		Kilkitt	2.5
	Average		**15.9**
SO_2	2020	Asketon	1.6
		Cork Harbour	1.8
		Kilkitt	1.4
		Letterkenny	11.8
	Average		**4.2**
PM_{10}	2020	Askeaton	7
		Birr	10
		Carrick-on-shannon	10
		Castlebarr	14
		Cavan	9
		Claremorris	10
		Cobh	13
		Enniscorthy	15
		Kilkitt	8
		Macroom	15
		Roscommon Town	11
		Tipperary Town	12
	2005	Zone D	17
	Average		**11.6**
$PM_{2.5}$	2020	Askeaton	4
		Birr	6
		Carrick-on-shannon	7
		Cavan	6
		Claremorris	5

Pollutant	Year	Monitoring Location	Concentration µg/m^3
		Cobh	8
		Enniscorthy	12
		Longford	9
		Macroom	11
		Mallow	10
		Roscommon Town	7
		Tipperary Town	8
	2011	Zone D	9
	Average		**7.8**

7.4 Assessment Methodology

7.4.1 Particulates

The IAQM Guidance on the Assessment of Mineral Dust Impacts for Planning (2016) has been used for assessing the impacts of deposited dust. It follows a standard source-pathway-receptor methodology.

The residual source emissions are characterised based on the scale of the operations and the Site activities and are classified as either small, medium or large. Guidance on the appropriate scale of the residual source is provided in the IAQM guidance, Appendix 4 (2016). This source characterisation includes consideration of the routine management and mitigation measures which have or will be undertaken at the Site.

The pathway from the source to the receptor is assessed considering the distance and direction of receptors to the source relative to the prevailing wind and local meteorology. The local meteorological data is also used to assess the frequency of the winds in each direction. It has been found that deposited dust does not generally travel beyond 400 m (IAQM, Appendix 2, 2016), therefore all receptors within 500 m of the Site boundary are considered. The guidance states that it is commonly accepted that the greatest impacts will occur within 100 m of the source, with the potential for travel up to 400 m.

For full consideration of the effects of the access road, in the absence of any methodology within the IAQM minerals guidance, the IAQM Guidance on the Assessment of Dust from Demolition and Construction (2016) has been considered. This guidance states that human receptors within 50 m of the routes used by vehicles for 350 m from the Site exit point should be considered. For this reason, the Site access road will be subject to a 50 m buffer, which will then extend 350 m out onto the L5155 main road in both directions to account for the possibility of trackout from exiting vehicles. For conservatism, a 350 m length buffer has been applied from the point at which the Site exits onto the L5155 public road.

The full assessment is provided in Appendix 7.1 of this report.

7.5 Potential Effects

7.5.1 Particulates

7.5.1.1 Coarse Particulates

An assessment of the potential effects of deposited dust from the operation of the Site between 1990 and the present day is provided in Appendix 7.1 of this report. This assessment has been undertaken in accordance with the IAQM Guidance on the Assessment of Mineral Dust Impacts for Planning (2016), as described in Section 7.4.1 above.

The assessment defined residual source classifications to activities on Site since 1990 and used these to assign a magnitude to the dust effects likely to have been experienced at identified receptors. Consideration was given to mitigation measures which have been in place. Based on the magnitude of dust effects and the mitigation employed on Site, an overall significance of the effects of dust was assigned to key sources: site preparation, excavation/ extraction, material handling, transfer on haul roads, mineral processing, stockpiling and transfer on public roads. For each of these sources, the significance for Site activities since 1990 was defined as 'Slight' to 'Negligible' without mitigation, and 'Negligible' with the employed mitigation.

Dust impacts during the construction phase (i.e. initial stripping of overburden) may have had the potential to have been greater than those experienced during the operation phase. This is due to the nature of the materials, as soils contain finer particulates than rock and therefore can be carried further in the air. However, as mentioned, the mitigation measures employed at the Site have been in place, and therefore it is not expected, and neither is there evidence for, there being an increased impact during the operation phase.

With the application of the site-specific mitigation measures, it is therefore considered that the residual effects associated with the operation of the Site since 1990 have been Not Significant.

7.5.1.2 Fine Particulates

The IAQM recommend that if the PM_{10} background concentration is less than 17 µg/m^3 there is little risk that the process contribution (PC) from the Site would lead to an exceedance of the annual-mean objective. The background data from other equivalent Zone D areas is detailed in Section 7.3.5.2. The annual average of the historic Zone D stations is 11.6 µg/m^3 which is less than 17 µg/m^3. It is unlikely that the PC from the Site would lead to an exceedance of the AQS.

