10 Air Quality

The following Technical Appendices referred to in this chapter can be found at Appendix 10 to this document.

Figures

Figure 10.1: 10 Year Average Wind Rose Norwich

Figure 10.2: Dust Sensitive Receptors

Appendix 10 - Appendices

Appendix 10.1: References

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10.1 Introduction

10.1.1 This chapter of the ES has been prepared by Air Quality Assessments Ltd and assesses the likely effect that the operation of the proposed development will have on local air quality and dust.

10.1.2 The chapter describes the existing air quality conditions in proximity to the site and assesses the likely impact that dust from the operation of the proposed development will have on local air quality and the amenity of receptors close to the application site. Fugitive dust emissions during the operation of the proposed development can impact on amenity (visible dust) and health (fine particulate matter, PM_{10}).

10.1.3 The need for an assessment of the impact on local air quality due to vehicle emissions has been screened out based on the number of trips generated by the proposed development.

10.1.4 Where relevant, mitigation measures are proposed to minimise the impacts of the proposed development during both the preparation and operational phases of the scheme. Any anticipated residual effects of the proposals are then stated.

10.2 Study Area

10.2.1 The assessment of the potential impacts due to fugitive dust emissions considers the effect at receptors up to 250m from potentially dust generating activity.

10.3 Methodology

Previous Assessment Stages

A dust and fumes assessment was undertaken at part of an updated EIS in October 2013 as part of the 2010 planning application and appeal documentation.

Legislation and Planning Policy

EU Limit Values

10.3.1 The European Union's Directive on ambient air quality and cleaner air for Europe (European Parliament, Council of the European Union, 2008) set legally binding limit values for NO_2, PM_{10} and $PM_{2.5}$. The Air Quality Standards Regulations 2010 (The

Stationary Office, 2010) implement the EU Directive limit values in English legislation. Achievement of the limit values is a national obligation rather than a local one.

10.3.2 The limit values are the same as the objective values (see **Table 10.1**); however, the compliance dates differ, and the limit values apply at all locations (apart from where the public does not have access, where health and safety at work provisions apply and on the road carriageway). The PM_{10} and NO_2 limit value applied from 2005 and 2010 respectively, whereas the $PM_{2.5}$ limit value applied from 2015.

10.3.3 The United Kingdom left the European Union on 31st January 2020; however, the EU legislation currently remains enshrined in UK law through the Air Quality Standards Regulations.

Clean Air Strategy

10.3.4 Part IV of The Environment Act 1995 required the UK Government to prepare an Air Quality Strategy which includes standards and objectives for air quality and sets out measures which are to be taken by local authorities and the government in order to achieve those objectives. The Clean Air Strategy provides an overview of the actions that the government will take to improve air quality and promises new legislation that will tackle air pollution (Defra, 2019a).

10.3.5 Standards are the concentrations of pollutants in the atmosphere, below which there is a minimum risk of health effects or ecosystem damage; they are set with regard to scientific and medical evidence. Objectives are the policy targets set by the Government, taking account of economic efficiency, practicability, technical feasibility and timescale, where the standards are expected to be achieved by a certain date.

10.3.6 Part IV of the Environment Act 1995 also describes the system of Local Air Quality Management (LAQM), which requires every local authority to carry out regular review and assessments of air quality in its area. Where an objective has not been, or is unlikely to be achieved, the local authority must declare an AQMA, and prepare an action plan which sets out appropriate measures to be introduced in pursuit of the objectives.

10.3.7 The objectives for NO_2 and PM_{10}, as prescribed by the Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002 (The Stationary Office, 2000; The Stationary Office, 2002), are shown in Table 10.1. The objectives for PM_{10} and NO_2 were to have been achieved by 2004 and 2005 respectively and continue to apply in all future years thereafter. The $PM_{2.5}$ objective, also shown in Table 10.1, was

to have been achieved by 2020; however, although local authorities are expected to work towards reducing $PM_{2.5}$ concentrations, there is no obligation for local authorities to try to meet the $PM_{2.5}$ objective, and it is not included in the Regulations.

Table 10.1: The Objectives for NO_2, PM_{10} and $PM_{2.5}$

Pollutant	Concentration Measured As	Objective
NO_2	1-hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
PM_{10}	24-hour Mean	50 µg/m3 not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3
$PM_{2.5}$	Annual Mean	25 µg/m^3

10.3.8 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. Examples of where the objectives should apply are provided in the Local Air Quality Management Technical Guidance (Defra, 2016) issued by the Department for Environment, Food and Rural Affairs (Defra). The annual mean NO_2 and PM_{10} objectives should apply at the building façades of residential properties, schools, hospitals, care homes etc.; they should not apply at the building façades of places of work, hotels, gardens or kerbside sites. The 24-hour mean PM_{10} objective should apply at all locations where the annual mean objective applies, as well as the gardens of residential properties and hotels. The 1-hour mean NO_2 objective should apply at all locations where the annual and 24-hour mean objectives apply, as well as at kerbside sites where the public have regular access, e.g., the pavements of busy shopping streets.

National Policies

10.3.9 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied (Ministry of Housing, Communities & Local Government, 2021). It provides a framework within which locally-prepared plans for development can be produced. At paragraph 8c, the NPPF states that the purpose of the planning system is to contribute to the achievement of sustainable development and includes an overarching environmental objective:

"To protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."

10.3.10 With regard to environmental impacts from traffic, at Paragraph 104 the NPPF states that:

"Transport issues should be considered from the earliest stages of plan-making and development proposals, so that: …

d) the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains; …"

10.3.11 The NPPF also states at Paragraph 174 that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by: …

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; …"

10.3.12 The NPPF goes on to state at Paragraph 185:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development."

10.3.13 With specific reference to air quality, the NPPF states at Paragraph 186 that:

"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic

approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."

