Air Quality CONSULTANTS

Dust Management Plan: Land at Cliff Hill, Denby Dale

February 2024

Experts in air quality management & assessment

Document Control

Client	Urban Group (York) Ltd	**Principal Contact**	Andrew Black

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Report Prepared By:	Samantha Sarlo

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Air Quality Consultants Ltd
23 Coldharbour Road, Bristol BS6 7JT Tel: 0117 974 1086
24 Greville Street, Farringdon, London, EC1N 8SS Tel: 020 3873 4780
aqc@aqconsultants.co.uk

Registered Office: 23 Coldharbour Road, Bristol BS6 7JT
Companies House Registration No: 2814570

1 Introduction

1.1 This document sets out a fugitive dust assessment and Dust Management Plan (DMP) for the proposed development on land at Cliff Hill, Denby Dale, Kirklees (the "site"). It has been prepared by Air Quality Consultants Ltd (AQC) on behalf of Urban Group (York) Ltd.

1.2 The proposals involve the residential development of 62 homes on the site, which covers approximately 2 ha. Site investigation works have identified three seams of coal and one seam of fireclay present on site, alongside three recorded mine entries. The investigation concluded that the site is unsuitable for the proposed residential development without appropriate ground stabilisation works.

1.3 A previous planning application was rejected by Kirklees Council, principally on the basis that the plans for ground stabilisation works were inadequate. A new planning application is being submitted, incorporating revised information on proposed ground stabilisation works (detailed further in Section 4).

1.4 The ground stabilisation works have the potential to generate dust and therefore impact upon the amenity of nearby residential receptors. Additionally, Kirklees Council has indicated that they consider dust to be a potential problem, requiring further consideration. Dust may result in dust soiling and/or visible dust plumes and is described as "disamenity dust". Smaller dust particles (PM_{10}, which are <10 micrometres in diameter) remain suspended in the air for longer and are predominantly associated with health effects.

1.5 The fugitive dust assessment considers the risk associated with deposited (nuisance) dust and concentrations of particulate matter (PM) in the air with regards to human health.

1.6 The DMP utilises the dust assessment and outlines the overall approach to be taken during the ground stabilisation works to ensure that dust emissions are minimised, dust levels are measured, and any dust problems are satisfactorily dealt with. The DMP is an active document which requires continuous review and improvement.

2 Assessment Approach

Dust Guidance

On-Site Exhaust Emissions

2.1 There are no standards or formal assessment criteria for the assessment of on-site exhaust emissions (otherwise known as Non-Road Mobile Machinery (NRMM)). In the absence of formal criteria, guidance published by the Institute of Air Quality Management (IAQM)[1] on the assessment of dust from demolition and construction has been used (2024).

Ground Stabilisation Works

2.2 There are also no national standards defining levels of dust that can cause an annoyance or loss of amenity, or formal assessment criteria for the assessment of dust from ground stabilisation works. In the absence of formal criteria, the approach development by the IAQM for dust impacts from mineral sites (2016) has been adapted to inform the dust assessment. The guidance has been produced to address the potential impacts of dust emissions arising from mineral sites, but the general approach has been used for this study. This is considered conservative, given that the scale of the application site is smaller than the sites for which the guidance was intended, and therefore screening distances are likely to be conservative.

2.3 Screening criteria presented in the IAQM guidance (2016) identify that dust impacts at receptors within 400 m of the dust source should be assessed. The potential sources of dust for the ground stabilisation works are judged to be substantially smaller than for typical mineral sites. Therefore, applying the 400 m screening distance for the ground stabilisation works is considered conservative. The assessment methodology follows a sequence of steps:

- Step 1 is a basic screening stage to determine whether the more detailed assessment provided in Step 2 is required.
- Step 2 determines the potential for dust impact, based on the potential sources, frequency of potentially dusty winds, distance to source and therefore pathway effectiveness; and
- Step 3 determines the magnitude of effects.

2.4 Full details of the approach are provided in Appendix A1 of this report. The approach includes elements of professional judgement; the professional experience of the consultants preparing this report is included in Appendix A2.

[1] The IAQM is the professional body for air quality practitioners in the UK.

Assessment of Significance

2.5 There is no formal standard for quantifying dust impacts. In the absence of formal criteria, the significance of impacts has been judged based on professional experience and taking account of the IAQM's *Guidance on the Assessment of Mineral Dust Impacts for Planning* (2016), which although not designed to assess dust impacts from ground stabilisation works, is considered the most appropriate guidance available. Additionally, the significance of impacts from on-site exhaust emissions (or NRMM) has taken account of the IAQM's *Guidance on the assessment of dust from demolition and construction* (2024).

3 Existing Conditions

Background Concentrations

3.1 The estimated background annual mean PM_{10} concentration in the study area has been determined for the current year (2024) using Defra's 2018-based background maps (Defra, 2024). These maps cover the whole of the UK on a 1x1 km grid. The background annual mean PM_{10} concentration is presented in Table 1 and is well below the objective.

Table 1: Estimated Annual Mean Background PM_{10} Concentration (µg/m^3)

Year	Annual Mean PM_{10}
2024	10.9
Objective	**40**

Receptors

3.2 A number of residential receptors are located close to the site; residential receptors are considered highly sensitive to the effects of dust soiling. Receptors have been identified to represent worst-case exposure and sensitivity, and are described in Table 2 and shown in Figure 1.

