Project

Station Road, Buxton
Air Quality Assessment

Prepared for

McCarthy & Stone Retirement Lifestyles Ltd
and Derbyshire Community Health Services
NHS Foundation Trust

By

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Summary

SRL Technical Services Limited has been commissioned by McCarthy & Stone Retirement Lifestyles Ltd and Derbyshire Community Health Services NHS Foundation Trust to prepare an air quality assessment for the proposed development of land off Station Road, Buxton, hereafter referred to as the 'Proposed Development' or 'Site'. The proposals include the construction of a residential care home facility and an NHS Health Centre, incorporating office space for High Peak Borough Council (HPBC), and with associated car parking.

The Site lies within the HPBC administrative area and no Air Quality Management Areas (AQMA) have been declared by HPBC.

There is a risk that additional traffic generated by the Proposed Development will impact on air quality at existing sensitive receptors.

Additionally, due to the location of the Site close to busy main roads and the entrance to Buxton Station, there is a risk that future residents and users of the Proposed Development will be exposed to elevated pollutant concentrations.

This report considers the potential air quality impacts associated with both the construction and operation of the Proposed Development. Construction phase impacts can be effectively managed through the implementation of best practice mitigation measures. Appropriate measures are recommended based on the identified level of risk.

The impact of traffic emissions generated by the Proposed Development once operational on local air quality has been assessed and found to be slight adverse. Additionally, air quality for future residents and users of the Proposed Development has been considered and found to be acceptable.

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Contents

1.0 Introduction

The potential air quality impacts relating to the Proposed Development of land off Station Road, Buxton (**Figure 1**) have been assessed. This report sets out the findings.

The potential air quality impacts associated with the Proposed Development relate to:

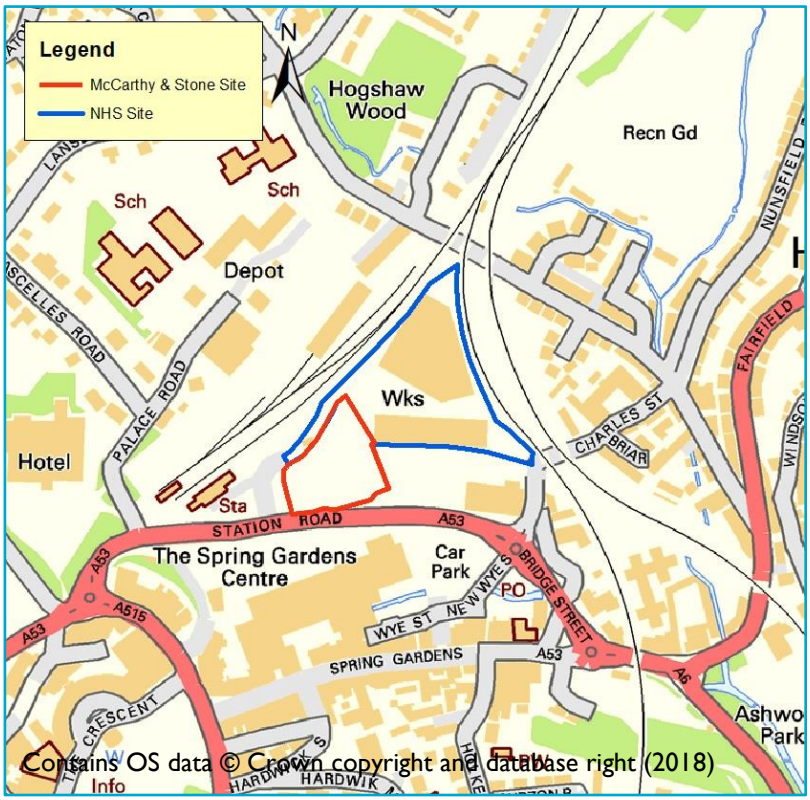
- dust and particulate matter generated by construction activities; and
- increases in concentrations of NO_2 and particulate matter (PM_{10} and $PM_{2.5}$) due to emissions generated by the Proposed Development once operational.

The potential exposure of future residents and users of the Site to poor air quality has also been considered.

This report looks at the existing air quality conditions around the Site, the potential impacts on local air quality at existing sensitive receptors, exposure of future residents and users of the Site to poor air quality, and the likelihood of significant impacts. Mitigation measures are recommended where the assessment identifies potentially adverse effects.

The assessment takes account of relevant local and national policy and guidance. A glossary of terms used in this report is provided in **Appendix A**.

Figure 1 - Site Location



2.0 Relevant Policy and Guidance

The Air Quality Strategy

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland[1] sets out air quality objectives (**Appendix B**) and policy options to improve air quality in the UK. The main aim of the Strategy is to ensure that ambient air quality is of an acceptable level to protect human health and the environment. It takes account of the Limit Values set out in EU legislation.

Local Air Quality Management (LAQM)

The Environment Act 1995 introduced the LAQM system, whereby local authorities have a duty to review and assess air quality within their areas against the air quality objectives defined in the Air Quality Strategy. Where exceedances of the objectives are identified, the authority must then declare an Air Quality Management Area (AQMA) and define the measures which will be implemented to improve air quality.

National Planning Policy Framework

The National Planning Policy Framework (2012)[2] sets out the Government's planning policies for England and outlines how they are expected to be applied to achieve the Government's aim of sustainable development. The NPPF states that:

"*To prevent unacceptable risks from pollution….. planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account.*"

The High Peak Adopted Local Plan 2016

The High Peak Adopted Local Plan[3] was published in April 2016 and sets out the Council's vision and strategy for development within the borough until 2031. Included in the Local Plan is Policy EQ10 - Pollution Control and Unstable Land, which states:

"*The Council will protect people and the environment from unsafe, unhealthy and polluted environments.*

This will be achieved by:

- *Ensuring developments avoid potential adverse effects and only permitting developments that are deemed (individually or cumulatively) to result in the following types of pollution if any remaining potential adverse effects are mitigated to an acceptable level by other environmental controls or measures included in the proposals. This*

[1] Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2)

[2] Department for Communities and Local Government (2012). National Planning Policy Framework.

[3] High Peak Borough Council (2016) The High Peak Adopted Local Plan 2016

may be achieved by the imposition of planning conditions or through a planning obligation. The Council will not permit any proposal that has an adverse effect on:

- *Air pollution (including odours or particulate emissions).*".

Guidance

The following guidance documents have also been used where appropriate, in this assessment:

- Local Air Quality Management Technical Guidance (LAQM.TG(16))[4]
- Land-Use Planning and Development Control: Planning for Air Quality. V1.2[5]
- Guidance on the Assessment of Dust from Demolition and Construction[6]
- National Planning Practice Guidance - Air Quality[7]

[4] Defra (2016). Part IV of the Environment Act 1995 Environment (Northern Ireland) Order 2002 Part III Local Air Quality Management Technical Guidance (TG16)

[5] Environmental Protection UK / Institute of Air Quality Management (2017).