10.3.14 The NPPF also includes the following statement at Paragraph 188:

"The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

10.3.15 The NPPF is supported by Planning Practice Guidance (PPG) (DCLG, 2019). The PPG states that:

"The Department for Environment, Food and Rural Affairs carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with relevant Limit Values. It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit, or where the need for emissions reductions has been identified."

10.3.16 The PPG goes on to state that:

"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity."

10.3.17 The PPG also sets out the information that may be required in an air quality assessment, stating that:

"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific."

10.3.18 It also provides guidance on options for mitigating air quality impacts, and makes clear that:

"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact."

10.3.19 The PPG makes clear that:

"… dust can also be a planning concern, for example, because of the effect on local amenity."

Minerals and Waste Development Plan Policies

Norfolk Core Strategy and Minerals and Waste Development Management Policies Development Plan Document 2010-2026

10.3.20 The relevant parts of Core Strategy Policy CS14 – Environmental Protection state:

"The protection and enhancement of Norfolk's natural and built environments is a vital consideration for future minerals extraction and associated development and waste management facilities in the county. In particular, developments must ensure that there are no unacceptable adverse impacts on, and ideally improvements to:

- *Natural resources, including water, air and soil; …*
- *Residential amenity e.g. noise, vibration, dust, lighting, and visual intrusion.*

Where any development proposals would potentially have adverse impacts on any of the assets listed above, the adequacy of any proposed mitigation measures will be assessed on a case-by-case basis.

The highest standards of design, operation and (where relevant) restoration and aftercare of sites must be practised."

10.3.21 The relevant parts of Core Strategy Policy CS15- Transport state:

"All proposed minerals extraction and waste management facilities must assess and consider positively the potential for non-HGV transportation of materials to and/or from the facilities, principally by rail or water. This assessment must be included within the Transport Statement/Transport Assessment, if one is required (see Policy DM10).

The County Council will consider minerals and waste development proposals to be satisfactory in terms of access where anticipated HGV movements, taking into account any mitigation measures proposed, do not generate: …

c) Unacceptable impacts on air quality (particularly in relation to any potential breaches of National Air Quality Objectives and impacts on any Air Quality Management Areas) and residential and rural amenity, including from odour and noise; …"

10.3.22 Development Management Policy DM12 – Amenity states:

"The protection of amenity for people in close proximity to potential minerals extraction and associated developments and waste management facilities will be a key consideration. Where appropriate, buffer zones, advanced planting and/or screening and other mitigation measures, such as restriction on hours of working and dust suppression measures, will be required.

Development will be permitted only where it can be demonstrated that the scale, siting and design of a proposal is appropriate and that unacceptable impact to local amenity will not arise from the construction and/or operation of a facility."

10.3.23 Development Management Policy DM13 – Air Quality states:

"Applicants for planning permission will be required to submit information to demonstrate that proposals effectively minimise harmful emissions to air and would not impact negatively on existing Air Quality Management Areas, nor lead to the declaration of a new AQMA. Development will be permitted if adequate measures can be agreed through planning conditions to mitigate potentially harmful air quality impacts to human health.

Planning permission will only be granted in areas nearing AQMA threshold limits if an Air Quality Impact Assessment shows that the development in question and its associated activities would not increase air pollution to unacceptable levels, as defined in the National Air Quality Strategy."

Norfolk Minerals and Waste Local Plan Review Draft Publication Document

10.3.24 The relevant parts of Policy MW1: Development Management Criteria state:

"Mineral development and waste management development will be acceptable where the proposals demonstrate that the development would not have an unacceptable impact (including cumulative impact in combination with other existing or permitted development) on:

a. Local amenity and health (including noise levels, odour, air quality, dust, litter, light pollution and vibration); …"

10.3.25 The relevant parts of Policy MW2: Transport:

"The County Council will consider minerals and waste development proposals to be satisfactory in terms of access where anticipated HGV movements, taking into account cumulative impacts and any mitigation measures proposed, do not generate: …

c) Unacceptable impacts on air quality (particularly in relation to any potential breaches of National Air Quality Objectives and impacts on any Air Quality Management Areas); …"

10.3.26 The relevant parts of Policy MPSS1: Silica sand extraction sites – Strategic Policy state:

"Planning applications for silica sand extraction located outside of allocated sites, which would address the shortfall in permitted reserves, will be subject to compliance with the Minerals and Waste Local Plan policies and all the following requirements:

b. Submission of an acceptable noise assessment, an acceptable air quality/dust assessment and a programme of mitigation measures (e.g. standoff areas, screening and/or bunding, operational practices) to deal appropriately with any potential impacts; …"

10.3.27 The relevant parts of Specific Site Allocation Policy MIN 25 (land at Manor Farm, Haddiscoe) state:

"The site is allocated as a specific site for sand and gravel extraction. Development will be subject to compliance with the Minerals and Waste Local Plan policies and all the following requirements:

a. The submission of acceptable noise and dust assessments and a programme of mitigation measures to deal appropriately with any amenity impacts; mitigation measures should include setting back the working area at least 100 metres from the nearest residential properties; …"

Joint Core Strategy for Broadland, Norwich and South Norfolk

10.3.28 There are no policies relating to air quality or dust in the Joint Core Strategy for Broadland, Norwich and South Norfolk

Local Plan Policies

South Norfolk Local Plan Development Management Policies Document

10.3.29 The relevant parts of Policy DM 3.13 Amenity, Noise and Quality of Life state:

"(1) Development should ensure a reasonable standard of amenity reflecting the character of the local area. In all cases particular regard will be paid to avoiding: …

c. Introduction of incompatible neighbouring uses in terms of noise, odour, vibration, air, dusts, insects, artificial light pollution and other such nuisances.