Fine particulate PC can be assessed using the calculation of concentration with distance from source as detailed in LAQM TG03. The guidance document also states that the likely PM_{10} contribution from fugitive dusts, stockpiles, quarries and construction is variable but up to 5 µg/m^3. Therefore, the likely concentration at the receptor locations can be estimated using the calculation considering the distance from source. As $PM_{2.5}$ is a sub-fraction of PM_{10}, the contribution of $PM_{2.5}$ will be lower but if it is conservatively assumed that all of the PM_{10} is $PM_{2.5}$, the increase in concentration due to the changed location of the extraction area is low.

When combining the likely concentration at the closest receptor (0.4 µg/m^3) with the average historical background value (11.6 µg/m^3) for Zone D areas, the maximum annual PM_{10} predicted environmental concentration (PEC) would be 12 µg/m^3 which is approximately 48% of the AQS, and the annual $PM_{2.5}$ PEC would be 48% of the Stage 1 AQS and 60% of the Stage 2 AQS, at the closest receptor. The PEC is predicted to be below the annual AQS, with headroom, even if the closest receptor distance was less than 50 m from the source. The impact from fine particle PC from the Site is considered to be Negligible to Slight prior to mitigation which would reduce to Negligible due to the mitigation measures employed historically by the Site.

7.6 Climate Factors

The Development is not considered to be of a sufficient scale to have had the potential to impact the regional or local climate in any significant manner. In addition, the operation of plant and traffic movements at the Site are estimated to have generated less than 0.75 kt CO2e per annum, equaling approximately 24 kt CO2e over the 32- year assessment period. The Site has not had any significant effects on local prevailing weather conditions, nor has the Development increased the potential of flooding in the surrounding area. Therefore, the historical impacts on climate and climate change are considered to be Not Significant.

7.7 Cumulative Effects

Research has shown that the greatest proportion of dust predominantly deposits within the first 100 m away from the source (The Environmental Effects of Dust from Surface Mineral Workings, Volume 1 DETR, HMSO

1995) as dust has a higher deposition velocity than finer particles (i.e. PM_{10} and $PM_{2.5}$). The finer particles of less than 10 microns aerodynamic diameter may remain airborne for longer and therefore travel larger distances, although a large proportion may still deposit within 200 m of the source.

The assessment undertaken has considered publicly available background monitoring data and incorporated this into the assessment, therefore the assessment includes a consideration for other Sites operating in the area.

There is a permitted C&D recycling facility located approximately 400m to the southeast of the quarry that accepts low volumes of C&D wastes (c.5,000t per annum) such as waste concrete and soil and stone for recovery and recycling. This facility carries out independent dust monitoring for the facility in accordance with the conditions of the Waste Facility permit. There have been no exceedances of the dust threshold limit to date at facility. Therefore, there have been no opportunities for significant cumulative impacts to arise as a result of the activities at the Site since 1990.

7.8 Summary and Conclusions

This rEIAR chapter has assessed the potential impacts of the operation of the Site between 1990 and the present day on Air Quality and Climate.

The impact of coarse particulates (dust) on the surrounding area as a result of the previous activities at the Site is considered to have been 'Negligible' and therefore **Not Significant**. The assessment considered the employed mitigation measures which have been and will continue to be in place.

With regards to fine particulates, it is considered that there may have been the potential for an increase in PM_{10} and $PM_{2.5}$ concentrations at the residential receptors downwind in the vicinity of the Site, due to the moving of the extraction area, but the PEC is still predicted to be below the annual AQS, with headroom. The impact of fine particle PC from the Site is therefore considered to be imperceptible and therefore **Not Significant**.

When considering the emissions to air associated with the historical operation of the Site, the historical impacts are considered to be **Not Significant**.

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APPENDIX 7.1

Assessment of Dust Impacts

DUST ASSESSMENT

1.0 INTRODUCTION

1.1 Background

This appendix supports the Air Quality & Climate chapter of the rEIAR and considers the potential effects of historical activities relating to the development and operation at Ballinabarny North and Bolagh Lower, Redcross, Co. Wicklow ('the Site') on the receiving (air) environment between 1990 and the present day.