[6] Institute of Air Quality Management (2014).

[7] Department of Communities and Local Government (DCLG) (2014).

3.0 Assessment

3.1 Existing Conditions

Existing air quality conditions near to the Site have been defined based on a review of the following sources of data:

- HPBC's Review and Assessment reports and monitoring data;
- Defra's Local Air Quality Management (LAQM) Support Pages, including background maps;
- Environment Agency 'Whats In My Backyard' tool; and
- Maps and plans of the Site and surrounding area.

HPBC have not declared any AQMAs in their administrative area.

A review of the data provided by the Environment Agency indicates that there are no industrial pollution sources in the immediate vicinity of the Site that will influence the local air quality; the main influence is emissions from road transport using the local road network.

Table 1 summarises the background pollutant concentrations of NO_2, PM_{10} and $PM_{2.5}$ used in the assessment. Background concentrations of PM_{10} and $PM_{2.5}$ have been taken from the most recent maps provided by Defra (released November 2017).

HPBC monitor urban background NO_2 concentrations at site HP13 on Granby Road. A comparison of the measured concentration to the value provided for the appropriate grid square of Defra's background map indicates that the maps are underestimating background NO_2 concentrations. A ratio was therefore determined (**Appendix D**) and was applied to the Defra background NO_2 concentrations to provide more accurate background concentrations for use in the assessment.

In each assessment year, the annual mean background concentrations are well below the relevant objectives.

Table 1: Background Pollutant Concentrations (µg/m^3)

Grid Square	NO_2		PM_{10}		$PM_{2.5}$	
	2016	2020	2016	2020	2016	2020
405500, 373500	14.7	12.5	12.8	12.5	8.5	8.1
406500, 373500	15.8	13.4	13.5	13.1	8.8	8.1

HPBC monitor concentrations of NO_2 using diffusion tubes at a number of locations within their administrative area, the closest of which is located approximately 75m west of the Site. Monitoring data for this location for 2016 is set out in **Table 2**.

Table 2: Measured Annual Mean NO_2 Concentration (µg/m^3)

Monitoring Site	Site Type	2016
HP19	Roadside	41.0

Data provided by HPBC.

The measured concentration at HP19 in 2016 marginally exceeded the annual mean NO_2 objective of 40µg/m^3. There is insufficient data available to derive a trend in concentrations (minimum five years data required).

HPBC do not monitor PM_{10} or $PM_{2.5}$ concentrations.

3.2 Construction Impacts

During the construction phase, activities may generate dust and particulate matter, as well as exhaust emissions from construction vehicles and plant, which could result in complaints of nuisance and human health effects.

The likely level of risk has therefore been assessed following guidance published by the Institute of Air Quality Management (IAQM). The assessment considers the nature and scale of the activities of the construction activities and the sensitivity of the surrounding area. Mitigation measures proportionate to the level of risk identified are then set out.

Additionally, exhaust emissions from construction vehicles and plant may have an impact on local air quality adjacent to the routes used by these vehicles to access the Site and near the Site itself. As precise information on the number of vehicles and plant associated with each part of the construction phase is not yet known, a qualitative assessment of their impact on local air quality has been done using professional judgement and by considering the following:

- The likely number and type of construction traffic and plant;
- The number and proximity of sensitive receptors to the Site;
- The likely duration of the construction period; and
- The nature of the activities undertaken.

The IAQM assessment methodology has been used to determine the potential dust emission magnitude for the following four different dust and PM_{10} sources: demolition; earthworks; construction; and, trackout.

For this assessment, the construction phase of both the McCarthy & Stone Retirement Lifestyle development and the NHS Health Centre have been considered cumulatively to provide a worst-case assessment of the potential risks from construction phase activities.

Demolition

- The Site has already been cleared and no demolition is required; this has not been considered further.

Earthworks

- The total area of the Site is larger than 10,000m^2, therefore, the potential dust emission magnitude is judged to be **large** for earthwork activities.

Construction

- The total volume of buildings to be constructed on the Site is estimated to be between 25,000m^3 - 100,000m^3, therefore, the potential dust emission magnitude is judged to be **medium** for construction activities.

Trackout

- Information regarding the number of Heavy Duty Vehicle (HDV) movements during the construction phase was not available at the time of assessment and therefore, an estimate has been made based on the size of the Site, volume of buildings to be constructed and professional judgement. It is anticipated that there will be between 10 and 50 HDV outward movements per day over an unpaved road length of less than 50m. Therefore, it is judged that the potential dust emission magnitude is **medium** for trackout.

Sensitivity of the Study Area

A windrose generated using the meteorological data used for the dispersion modelling is provided in **Appendix C**. This shows that the prevailing wind direction is from the southwest, with a significant easterly component. Therefore, receptors located to the northeast and west of the Site are more likely to be affected by dust and particulate matter emitted and re-suspended during the construction phase.

Most dust will be deposited in the area immediately surrounding the source. The area surrounding the Site is a mix of residential and retail, with residential dwellings to the north, east and southeast of the Site and retail premises to the south. Buxton Station is located to the west of the Site. There are approximately 20 residential dwellings located within 20 - 50m of the Site boundary, along with the car park for Buxton Station. Residential receptors and Buxton Station car park are considered to be of high sensitivity to dust soiling whilst the residential receptors are also high sensitivity to human health. The retail premises are medium sensitivity and the short-term car parks associated with the retail premises are low sensitivity.

Using the IAQM guidance, the overall sensitivity of the local area is:

- Medium for dust soiling due to the number of residential properties and long term car parks within 50m of the Site; and
- Low sensitivity to human health due to the low background PM_{10} concentrations.

There are no designated ecological sites within 50m of the Site boundary nor within 50m of roads potentially affected by trackout so an assessment of the impact of the construction phase on ecological sites is not required.

Impact Assessment

The predicted dust emission magnitude has been combined with the defined sensitivity of the area to determine the risk of impacts during the construction phase, prior to mitigation. **Table 3** provides a summary of the risk of construction phase impacts for the Proposed Development. The risk category identified for each construction activity has been used to determine the level of mitigation required.