Table 2: Description of Receptor Locations

Receptor ID	Description	Dust Sensitivity
R01	Residential property along Leak Hall Crescent	High
R02	Residential property along Leak Hall Crescent	High
R03	Residential property along Leak Hall Crescent	High
R04	Residential property along Leak Hall Crescent	High
R05	Residential property along Leak Hall Crescent	High
R06	Residential property along Leak Hall Road	High
R07	Residential property along Springhead Gardens	High
R08	Residential property along Springhead Gardens	High
R09	Residential property along Springhead Gardens	High
R10	Residential property off A636 Wakefield Road	High
R11	Residential property off Cumberworth Lane	High
R12	Residential property off Cumberworth Lane	High
R13	Residential property off Cumberworth Lane	High
R14	Residential property off Cumberworth Lane	High
R15	Residential property off Leak Hall Lane	High

Figure 1: Receptor Locations

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Soil Characteristics

3.3 The characteristics of the surface soil at the site have been defined using the British Geological Survey's UK Soil Observatory website (British Geological Survey, 2024), as set out in Table 3. Overall, it is considered that, when dry, this soil has the potential to be moderately dusty.

Table 3: Summary of Soil Characteristics

Category	Record
Soil Layer Thickness	Intermediate - Shallow
Soil Parent Material Grain Size	Mixed (Argillaceous [a] – Arenaceous [b])
European Soil Bureau Description	Mudstone and Sandstone
Soil Group	Light (Silty) to Medium (Silty) / Medium to Heavy
Soil Texture	Clayey Loam [c] to Sandy Loam

[a] grain size < 0.06 mm.

[b] grain size 0.06 – 2.0 mm.

[c] a loam is composed mostly of sand and silt.

Meteorological Conditions

3.4 Meteorological conditions are an important factor influencing the dispersion of dust. High wind speeds increase the potential for dust to become airborne and rainfall acts as a natural dust suppressant. The higher the wind speed, the more energy is available to entrain the dust. Rainfall reduces dust entrainment as the higher moisture content increases the particle cohesion, while in contrast, warm temperatures reduce the particle moisture content and cohesion, allowing dust to become more easily airborne. Meteorological conditions that represent the highest risk in terms of fugitive dust emissions are moderate to strong winds (moderate breeze >5 m/s) and periods of little or no rainfall (taken as <0.2 mm/day) (IAQM, 2016).

3.5 Meteorological conditions also affect the direction of transport of dust. When the wind is blowing from the source towards a receptor, the risk of impacts at that receptor is increased. However, when dust generating activities are in close proximity to the receptor (typically <30 m), then the receptor mat potentially be affected whatever the wind direction (generally only in light winds).

3.6 The pattern of winds averaged over five years is displayed in Figure 2, with data taken from Emley Moor meteorological monitoring station, located approximately 4.4 km to the northwest of the site. This demonstrates that the most frequent winds are from the west and southwest; wind from all other sectors are less frequent.

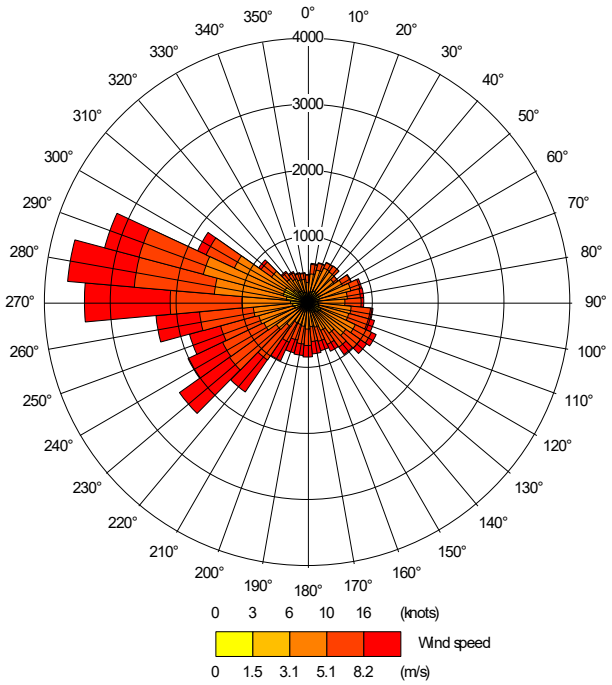

Figure 2: Windrose for Emley Moor Meteorological Monitoring Station (2018 – 2022)

3.7 The historic average number of days with rainfall greater than 0.2 mm/day is about 160 to 180 days per year within this part of West Yorkshire, and therefore dust would naturally be supressed for around 45% to 50% of the days in the year.

4 Dust Impact Assessment

On-Site Exhaust Emissions

4.1 The IAQM's *Guidance on the assessment of dust from demolition and construction* (2024) states:

"Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur".

4.2 Taking the above into account, it is judged that the emissions from on-site plant (or NRMM) will be 'not significant'.

Ground Stabilisation Works

Human Health

4.3 The background annual mean PM_{10} concentration at the site in 2024 (current year) is 10.9 µg/m^3 (see Table 1). The IAQM guidance states if background PM_{10} concentrations are less than 17 µg/m^3 there is little risk of the process contribution from the site leading to an exceedance of the objective (IAQM, 2016). Background concentrations are well below this and therefore the impacts on human health are considered to be 'negligible'.

Disamenity Dust

Screening Assessment

4.4 Step 1 of the IAQM assessment procedure is to screen the need for a detailed assessment. Although the background PM_{10} concentration within the study area is below the objective (see Table 1), there are sensitive human health receptors within 400 m of the site and therefore a detailed risk assessment for these receptors has been undertaken.

4.5 The approach to the disamenity dust risk assessment considers the residual source emissions, pathway effectiveness and receptors sensitivity to determine an overall magnitude of effect in accordance with the methodology detailed within Appendix A1.

Detailed Risk Assessment

Residual Source Emissions

4.6 The revised ground stabilisation works will include extensive drilling and grouting to fill voids across the entire site. It is understood that approximately 550 holes will be drilled in a primary and secondary

grid (300 primary holes and 250 secondary holes), as shown in Figure 3. The treatment holes are anticipated to be approximately 20 m deep.