The existing development use is for the extraction of sand and gravel, together with processing and temporary stockpiling areas where materials are stored prior to being sold to market.

1.2 Report Context

This report forms an Appendix to the rEIAR Air Quality Assessment and should be read in conjunction with that report.

The report sets out a qualitative assessment of dust impacts (coarse particles for deposited dust and fine particles for human health) from the historical operation of the Site, which has been undertaken in line with IAQM 'Guidance on the assessment of Mineral Dust Impacts for Planning (IAQM 2016).

2.0 ASSESSMENT METHODOLOGY

The following section details the IAQM methodology used for assessing the impacts of deposited dust and fine particulates from the extraction activities. It follows a standard source-pathway-receptor methodology.

The residual source emissions are characterised based on the scale of the operations and the Site activities and are classified as either small, medium or large. Guidance on the appropriate scale of the residual source is provided in the IAQM guidance, Appendix 4 (2016). This source characterisation includes consideration of the routine management and mitigation measures which will be undertaken at the Site.

The pathway from the source to the receptor is assessed considering the distance and direction of receptors to the source relative to the prevailing wind and local meteorology. The local meteorological data is also used to assess the frequency of the winds in each direction. It has been found that deposited dust does not generally travel beyond 400 m (IAQM, Appendix 2, 2016), therefore all receptors within 500 m of the Site boundary are conservatively considered. The guidance states that it is commonly accepted that the greatest impacts will occur within 100 m of the source, with the potential for travel up to 400 m.

For full consideration of the effects of the access road, in the absence of any methodology within the IAQM minerals guidance, the IAQM Guidance on the Assessment of Dust from Demolition and Construction (2016) has been considered. This guidance states that human receptors within 50 m of the routes used by vehicles for 350 m from the Site exit point should be considered. For this reason, the Site access road will be subject to a 50 m buffer, which will then extend 350 m out onto the L5155 main road in both directions to account for the possibility of trackout from exiting vehicles. For conservatism, a 350 m length buffer has been applied from the point at which the Site exits onto the L5155 public road.

The criteria for the categorisation of the frequency of potentially dusty winds (Table 1) and the receptor distance from source (Table 2) is used to define the pathway effectiveness (Table 3).

The residual source emissions and the pathway effectiveness are combined to predict the Dust Impact Risk as shown inTable 4.

Table 1: Categorisation of Potentially Dusty Winds

Pathway Effectiveness	Criteria
Infrequent	Frequency of winds (>5 m/s) from the direction of the dust source on dry days are less than 5%
Moderately Frequent	Frequency of winds (>5 m/s) from the direction of the dust source on dry days are between 5% and 12%
Frequent	Frequency of winds (>5 m/s) from the direction of the dust source on dry days are between 12% and 20%
Very Frequent	Frequency of winds (>5 m/s) from the direction of the dust source on dry days are greater than 20%

Table 2: Categorisation of Receptor Distance from Source

Category	Criteria
Distant	Receptor is between 200 m and 400 m from the dust source
Intermediate	Receptor is between 100 m and 200 m from the dust source
Close	Receptor is less than 100 m from the dust source

Table 3: Pathway Effectiveness

		Frequency of Potentially Dusty Winds			
		Infrequent	Moderately Frequent	Frequent	Very Frequent
Receptor Distance Category	Close	Ineffective	Moderately Effective	Highly Effective	Highly Effective
	Intermediate	Ineffective	Moderately Effective	Moderately Effective	Highly Effective
	Distant	Ineffective	Ineffective	Moderately Effective	Moderately Effective

Table 4: Estimation of Dust Impact Risk

		Residual Source Emissions		
		Small	Medium	Large
Pathway Effectiveness	Highly Effective Pathway	Low Risk	Medium Risk	High Risk
	Moderately Effective Pathway	Negligible Risk	Low Risk	Medium Risk
	Ineffective Pathway	Negligible Risk	Negligible Risk	Low Risk

The final step is to assess the likely magnitude of the dust effects since 1990 (Table 5). This is determined using both the dust impact risk and the receptor sensitivity. Receptor sensitivity is classified as either low, medium or high based on the receptor type.