Planning permission will be refused where proposed development would lead to an excessive or unreasonable impact on existing neighbouring occupants and the amenity of the area or a poor level of amenity for new occupiers."

10.3.30 The relevant parts of Policy DM 3.14 Pollution, Health and Safety state:

a) All development should minimise and where possible reduce the adverse impact of all forms of emissions and other forms of pollution, and ensure that there is no deterioration in water quality or water courses.

b) When assessed individually or cumulatively, development proposals should ensure that there will be no unacceptable impacts on:

i. Air quality …

d) Developments which may impact on air quality will not be permitted where they have an unacceptable impact on human health, sensitive designated species or habitats, and general amenity, unless adequate mitigation can be ensured. Development will not be granted in locations where it is likely to result in an Air Quality Management Area being designated or the worsening of air quality in an existing Air Quality Management Area. …"

Guidance

10.3.31 The Institute of Air Quality Management (IAQM) has published Guidance on the Assessment of Mineral Dust Impacts for Planning (IAQM, 2016). The guidance has been prepared to assist practitioners in undertaking dust assessments for the operational phases of minerals developments and the source-pathway-receptor approach outlined in the guidance has been used for this assessment.

10.3.32 The IAQM has also published guidance on Land-Use Planning & Development Control: Planning for Air Quality to ensure that air quality is adequately considered within the planning system (EPUK and IAQM, 2017).

Assessment Methodology

Existing Conditions

10.3.33 Information on existing air quality within the study area has been collated from the following sources:

- The results of monitoring and the LAQM Air Quality Annual Status Reports undertaken by South Norfolk Council (Broadland and South Norfolk District Councils, 2020); and
- Background pollutant concentration maps published by Defra (Defra, 2022b).

Road Traffic Impacts

10.3.34 The EPUK/IAQM Land-Use Planning & Development Control: Planning for Air Quality guidance sets out criteria to help establish when an air quality assessment of road traffic emissions is likely to be considered necessary.

10.3.35 For development not within or likely to affect an AQMA, an assessment can be screened out if:

- There is a change in light duty vehicle (LDV) flows of less than 500 annual average daily traffic (AADT); or
- There is a change in heavy duty vehicle (HDV) flows of less than 100 AADT.

10.3.36 The EPUK/IAQM guidance is clear that:

"If none of the criteria are met, then there should be no requirement to carry out an air quality assessment for the impact of the development on the local area, and the impacts can be considered as having an insignificant effect."

Operational Dust Impacts

10.3.37 The IAQM Guidance on the Assessment of Mineral Dust Impacts for Planning includes an assessment methodology, which has been used for this assessment.

10.3.38 Locations sensitive to dust emitted during site operations will be places where members of the public are regularly present. Residential properties close to the application site will be most sensitive to operational dust. Any areas of sensitive vegetation or ecology that are very close to dust sources may also be susceptible to some negative effects.

10.3.39 The IAQM minerals guidance describes a qualitative source-pathway-receptor approach to determine the risk of dust effects. The assessment method uses a number of steps to determine the site characteristics and baseline conditions, an estimate of the dust impact risk and an estimate of the likely magnitude of effects. Potential dust sources and activities have been identified and the risk of impacts at sensitive receptors determined based on the prevailing meteorological conditions and topography, the likely magnitude of emissions (with mitigation in place) and the distances over which effects may occur.

10.3.40 The IAQM minerals dust guidance divides activities on minerals sites into seven types to reflect their different potential impacts:

- Site preparation/restoration;
- Mineral extraction;
- Material handling;
- On-site transportation;
- Mineral processing;
- Stockpiling/exposed surfaces; and
- Off-site transportation.

10.3.41 A series of steps then consider the potential impact due to:

- the risk of health effects from an increase in exposure to PM_{10};
- annoyance due to the deposition of dust;
- harm to the natural environment.

Screening

10.3.42 A detailed dust assessment would usually be required where there is a human or sensitive ecological receptor within 250m of a sand and/or gravel site, or within 400m of a hard rock quarry, measured from the nearest dust generating activities.

10.3.43 Where there are no sensitive receptors within 250m of a sand and/or gravel site, or within 400m of a hard rock quarry, it would normally be assumed that a detailed dust assessment is not required.

The sensitivity of receptors is defined in Table 10.2,

Table 10.3 and

10.3.44 Table 10.4; however, professional judgement should be used to identify where on the spectrum between high and low sensitivity a receptor lies.

Table 10.2: Sensitivities of People to Dust Soiling

Class	Principles	Examples
High	Users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land.	Dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms.
Medium	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	Parks and places of work.
Low	The enjoyment of amenity would not reasonably be expected; or property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.	Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.

Table 10.3: Sensitivities of People to PM_{10}

Class	Principles	Examples
High	Locations where members of the public may be exposed for eight hours or more in a day.	Residential properties, hospitals, schools and residential care homes.
Medium	Locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	Office and shop workers, but will generally not include workers occupationally exposed to PM_{10}
Low	Locations where human exposure is transient.	Public footpaths, playing fields, parks and shopping streets.

Table 10.4: Sensitivities of Receptors to Ecological Effects

Class	Principles	Examples
High	Locations with an international or national designation and the designated features may be affected by dust soiling; or locations where there is a community of a particularly dust sensitive species.	Special Areas of Conservation (SAC) with dust sensitive features.
Medium	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition.	Sites of Special Scientific Interest (SSSI) with dust sensitive features.
Low	Locations with a local designation where the features may be affected by dust deposition.	Local Nature Reserves with dust sensitive features.