Figure 3: Proposed Drill and Grout Treatment Grid

Imagery ©2024 Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group. Taken from Appendix H of Cliff Hill, Cumberworth Lane, Denby Dale Ground Stabilisation Remedial Strategy prepared by GRM Development Solutions Limited.

4.7 A typical drill and grout treatment specification will include the following:

- grout to be pressure injected to the depth of the coal workings using tremie pipes, with the fills isolated via temporary steels casings socketed into rockhead;
- utilisation of a grout mix comprising 1:10 OPC: PFA[2]. Weekly grout cube validation testing to be conducted to confirm compliance, tested at 28 days with a minimum compressive strength of 1.0 N/mm^2;
- depths of target seams to be established during the ground investigation; depths vary across the site and in turn, the requirement for treatment due to areas in which sufficient competent rock cover will be present (10 times a conservative average worked seam thickness in equivalent competent rock cover above);

[2] OPC = Ordinary Portland Cement, PFA = Pulverised Fuel Ash.

- primary holes drilled on a 6 m grid, with centre (secondary) holes beneath and in the immediate areas surrounding the proposed new buildings;
- check (tertiary) holes may also be required to prove grouting success;
- if excessive voiding is encountered, the use of sand will be adopted;
- steel casing will be used in all treatment holes; and
- treatment holes injected with grout to surface, to ensure full depth reinstatement.

4.8 In addition to the above, there are three recorded mine entries at the site that require treating prior to development (see red shaded circles in Figure 4 below). The mine entries will be stabilised by full depth grouting, utilising the grout mix specified above in Paragraph 4.7, and a rotary grouting rig and platform. Shafts will be treated via three probe holes, one of which will extent 5 m below their base to prove the underlying ground conditions.

4.9 Once treated, a reinforced concrete cap should be installed at rock head and include the use of mesh reinforcement and cover an area twice the size of the shaft diameter.

4.10 For mine entries with recorded depths less than 3m, it may be possible to treat the shafts by full depth excavation and backfilling with lean mix concrete or engineered fill.

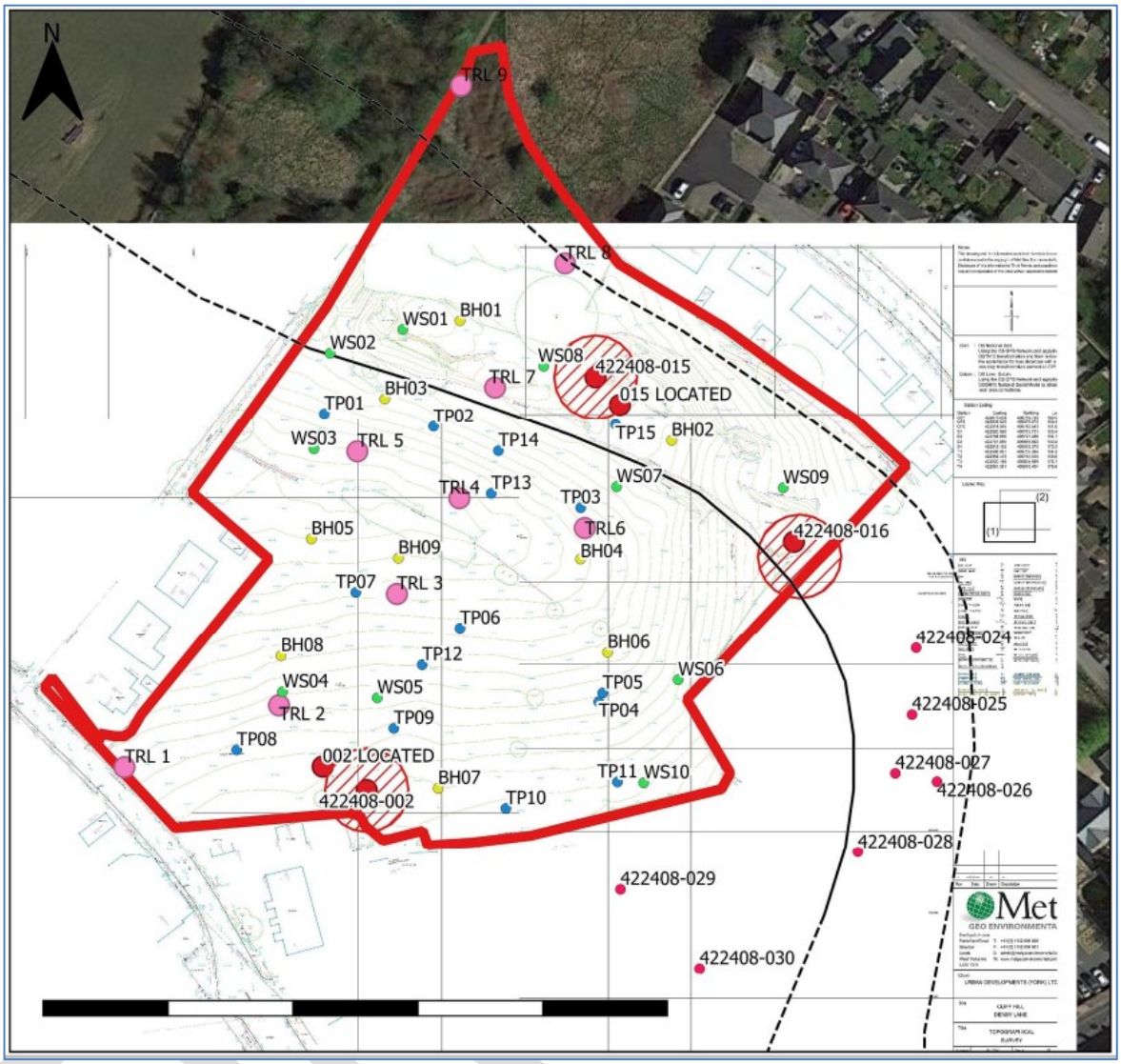

Figure 4: Mine Shafts / Entries

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4.11 In the central area of the site, proposed finished levels are anticipated to be up to 2.5 m lower than existing topographic levels. Where ground levels are to be reduced during the earthworks, an coal seam may be within the influencing distance of the base foundation (<0.5 m cover). In this instance, it may be more cost effective to over-dig the earthworks and remove the workings/shallow seam in full, indicated by the green area in Figure 5 below which is approximately 4,500 m^2. It is anticipated that the potential extraction volume of coal from this area will be approximately 4,150 m^3.

