Proposed Residential Development

Darwen Hollins Paper Mill, Darwen

Air Quality Assessment

Gleeson Developments

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1.0 INTRODUCTION

1.1 Background

SLR Consulting Ltd (SLR) has been commissioned by Gleeson Developments to undertake an Air Quality Assessment to support the planning application for a proposed residential development on land off Hollins Grove Street (the 'Application Site'). The proposed development site is located on land of the former Darwen Hollins Paper Mill.

The proposals are for 151 residential dwellings and associated infrastructure, with access from Hollins Grove Street.

The assessment describes the scope, relevant legislation, assessment methodology and the baseline conditions currently existing at the application site and its surroundings. It then considers any potentially significant environmental affects the development may have on this baseline environment; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual impacts after these measures have been employed.

1.2 Scope

Discussions have been undertaken with Blackburn & Darwen Borough Council (BDBC) in order to agree upon the methodology of assessment. The following aspects of the assessment were agreed with the relevant Environmental Health Departments[1]:

- determination of baseline scenario, using council monitoring data;
- assessment of potential air quality impacts during the construction phase;
- assessment of potential air quality impacts during the operational phase; and
- identification of required mitigation measures.

The results of the assessment are detailed in the following sections of this report.

1.3 Structure of Report

The remainder of this report is structured as follows:

- Section 2 describes the relevant legislation and guidance referred to in the assessment;
- Section 3 describes the assessment methodology;
- Section 4 characterises the baseline environment in the vicinity of the Application Site from an air quality perspective, with regard to site location and nearby receptors ;
- Section 5 assesses the potential effects from dust during construction;
- Section 6 presents the inputs used to model the impacts from traffic emissions;
- Section 7 presents the results of the traffic emission modelling assessment;
- Section 8 presents mitigations measures considered as part of the scheme; and
- Section 9 concludes the assessment.

[1] Email communication with Simon Kirby, Senior Environmental Health Officer within Public Protection at BDBC and SLR Consulting, dated 22nd November 2016.

2.0 RELEVANT AIR QUALITY LEGISLATION AND GUIDANCE

2.1 UK Legislation

2.1.1 Air Quality Strategy

The United Kingdom Air Quality Strategy (UK AQS) 2007 for England, Scotland, Wales and Northern Ireland[2] sets out the Government's policies aimed at delivering cleaner air in the United Kingdom (UK). It sets out a comprehensive strategic framework within which air quality policy will be taken forward in the short to medium term, and the roles that Government, industry, the Environment Agency (EA), local government, business, individuals and transport have in protecting and improving air quality.

2.1.2 Air Quality Standards

The Air Quality Standards Regulations 2010 seek to simplify air quality regulation and provide a new transposition of the Air Quality Framework Directive, and also transpose the Fourth Daughter Directive within the UK. The Air Quality Limit Values are transposed into the updated Regulations as Air Quality Standards, with attainment dates in line with the European Directives. SI 2010 No. 1001 Regulation 14 extends powers, under Section 85(5) of the Environment Act (1995), for the Secretary of State to give directions to Local Authorities (LAs) for the implementation of these Directives.

The UK AQS is the method for implementation of the air quality limit values in England, Scotland, Wales and Northern Ireland and provides a framework for improving air quality and protecting human health from the effects of pollution. For each nominated pollutant, the Air Quality Strategy sets clear, measurable, outdoor air quality standards and target dates by which these must be achieved; the combined standard and target date is referred to as the Air Quality Objective (AQO) for that pollutant. The UK AQS includes more exacting Objectives for some pollutants than those required by EU legislation. This Air Quality Assessment refers to UK Air Quality Standards, as compliance with these standards will also ensure that the less demanding EU Air Quality limit values would also be met.

The Air Quality Strategy defines 'standards' and 'objectives' in paragraph 17:

> *'For the purposes of the strategy:*
>
> *standards are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups or on ecosystems;*
>
> *objectives are policy targets often expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedences, within a specified timescale.'*

The air quality Standards and Objectives considered within this Air Quality Assessment are presented within Table 2-1.

[2] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA. July 2007.