Table 5: Descriptors for Magnitude of Dust Effects

		Receptor Sensitivity		
		Low	**Medium**	**High**
Dust Impact Risk	**High Risk**	Slight Adverse Effect	Moderate Adverse Effect	Substantial Adverse Effect
	Medium Risk	Negligible Effect	Slight Adverse Effect	Moderate Adverse Effect
	Low Risk	Negligible Effect	Negligible Effect	Slight Adverse Effect
	Negligible Risk	Negligible Effect	Negligible Effect	Negligible Effect

3.0 SOURCES

The activities associated with the operations at the Site between 1990 and the present day that are potential dust generating sources are listed below:

- Earthmoving operations during the overburden stripping phase;
- Excavation of sand and gravel via excavators from the quarry floor;
- Transport of materials within the Site on haul routes via dump truck;
- Loading and unloading of materials via loading trucks;
- Temporary stockpiling of materials within the quarry floor;
- Haulage, where the weight of vehicles, their speed of passage and number of wheels in contact with the ground, and the nature and condition of road surfaces or haul routes all affect the amount of dust emitted; and
- Wind blow from material stockpiles, unsurfaced internal haul roads and the quarry floor.

The following residual source classifications can be attributed based on the identified sources and management and assessment methodology outlined above and in Appendix 4 of the IAQM guidance (2016).

Site preparation is classified as a large magnitude source due to the size of the working area. The land subject to this rEIAR extends approximately 23.7 ha. reflecting historic operational site information including the extractable area declared under S.261 quarry registration in 2007. The actual working area may have been smaller, but this conservative value has been used in the assessment. Further to this, the nature of the materials being moved during the preparation phase (clays/soils) have a higher dust potential due to their fine particle size.

Mineral extraction is classified as a small magnitude source due to the annual extraction rate being up to 108,558 t/yr within a small to medium working area (annual maximum between 1990 and 2021), and a low dust potential as the extraction material is sand and gravel which tend to have a high moisture content which acts as a natural dust suppressant.

Materials handling is classified as a medium magnitude source, as there are and have historically been up to 9 heavy plant operational across the Site, used for excavation, loading and transport of material to the washing and screening plant, and occasionally for overburden clearance and haul road construction. The excavated material is handled at a low volume and has a low dust potential.

On-site transportation is classified as a small magnitude source as there are approximately 20 one-way on-site HDV trips per day, making short trips of approximately 100 m from the excavation area to the washing and screening plant and back. Material is largely transported via dump truck on compacted internal roadways/surfaces, with a speed limit of <15 kph. There are 6 no. conveyors in use for transporting wet screened materials into temporary stockpiles from the washing and screening plant, prior to onward transport off-Site.

Mineral processing is classified as a small magnitude source due to up to 133,308 t/yr of material being processed with a high moisture content, using a wet process. The washing and screening processing plant being located in the centre of the Site, at the furthest distance from off-Site receptors.

Stockpiles (of sand and gravel) and exposed surfaces are classified as a small magnitude source due to the low annual quarry production of up to 108,558 t per annum, combined with the fact that stockpiles are temporary and located within quarry floor and dampened where necessary.

Off-site transportation is classified as a medium magnitude source as the movements since 1990 are consistent with the current AADT, (approximately 20 outward HDV movements per day), and the Site access road is constructed of compacted gravel with a mobile water bowser for dampening as required. The number of off-site vehicle movements would be classified as small magnitude but due to there only being na wheel wash present since 2016 and not since 1990, the classification is conservatively increased to medium.

4.0 ASSESSMENT

4.1 Site Parameters

The risks of potential dust emissions associated with the Site being transported off-site are largely determined by the local atmospheric conditions surrounding the Site and distance from the source to the receptor.

The conditions considered in the assessment include:

- Wind speed, to determine the likely occurrence of particles travelling beyond the Site boundary; and
- Wind direction, to identify the areas over which particles are likely to travel.

As detailed in the main Air Quality & Climate Chapter 7, the closest and most representative Met Éireann station to the Site is located at Carlow Oak Park, Co. Carlow, ca. 55 km west of the Site. Wind speed and wind direction are measured hourly by the station and a wind-rose has been presented in Figure 1 covering the period 01 January 2004 to 31 December 2021.

The prevailing wind direction is from the south, with a large portion of mid wind speeds between 7 - 17 knots and some higher wind speeds of >17 knots.

The receptors identified in Table 6 and presented in Figure 1, with their associated distance and direction, are located within 500 m of the Site boundary. This is a conservative approach to the assessment as Site activities were not undertaken directly at the boundary in all directions. Residential receptors have been categorised as high sensitivity receptors.