Table 3: Dust Risk Summary to Define Site Specific Mitigation

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	Medium Risk	Medium Risk	Low Risk
Human Health	N/A	Low Risk	Low Risk	Low Risk

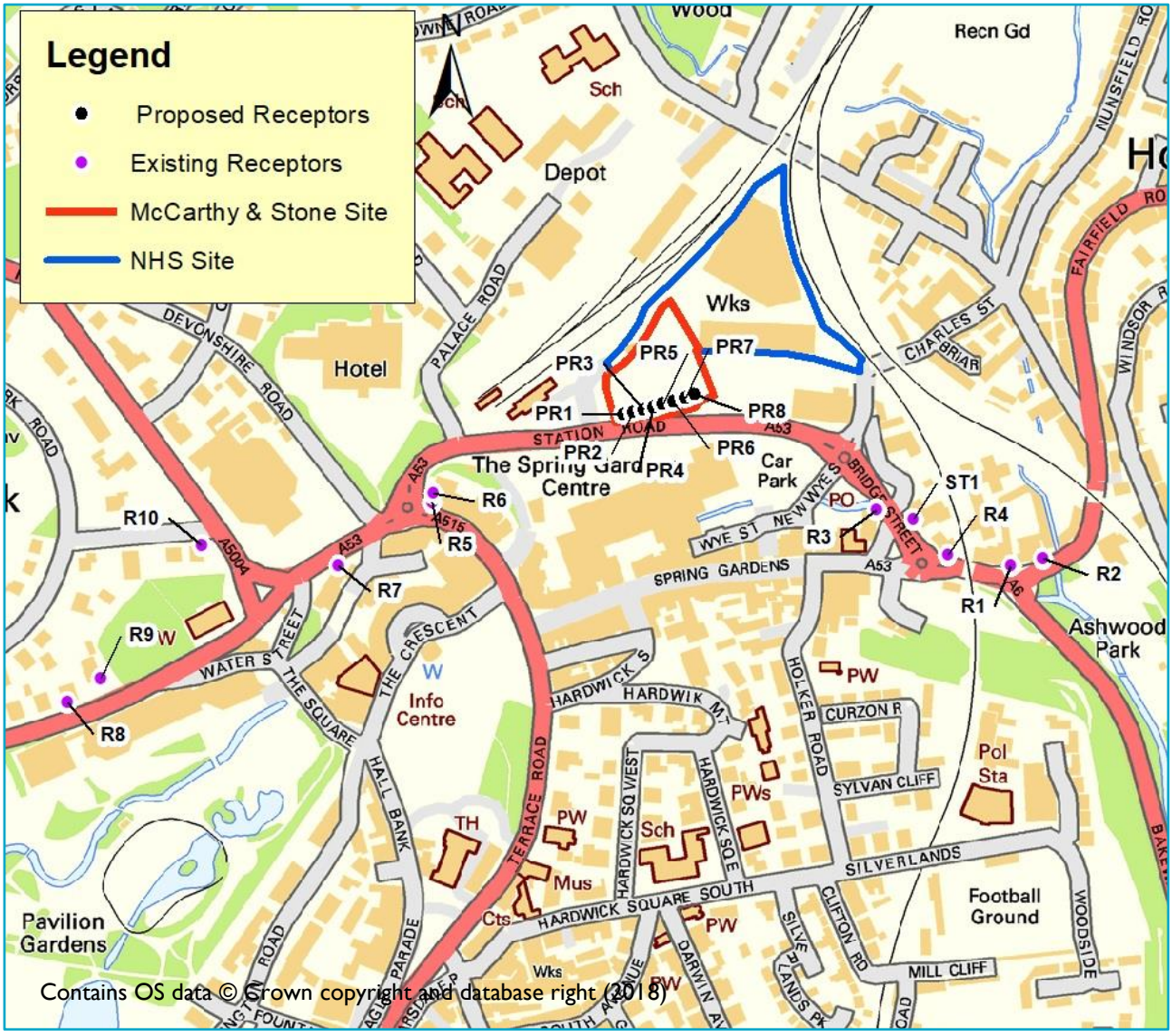
Construction Vehicles and Plant

It is anticipated that the Site will generate fewer than 100 HDVs per day. Outside of an AQMA, the EPUK / IAQM guidance defines a threshold of 100 HDVs, below which '*the impact can be considered to have an insignificant effect*' on local air quality. Based on this, the impacts are judged to be **negligible**.

3.3 Operational Road Traffic Impacts

During the operational phase, local air quality could be impacted by emissions from road traffic generated by the Proposed Development. The impact of emissions associated with the Proposed Development on air quality at existing sensitive receptors locations has been assessed using the atmospheric dispersion model ADMS Roads (version 4.1.1.0). Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted at a number of existing receptors close to roads where the Proposed Development will bring about a significant increase in traffic. Additionally, concentrations were predicted at a number of proposed receptors within the Site to investigate air quality for future users. These locations are shown in **Figure 2** and described in **Appendix D**.

Figure 2: Receptor Locations



Three assessment scenarios have been considered:

- 2016 - Model verification, and Baseline;
- 2020 - Future Baseline; and
- 2020 - Future year with entire development in place.

Further details of the methodology used in the assessment are set out in **Appendix D**. Traffic data and emissions used in the assessment are set out in **Appendix E**. Full results of the assessment are detailed in **Appendix F** and are summarised below.

Annual and Hourly Mean NO_2 Concentrations

The results of the impact assessment show that the annual mean NO_2 objective of 40µg/m³ is exceeded at four receptor locations in the 2016 Baseline scenario, and two receptors in both the 2020 Baseline and With Development scenario. The highest annual mean NO_2 concentrations were predicted in each scenario at R6, representing the residential property at the rear of 9 Station Road, close to the roundabout junction of the A53 and A515. An annual mean NO_2 concentration of 55.7µg/m³ was predicted at this receptor in the 2016 Baseline scenario, whilst concentrations of 44.9µg/m³ and 46.0µg/m³ were predicted in the 2020 Baseline and With Development scenarios respectively.

The change in annual mean NO_2 concentration at R6 is equal to 3% of the annual mean objective. The annual mean NO_2 concentration in the 2020 With Development scenario at R6 is 115% of the annual mean NO_2 objective and, therefore, using the significance criteria set out in **Appendix D Table D4**, the impact of the Proposed Development at this receptor is substantial adverse.

The greatest predicted change in annual mean NO_2 concentrations as a result of additional traffic emissions associated with the Proposed Development was 1.4µg/m³ at R7, which is equal to 3% of the annual mean objective. R7 is located at the ground floor of the George Mansions, adjacent to the A53. The annual mean NO_2 concentration predicted at this receptor was 34.4µg/m³ and 35.8µg/m³ in the 2020 Baseline and With Development scenarios respectively and, therefore, using the significance criteria set out in **Appendix D Table D4,** the impact of the Proposed Development on annual mean NO_2 concentrations is at this receptor is slight adverse.

The results of the modelling predicted two substantial adverse, one slight adverse and eight negligible impacts of the Proposed Development on annual mean NO_2 concentrations. The Proposed Development does not cause any new exceedances of the annual mean NO_2 objective.

The predicted exceedances of the annual mean objective are inconsistent with the findings of HPBC's Review and Assessment work; to date, no AQMAs have been declared. As a worst-case assessment was carried out (assuming the development is fully operational in 2020) and the results of the assessment are not consistent with HPBC's findings, the overall impact of the Proposed Development on annual mean NO_2 concentrations is judged to be slight adverse.