Table 2-1
Relevant Air Quality Strategy Standards and Objectives

Pollutant	Standard	Measured as	Equivalent percentile
Nitrogen dioxide (NO_2)	40µg/m^3	Annual mean	-
	200µg/m^3	1 hour mean	99.79th percentile of 1-hour-means (equivalent to 18 1-hour exceedences)
Particulate matter with an aerodynamic diameter of less than 10µm (PM_{10}) (gravimetric)	40µg/m^3	Annual mean	-
	50µg/m^3	24 hour mean	90.41th percentile of 24-hour-means (equivalent to 35 24-hour exceedences)
Particulate matter with an aerodynamic diameter of less than 2.5µm ($PM_{2.5}$) (gravimetric)	25µg/m^3	Annual mean	-

Applicable Public Exposure

In accordance with the Department for Environment, Food and Rural Affairs' (DEFRA) technical guidance on Local Air Quality Management (LAQM.TG(16)), the AQOs should be assessed at locations where members of the public are likely to be regularly exposed for a period of time appropriate to the averaging period of the objective. A summary of relevant exposure for the objectives presented in Table 2-1 are shown below in Table 2-2.

Table 2-2
Relevant Public Exposure

Objective Averaging Period	Relevant Locations	Objectives should apply at:	Objectives should not apply at:
Annual mean	Where individuals are exposed for a cumulative period of 6 months in a year	Building facades of residential properties, schools, hospitals etc.	Facades of offices Hotels Gardens of residences Kerbside sites
24-hour mean	Where individuals may be exposed for eight hours or more in a day	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure if expected to be short term
1-hour mean	Where individuals might reasonably expected to spend one hour or longer	As above together with kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access

2.1.3 Local Air Quality Management

Local Authorities (LAs), including BDBC, have formal powers to control air quality through a combination of Local Air Quality Management (LAQM) and by use of their wider planning policies.

Section 82 of the Environment Act 1995 (Part IV) requires local authorities to periodically review and assess the quality of air within their administrative area. The reviews have to consider the present and future air quality and whether any AQOs prescribed in regulations are being achieved or are likely to be achieved in the future.

Where any of the prescribed air quality Objectives are not likely to be achieved the authority concerned must designate an Air Quality Management Area (AQMA). For each AQMA the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the air quality Objectives.

DEFRA has published technical guidance for use by local authorities in their review and assessment work[3]. The results of BDBCs Review and Assessment of air quality are summarised in Section 4.4.1.

2.2 Planning Policy

2.2.1 National Policy

The National Planning Policy Framework (NPPF) describes the policy context in relation to pollutants including air pollutants:

> *'The Government's objective is that planning should help to deliver a healthy natural environment for the benefit of everyone and safe places which promote wellbeing.*
>
> *To achieve this objective, the planning system should contribute and enhance the natural and local environment by:*
>
> *[...] preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of land, air, water or noise pollution or land instability.'*

Where pollution is defined as:

> *'Any consideration of the quality of land, air, water, soils, which might lead to an adverse impact on human health, the natural environment or general amenity. Pollution can arise from a range of emissions, including smoke, fumes, gases, dust, steam and odour.'*

Specifically in terms of development with regard to air quality:

> *'Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan.'*

The NPPF is accompanied by supporting Planning Practice Guidance (PPG) which includes guiding principles on how planning can take account of the impacts of new development on air quality. In regards to air quality, the PPG states

> "*Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values […] It is important that the potential impact of new development on air quality is taken into account […] where the national assessment indicates that relevant limits have been exceeded or are near the limit*."

[3] Department for Environment, Food and Rural Affairs: Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(16), 2016.

> *"Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife).*

The PPG sets out the information that may be required within the context of a supporting air quality assessment, stating that "*assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality* […] *Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact*".

The policies within the NPPF and accompanying PPG in relation to air pollution are considered within this Air Quality Assessment.

2.2.2 Local Policy

Blackburn and Darwen's Core Strategy

BDBC adopted its Core Strategy[4] in January 2011, as part of the statutory Development Plan for the Borough. The Core Strategy sets out a spatial vision for the area, and key strategic objectives and strategic policies for delivering new housing and employment, retail, leisure and community facilities.

Within the Core Strategy, the following policy relates to air quality:

> *'Policy CS13: Environmental Strategy:*
>
> *Development will only be permitted where it creates no unacceptable environmental impact. Examples of unacceptable impacts include but are not limited to […] Development that would, in isolation or in combination with other committed or planned development, lead to an unacceptable deterioration in air quality'*

The policy contained within the BDBC Core Strategy relating to air quality is addressed within this assessment.