4.12 Where levels are to be raised, or excavation is deemed impractical, the seam will need grouting as outlined in Paragraphs 4.6 and 4.7.

Figure 5: Proposed Excavation Plan

Imagery ©2024 Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group. Taken from Appendix I of Cliff Hill, Cumberworth Lane, Denby Dale Ground Stabilisation Remedial Strategy prepared by GRM Development Solutions Limited.

4.13 Taking account of the above, the residual source emissions from the drilling and grouting process (including stabilisation of the mine entries) are considered to be *small* to *medium*. The residual source emissions from the excavation process (Figure 5) are anticipated to be *medium*, given the larger and more open nature of the works. The method is yet to be defined, and it is currently unknown whether the excavation works will be undertaken as part of the ground stabilisation works.

4.14 Notwithstanding, for the purpose of identifying appropriate mitigation for the ground stabilisation works associated with the proposed development, a worst-case approach has been adopted whereby a *medium* residual source emission has been utilised.

Pathway Effectiveness

4.15 In order to consider the effectiveness of the pathway, it is important to consider the receptor locations in terms of proximity to dust sources and the prevailing wind direction. The pathway effectiveness for each receptor is summarised in Table 4.

4.16 The pathway effectiveness is combined with the residual source potential of the site, using the matrix in Table A1.6 in Appendix A1 in order to assign a risk category to the site. Note that wind speeds are based on the Emley Moor meteorological station, which is more exposed to high winds than the site of the proposed development; this is therefore a conservative assessment.

Table 4: Assessment of Potential Dust Risk from the Ground Stabilisation Works

Receptor ID	Approx. Distance (m)	Categorisation of Receptor Distance from Source	Direction from Source (°)	% Winds from Source on Dry Days >5m/s	Frequency of Potentially Dusty Winds	Pathway Effectiveness	Estimation of Dust Risk Impact
R01	7.6	Close	135 – 325	20.0	Very Frequent	Highly Effective	Medium Risk
R02	13.7	Close	145 – 310	19.1	Frequent	Highly Effective	Medium Risk
R03	8.7	Close	155 – 305	18.5	Frequent	Highly Effective	Medium Risk
R04	8.5	Close	170 – 310	17.7	Frequent	Highly Effective	Medium Risk
R05	1.4	Close	210 – 310	15.9	Frequent	Highly Effective	Medium Risk
R06	40.2	Close	245 – 310	12.3	Frequent	Highly Effective	Medium Risk
R07	8.6	Close	215 – 0	16.4	Frequent	Highly Effective	Medium Risk
R08	9.8	Close	220 – 25	16.3	Frequent	Highly Effective	Medium Risk
R09	3.7	Close	235 – 35	15.4	Frequent	Highly Effective	Medium Risk
R10	49.9	Close	290 – 15	4.3	Infrequent	Ineffective	Negligible Risk
R11	1.5	Close	280 – 70	8.3	Moderately Frequent	Moderately Effective	Low Risk
R12	1.4	Close	285 – 90	9.3	Moderately Frequent	Moderately Effective	Low Risk
R13	2.7	Close	10 – 200	8.3	Moderately Frequent	Moderately Effective	Low Risk
R14	7.7	Close	335 – 210	9.3	Moderately Frequent	Moderately Effective	Low Risk
R15	21.3	Close	145 - 200	3.2	Infrequent	Ineffective	Negligible Risk

Sensitivity of the Area

4.17 This assessment step combines the sensitivity of individual receptors to risk of dust impact with the number of receptors in the area and their proximity to the site. Using the IAQM guidance, residential properties are judged to be 'high sensitivity' receptors.

Potential Dust Effects

4.18 The assessment of the potential dust effects at sensitive receptor locations are presented in Table 5. This brings together the residual source emissions, effectiveness of pathway and receptor sensitivity identified using the criteria described in Appendix A1, to identify an overall potential for dust effects.

Table 5: Assessment of Potential Dust Effects from the Ground Stabilisation Works

Receptor		Risk of Dust Impact	Receptor Sensitivity	Likely Dust Effect
ID	Description			
R01	Residential property along Leak Hall Crescent	Medium Risk	High	Moderate Adverse Effect
R02	Residential property along Leak Hall Crescent	Medium Risk	High	Moderate Adverse Effect
R03	Residential property along Leak Hall Crescent	Medium Risk	High	Moderate Adverse Effect
R04	Residential property along Leak Hall Crescent	Medium Risk	High	Moderate Adverse Effect
R05	Residential property along Leak Hall Crescent	Medium Risk	High	Moderate Adverse Effect
R06	Residential property along Leak Hall Road	Medium Risk	High	Moderate Adverse Effect
R07	Residential property along Springhead Gardens	Medium Risk	High	Moderate Adverse Effect
R08	Residential property along Springhead Gardens	Medium Risk	High	Moderate Adverse Effect
R09	Residential property along Springhead Gardens	Medium Risk	High	Moderate Adverse Effect
R10	Residential property off A636 Wakefield Road	Negligible Risk	High	Negligible Effect
R11	Residential property off Cumberworth Lane	Low Risk	High	Slight Adverse Effect
R12	Residential property off Cumberworth Lane	Low Risk	High	Slight Adverse Effect
R13	Residential property off Cumberworth Lane	Low Risk	High	Slight Adverse Effect
R14	Residential property off Cumberworth Lane	Low Risk	High	Slight Adverse Effect
R15	Residential property off Leak Hall Lane	Negligible Risk	High	Negligible Effect

4.19 There is a *moderate adverse* risk of effect at receptors R01 to R06 and R09, a *slight* adverse risk at receptors R07, R08 and R11 to R14, with a *negligible* risk of effect receptors R10 and R15.