As all predicted annual mean concentrations are well below 60µg/m³, based on the relationship between hourly and annual mean NO_2 concentrations[8], it is unlikely that the hourly mean NO_2 objective will be exceeded.

Therefore, in line with the significance criteria set out in **Appendix D Table D4**, the impact of the Proposed Development on hourly mean NO_2 concentrations is judged to be **negligible**.

[8] The hourly mean objective is unlikely to be exceeded where the annual mean NO_2 concentration is less than 60µg/m³.

Annual and Daily Mean PM_{10} Concentrations

The annual and daily mean PM_{10} objectives are predicted to be met at all existing receptors in all scenarios assessed, with the highest concentrations predicted at R2, representing 3 Fairfield Road. The annual mean PM_{10} concentration at this receptor was 19.8µg/m³ in the 2016 Baseline scenario and 19.2µg/m³ and 19.3µg/m³ in the 2020 Baseline and With Development scenarios respectively. The highest number of days exceeding 50µg/m³ was three days in the 2016 Baseline scenario, two days in the 2020 Baseline scenario and three days in the 2020 With Development scenario.

The predicted change in annual mean PM_{10} concentrations as a result of the Proposed Development was less than 0.5% of the relevant objective at all but three receptors. At these three receptors, the predicted change in concentrations was 1% of the annual mean PM_{10} objective. All predicted concentrations were less than 50% of the annual mean PM_{10} objective. Therefore, using the significance criteria in **Appendix D Table D4**, the impact of the Proposed Development on annual PM_{10} concentrations is **negligible**.

There greatest change in the number of days where PM_{10} concentrations exceed 50µg/m³ was one extra day at R2 however, the greatest number of days exceeding 50µg/m³ was three, which is considerably less than the 35 days allowed by the objective. Therefore, the impact of the development on daily mean PM_{10} concentrations is judged to be **negligible**.

Annual Mean $PM_{2.5}$ Concentrations

The predicted annual mean $PM_{2.5}$ concentrations were below the objective of 25µg/m³ at all existing receptors in all scenarios assessed. The highest annual mean $PM_{2.5}$ concentration was 12.6µg/m³ at R2 in the 2016 Baseline scenario and 11.8µg/m³ and 11.9µg/m³ in the 2020 Baseline and 2020 With Development scenarios respectively. The change in annual $PM_{2.5}$ concentrations at all receptors was less than 0.5% of the objective at all but three receptors where a change of 1% was predicted. At all receptors, the predicted annual mean $PM_{2.5}$ concentrations were less than 50% of the objective and therefore, using the significance criteria in **Appendix D Table D4,** the impact of the Proposed Development on annual mean $PM_{2.5}$ concentrations is **negligible**.

Proposed Receptors

The highest annual mean NO_2 concentration predicted at any of the receptors chosen to represent worst-case exposure within the Proposed Development was 31.6µg/m³ at receptor PR1, located closest to the junction of Station Road and the site access. All predicted annual mean NO_2 concentrations are below the objective. As all predicted annual mean concentrations are well below 60µg/m³, it is also unlikely that the hourly mean NO_2 objective will be exceeded within the Site.

The highest predicted annual mean PM_{10} concentration within the Site is 16.6µg/m³ at PR3 located adjacent to Station Road. The maximum number of days exceeding 50µg/m³ at any receptor is one day. The highest predicted $PM_{2.5}$ annual mean concentration within the Site is 10.4µg/m³ at PR1 and PR3.

The predicted concentrations are all well below the relevant objectives for each pollutant; air quality is therefore suitable for future users of the Proposed Development.

3.4 Railway Line Impacts

Diesel or coal fired stationary locomotives can give rise to elevated levels of sulphur dioxide (SO_2) close to the point of emission. Large numbers of moving diesel locomotives can give rise to high levels of NO_2 close to the track[9].

LAQM.TG16 outlines an approach to assess the potential for exceedance of the NO_2 and SO_2 objectives as a result of emissions from diesel and steam locomotives. Outdoor areas within 15 m of railway lines where trains may be stationary for 15 minutes or more may result in elevated sulphur dioxide concentrations. Residential properties within 30 m of railway lines where there are large numbers of diesel locomotive movements (identified in the guidance), and where backgrounds nitrogen dioxide concentrations are greater than 25 µg/m^3, may be at risk of elevated nitrogen dioxide concentrations. Only locations which meet these criteria require further assessment.

The railway lines adjacent to the Site are not identified in LAQM.TG16, and therefore there are unlikely to be any significant impacts from locomotives using these lines. No further assessment is required.

[9] Defra (2016). Part IV of the Environment Act 1995 Environment (Northern Ireland) Order 2002 Part III Local Air Quality Management Technical Guidance (TG16).

4.0 Mitigation

4.1 Construction Phase

The assessment of potential construction phase impacts has found that the Proposed Development is low to medium risk for dust soiling, and low risk for human health effects. **Appendix G** presents the mitigation measures recommended to reduce the risk of air quality impacts during the construction phase of the Proposed Development.

4.2 Operational Phase

The results of the impact assessment demonstrate that the Proposed Development will have a slight adverse impact on air quality at existing sensitive receptor locations. A Framework Travel Plan has been prepared by the project transport consultants, Curtins, which includes measures to encourage sustainable transport choices and, therefore, reduce emissions associated with the Proposed Development. Measures included in the Framework Travel Plan include:

- Staff Welcome Packs for staff working at the NHS Centre and HPBC office providing information on local public transport links, walking and cycling routes and personal travel initiatives to encourage sustainable travel.
- Clear signage on pedestrian routes within and adjacent to the Site to encourage walking.
- Provision of on-site shower and changing facilities for employees to encourage cycling.
- Promotion of the 'Walkit' website to assist journey planning on foot.
- Provision of on-site puncture repair kits for employees.
- Registration of all employees to the Cycle2Work scheme to encourage the uptake of cycling.
- Provision of local bus and train timetables to encourage public transport use.
- Travel Plan Co-ordinators for each element of the Proposed Development to be responsible for ensuring the Travel Plan measures are delivered and to monitor the use of the initiatives.

The Travel Plan aims to achieve a 10% reduction in single car occupancy trips to the Proposed Development as a total long-term model shift target.

With these measures in place, the impact of the Proposed Development on air quality has the potential to be reduced.

Air quality for future users of the Site will be acceptable and consequently, no specific mitigation is required.

5.0 Discussion

A qualitative assessment of the potential impacts on local air quality from construction activities has been carried out for the Proposed Development. This assessment identified that the Proposed Development is low to medium risk for dust soiling, and low risk for human health effects. Through good site practice and the implementation of suitable mitigation measures, these effects will be reduced; the residual effects are therefore considered to be negligible.

A quantitative assessment of the potential impacts on local air quality from the additional road traffic emissions associated with the operation of the Proposed Development has been performed. Overall, it is judged that the Proposed Development will have a slight adverse impact on local pollutant concentrations at existing receptors. Measures included in the Framework Travel Plan for the Site will help to reduce the impact of the Proposed Development on local air quality.