2.3 Environmental Protection UK and Institute of Air Quality Management Guidance

Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have together published guidance[5] to help ensure that air quality is properly accounted for in the development control process. It clarifies when an air quality assessment should be undertaken, what it should contain, and how impacts should be described and assessed. Importantly, it sets out a recommended approach to assess the significance of impacts.

The guidance also states that best-practice design and operational measures should be recommended and applied to all developments that require an Air Quality Assessment, to reduce emissions and human exposure to poor air quality. Additional measures are also suggested to off-set emissions, depending on the nature and scale of the development proposals.

[4] Blackburn and Darwen Local Development Framework, Core Strategy, , January 2011.
[5] EPUK and IAQM, *'Land-Use Planning and Development Control: Planning for Air Quality'*, 2015.

2.4 Design Manual for Roads and Bridges

The Design Manual for Roads and Bridges (DMRB) (207/07) considers the following criterion to determine 'affected roads' which have the potential to impact upon ambient air quality at surrounding receptors:

- road alignment will change by 5m or more; daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more; or
- heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or
- daily average speed will change by 10km/hr or more; or
- peak hour speed will change by 20km/hr or more.

The DMRB[6] considers any receptor within 200m of a road source to be potentially affected by that operation. Receptors, including ecological designations within 200m of a road source require further assessment of potential impacts.

If none of the roads in the network meet any of the traffic/alignment criteria or there are no properties or relevant Designated Sites near the affected roads, then the impact of the scheme can be considered to be neutral in terms of local air quality and no further air quality assessment is required.

2.5 Construction and Dust Demolition Guidance

There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist – 'nuisance' is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred.

'*Guidance on the assessment of dust from demolition and construction*' has been prepared by the IAQM[7].

[6] Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, HA 207/07 - Air Quality, Highways Agency, 2007.

[7] Institute of Air Quality Management, Guidance on the assessment dust from demolition and construction, v1.1 2016.

3.0 ASSESSMENT METHODOLOGY

This section provides information relating to methods used in this assessment.

3.1 Construction Dust Assessment

The assessment has been undertaken with reference to IAQM '*Guidance on the assessment of dust from construction and demolition*'.

Descriptors for magnitude of impact and impact significance used in this assessment of construction phase dust are from the IAQM Guidance and reproduced in Appendix AQ1 of this report.

3.2 Vehicular Pollutants Assessment

The assessment has been undertaken with reference to the following documents:

- LAQM.TG(16);
- DMRB[8] Volume 11, Section 3, Part 1 HA207/07- Air Quality (an Interim Advice Note); and
- Land-Use Planning and Development Control – Planning for Air Quality – EPUK and IAQM[9].

Reference should be made to Appendix AQ2 for the EPUK and IAQM screening criteria used within the operational phase screening assessment.

For the purposes of this assessment detailed air dispersion modelling has been undertaken using the Cambridge Environmental Research Consultants (CERC) ADMS Roads v4.0 air dispersion model, following guidance provided in LAQM.TG(16) to predict concentrations of NO_2 and PM_{10} for the various scenarios.

[8] Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, HA 207/07 - Air Quality, Highways Agency, 2007.
[9] EPUK and IAQM, *'Land-Use Planning and Development Control: Planning for Air Quality'*, 2015.

4.0 BASELINE ENVIRONMENT

4.1 Location

The Application Site is located within Darwen approximately 8.6km south of Blackburn centre and 1 mile to the north of Darwen town centre, at approximate National Grid Reference (NGR): x 368836, y 423543. The development area comprises of cleared land, industrial buildings and associated infrastructure and is approximately 15.74 acres in size. The south-west corner of the Application Site is defined by vegetation. Vegetation borders the south and west of the Site.

The Application Site is part of the wider development area of the former paper mill and is currently bordered and defined by:

- Hollins industrial works and mill to the north and north-west;
- Darwen Waste water Treatment Works (WwTW) to the north of the Site;
- industrial buildings dominating the area to the north-east, with a traveller's site adjacent to the Site's north-eastern corner;
- the railway line runs parallel to the sites eastern boundary, beyond which is an area of predominately arable land and the Express asphalt plant;
- allotment gardens are located immediately to the southwest, beyond which is a significant residential area, comprising the urban area of Darwen; and
- a reservoir located to the west with the River Darwen flowing along the north-western boundary.

The closest residential dwellings are located within 20m of the Application Sites southern boundary, along Hollins Grove Street and Surrey Avenue.