Dust Impact Risk and Magnitude of Dust Effect

10.3.45 The amenity dust impact risk is determined by combining the residual source emissions and the pathway effectiveness, as shown in **Table 10.5**. The magnitude of the dust effect is then described by combining the dust impact risk with the receptor sensitivity, as shown **Table 10.6**. The significance of the effect on amenity is determined to be either significant or not significant. The judgement of significance should be made by a competent, suitably qualified professional, and the professional experience of the consultant preparing this chapter is set out in Appendix 10.2.

10.3.46 With regard to health effects, the IAQM minerals guidance takes the approach that, if background ambient PM_{10} concentrations are below 17µg/m^3, there is little risk that a process contribution from a dust source would lead to an exceedance of the objectives. For this assessment, should the background PM_{10} concentration at the application site be less than 17µg/m^3, the impact from the proposed development on health will be deemed as not significant.

10.3.47 Where background PM_{10} concentrations are above 17 µg/m^3, the impact has been described by estimating the contribution to annual mean PM_{10} concentrations due to the operation of the proposed development and adding this to the background PM_{10} concentration to determine the total annual mean PM_{10} concentration and comparing this with the annual mean air quality objective.

Table 10.5: Estimation of Dust Impact Risk

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

Table 10.6: Descriptors for Magnitude of Dust Effects

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

10.3.48 The residual source emissions and pathway effectiveness have been defined using the following guidelines.

Residual Source Emissions

10.3.49 The IAQM guidance sets out examples of the residual source emissions magnitude for a number of activities (see Table 10.7). The residual source emissions take account of designed in mitigation measures and landscaping.

Table 10.7: Examples of Residual Source Emissions Magnitude

Large	Small
Site Preparation / Restoration	
Large working area (>10ha)	Small working area (<2.5ha)
High bunds (>8m)	Low bunds (<4m)
High volume of material movement (>100,000m^3)	Low volume of material movement (<20,000m^3)

Large	Small
High no. of heavy plant (>10 simultaneously active)	Low no. of heavy plant (<5 simultaneously active)
Minimal seeding/sealing of bund surface	Bunds seeded/sealed immediately
Material of high dust potential (fine grained, friable)	Material of low dust potential (high moisture content)
Mineral Extraction	
Large working area (>100ha)	Small working area (<20ha)
High energy extraction methods (drilling and blasting)	Low energy extraction methods (hydraulic excavator)
Material of high dust potential (small particle size and/or low moisture content)	Material of low dust potential (coarse material and/or high moisture content)
Potential high extraction rate (1,000,000 tpa)	Low extraction rate (<200,000 tpa)
Materials Handling	
High no. heavy plant (>10 loading plant)	Low no. of heavy plant (<5 loading plant)
Unconsolidated / bare surface	Hard standing surface
Activities close to site boundary (<50m of site boundary)	Activities within quarry void or >100m of site boundary
Material of high dust potential	Material of low dust potential
On-site Transportation	
Unconsolidated/unpaved haul road	Conveyors and/or paved haul road
Road surface of high dust potential	Road surface of low dust potential
High no. of HDV movements (>250)	Low no. of HDV movements (<100)
High total haul road length	Low total haul road length (<500m)
Uncontrolled vehicle speed	Controlled vehicle speed (<15 mph)
Mineral Processing	
Raw material of high dust potential (hard rock)	Raw material of low dust potential (wet sand/gravel)
End product of high dust potential (cement)	End product of low dust potential
Complex or combination of processes	Single process
High volume of material processed (>1,000,000 tpa)	Low volume of material processed (<200,000 tpa)
Stockpiles / Exposed Surfaces	
Long term stockpile (>12 months)	Short term stockpile (<1 month)

Large	Small
Frequent material transfers (daily)	Infrequent material transfers (weekly)
Material of high dust potential	Material of low dust potential
Unconsolidated ground surface	Hardstanding
Stockpiles close to boundary (<50m)	Stockpiles well within quarry void or away from boundary (>100 m)
Large areas of exposed surfaces (>10ha)	Small areas of exposed surfaces (<2.5 ha)
High wind speeds / low dust threshold	Low wind speeds / high dust threshold
Large quarry production (1,000,000 tpa)	Small quarry production (<200,000 tpa)
Off-site Transportation	
High no. HDV movements (>200/day)	Low no. HDV movements (<25/day)
Unconsolidated access road	Paved access road
Limited/no vehicle cleaning facilities	Extensive vehicle cleaning facilities
Small length of access road (<20m)	Large length of access road (>50m)

Pathway Effectiveness

10.3.50 A frequency category, derived from wind and rainfall data (Table 10.8), and a receptor distance category (Table 10.10) are combined in a matrix (Table 10.9) to classify the pathway effectiveness.

Table 10.8: Categorisation of Frequency of Potentially Dusty Winds

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

Table 10.9: Categorisation of Receptor Distance from Source

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

Table 10.10: Pathway Effectiveness

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

10.4 Baseline Environment

LAQM Review and Assessment

10.4.1 South Norfolk Council has not declared any AQMAs; therefore, it is unlikely that the objectives for PM_{10} are exceeded anywhere in the study area.

Local Air Quality Monitoring

10.4.2 South Norfolk Council does not operate any PM_{10} automatic monitoring sites, and no monitored PM_{10} data is available.

Defra Background Concentrations

10.4.3 The estimated annual mean PM_{10} background concentrations in 2022 across the study area are shown in Table 10.11. The background concentrations are well below the objectives.