The remaining non-residential (industrial/ commercial) receptors have been categorised as medium sensitivity receptors. The category of receptor distance is defined based on the criteria in Table 2 of the methodology and the frequency of dusty winds is determined based on the criteria in Table 1 of the methodology.

The receptor distance category and the frequency of dusty winds are then combined using Table 3 of the methodology to define the pathway effectiveness.

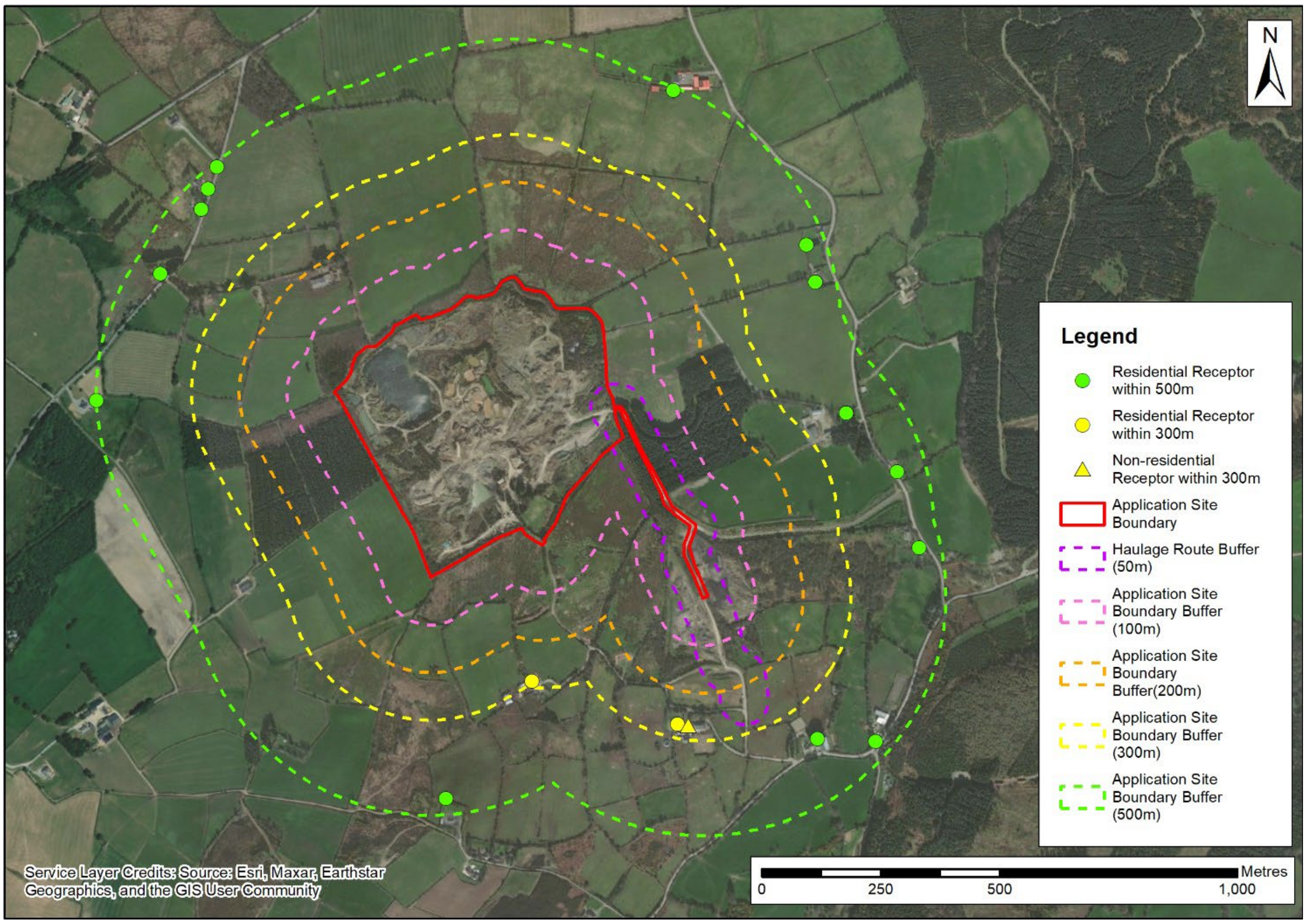

Figure 1: Location of receptors within 500 m of the Site (including Site Boundary) and within 50 m of the Haulage Route (extending 350 m from the point of exit of the Site Boundary).