4.2 Meteorology

The generation, release and dispersion of fugitive dust associated with construction activities and the influence of dispersion of traffic emission pollutants are particularly dependent upon weather conditions and the nature of the handled material. The prevailing meteorological conditions at any site would be dependent upon many factors including its location in relation to macroclimatic conditions as well as more site specific, microclimatic conditions. The most important climatic parameters governing the emission and magnitude of impact of dust are:

- wind direction which determines the broad transport of the emission and the direction in which it is dispersed; and
- wind speed will affect ground level emissions by increasing the initial dilution of pollutants in the emission; it will also affect the potential for dust entrainment.

Rainfall is also an important climatological parameter in the generation of dust; sufficient amounts of rainfall can suppress dust at the source and eliminate the pathway to the receptor. According to Arup (1995)[10] rainfall greater than 0.2mm per day is sufficient to suppress dust emissions.

4.2.1 Wind Speed and Direction Data

As agreed with the Environmental Health Officer of BDBC, the meteorological station at Manchester Airport has been identified as the closest representative observation station to

[10] Arup & Ove Arup Environmental. Environment Effects of Surface Mineral Workings. DoE, October 1995.

the proposed development site. Manchester Airport is located approximately 41km south of the site. A wind rose is presented in Figure 4-1.

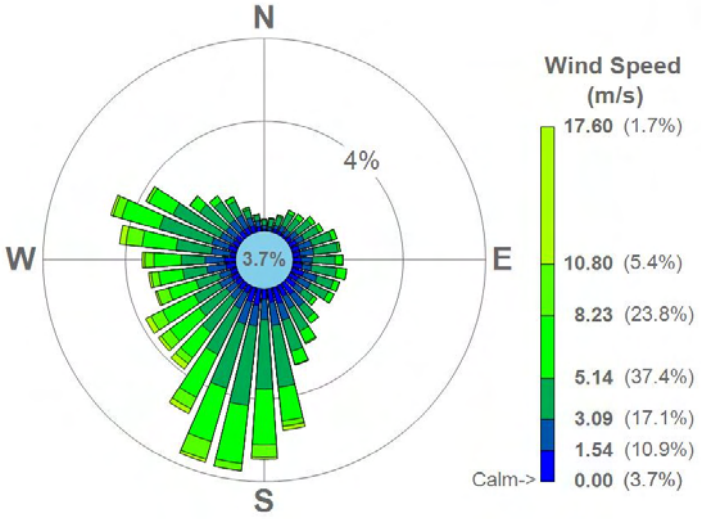

Figure 4-1
Wind Rose for Manchester Airport (2015)

From Figure 4-1 it can be seen that the majority of winds are from the south and south south-west with winds from these sectors (160° – 240°) occurring for approximately 44% of the year. Winds from the west north-west are also relatively frequent with winds from these sectors (270° – 310°) occurring for approximately 16% of the year.

On this basis, it is locations in north and north-eastern sectors which have the highest potential for impacts from any dust emissions originating from the site, as well as locations to the east south-east.

4.2.2 Rainfall

Relevant rainfall data applicable to the site has been obtained from the Met Office website[11] of UK mapped climate averages for 1981-2010. The average annual rainfall >0.2mm/day for the area of the site is 180-200 days per year, comprising approximately 52% of the year.

4.3 Sensitive Receptors

The term 'sensitive receptors' includes any persons, locations or systems that may be susceptible to changes in abiotic factors as a consequence of the development. These have been identified as construction dust, ecological and road vehicle emission human sensitive receptors to which the AQOs apply, in the following sections.

4.3.1 Construction Dust Receptors

The main receptors likely to be affected by the generation of construction dust are those existing receptors within approximately 350m of the proposed development site boundary and/or within 100m of the route(s) used by vehicles on the public highway, up to 500m from the site entrance(s). However, for those receptors sited in a downwind location from the

[11] Met Office, http://www.metoffice.gov.uk/public/weather/climate, accessed December 2016.

development site boundary, potential dust impacts can be witnessed at a distance of greater than 100m on occasion under worst case conditions.

Receptors that are identified as being potentially at risk from dust generation during the construction phase of the development are presented below in Table 4-1. Where these are referenced within the report text, they are referred to as DR1 – DR11. Drawing AQ1 presents buffer distances, based upon screening distances presented within the IAQM guidance, illustrating all receptors which have the potential to be impact upon as a result of construction phase dust.