Table 10.11: Estimated Annual Mean 2022 Background Concentrations (µg/m^3)

Grid	PM_{10}
643500,296500	15.2
643500,297500	14.6
644500,296500	13.7
644500,297500	13.0
Objective	40

10.5 Embedded Mitigation

10.5.1 With regard to vehicle emissions, all of the HGVs in the Breedon fleet will be Euro VI compliant.

10.5.2 The following is a summary of the dust mitigation measures that would be utilised during the operation of the proposed development.

- 3m high screening bunds will be constructed between the area of extraction and dust sensitive receptors within 100m of the extraction area. The bunds will be seeded immediately on completion;
- An existing screen of hedgerow and trees around the site perimeter will be retained;
- The stockpile and vehicle loading and turning area will be located more than 100m from any dust sensitive receptors;
- Drop heights will be minimised;
- Water suppression will be used as necessary;
- Duration and timing of dust generating activities will be restricted when undertaken within 100m of dust sensitive receptors during dry/windy conditions, when operationally possible;
- On-site vehicle speeds will be kept below 10mph;
- All HGVs would be covered prior to leaving the site. All HGVs leaving the site will turn left onto Crab Apple Lane and then right onto the B1136 and travel along more than 2km of the public highway before reaching any dust sensitive receptors;
- A road sweeper will be used, as required.
- Dust control training will be provided for all employees.

10.6 Likely Significant Environmental Effects

Operational Phase (Extraction and Restoration)

Screening

10.6.1 The operation of the proposed development will potentially lead to dust emissions. There are human receptors within 250m of dust generating activities; therefore, a detailed dust assessment is required. There are no dust sensitive ecological features within 250m of dust generating activities and dust impacts on ecology have not been considered further.

Dust Generating Activities

10.6.2 The following activities have potential for dust emissions:

- Site preparation;
- Mineral extraction;
- Materials handling;
- On-site transportation;
- Mineral processing
- Stockpiles and exposed surfaces;
- Site restoration; and
- Off-site transportation.

Residual Source Emissions

10.6.3 The residual source emissions, i.e., the emissions with designed in mitigation in place, have been estimated for each of the main operational activities.

Site Preparation and Restoration

10.6.4 The quarry will be worked in seven phases, with site preparation undertaken prior to extraction within each phase. Works will start with the removal of topsoil and overburden from the Phase 1 area (as shown in the Phasing Overview – Reference – 2022_05-26_H20_006), with the soils used to create 3m high bunds between the extract area and receptors within 100m of the extract area. The bunds will be grass seeded immediately on completion.

10.6.5 Each phase area would be progressively restored as extraction takes place. The site will be restored using sand separated from the gravel, no other restoration material will be imported, and the topsoils replaced from the screening bunds on completion of extraction.

10.6.6 Working areas during site preparation and restoration will be less than 2.5ha, with less than 5 heavy plant operating simultaneously. Overall, with regard to Table 10.7 and the embedded mitigation, the residual source emission magnitude due to site preparation/restoration is considered to be small.

Mineral Extraction

10.6.7 Gravel will be extracted over a seven-year period at a rate of up to 100,000 tonnes per year. An excavator will be used to extract the minerals. The quarry will be worked dry, with no dewatering required; however, there will be some inherent moisture within the mineral that will help prevent dust emissions. The mineral extraction working area will never be more than 2.5ha at any one time. The bunds placed during site preparation and the retained planting will provide a screen to the dispersion of dust from the mineral extraction areas during the extract phase. With regard to Table 10.7 and the embedded mitigation, the residual source emission magnitude due to mineral extraction is considered to be small.

Mineral Processing

10.6.8 A mobile screen will be used to separate off the sand, which will be moved to each new phase area when extraction starts. The separated sand will be used in the void to shape the restoration landform. No other mineral processing will take place at the site as the extracted gravel will be taken to the main Norton Subcourse Quarry to the west along the B1136 for processing.

10.6.9 Less than 100,000 tonnes per year will be screened and the raw material will have a low dust potential. With regard to Table 10.7 and the embedded mitigation, the residual source emission magnitude due to mineral processing is considered to be small.

Materials Handling and On-site Transportation

10.6.10 A dump truck will be used to move extracted minerals to a lorry loading and turning area, where an as dug stockpile will be located. The dump truck will be loaded using a loading shovel. No more than five loading and transport plant will be operational at any one time. The mineral will have some residual moisture and will have a low dust potential.

10.6.11 The dump truck will be moving over an unconsolidated surface when carrying the minerals to the loading area, which may lead to some re-suspension of dust; however, internal haul routes from the mineral extraction areas to the loading area will be less than 500m in length and speeds will be limited to less than 15 mph. The haul road will be located more than 100m from any dust sensitive receptors. Water suppression will be used as necessary in order to prevent excessive dust emissions. With regard to **Table 10.7** and the embedded mitigation, the residual source emission magnitude due to materials handling and on-site transportation is considered to be small.

Stockpiles and Exposed Surfaces

10.6.12 The phased extraction would ensure that no more than 2.5ha of mineral surface is exposed at any one time. The exposed minerals will be coarse sand/gravel with a low dust potential. The bunds constructed to the north and south of the extract area will form a barrier to the dispersion of dust from the exposed surfaces, along with the retained planting.

10.6.13 The stockpile in the lorry loading and turning area will remain in place for the duration of the mineral extraction phase. The stockpile will be located more than 200m from the closest dust sensitive receptors. Screened sand will be stockpiled within the active quarry face prior to use for restoration and all of these stockpiles will be located more than 100m from dust sensitive receptors. With regard to **Table 10.7** and the embedded mitigation, the residual source emission magnitude due to stockpiles and exposed surfaces is considered to be small.