The results of the exposure assessment show that air quality for future users of the Proposed Development is compliant with relevant objectives and therefore no mitigation is required.

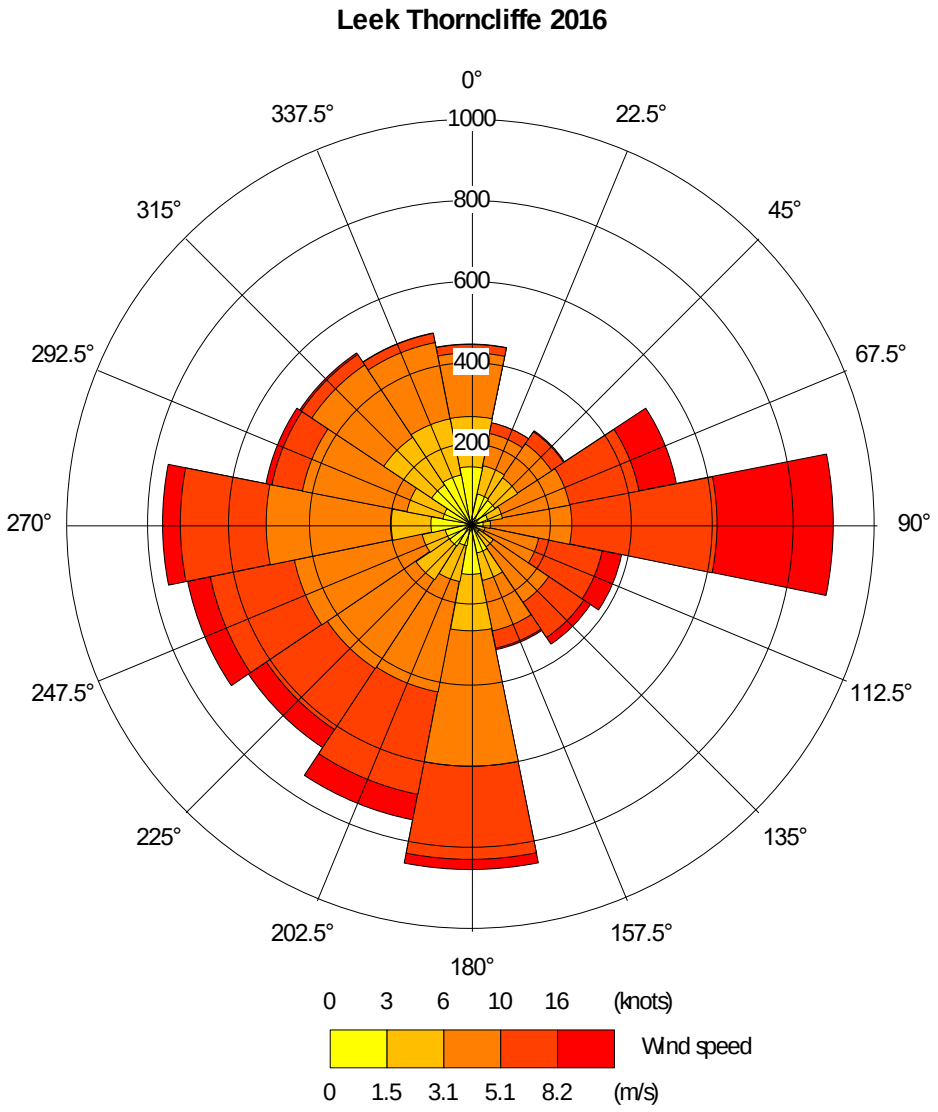
Appendix A - Glossary

Term	Definition
AADT	Annual Average Daily Traffic.
Annual mean	The average of the hourly mean concentrations measured for one year.
AQMA	Air Quality Management Area.
CURED	Calculator Using Realistic Emissions for Diesels.
Defra	Department for Environment, Food and Rural Affairs.
Exceedance	Where the concentration of a pollutant is greater than the appropriate air quality objective.
HDV / HGV	Heavy Duty Vehicle / Heavy Goods Vehicle.
HPBC	High Peak Borough Council.
LAQM	Local Air Quality Management.
NO_2	Nitrogen dioxide.
NO_x	Oxides of nitrogen.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.

Appendix B - Air Quality Objectives

Pollutant	Objective	Averaging Period
Nitrogen dioxide (NO_2)	40µg/m^3	Annual mean
	200µg/m^3 not to be exceeded more than 18 times per year	Hourly mean
Particulate Matter (PM_{10})	40µg/m^3	Annual mean
	50µg/m^3 not to be exceeded more than 35 times per year	Daily mean
Particulate Matter ($PM_{2.5}$)	25µg/m^3	Annual mean

Appendix C - Windrose



Appendix D - Assessment Methodology and Results

Pollutant concentrations have been predicted at a number of existing receptor locations using the dispersion model ADMS Roads (version 4.1.1.0) which is widely used for this type of modelling. The model allows concentrations to be predicted at user defined locations (receptors), taking account of local conditions (road geometry, width and height, and local meteorological conditions).

Meteorological data from Leek Thorncliffe for 2016 has been used in the model as this is considered to be most representative of conditions in the study area. Traffic data (AADT flows and percentage of HDVs) have been obtained from the project transport consultants, Curtins. Traffic speeds have been estimated from local speed limits taking account of the proximity to junctions. The following scenarios were modelled:

- 2016 - Model Verification and Existing Baseline;
- 2020 - Future Baseline; and
- 2020 - Future With Development (with entire development operational).

2016 is the most recent year for which a full year of monitoring and meteorological data are available. 2020 is the anticipated opening year of the McCarthy & Stone site. To provide a worst-case assessment it has been assumed that the NHS Health Centre and HPBC offices are also fully operational in 2020; these elements won't be operational until 2021.

D1. Vehicle Emission Factors

Vehicle emission factors for NOx, PM_{10} and $PM_{2.5}$ used in the assessment were taken from the most recent version of Defra's Emissions Factor Toolkit (EFT) (version 8) which predicts emissions from 2015 to 2030.

D2. Background Concentrations

The most recent version of Defra's background maps was used to obtain background concentrations for PM_{10} and $PM_{2.5}$ for the assessment. These provide estimated background concentrations in the UK at 1km x 1km grid resolution for years between 2015 and 2030.

A ratio of the measured background NO_2 concentration at HP13 and the predicted Defra background map concentration for the grid square in which it lies was used to calibrate the background concentrations used in the assessment. The data used to derive the ratio is set out in **Table D1**. This ratio has been applied to the mapped NO_2 background concentrations used in this assessment.