Table 4-1
Construction Dust Sensitive Receptors

	Receptor	NGR (m)		Approximate Distance from development Boundary (m)	Approximate Direction from Boundary
		X	Y		
DR1	Crown Industrial Building	369073	423860	<20m	North-east
DR2	Traveller's Site	369117	423818	<50m	North-east
DR3	Salvage Management storage	369153	423623	120m	South-east
DR4	Hollins Grove / Surrey Avenue Residence	368882	423447	<20m	South
DR5	Hollins Grove Street Residence	368726	423419	120m	South-west
DR6	Allotment Gardens	368812	423492	<50m	South-west
DR7	Staff Car Park	368680	423643	120m	West
DR8	Industrial Building	368644	423720	170m	West
DR9	Industrial Building Hollins Road	368840	423840	<50m	North-west
DR10	Football Ground / Car Park	368658	423969	250m	North-west
DR11	Public Right of Way	Various		<20m	North

The dust sensitive receptors identified in Table 4-1 represent worst-case locations and have been chosen as the closest dust sensitive receptors to the site which may be affected by the generation of construction dust.

It should be noted that distances and directions have been based on the receptor location from the red line boundary for the Application Site. Reference should be made to Drawing AQ1 for an illustration of the location of these receptors, relative to the proposed development.

4.3.2 Road Vehicle Exhaust Emission Sensitive Receptors

The DMRB method considers any receptor within 200m of a road source to be potentially affected by air quality. Human receptor locations have been characterised with reference to LAQM.TG(16) Box 1.1. According to LAQM.TG(16) exceedences of the AQOs should be assessed in relation to:

> *'the quality of the air at locations which are situated outside of buildings or other natural or man-made structure, above or below ground, and where members of the public are regularly present'.*

The receptor locations considered representative of potential exposure for the operational phase Air Quality Assessment are shown below in Table 4-2, based upon appropriate exposure locations outlined within Table 2-2.

Where these are referenced within the report text, they are referred to as R1 – R16.

Table 4-2
Receptor Locations in Operational Phase Exhaust Emission Assessment

Receptor	Description	UK NGR (m)	
		X	Y
R1	Darwen Vale High School	368169	424383
R2	555 Blackburn Road Residence	368230	424386
R3	553 Blackburn Road (Ground Floor Retail)	368235	424373
R4	490 Blackburn Road Residence	368238	424305
R5	507 Blackburn Road Residence	368275	424273
R6	459 Blackburn Road Residence	368303	424137
R7	St Edwards RC Primary School	368303	423933
R8	133 Blackburn Road Residence	368570	423328
R9	144 Blackburn Road Residence	368539	423351
R10	141 Blackburn Road Residence	368560	423349
R11	46 Hollins Grove Street Residence	368741	423415
R12	53 Hollins Grove Street Residence	368884	423454
R13	Caravan Park	369091	423775
R14	Public House, Bury Street	369041	422492
R15	1 Bridge Street (Ground Floor Retail / Office)	369253	422148
R16	43 Green Street (Ground Floor Retail)	369267	422018

The sensitive receptors identified in Table 4-2 represent worst-case locations and have been chosen as the closest residences to each road which may be affected by traffic associated with the proposed development. Receptors have been modelled at a height of 1.5m (z=1.5m) to be representative of exposure.

Based upon the proposed layout of the development, a representative selection of residential premises in proximity to the site access road and Hollins Grove Street has been identified. These are presented in Table 4-3.

Table 4-3
Proposed Receptor Locations within the Proposed Development

Receptor	UK NGR (m)	
	X	Y
PR1	369076	423829
PR2	369063	423718
PR3	368996	423653
PR4	368866	423466

Reference should be made to Drawing AQ2 for an illustration of the location of these receptors.

4.3.3 Ecological Receptors

Air quality impacts associated with the operational phase of the development have the potential to impact on receptors of ecological sensitivity within the vicinity of the site. The

Conservation of Habitats and Species Regulations (2010) requires competent authorities to review planning applications and consents that have the potential to impact on European designated sites (e.g. Special Areas of Conservation (SAC)).

Guidance from the IAQM[12] states that dust impacts at ecological receptors require assessment at locations up to 50m from a development boundary. Furthermore, the DMRB[13] states that SACs including candidate sites, Special Protection Areas (SPAs including potential sites), Sites of Special Scientific Interest (SSSIs) and Ramsar sites within 200m of an 'affected road' require an assessment of the potential impact upon ambient air quality.