Off-site Transportation

10.6.14 The proposed development could result in an average of 35 HGVs leaving the application site in a day, all of which would turn left onto Crab Apple Lane and then travel west along the B1136 to the main Norton Subcourse Quarry for processing. The access would be hard surfaced. A road sweeper will be deployed as and when necessary to ensure the access and the Crab Apple Lane surface is clean and safe. HGVs leaving the site would travel over more than 2m of the public highway before reaching any dust sensitive receptors; therefore, there would be no impact at local receptors due to trackout. With regard to **Table 10.7** and the embedded mitigation, the residual source emission magnitude due to off-site transportation is considered to be small.

Summary of Residual Source Emissions

10.6.15 A summary of the residual source emissions is shown in Table 10.12. The overall residual source emission from the proposed quarry is considered to be small.

Table 10.12: Summary of Residual Source Emissions for Each Phase

Activity	Residual Source Emissions
Site Preparation/Restoration	Small
Mineral Extraction	Small
Material Handling and On-site Transportation	Small
Mineral Processing	Small
Stockpiling/Exposed Surfaces	Small
Off-site Transportation	Small

Pathway Effectiveness

10.6.16 The transport of fugitive dust in the air is dependent on the prevailing meteorological conditions. Receptors downwind of the dust emissions source, with regard to the prevailing wind, will be exposed to dust more frequently than those located upwind. A 10-year average wind rose from Norwich meteorological station shows that the prevailing wind direction is from the southwest (see Figure 10.1).

10.6.17 There is a risk that dust will be entrained from the ground even when no dust generating activities are taking place. Wind speeds greater than 5 m/s are considered strong enough to initiate the suspension of dust from the ground, and the risk is increased on dry days, i.e., when less than 0.2 mm of rainfall are recorded over a 24-hour period. The prevailing wind data show that, for approximately 67% of the time, wind speeds are likely to be below 5 m/s, when dust is unlikely to become suspended in the air.

10.6.18 Analysis of average rainfall data for the area shows that, over the 30 year period from 1981 to 2010, an average of 160-170 days will be wet days, i.e., rainfall will be greater than 0.2 mm (Met Office, 2022). Therefore, for approximately 45% of the time, daily rainfall will be greater than 0.2 mm, when there will be natural dust suppression.

10.6.19 The closest dust sensitive receptors in all directions within 250m of dust generating activities are described in Table 10.13, with the locations shown in Figure 10.2. It is

commonly accepted that the greatest impacts on dust deposition will occur within 100m of an emissions source (IAQM, 2016).

10.6.20 The wind frequency category towards each dust receptor, estimated from the meteorological data and with regard to Table 10.8, is shown in Table 10.14.

Table 10.13: Receptor Areas

Receptor ID in Figure 10.4	Receptor Area	Land Use	Sensitivity Dust Soiling	Sensitivity PM_{10}
R1	Low Farm	Residential	High	High
R2	Windmill Cottage	Residential	High	High
R3	The Boundaries	Residential	High	High
R4	Willow Barn	Residential	High	High
R5	2 Gravel Pit Lane	Residential	High	High
R6	4 The Loke	Residential	High	High
R7	Manor Farm	Residential	High	High
R8	Polperro	Residential	High	High
R9	St Mary's Church	Church	Medium	Medium
R10	1 Church Lane	Residential	High	High