Overall Significance of Dust Effects

4.20 The final stage of the risk assessment is to make an overall judgement as to the likely significance of effects.

4.21 The risk assessment has identified a *moderate adverse* risk of dust effects at several receptors. This assessment has not taken into account the effects of any particular mitigation measures. It is therefore judged that a range of mitigation measures will be required to ensure that the overall significance of dust effects from the ground stabilisation works associated with the proposed development is 'not significant'.

4.22 This risk assessment will inform the mitigation, management and monitoring sections of the DMP.

4.23 It is judged that with the implementation of the mitigation measures presented in the DMP, the residual risk will be 'not significant'.

4.24 It should be noted that the risk assessment includes a number of pessimistic assumptions, for example, around likely wind speeds and the magnitude of the dust sources. It should also be noted that the ground stabilisation works will be of temporary duration; this is in contrast to the IAQM minerals guidance (2016), which is designed for long-term operations such as quarries.

5 Dust Management Measures

5.1 Dust emissions should be adequately controlled through good process and site design, and subsequent good housekeeping, i.e. avoidance of dust generation. The control hierarchy has been based on:

- good operating and management practices to avoid emissions arising from activities;
- good process design to minimise emissions;
- abatement or control to reduce dust emissions, e.g. use of water sprays and bowsers; and
- disrupting the emission pathway to sensitive receptors, i.e. shielding receptors through the use of earth banks or vegetative screening (e.g. trees).

5.2 The IAQM guidance (2016) states "*the scale and nature of dust mitigation measures applied should be commensurate to the risk of dust impact from the site."* All sites are expected to apply 'good practice mitigation measures' to control dust.

5.3 The risk of impact of the ground stabilisation works associated with the proposed development on the amenity of residents without mitigation is assessed as significant; therefore, the application of the following mitigation measures is considered necessary and appropriate, such that the residual risk of impact is 'not significant'.

5.4 Operational dust management measures that accord with best practice are provided below, which will be combined with effective site management practices detailed within Section 6. Good practice mitigation measures have been identified through guidance (IAQM, 2016; 2024). The following good practice measures will be employed on-site:

Operating Vehicles/Machinery and Vehicle Movements (On and Off-site Transportation)

- Regular application of water, whether by bowser or by fixed sprays, in dry conditions;
- speed limit of 10 mph enforced;
- all necessary heavy-duty vehicles use wheel washer before leaving site;
- abrupt changes in direction avoided;
- all necessary on-site plant fitted with water hoses to suppress dust;
- even loading of vehicles to avoid spillages;
- use paved roads where practicable;
- all vehicles will have their engines switched off when stationary; and

- ensuring loads entering and leaving the site are covered.

Preparing and Maintaining the Site

- Erect solid screens or barriers around the site boundary that are at least as high as any stockpiles on site;
- enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing and barriers clean using wet methods;
- remove materials that have the potential to produce dust from site as soon as possible; and
- cover, seed, or fence stockpiles to prevent wind whipping.

Material and Soil Handling & Stockpiling

- Site stripping operations should be avoided during dry and windy conditions;
- ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use fixed sprays where required;
- clearance of any spillages to minimise accumulations of loose dry material;
- minimisation of drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;
- avoidance of double handling of material where practicable;
- protection of material from wind using existing features (where possible);
- dampening material using sprays;
- storage of material in three sided bays were possible;
- ensuring vehicles do not track over the base of stockpiles;
- spraying exposed surfaces of mounds regularly to maintain surface moisture (unless mound surface has formed a crust after rainfall); and
- vegetate exposed surfaces, e.g. overburden mounds, with quick growing plants.

5.5 Dust mitigation is a dynamic process involving the review and regulation of the mitigation applied, as per the conditions on site. Such measures include restriction of some of the working areas, but may also include in extreme cases ceasing the site activities until the dust levels return to their normal levels, which is detailed further in Section 8.

6 Responsibilities and Records

Key Responsibilities

Site Manager

6.1 The day-to-day operations at the site will be the responsibility of the Site Manager, who will be responsible for ensuring that the dust management protocol set out in Section 5, and the dust monitoring protocol in Section 7 are adhered to. If the monitoring indicates that dust emissions are likely to have an impact on the local community, then further mitigation measures are required as set out in Section 8.

6.2 The name and contact details of the person(s) accountable (i.e. the Site Manager and/or Environmental Manager/Engineer) for dust issues will be displayed on the site boundary.

6.3 If any exceptional dust and/or air emissions occur, or any complaints are received, they will be investigated by the Site Manager or a delegated representative, who will record the complaint. They will then identify the cause, take appropriate measures to reduce emissions in a timely manner, and record the measures taken. This information will be made available to Kirklees Council upon request. Section 5 details specific measures that will be taken to address dust issues, and the Appendices to this DMP provide various forms to be used to record events.