Table D1: Background Map Calibration

Measured Concentration at HP13	Defra Background Concentration for Grid Square 406500, 373500	Ratio
15.8	11.8	1.3

D3. Model verification

Whilst ADMS Roads is widely validated for use in this type of assessment, model verification for the area around the Site will not have been included. To determine model performance at a local level, a comparison of modelled results with monitored results in the study area was done in line with methodology specific in LAQM.TG(16). This process of verification aims to minimise modelling uncertainty by correcting modelled results by an adjustment factor to give greater confidence to the results.

The model was run to predict the 2016 annual mean road-NO_x contribution at the HP19 monitoring location. The model output of road-NO_x has been compared to the 2016 'measured' road-NO_x, which was determined from the nitrogen dioxide concentration measured at the monitoring location, utilising the NO_x from NO_2 calculator provided by Defra and the adjusted NO_2 background concentration.

Table D2: Verification Data

Monitoring Site	Measured Annual Mean NO_2 Concentration ($\mu g/m^3$)	Background NO_2 ($\mu g/m^3$)	Measured Road-NO_x ($\mu g/m^3$) (from NO_x:NO_2 Calculator)	Modelled Road-NO_x	Ratio
HP19	41.0	14.7	55.2	16.6	3.317

A road-NOx adjustment factor of **3.317** was determined as the ratio of the 'measured' road contribution and the model derived road contribution. This factor was then applied to the modelled road-NO_x concentration at each receptor, before conversion to NO_2 concentrations using the NO_x to NO_2 calculator provided by Defra, and the adjusted NO_2 background concentration.

As there are no PM_{10} or $PM_{2.5}$ monitoring locations within the study area, the predicted road-PM_{10} and road-$PM_{2.5}$ components have been adjusted using the road-NO_x factor before adding the appropriate background concentration. The number of days where PM_{10} concentrations were greater than $50\mu g/m^3$ was estimated using the relationship with the annual mean concentration described in LAQM.TG(16).

Processed results were compared against the relevant objectives set out in **Appendix B**. LAQM.TG(16) advises that, where road traffic is the predominant source, an exceedance of the 1 hour mean NO_2

objective is unlikely to occur where the annual mean concentration is below 60µg/m^3. This concentration has been used to screen whether the hourly mean NO_2 objective is likely to be achieved.

D4. Sensitive Receptors

Relevant sensitive receptor locations for the assessment are places where the public may be expected to be regularly present for the averaging period of the objective. Based on guidance in LAQM.TG(16), existing and proposed residential dwellings, and the proposed NHS Health Centre, are sensitive receptors to the annual mean and short term objectives; existing outdoor seating areas are relevant exposure for short term objectives only.

Several existing receptors were chosen at worst case locations adjacent to the local road network affected by traffic associated with the Proposed Development. Additionally, a number of proposed receptor locations were chosen within the Site representative of the McCarthy & Stone residential home which is located closest to Station Road. Receptors were modelled at heights representing exposure at ground or first floor, taking into account the height of the nearest road.

The receptors are summarised in **Table D3** and are shown in **Figure 2**.

Table D3: Receptor Locations

Receptor ID	Receptor Description	Height (m)	X	Y
R1	117 Spring Gardens	4.5	406331.8	373596.7
R2	3 Fairfield Road	2.0	406359.9	373604.9
R3	Flat above Thai Delight	4.0	406210.8	373647.8
R4	107 Spring Gardens	4.5	406274.6	373607.4
R5	9 Station Road	4.5	405814.1	373650.6
R6	Flat at back of 9 Station Road	1.0	405815.6	373659.1
R7	George Mansions	1.0	405734.2	373599.6
R8	22 St John's Road	2.0	405489.6	373476.1
R9	20 St John's Road	2.0	405519.8	373497.8
R10	1 Park Road	1.5	405609.5	373616.3
ST1	Outdoor seating at The Railway Public House	1.5	406244.3	373639.4
PR1	Proposed McCarthy & Stone Residential	1.5	405985.5	373733.3
PR2		1.5	405994.3	373735.1

Receptor ID	Receptor Description	Height (m)	X	Y
PR3		1.5	406003.1	373737.5
PR4		1.5	406012.1	373739.6
PR5		1.5	406020.8	373742
PR6		1.5	406030.2	373744.6
PR7		1.5	406040.7	373747.8
PR8		1.5	406049.7	373750.8

D5. Significance Criteria

The principles set out in the IAQM / EPUK guidance have been used within this assessment, along with professional judgement, to describe the impact of the Proposed Development on local air quality once operational. The guidance states that the judgement of significance should take into account relevant factors, including:

- The extent to which an objective or limit value is exceeded; and
- The influence and validity of any assumptions adopted when undertaking prediction of concentrations, including the extent to which any assumptions are worst-case.

Table D4 sets out the significance criteria used in this assessment.

Table D4: Impact Descriptors for Individual Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2 - 5	6 - 10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 - 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 - 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 - 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Significant	Substantial	Substantial

Notes:

The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as Negligible.

The table is only designed to be used with annual mean concentrations.

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2 - 5	6 - 10	>10
When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme' concentration for an increase. Where concentrations increase, the impact is described as adverse, and where it decreases as beneficial. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.				

D6. Limitations and Assumptions

There are uncertainties associated with both measured and predicted concentrations. The model relies on input data (including projected traffic flows), which also have uncertainties associated with them. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that the ADMS Roads model will not take into account.

To reduce the uncertainty associated with predicted concentrations, model verification has been carried out following guidance set out in LAQM.TG(16), which recommends the use of roadside monitoring for this process. As the model has been verified against 2016 measured concentrations and has been adjusted to take account of the apparent under-prediction, there can be reasonable confidence in the predicted concentrations.

Appendix E - Traffic Data and Emissions

2016 Verification and Baseline

Road Name	AADT	HDV%	Speed (kph)	NO_x Emissions (g/km/s)	PM_{10} Emissions (g/km/s)	$PM_{2.5}$ Emissions (g/km/s)
Bridge Street junction with A53	15704	6.5	32.16	0.113921	0.007834	0.004750
Station Road East of Site	15704	6.5	48.28	0.091923	0.007562	0.004492
Station Road East of Site junction with Bridge Street	15704	6.5	32.16	0.113921	0.007834	0.004750
A53 between Bridge Street and Fairfield	15704	6.5	40.32	0.100831	0.007668	0.004593
Bridge Street	15704	6.5	40.32	0.100831	0.007668	0.004593
A53 junction with Bakewell Road	15704	6.5	32.16	0.113921	0.007834	0.004750
Fairfield Road	22774	6.0	40.32	0.142894	0.010968	0.006564
Fairfield Road junction with A53	22774	6.0	32.16	0.161119	0.011201	0.006785
Bakewell Road	13990	4.3	48.28	0.073794	0.006313	0.003737
Bakewell Road junction with A53	13990	4.3	32.16	0.089774	0.006521	0.003935
Site Access	583	0.0	40.32	0.002588	0.000232	0.000137
Site Access junction with Station Road	583	0.0	24.14	0.003111	0.000240	0.000145
Station Road West of Site	15871	6.4	48.28	0.092488	0.007621	0.004526
Station Road West of Site junction with A515	15871	6.4	24.14	0.133739	0.008137	0.005017
A515	12596	5.7	48.28	0.071023	0.005924	0.003514
A515 junction with Station Road	12596	5.7	24.14	0.101698	0.006314	0.003885