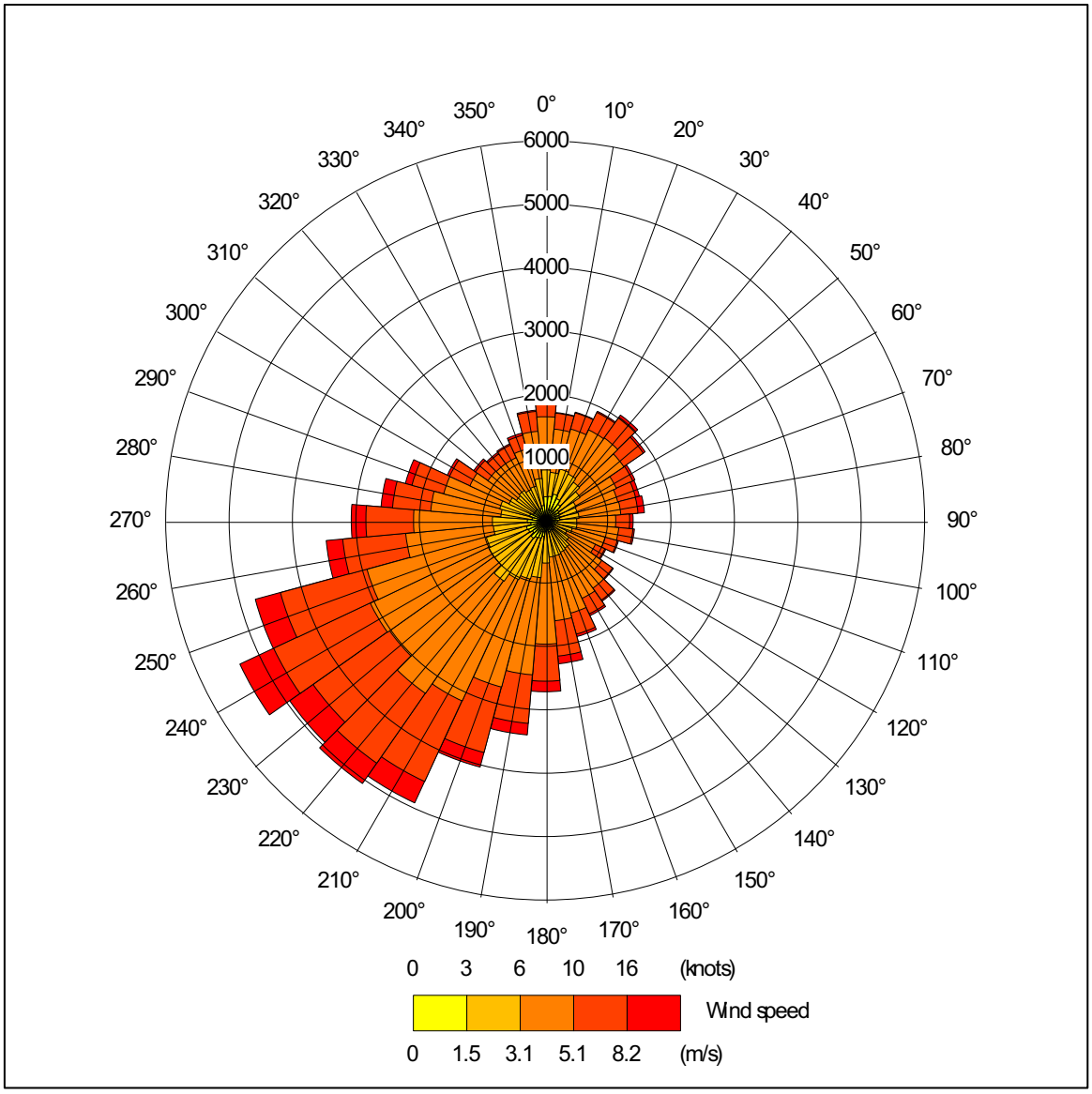

Figure 10.1: 10 Year Average Wind Rose Norwich

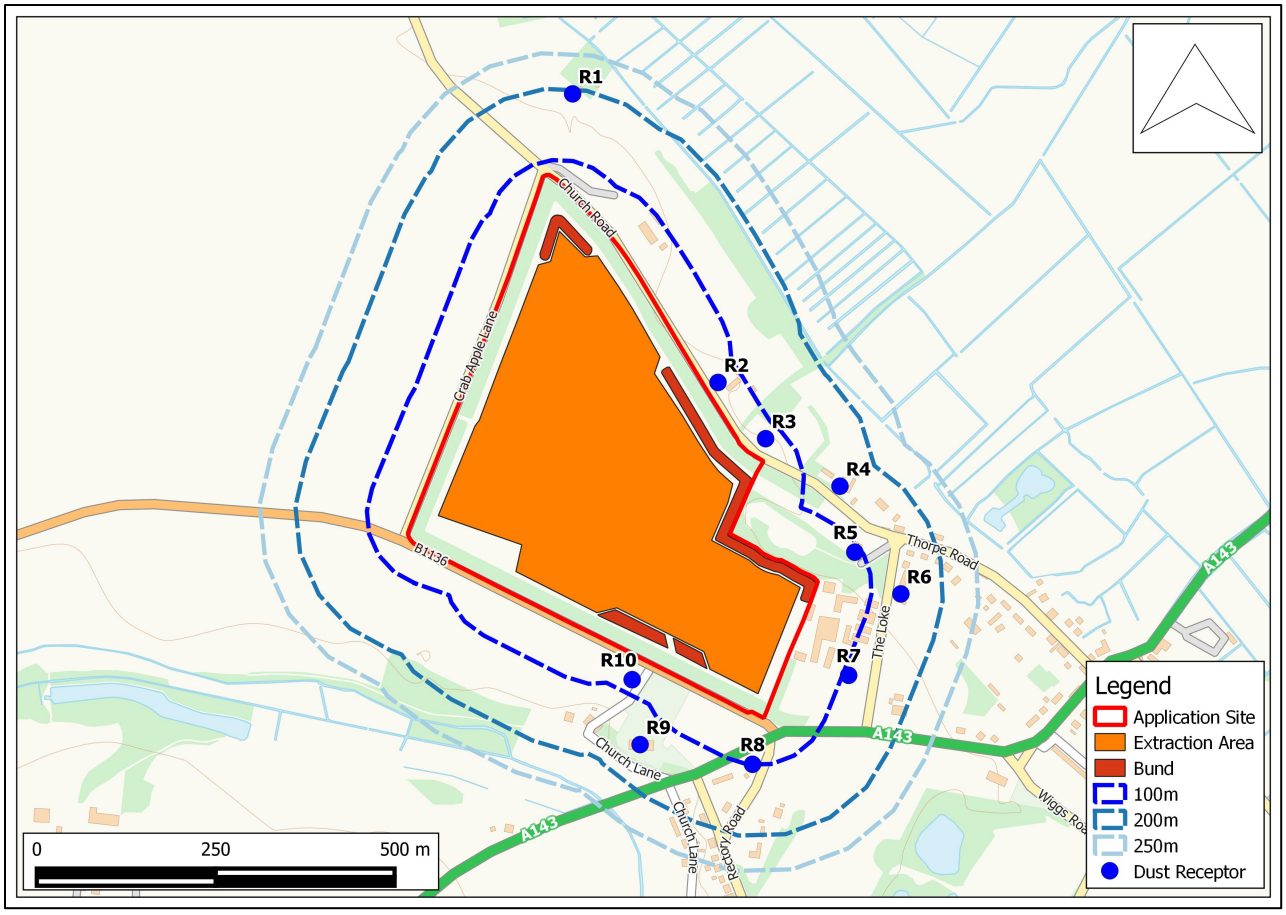

Figure 10.2: Dust Sensitive Receptors
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Table 10.14: Wind Frequency Category for Each Receptor