All Staff

6.4 All staff will be responsible for minimising any dust emissions from the site.

6.5 All operational staff will be trained in their responsibilities with regard to dust control at the site. The Site Manager will maintain a statement of training requirements for each operational position, and a record will be kept detailing the training received by each operator.

6.6 All site personnel will be responsible for reporting dust problems to the Site Manager immediately, on an on-going basis.

Managing the DMP

6.7 The Site Manager will review the DMP at regular intervals, in light of any complaints or issues that have been identified during the previous year. The following issues will be considered during the review:

- effectiveness of mitigation measures employed;
- responses to any updates to measures that are now considered best practice;
- additional mitigation measures implemented since the last review;
- complaints received in relation to dust impacts at off-site receptors;

- any dust events recorded since the last review;
- the effectiveness of the visual monitoring scheme;
- results of the quantitative monitoring scheme (if applicable); and
- the effectiveness of personnel training on dust awareness.

6.8 Should any control measures be shown to be failing, or should a need for further control measures be identified, new controls will be agreed and implemented in an updated DMP.

7 Monitoring Scheme

Visual Inspections

7.1 A daily visual inspection of the site will be carried out by the Site Manager, or an appropriately trained operator. The inspection will consist of a walk around the edge of the working area with observations made of any dust emissions. Particular attention will be paid to any areas where there is a risk of dust emissions, especially the site entrance. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills close to the site boundary. Inspection results will be recorded and the log (Appendices A2 and A4) will be made available to Kirklees Council when requested. If significant dust is identified beyond the site boundary, a Dust Event Form will be completed (see Appendix A5), and investigation/remedial action will be taken, as outlined in Section 8. The Site Manager will review Dust Event Forms regularly to ensure that any necessary actions have been implemented, and to identify problem areas where additional mitigation against further dust emissions may be necessary.

7.2 During adverse meteorological conditions such as during high wind speeds or prolonged period of dry weather, additional inspections will be carried out downwind of any dust generating activities, particularly to the east of the site.

Meteorology

7.3 The wind speed and direction will be monitored by the Site Manager in order to alert staff to potential adverse conditions that may trigger the additional mitigation measures outlined in Section 8. This will be either by direct observation or from published weather forecasts. Meteorological conditions at the time of any significant dust emissions will be recorded in the Dust Event Form.

8 Emergency Responses

8.1 Adverse weather is the major risk factor that has been identified that may require contingency action in order to prevent dust emissions such as long periods of dry weather and/or high wind speeds. The daily inspection carried out by the Site Manager, or an appropriately trained operator, will allow observations on the meteorological conditions and dust emissions to be made (see Section 7.1).

8.2 In the event that the following combination of conditions is experienced on site, additional mitigation measures will be employed (see Figure 6):

- wind speeds of 5 or above on the Beaufort wind scale, i.e. a fresh breeze (9-11 m/s) predicted on a weather forecast;
- winds predominantly blowing from the southwest towards the sensitive receptors along Leak Hall Crescent;
- observations of dust due to site operations extending beyond the site boundary.

8.3 The additional measures will include:

- immediate identification of the source of the dust;
- the liberal use of water suppression;
- further reduction of drop heights;
- covering or sheeting sources of unacceptable dust emissions; and
- use of short-term weather forecasts to plan future operations.

8.4 In the event that unacceptable dust emissions continue, despite the additional mitigation measures, consideration should be given to modifying site operations, in liaison with the regulator, and temporarily suspending site operations until the issue can be resolved.