Road Name	AADT	HDV%	Speed (kph)	NO_x Emissions (g/km/s)	PM_{10} Emissions (g/km/s)	$PM_{2.5}$ Emissions (g/km/s)
A53 between A515 and St Johns Road	13977	5.3	48.28	0.077482	0.006504	0.003856
A53 junction with A515	13977	5.3	24.14	0.110368	0.006926	0.004257
RA1 Station Road - A515	11028	6.0	32.16	0.077902	0.005419	0.003283
RA2 A515 - A53	10472	5.9	32.16	0.073533	0.005129	0.003106
RA3 A53 - Station Road	10337	5.6	32.16	0.071435	0.005018	0.003037
Manchester Road North of St Johns's Road	8891	2.3	48.28	0.042396	0.003776	0.002228
St Johns Road	9565	7.7	48.28	0.058952	0.004761	0.002833
St Johns Road - A53 junction	8053	8.8	32.16	0.065340	0.004288	0.002611
St Johns Road - Manchester Road junction	1537	2.1	32.16	0.008623	0.000668	0.000401
Manchester Road	7609	2.2	48.28	0.036088	0.003222	0.001900

2020 Future Baseline

Road Name	AADT	HDV%	Speed (kph)	NOx Emissions (g/km/s)	PM_{10} Emissions (g/km/s)	$PM_{2.5}$ Emissions (g/km/s)
Bridge Street junction with A53	16506	6.5	32.16	0.082404	0.007427	0.004231
Station Road East of Site	16506	6.5	48.28	0.067097	0.007286	0.004096
Station Road East of Site junction with Bridge Street	16506	6.5	32.16	0.082404	0.007427	0.004231
A53 between Bridge Street and Fairfield	16506	6.5	40.32	0.073338	0.007342	0.004150
Bridge Street	16506	6.5	40.32	0.073338	0.007342	0.004150
A53 junction with Bakewell Road	16506	6.5	32.16	0.082404	0.007427	0.004231
Fairfield Road	23835	6.0	40.32	0.104387	0.010469	0.005917
Fairfield Road junction with A53	23835	6.0	32.16	0.117048	0.010589	0.006030
Bakewell Road	14642	4.3	48.28	0.055996	0.006088	0.003422
Bakewell Road junction with A53	14642	4.3	32.16	0.067513	0.006198	0.003526
Site Access	612	0.0	40.32	0.002192	0.000226	0.000128
Site Access junction with Station Road	612	0.0	24.14	0.002630	0.000231	0.000132
Station Road West of Site	16681	6.4	48.28	0.067629	0.007344	0.004129
Station Road West of Site junction with A515	16681	6.4	24.14	0.096103	0.007611	0.004383
A515	13183	5.7	48.28	0.052412	0.005694	0.003201
A515 junction with Station Road	13183	5.7	24.14	0.073743	0.005896	0.003393
A53 between A515 and St John's Road	14691	5.3	48.28	0.057827	0.006283	0.003532
A53 junction with A515	14691	5.3	24.14	0.080942	0.006503	0.003741

Road Name	AADT	HDV%	Speed (kph)	NOx Emissions (g/km/s)	PM_{10} Emissions (g/km/s)	$PM_{2.5}$ Emissions (g/km/s)
RA1 Station Road - A515	11583	6.0	32.16	0.056826	0.005142	0.002928
RA2 A515 - A53	10987	5.9	32.16	0.053693	0.004863	0.002769
RA3 A53 - Station Road	10850	5.6	32.16	0.052469	0.004763	0.002712
Manchester Road North of St John's Road	9259	2.3	48.28	0.033460	0.003642	0.002047
St Johns Road	10053	7.7	48.28	0.042164	0.004575	0.002573
St Johns Road - A53 junction	8464	8.8	32.16	0.045573	0.004041	0.002304
St Johns Road - Manchester Road junction	1616	2.1	32.16	0.006855	0.000642	0.000365
Manchester Road	7998	2.2	48.28	0.028815	0.003137	0.001763

2020 Future With Development

Road Name	AADT	HDV%	Speed (kph)	NOx Emissions (g/km/s)	PM_{10} Emissions (g/km/s)	$PM_{2.5}$ Emissions (g/km/s)
Bridge Street junction with A53	17709	6.0	32.16	0.086902	0.007863	0.004478
Station Road East of Site	17709	6.0	48.28	0.071036	0.007715	0.004338
Station Road East of Site junction with Bridge Street	17709	6.0	32.16	0.086902	0.007863	0.004478
A53 between Bridge Street and Fairfield	17709	6.0	40.32	0.077509	0.007774	0.004394
Bridge Street	17709	6.0	40.32	0.077509	0.007774	0.004394
A53 junction with Bakewell Road	17709	6.0	32.16	0.086902	0.007863	0.004478
Fairfield Road	24437	5.9	40.32	0.106541	0.010692	0.006042
Fairfield Road junction with A53	24437	5.9	32.16	0.119385	0.010813	0.006157
Bakewell Road	15243	4.1	48.28	0.058021	0.006309	0.003546
Bakewell Road junction with A53	15243	4.1	32.16	0.069850	0.006422	0.003653
Site Access	3151	0.0	40.32	0.011283	0.001164	0.000656
Site Access junction with Station Road	3151	0.0	24.14	0.013536	0.001188	0.000680
Station Road West of Site	18016	5.9	48.28	0.072076	0.007829	0.004401
Station Road West of Site junction with A515	18016	5.9	24.14	0.101736	0.008109	0.004667
A515	13183	5.7	48.28	0.052412	0.005694	0.003201
A515 junction with Station Road	13183	5.7	24.14	0.073743	0.005896	0.003393
A53 between A515 and St John's Road	16027	4.9	48.28	0.062396	0.006781	0.003812
A53 junction with A515	16027	4.9	24.14	0.086833	0.007015	0.004034

Road Name	AADT	HDV%	Speed (kph)	NOx Emissions (g/km/s)	PM_{10} Emissions (g/km/s)	$PM_{2.5}$ Emissions (g/km/s)
RA1 Station Road - A515	12394	5.6	32.16	0.059969	0.005444	0.003099
RA2 A515 - A53	11534	5.6	32.16	0.055817	0.005066	0.002885
RA3 A53 - Station Road	11502	5.3	32.16	0.055037	0.005009	0.002851
Manchester Road North of St John's Road	9818	2.2	48.28	0.035373	0.003851	0.002164
St Johns Road	10830	7.1	48.28	0.044725	0.004855	0.002730
St Johns Road - A53 junction	9241	8.0	32.16	0.048498	0.004323	0.002465
St Johns Road - Manchester Road junction	1616	2.1	32.16	0.006855	0.000642	0.000365
Manchester Road	8556	2.1	48.28	0.030736	0.003346	0.001880