Receptor	Wind Sectors Affecting Receptor (°)	Frequency of Wind >5m/s Towards Receptor (%)	Frequency of Wind >5m/s Towards Receptor on Dry Days (%)	Wind Frequency Category
R1	150-200	6	3	Infrequent
R2	160-320	25	13	Frequent
R3	160-320	25	13	Frequent
R4	210-310	19	10	Moderately Frequent
R5	210-310	19	10	Moderately Frequent
R6	240-310	11	6	Moderately Frequent

Receptor	Wind Sectors Affecting Receptor (°)	Frequency of Wind >5m/s Towards Receptor (%)	Frequency of Wind >5m/s Towards Receptor on Dry Days (%)	Wind Frequency Category
R7	260-330	7	4	Infrequent
R8	310-20	3	2	Infrequent
R9	320-70	6	3	Infrequent
R10	310-100	7	4	Infrequent

10.6.21 The potential impact of dust emissions at receptors is dependent on the distance from the source to the receptor and the presence of any physical features that may affect dispersion.

10.6.22 Combining the wind frequency category with the receptor distance category using Table 10.10 determines the pathway effectiveness for each receptor area, as shown in Table 10.15.

Table 10.15: Pathway Effectiveness for Each Receptor Area

Receptor	Frequency of Potentially Dusty Wind	Receptor Distance Category	Pathway Effectiveness
R1	Infrequent	Intermediate	Ineffective
R2	Frequent	Close	Highly Effective
R3	Frequent	Close	Highly Effective
R4	Moderately Frequent	Intermediate	Moderately Effective
R5	Moderately Frequent	Close	Moderately Effective
R6	Moderately Frequent	Intermediate	Moderately Effective
R7	Infrequent	Intermediate	Ineffective
R8	Infrequent	Close	Ineffective
R9	Infrequent	Intermediate	Ineffective
R10	Infrequent	Close	Ineffective

Potential Dust Deposition Effects

10.6.23 The pathway effectiveness for each receptor area has been combined with the overall residual source emission to estimate the dust impact risk at each receptor area using Table 10.5. The dust impact risk and receptor sensitivity have then been used to determine the magnitude of the dust effect at each receptor area using Table 10.6. The overall dust deposition effects are summarised in Table 10.16. The dust deposition effects are described as negligible at most receptors, and as slight adverse at receptors R2 and R3 to the northeast of the application site. The slight adverse effects would only be a risk when extraction works are being undertaken within 100m of these receptors during the Phase 4 and Phase 5 works, with a negligible risk of adverse effects for most of the period of operation of the quarry.

Table 10.16: Summary of Dust Deposition Effects

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

Health Effects

10.6.24 Annual mean PM_{10} concentrations at receptors that may be affected by emissions from the proposed development would be close to background levels, i.e., 13.0-15.2µg/m^3 (see Table 10.11). IAQM minerals guidance takes the approach that there is little risk that a process contribution from a dust source would lead to an exceedance of the objectives where background ambient PM_{10} concentrations are below 17µg/m^3; therefore, the proposed development will have an insignificant effect on health due to fugitive emissions of PM_{10}.

Post Restoration

10.6.25 Post-restoration there will no longer be any dust emissions and there will be no air quality effects.

10.7 Additional Mitigation, Compensation, Enhancement Measures

10.7.1 The overall magnitude of dust effects at local receptors has been shown to be negligible, with a risk of slight adverse effects at two receptors during the Phase 4 and Phase 5 works. There would be a negligible risk of adverse effects at these two receptors for most of the period of operation of the quarry. The receptors will be separated from onsite activities by a screening bund and the retained screen of hedgerow and trees, and even during works within 100m of these receptors, dust effects are unlikely.

10.7.2 Given that particles responsible for most dust annoyance will usually deposit within 100m of the source and that the bunds and planting will provide an effective screen to dust emissions, there would not be a significant effect on dust deposition at the two receptors.

10.7.3 During the screening bund construction and removal, consideration will be given to meteorological conditions at the time of the works, and additional water suppression will be used if visible dust emissions occur during works close to dust receptors R2 and R3. Bund construction/removal will be paused if water suppression does not control dust emissions during the works.

10.7.4 It is considered that the designed in mitigation measures provide an appropriate level of mitigation at the site. During adverse weather conditions, such as prolonged dry weather and/or high winds, additional water suppression will be used. Activities with the potential to cause dust emissions will be monitored, and should visible dust be generated, corrective will be taken, including the use of water suppression.

10.8 Cumulative and Combined Effects

10.8.1 There would be no cumulative effects with any other recently permitted or future potential developments in the area with regard to air quality or dust.

10.9 Assessment Summary and Likely Significant Residual Environmental Effects

10.9.1 With the designed-in mitigation measures, dust emissions will not have a significant effect and there will be no residual environmental effects.

10.10 Conclusion

10.10.1 The operational phase dust risk assessment has determined that, with the designed in mitigation measures, there will not be any significant effects due to dust emissions.

10.10.2 It is considered that the effects of the operation of the proposed development on air quality and dust will be insignificant.

10.10.3 There should be no constraints to the development of the site as a gravel quarry, with regard to the air quality and dust effects on local receptors, as the proposed development is consistent with the relevant parts of:

- The NPPF and PPG;
- Policies SC14, CS15, DM12 and DM13 of the Norfolk Core Strategy and Minerals and Waste Development Management Policies Development Plan Document 2010-2026;
- Policies MW1, MW2 MPSS1 and MIN 25 of the Norfolk Minerals and Waste Local Plan Review Draft Publication Document; and Policies DM 3.13 and DM 3.14