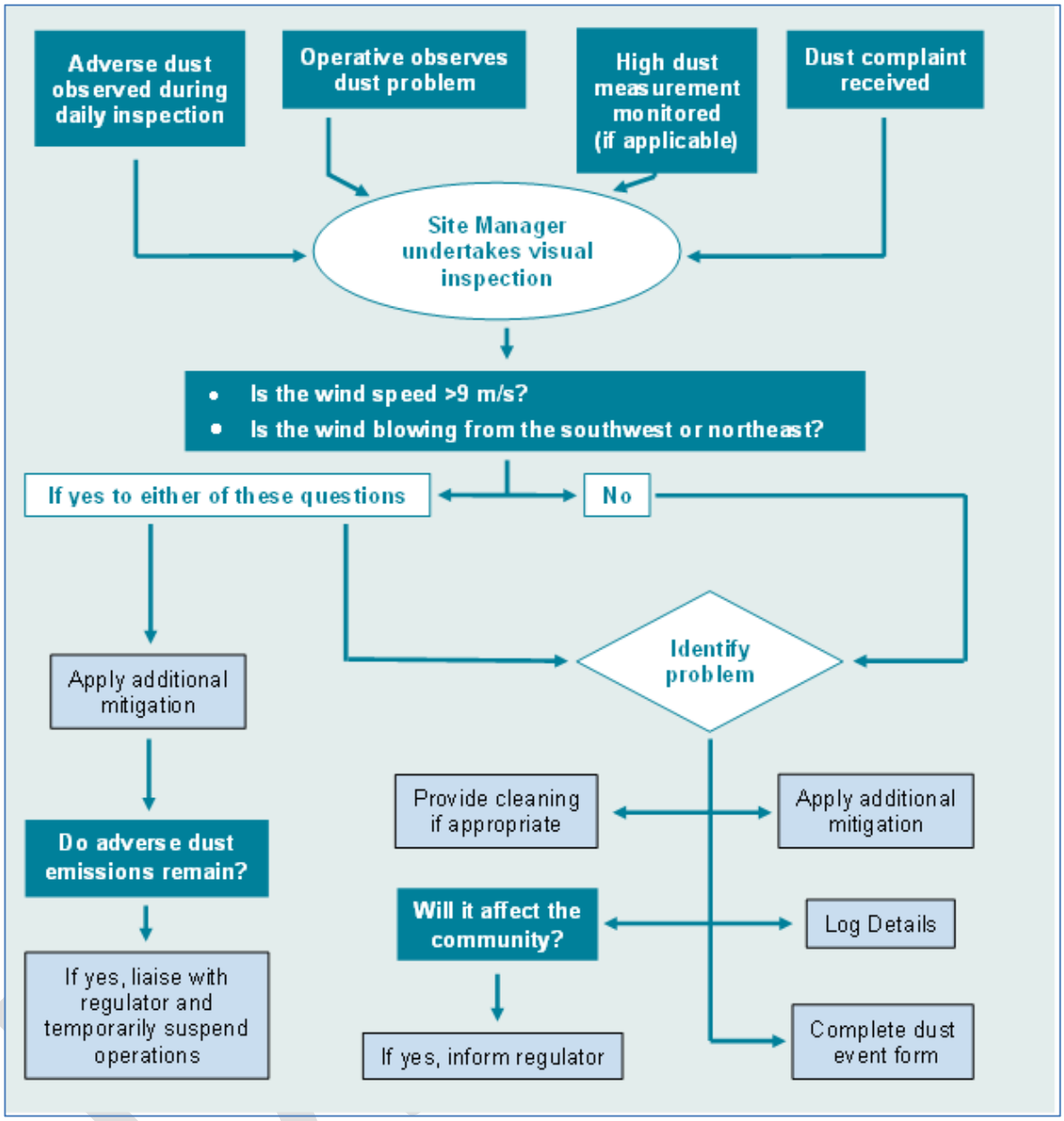

Figure 6: Dust Event Response Flowchart

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10 Glossary

AQC	Air Quality Consultants
Defra	Department for Environment, Food and Rural Affairs
DMP	Dust Management Plan
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
IAQM	Institute of Air Quality Management
mph	miles per hour
µg/m^3	Microgrammes per cubic metre
NRMM	Non-Road Mobile Machinery
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal

11 Appendices

A1 Mineral Dust Assessment Procedure

A1.1 The IAQM's *Guidance on the Assessment of Mineral Dust Impacts for Planning* (2016) provides criteria to screen the need for a detailed assessed, and if required a suggested approach to the detailed assessment of mineral developments.

Screening Assessment

A1.2 The guidance sets out screening criteria that can be used to determine whether a detailed air quality assessment is required.

A1.3 If there are no relevant receptors within 1 km of the operations, then a detailed dust assessment can be screened out. In such a case, it is considered that irrespective of the nature, size and operation of the site, the risk of an impact is likely to be "negligible" and any resulting effects are likely to be 'not significant'.

A1.4 In cases whereby receptors are located between 400 m, or 250 m (depending on the rock type) and 1 km of operations, it would normally be assumed that a detailed disamenity dust impact assessment is not required. However, the decision on whether to assess should be made and justified on a site-specific basis by a suitably experienced air quality professional taking into account local factors.

A1.5 If there are relevant human and / or ecological receptors within 250 m or 400 m (depending on the rock type) then a disamenity dust impact assessment will almost always be required. This step is deliberately chosen to be conservative (and will in practice result in assessments being required for most minerals development schemes).

Detailed Assessment

A1.6 If a detailed assessment is required the guidance describes the assessment approach in three steps, which are described in detail in the sections below.

Table A1.1: Detailed Assessment Steps

Step	Action	Consideration
Step 1	Describe Site Characteristics and Baseline Conditions	Such as extent of site boundary, operations, mineral type, production rate, working method, scale and duration of works, consideration of existing baseline conditions and dust sources
Step 2	Estimate Dust Risk	Consideration of pathway effectiveness and residual source emissions
Step 3	Estimate Likely Magnitude of Effect	Consideration of dust impact risk and receptor sensitivity

Step 2

Determination of Residual Source Emissions

A1.7 The residual source emission is determined considering site characteristics and the potential for emissions from each source, taking in account designed in mitigation measures.

A1.8 As stated within the guidance the following factors should be considered;

- the activities being undertaken (blasting, crushing, screening, methods of handling and storage etc.);
- the types and properties of the materials involved;
- the size of the site and, specifically, the area of land being worked (and hence the quantities of materials involved and the number of vehicles and plant etc.);
- the durations and frequencies of the activities;
- the likely effectiveness of the dust control measures incorporated into the design of the submitted development scheme, including design features, management controls (ideally formalised within a Dust Management Plan) and, where appropriate, engineering controls;
- other mitigation measures applied to reduce or eliminate dust; and
- the meteorological conditions that can promote or inhibit the raising of dust at the source (high winds and rainfall, respectively).

A1.9 The guidance provides examples illustrating factors that need to be considered when making a professional judgement as to the residual source emissions.

Table A1.2: Factors to Consider When Determining Residual Source Emissions

Source Activity	Factor Consideration
Site Preparation/Restoration	Size of working area
	Height of bunds
	Volume of Material movement
	No. of heavy plant
	Whether bunds are seeded or sealed
	Potential of material for dust generation
Mineral Extraction	Size of working area
	Extraction method (low or high energy)
	Potential of material for dust generation

Source Activity	Factor Consideration
Materials Handling	No. of heavy plant
	Type of surface (paved or unconsolidated)
	Distance of activities to site boundary (or in void)
	Potential of material for dust generation
On-site Transportation	Transport method (un-consolidated haul road or use of conveyors)
	Type of haul road (unpaved or paved)
	Dust potential of road surface
	No. of heavy vehicle movements
	Length of haul roads
	Vehicle speed (controlled or uncontrolled)
Mineral Processing	Potential of raw material for dust generation
	Potential of end product for dust generation
	Complexity of process
	Volume of material processed
Stockpiles/Exposed Surfaces	Length of stockpile storage
	Frequency of material transfer
	Potential of raw material for dust generation
	Type of surface (paved or unconsolidated)
	Distance of stockpiles to site boundary (or in void)
	Area of exposed surfaces
	Wind speed and dust threshold
Off-site Transportation	No. of HGV movements
	Type of Access Road (unpaved or paved)
	Vehicle cleaning facility provision
	Length of access road

Estimation of Pathway Effectiveness

A1.10 The effectiveness of pathway is determined based on site-specific factors considering the distance and direction of each receptor relative to the prevailing wind direction. The frequencies of wind in each direction are calculated based on meteorological data for five years from a nearby meteorological station. The frequency of exposure of receptors to moderate to high winds from the direction of the source is categorised as follows in Table A1.3 and the distance of the receptor to

source as detailed within Table A1.4. Consideration of topography and physical features is also required.