A study was undertaken to identify any statutory designated sites of ecological or nature conservation importance within 50m of the site boundary or 200m of any road with a traffic flow affected by the development site, to determine the potential impact resulting from the operational phase movements. This was completed using the Magic web-based interactive mapping service, which draws together information on key environmental designations[14].

A search within 50m of the development boundary and 200m of any 'affected road' surrounding the development indicated no sensitive ecological receptors.

It is noted that the closest statutory ecological designation to the Application Site is Oak Field Site of Scientific Interest (SSSI), located 7.9km south of the Site boundary.

The closest non-statutory ecological site is the Sunnyhurst Woods Local Nature Reserve (LNR), located approximately 500m west of the Application Boundary. Sunnyhurst Woods is predominantly used as a recreational area, comprising of 85 acres of woodland acknowledged for its bird population.

4.4 Baseline Air Quality

4.4.1 Local Authority Review and Assessment

As required under Section 82 of the Environment Act (1995) (Part IV), BDBC has conducted an on-going exercise to review and assess air quality within their area of jurisdiction. This process has indicated that annual mean concentrations of NO_2 are above, and predicted to remain above, the Objective at locations of relevant exposure. As such, BDBC has declared eight AQMAs for NO_2 concentrations. A brief description of each AQMA is provided below:

- AQMA No.1 Intack - an area encompassing the junction between Accrington Road, Whitebirk Road, St Ives Road and Shadsworth Road in Intack, Blackburn;
- AQMA No.2 Bastwell - an area encompassing a section of Whalley New Road in Bastwell, including the junctions with Maple Street, Plane Street and Whalley;
- AQMA No.3 A66 Between Robert Street & Wraith Street - an area along the A666 (Duckworth Street/Market Street/Bolton Road) in Darwen, between Robert Street and Wraith Street;
- AQMA No.4 Witton - an area encompassing the junction of Redlam, Preston Old Road and Buncer Lane in Witton, Blackburn;
- AQMA No.5 Earcoft - a section of the A666 Blackburn Road between the M65 and Redvers Road;

[12] IAQM, Guidance on the assessment dust from demolition and construction, 2014.

[13] Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, HA 207/07 - Air Quality, Highways Agency, 2007.

[14] Natural England, www.magic.gov.uk, accessed July 2016.

- AQMA No.6 Blackamoor – an area incorporating sections of Stopes Brow, Roman Road, Blackamoor Road and Wisteria Drive;
- AQMA No.7 Four Lane Ends – an area incorporating sections of Revidge Road, Lammack Road, Pleckgate Road and Shear Brow; and
- AQMA No.8 – the junction of Accrington Road and Burnley, incorporating sections of Accrington Road, Longton Street and Burnley Road, Blackburn.

The Application Site is in proximity to two of the declared AQMAs; AQMA No.3 and AQMA No.5. The location of the AQMAs relative to the Application Boundary is presented in Drawing AQ2.

The most recent LAQM report, the 2016 Annual Status Report[15] (ASR) published in June 2016, states that AQMAs No.3 and No.5 have met the relevant NO_2 Objectives each year since 2011. Further assessment and consideration of future developments are however required before any revocations of AQMAs are declared.

BMDC have identified a significant decreasing trend in AQMA No.3 since the implementation of the Action Plan measures in 2009 / 2010. The revocation of this AQMA (as well as AQMAs No.1, 2 and 4) shall be considered during the 12 months following the publication of the 2016 ASR. A Detailed Assessment for AQMA No.5 has commenced with a view to its revokation. However, following the location of strategic land allocations in the 2015 Local Plan, BDBC have decided to continue monitoring concentrations to assess the cumulative impacts of additional developments.

The proposed development has the potential to impact upon concentrations of NO_2 within AQMA No.3 and No.5, as such receptors of relevant exposure located within these AQMAs have been included in the assessment.

All other Air Quality Strategy pollutants were below the relevant AQOs at locations of relevant public exposure, as such no further AQMAs have been declared within the Council's administrative area

4.4.2 Automatic Air Quality Monitoring

The UK Automatic Urban and Rural Network (AURN) is a countrywide network of air quality monitoring stations operated on behalf of the DEFRA. Monitoring data for AURN sites is available from the UK Air Information Resource website (UK AIR)[16].