Appendix F - Results

Annual Mean NO_2 Concentrations ($\mu g/m^3$)

Receptor ID	2016	2020 Baseline	2020 With Development	Change*	% Change relative to AQAL	% of AQAL	Significance
R1	33.6	27.0	27.6	0.5	1	69	Negligible
R2	**55.0**	**44.3**	**45.1**	0.7	2	113	Substantial adverse
R3	30.4	24.5	25.1	0.6	1	63	Negligible
R4	31.0	24.9	25.5	0.6	1	64	Negligible
R5	34.3	27.6	28.2	0.6	2	71	Negligible
R6	**55.7**	**44.9**	**46.0**	1.2	3	115	Substantial adverse
R7	**42.5**	34.4	35.8	1.4	3	90	Slight adverse
R8	26.4	21.3	21.8	0.5	1	54	Negligible
R9	23.5	19.1	19.5	0.4	1	49	Negligible
R10	24.4	20.1	20.5	0.4	1	51	Negligible
ST1	*44.5*	*35.7*	*36.7*	*1.1*	*3*	92	*Negligible*
PR1	-	-	31.6	-	-	79	-
PR2	-	-	30.7	-	-	77	-
PR3	-	-	30.2	-	-	76	-
PR4	-	-	29.2	-	-	73	-
PR5	-	-	28.0	-	-	70	-
PR6	-	-	26.9	-	-	67	-
PR7	-	-	25.7	-	-	64	-
PR8	-	-	24.7	-	-	62	-

* Change based on unrounded values

Italics indicates that only the short-term objective applies at this receptor. Bold indicates exceedance of the annual mean NO_2 objective.

Annual Mean PM_{10} Concentrations ($\mu g/m^3$)

Receptor ID	2016	2020 Baseline	2020 With Development	Change*	% Change relative to AQAL	% of AQAL	Significance
R1	16.1	15.6	15.7	0.1	0	39	Negligible
R2	19.8	19.2	19.3	0.2	0	48	Negligible
R3	15.6	15.1	15.3	0.1	0	38	Negligible
R4	15.7	15.2	15.3	0.1	0	38	Negligible
R5	15.6	15.1	15.2	0.1	0	38	Negligible
R6	19.0	18.4	18.6	0.3	1	47	Negligible
R7	17.5	17.0	17.3	0.3	1	43	Negligible
R8	14.7	14.2	14.4	0.1	0	36	Negligible
R9	14.2	13.8	13.9	0.1	0	35	Negligible
R10	14.4	14.0	14.1	0.1	0	35	Negligible
ST1	*17.9*	*17.3*	*17.6*	*0.2*	*1*	*44*	*Negligible*
PR1	-	-	16.5	-	-	41	-
PR2	-	-	16.3	-	-	41	-
PR3	-	-	16.6	-	-	42	-
PR4	-	-	16.4	-	-	41	-
PR5	-	-	16.2	-	-	40	-
PR6	-	-	15.9	-	-	40	-
PR7	-	-	15.6	-	-	39	-
PR8	-	-	15.4	-	-	39	-

*Change based on unrounded values

Italics indicates that only the short-term objective applies at this receptor.

Number of Days with PM_{10} Concentrations Exceeding 50µg/m^3

Receptor ID	2016	2020 Baseline	2020 With Development	Change*	Significance
R1	0	0	0	0	Negligible
R2	3	2	3	0	Negligible
R3	0	0	0	0	Negligible
R4	0	0	0	0	Negligible
R5	0	0	0	0	Negligible
R6	2	2	2	0	Negligible
R7	1	1	1	0	Negligible
R8	0	0	0	0	Negligible
R9	0	0	0	0	Negligible
R10	0	0	0	0	Negligible
ST1	1	1	1	0	Negligible
PR1	-	-	0	-	-
PR2	-	-	0	-	-
PR3	-	-	1	-	-
PR4	-	-	0	-	-
PR5	-	-	0	-	-
PR6	-	-	0	-	-
PR7	-	-	0	-	-
PR8	-	-	0	-	-

* Change based on unrounded values

Annual Mean $PM_{2.5}$ Concentrations ($\mu g/m^3$)

Receptor ID	2016	2020 Baseline	2020 With Development	Change*	% Change relative to AQAL	% of AQAL	Significance
R1	10.3	9.8	9.9	0.1	39	0	Negligible
R2	12.6	11.8	11.9	0.1	48	0	Negligible
R3	10.0	9.5	9.6	0.1	38	0	Negligible
R4	10.1	9.6	9.6	0.1	39	0	Negligible
R5	10.1	9.6	9.7	0.1	39	0	Negligible
R6	12.3	11.5	11.6	0.2	47	1	Negligible
R7	11.3	10.7	10.8	0.2	43	1	Negligible
R8	9.6	9.1	9.2	0.1	37	0	Negligible
R9	9.3	8.9	8.9	0.0	36	0	Negligible
R10	9.4	9.0	9.0	0.1	36	0	Negligible
ST1	*11.4*	*10.8*	*10.9*	*0.1*	*44*	*1*	*Negligible*
PR1	-	-	10.4	-	42		-
PR2	-	-	10.3	-	41		-
PR3	-	-	10.4	-	41		-
PR4	-	-	10.2	-	41		-
PR5	-	-	10.1	-	40		-
PR6	-	-	10.0	-	40		-
PR7	-	-	9.8	-	39		-
PR8	-	-	9.7	-	39		-

* Change based on unrounded numbers

Italics indicates that only the short-term objective applies at this receptor.

Appendix G - IAQM Construction Phase Mitigation Measures

The following mitigation measures are recommended to reduce the identified risk associated with dust soiling and human health effects during the construction phase.

Communications

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary as well as the head or regional office contact information.
- Develop and implement a Dust Management Plan (DMP) as part of the Construction Management Plan.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Make the complaints log available to the local authority when asked.
- Record any exceptional incidents that cause dust and/or emissions to air, either on or off-site and the action taken to resolve the situation in the log book.

Monitoring

- Carry out regular inspections to monitor compliance with the DMP.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

Preparing and Maintaining the Site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Fully 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 water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on site, cover as appropriate.
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating vehicle / machinery and sustainable travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol-powered generators and use main electricity or battery powered equipment where practicable.
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.

Operations

- Only use cutting, grinding or sawing equipment fitted or alongside suitable dust suppression techniques such as water sprays or local extraction.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on site to clean any dry spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- Avoid bonfires and burning of waste materials

Construction

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for particular process, in which case ensure that appropriate additional control measures are in place.

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