Table A1.3: Categorisation of Frequency of Potentially Dusty Winds

Frequency Category	Criteria
Infrequent	Frequency of winds (>5m/s) from the direction of the dust source on all days are less than 5%
Moderately Frequent	The frequency of winds (>5m/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 A1.4 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

A1.11 The resulting pathway effectiveness for each receptor is identified using the criteria in Table A1.3 and Table A1.4, as shown in Table A1.5.

Table A1.5: 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

A1.12 The risk ratings for residual source emissions and pathway effectiveness (for each receptor) identified using the criteria in Table A1.2 and Table A1.5 are then combined using the matrix shown in Table A1.6 to estimate an overall risk of dust impact at each specific receptor location.

Table A1.6: 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

Step 3

A1.13 The next stage of the risk assessment is to identify the potential dust effect at each receptor location. This is done using the matrix presented in Table A1.7, which combines the overall dust impact risk descriptor for each receptor with the receptor sensitivity.

Table A1.7: Assessment of Dust Magnitude of 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

A1.14 As a final stage of assessment, an overall significance of dust effects is determined, based on professional judgment and taking into account the significance of effect at each specific receptor location for each activity.

A2 Professional Experience

Martin Peirce, BSc (Hons), MSc, MIEncSci, MIAQM

Mr Peirce is an Associate Director with AQC and has some thirty years' experience in environmental modelling and assessment, most relating to air quality and carbon and greenhouse gases (GHGs). He has extensive experience in the calculation of emissions to air and compiling emission inventories, for both local air quality assessments and carbon footprinting. For air quality, he also has extensive expertise in modelling the atmospheric dispersion of pollutants for comparison against regulatory limits and for assessment of health and environmental impacts. He has prepared assessments in support of Environmental Impact Assessments (EIA), permit applications and planning applications (under both Town and Country Planning Act (TCPA) and Development Consent Order (DCO) regimes), and has acted as expert witness. He has particular experience in modelling aviation and transport sources, non-road mobile machinery, construction and industrial sources.

Samantha Sarlo, MChem (Hons) AMIEnvSc AMIAQM

Mrs Sarlo is a Senior Consultant with AQC, having joined the company in November 2017. She has carried out assessments of air quality impacts for a range of projects, including EIA schemes, residential, commercial and mixed-use schemes, energy centres and power generation schemes. Mrs Sarlo has also prepared construction dust risk assessments, Air Quality Neutral assessments, local authority Annual Status Reports (ASRs) and odour assessments. She has carried out numerous passive nitrogen dioxide monitoring surveys, and construction dust monitoring, at sites across Greater London.

A3 Daily Inspection Checklist

Land at Cliff Hill, Denby Dale
Daily Inspection Checklist

Week Commencing:								
Inspected Items	Frequency	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Person completing the checklist	*Initials*							
Dust being controlled correctly by personnel	Daily							
Visual inspection of mud/debris on access routes	Daily							
Visual inspection of dust soiling on local streets, cars and windowsills	Daily							
Mitigation of dust from vehicle movements across surfaces is effective	Daily							
Vehicles exiting sites are sheeted	Daily							
Wheelwash being used and operating satisfactorily	Daily							
Wind direction	Daily							
Wind speed	Daily							
Weather forecast	Daily							

A4 Daily Inspection Notes

Land at Cliff Hill, Denby Dale
Daily Inspection Notes

Week Commencing:
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Other Comments

A5 Dust Event Form

Land at Cliff Hill, Denby Dale
Dust Event Form

Sheet No.:
Time & date form completed:
Date, time and duration of event:
Location of dust:
Weather conditions (i.e. dry, rain, fog, snow):
Cloud cover (Cloud height (low, high, very high): none, slight, partial complete):
Wind strength (light, steady, strong, gusting):
Wind direction (from/to):
Description of dust event, dust (i.e. colour, particle size) & any other comments:
On-site activities at the time the dust emission occurred:
Has a previous event occurred relating to this source:
Any other relevant information:
Any upwind dust?
Operating conditions at the time the dust emission occurred:
Any remedial actions taken or to be taken:
Form completed by (name & signature):

A6 Dust Complaint Form

Land at Cliff Hill, Denby Dale
Dust Complaint Form

Sheet No.:	
Date:	Time & date of complaint:
Name and address of complainant:	
Date, time and duration of offending dust:	
Location of dust, if not at the above address:	
Weather conditions (i.e. dry, rain, fog, snow):	
Cloud cover (Cloud height (low, high, very high): none, slight, partial complete):	
Wind strength (light, steady, strong, gusting):	
Wind direction (from/to):	
Complainant's description of dust & any other comments (i.e. colour, particle size):	
Has complainant previously made complaint relating to the site:	
Any other relevant information:	
Any upwind dust?	
On-site activities at the time the dust emission occurred:	
Operating conditions at the time the dust emission occurred:	
Any remedial actions taken or to be taken:	
Form completed by (name & signature):	