The closest AURN monitor to the Application Site is the Blackburn Accrington Road AURN, located approximately 4.4km north-east of the Application Site (NGR: x370242, y428026). This monitor is classified as an 'urban traffic' monitoring location, defined as "*a continuously built-up area whereby the pollution level is determined predominantly by emissions from nearby traffic".* On this basis, this monitor is not considered to provide background monitoring data which would be representative of the Application Site. As such, this source of data is not considered within this assessment.

4.4.3 Passive Diffusion Tube Monitoring

Passive diffusion tube monitoring is undertaken by BDBC at 47 locations throughout the Council's area, as part of their commitment to LAQM. The diffusion tubes are located in areas which are deemed to require further assessment of NO_2 concentrations. Analysis of

[15] Blackburn with Darwen Borough Council, 2016. 2016 Air Quality Annual Status Report (ASR), June 2016.

[16] DEFRA, UK Air Information Resource (UK-AIR) website, http://uk-air.defra.gov.uk/, accessed December 2016.

BDBC's 2016 ASR[15] indicates that there are six monitoring locations within or in close proximity to AQMA No. 5, 3 locations within or in close proximity to AQMA No. 3, and one location on the A666 in proximity to the Application Site.

A summary of recent NO_2 monitoring results for the sites considered relevant to the assessment are presented within Table 4-4.

Table 4-4
NO_2 Diffusion Tube Monitoring Results, BDBC

Monitoring Location		NGR (m)		Site Classification(B)	Bias Adjusted Annual Mean Concentration (µg/m³) (A)		
		X	Y		2013	2014	2015 (B)
DT20	54 - 33 Bolton Road	369259	422050	RS (AQMA No.3)	36.4	36.5	34.6
DT21	51 - 20 Market St	369244	422192	RS (AQMA No.3)	28.0	27.4	25.0
DT22	84 - 15 Tudor Close	369157	422494	UB	16.6	16.9	16.1
DT29	79 - 639 Blackburn Road	368170	424617	RS	34.0	34.0	32.2
DT31	145 Blackburn Road, Darwen	368552	423366	RS	31.4	34.5	28.7
DT33	59 - 555 Blackburn Road	368231	424376	RS (AQMA No.5)	34.8	34.5	30.0
DT34	60 - 486 Blackburn Road	368240	424299	RS (AQMA No.5)	33.2	33.5	31.7
DT35	81 - 442 Blackburn Road	368274	424164	RS (AQMA No.5)	32.6	33.1	32.8
DT36	82 - 9 View Road	368371	424195	UB	21.0	21.6	21.5

Note:
(A) All results have been bias adjusted by BDBC and 'annualised' in accordance with LAQM.TG(16) if valid data capture for the full calendar year is less than 75%.
(B) Site classifications are as follows:
Roadside: a site sampling between 1m of the kerb of a busy road and the back of the pavement.
Urban Background: An urban locations distanced from sources and therefore broadly representative of city-wide background concentrations.

The data indicates that the annual mean NO_2 AQO of 40µg/m^3 has not been exceeded at the diffusion tubes in the locale of the Application Site. The results do identify that concentrations have been greater than 75% of the AQO in recent years at the roadside location of DT20, at the junction of the A666 and Sudell Road.

4.4.4 DEFRA Background Maps

Background pollutant concentration data on a 1km x 1km spatial resolution is provided by DEFRA through the UK AIR website[17] and is routinely used to support LAQM and Air Quality Assessments.

Mapped background concentrations of NO_X, NO_2 and PM_{10} were downloaded for the following grid squares containing the Application Site, diffusion tubes and those receptors presented within Tables 4-1 to 4-3:

- X368500, y424500;
- X368500, y423500;

[17] DEFRA, UK Air Information Resource (UK-AIR) website, http://uk-air.defra.gov.uk/, accessed December 2016.

- X369500, y423500;
- X368500, y422500
- X369500, y422500; and
- X369500, y421500.

Mapped background concentrations of NO_X, NO_2 and PM_{10} for each considered grid square have been obtained based upon the 2013 base year DEFRA update[18].

In accordance with the methodology presented within LAQM.TG(16), the NO_X and PM_{10} proportions from the 'primary A-road in' sectors of each grid square, where relevant, were removed from the 'total' background concentrations downloaded for each respective pollutant from UK-AIR. The 'primary A-road in' label has been assumed to represent the A666 Blackburn Road. All other modelled roads, which are considered to correlate in part to the 'minor road in' sector has not been removed as a worst-case assessment.