Table 6: Receptors within 500 m of the Site Boundary

Receptor Type and Distance Band from Site Boundary	Number of Receptors in Group	Category of Receptor distance	Number of Receptors in Prevailing Wind Direction (N of Boundary or haul route)	Frequency of dusty winds	Pathway Effectiveness
Residential within 200 m - 300 m	2	Distant	0	Moderate	Ineffective
Residential within 300 m - 500 m	14	Distant	4	Moderate	Ineffective
Non-Residential within 200 m – 300 m	1	Distant	0	Moderate	Ineffective

4.2 Assessment of Coarse Particles

Assessment of the dis-amenity dust associated with the operation of the Site between 1990 and the present day is summarised for each receptor in Table 7. Following the IAQM guidance, the nature of the activities at the Site and the existing mitigation measures (outlined in Section 5.0) suggest that the magnitude of any deposited dust effects will range from ‘Slight Adverse’ to ‘Negligible’, with the majority of receptors receiving ‘Slight Adverse’ effects.

Table 7: Assessment of Dust Dis-amenity Effects at Receptors

Receptor Type and Distance Band from Site Boundary	Maximum Residual Source Emissions	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust Effects
Residential within 200 m - 300 m	Large	Ineffective	Low risk	High	Slight Adverse effect
Residential within 300 m - 500 m	Large	Ineffective	Low risk	High	Slight Adverse effect
Non-Residential within 200 m – 300 m	Large	Ineffective	Low risk	Medium	Negligible effect

4.3 Assessment of Fine Particles

The IAQM recommend that if the PM_{10} background concentration is less than 17 µg/m^3 there is little risk that the process contribution (PC) from the Site would lead to an exceedance of the annual-mean objective. The background data from other equivalent Zone D areas is detailed in Section 7.3.5.2 of the rEIAR chapter. The annual average of the historic Zone D stations is 11.6 µg/m^3 which is less than 17 µg/m^3. It is unlikely that the PC from the Site would lead to an exceedance of the AQS.

Fine particulate PC can be assessed using the calculation of concentration with distance from source as detailed in LAQM TG03. The guidance document also states that the likely PM_{10} contribution from fugitive dusts, stockpiles, quarries and construction is variable but up to 5 µg/m^3. Therefore, the likely concentration at the receptor locations can be estimated using the calculation considering the distance from source. As $PM_{2.5}$ is a sub-fraction of PM_{10}, the contribution of $PM_{2.5}$ will be lower but if it is conservatively assumed that all of the PM_{10} is $PM_{2.5}$, the increase in concentration due to the changed location of the extraction area is low.

When combining the likely concentration at the closest receptor (0.4 µg/m^3) with the average historical background value (11.6 µg/m^3) for Zone D areas, the maximum annual PM_{10} predicted environmental concentration (PEC) would be 12 µg/m^3 which is approximately 48% of the AQS, and the annual $PM_{2.5}$ PEC would be 48% of the Stage 1 AQS and 60% of the Stage 2 AQS, at the closest receptor. The PEC is predicted to be below the annual AQS, with headroom, even if the closest receptor distance was less than 50 m from the source. The impact from fine particle PC from the Site is considered to be Negligible to Slight prior to mitigation which would reduce to Negligible due to the mitigation measures employed historically by the Site.

Table 8: Assessment of Fine Particulates at Closest Downwind Receptors

Receptor Type and Distance Band	Number of Receptors in Distance Band	Number of Receptors in Prevailing Wind Direction	Distance from source (m)	Relative concentration (with fallout from source)	Estimated concentration (µg/m^3) at receptor band, assuming source emission of 5 µg/m^3
Residential within 0 m - 100 m of source	0	0	50	30%	1.5

Receptor Type and Distance Band	Number of Receptors in Distance Band	Number of Receptors in Prevailing Wind Direction	Distance from source (m)	Relative concentration (with fallout from source)	Estimated concentration ($\mu g/m^3$) at receptor band, assuming source emission of 5 $\mu g/m^3$
Residential within 100 m - 200 m	0	0	100	18%	0.9
Residential within 200 m - 300 m	2	0	200	8%	0.4

5.0 MITIGATION

Since 1990, the Site has had a number of mitigation measures in place which aimed to reduce the impact of dust emissions on the surrounding area and identified sensitive receptors. These mitigation measures are as follows:

- Dust monitoring at designated monitoring locations;
- Regular visual inspections by Site personnel to assess visual dust emissions;
- The timing of operations is optimised in relation to meteorological conditions;
- A water bowser is available on Site for dust suppression/dampening of internal haul roads and stockpiles to minimise dust blow during working hours;
- Screening equipment in plant area are fitted with dust suppression systems;
- Stockpiles are located within the quarry floor to take advantage of shelter from the wind, in the centre of the Site.
- Screening bunds are in place along the Site boundaries;
- Plant is regularly maintained;
- Conveyors are partially enclosed where possible;
- Internal haul roads are partially compacted where possible;
- On site speed restrictions (<15 kph) are maintained in order to limit the generation of fugitive dust emissions; and
- A tractor-drawn water bowser is in place along the Site access road and internal roadways as required.

Table 9 assesses the potential impacts from the operation of the Site since 1990 on the local air quality both with and without the establishment of appropriate mitigation measures detailed above based on the IAQM, 2016 guidance and the application of expert judgement. The duration of these effects will have occurred in the medium term during the quarry's phased operations (i.e. during stripping and extraction). Definitions of effect significance are as defined in the EPA's 2017 'Guidelines on the information to be contained in environmental impact assessment reports'.

Without mitigation measures it is considered that dust impacts from extraction activities may not have affected the character of the environment but would have had noticeable changes. Through the implementation of the ongoing environmental management programme, it is likely that the dust from various activities has had an effect capable of measurement but without noticeable consequences to the environment.

Table 9: Assessment of Impacts to Local Air Quality and Mitigation Measures Employed (based on IAQM 2016 guidance and expert judgement)

Impact	With / Without the establishment of Mitigation Measures	Type of Effect	Quality of Effects	Significance of Effects	Duration of Effects
Dust from excavation	Without	Direct	Negative	Slight	Medium Term (7-15 years)
Dust from excavation	With	Direct	Negative	Negligible	Medium Term (7-15 years)
Dust from transfer on haul roads	Without	Direct	Negative	Slight	Medium Term (7-15 years)
Dust from transfer on haul roads	With	Direct	Negative	Negligible	Medium Term (7-15 years)
Dust from transfer on public roads	Without	Direct	Negative	Slight	Medium Term (7-15 years)
Dust from transfer on public roads	With	Direct	Negative	Negligible	Medium Term (7-15 years)
Dust from on-site processing (screening)	Without	Direct	Negative	Slight	Medium Term (7-15 years)
Dust from on-site processing (screening)	With	Direct	Negative	Negligible	Medium Term (7-15 years)

6.0 RESIDUAL IMPACTS

Residual impacts of deposited dust and particulates generated during the operations at the Site since 1990 on air quality are considered to be slight. During long spells of dry weather, dust emissions may have had the potential to be elevated, however dust nuisance from the operation is expected to have been unlikely as the above mitigation measures were implemented during construction and operation. The overall impact from the operation of the Site since 1990, in terms of dust emissions and particulates, is considered 'Negligible' to the air environment and **Not Significant**.

7.0 CUMULATIVE IMPACTS

Research has shown that the greatest proportion of dust predominantly deposits within the first 100 m away from the source (The Environmental Effects of Dust from Surface Mineral Workings, Volume 1 DETR, HMSO 1995) as dust has a higher deposition velocity than finer particles (i.e. PM_{10} and $PM_{2.5}$). The finer particles of less than 10 microns aerodynamic diameter may remain airborne for longer and therefore travel larger distances, although a large proportion may still deposit within 200 m of the source.

The assessment undertaken has considered publicly available background monitoring data and incorporated this into the assessment, therefore the assessment includes a consideration for other Sites operating in the area.

There are no other identified operations in close proximity to the Site which may have generated significant emissions to air. Therefore, there have been no opportunities for significant cumulative impacts to arise as a result of the activities at the Site since 1990.

8.0 REFERENCES

Environmental Protection UK / Institute of Air Quality Management (EPUK/IAQM, 2017) Land-Use Planning and Development Control: Planning for Air Quality,v1.2, 2017.

Institute of Air Quality Management (IAQM, 2016) Guidance on the assessment of mineral dust for Planning.

The Environmental Effects of Dust from Surface Mineral Workings, Volume 1 DETR, HMSO 1995.