Background NO_2 concentrations can be updated and revised according to the methodology prescribed within LAQM.TG(16), in light of the source apportioned background NO_X concentration. This 'calculated' background concentration was then input into the Air Quality Assessment avoiding double counting of potential source contributions (i.e. existing baseline traffic flows included within the detailed dispersion modelling assessment).

Background pollutant concentrations, which include an adjustment to account for emissions from the 'primary A-road in' sector are displayed in Table 4-5.

Table 4-5
Adjusted Background Concentrations – 2013

Pollutant	Mapped Background Concentration (µg/m^3)	Sector Total to be Removed (µg/m^3)	Adjusted Background (µg/m^3)
Grid Square: 368500, 424500			
NO_2	20.5	-	19.9
NO_x	29.6	1.01	28.5
PM_{10}	15.8	0.03	15.7
Grid Square: 368500, 423500			
NO_2	17.9	-	16.8
NO_x	25.7	1.79	24.0
PM_{10}	14.0	0.05	14.0
Grid Square: 369500, 423500			
NO_2	15.9	-	15.9
NO_x	22.6	0.00	22.6
PM_{10}	13.4	0.00	13.4
Grid Square: 368500, 422500			
NO_2	15.8	-	15.2
NO_x	22.3	0.89	21.4
PM_{10}	13.1	0.02	13.0
Grid Square: 369500, 422500			
NO_2	21.4	-	20.3
NO_x	32.1	1.80	30.3

[18] Background mapping data for local authorities – http://uk-air.defra.gov.uk/data/laqm-background-home, accessed December 2016.

Pollutant	Mapped Background Concentration (µg/m^3)	Sector Total to be Removed (µg/m^3)	Adjusted Background (µg/m^3)
PM_{10}	13.1	0.05	16.1
Grid Square: 369500, 421500			
NO_2	17.4	-	16.5
NO_x	25.1	1.34	23.7
PM_{10}	13.8	0.04	13.8

A sensitivity analysis of background concentrations utilised within the assessment is presented within Appendix AQ4.

4.4.5 Committed Developments

Planning permission has recently been consented for a 20MW gas generation power plant in the locale of the proposed development (Reference 10/16/0425). The development, referred to as the Goose House Lane facility will be located approximately 250m southeast of the Application Site boundary. During pre-application discussion with the BDBC, it was requested that the modelled process contribution from this development was considered to provide a cumulative assessment.

An air quality assessment[19] was submitted in support of the planning application for the power plant, with predicted Process Contributions presented at a number of discrete receptor locations.

Where those receptor locations are within 200m of a road where a change in development trips associated with the operation of the Gleeson residential scheme is predicted, the corresponding Process Contributions for the gas generation power plant has been included within this assessment to present a cumulative assessment scenario.

[19] Amec Foster Wheeler Environment & Infrastructure UK Limited, 2016. Air Quality Impact Assessment of Emissions to Atmosphere from Goose House lane Capacity Mechanism Power Plant, August 2016.

5.0 ASSESSMENT OF DUST EFFECTS AND SIGNIFICANCE: CONSTRUCTION PHASE

This chapter presents the potential air quality impacts associated with the construction of the development, including any required mitigation options.

5.1 Construction Dust

Construction activities will include:

- demolition works;
- material import and export;
- temporary stockpiling of materials;
- landscaping works;
- construction of new on-site facilities; and
- associated vehicle movements (including track-out of material by construction phase movements).

Potential air quality impacts associated with these activities have been identified as:

- generation of dust emissions on-site during construction works;
- generation of exhaust emissions from construction phase road traffic, including Light Duty Vehicles (LDVs) carrying construction workers to and from the development site and HDV movements involved with the export and import of construction material; and
- generation of exhaust emissions from non-road mobile machinery (NRMM) plant on-site.

The following subsections provide a consideration of potential construction dust and conclude with a determined emission class and risk category, from each of the 4 categories identified by the IAQM Guidance.

5.1.1 Initial Screening

As defined within the guidance a dust assessment is as required where there is:

- a human receptor with 350m of the site; or
- a human receptor within 50m of the access roads (up to 500m from the site entrance);
- an ecological receptor with 50m of the site; or
- a human receptor within 50m of the access roads (up to 500m from the site entrance).

As shown in Table 4-1, Section 4.3.1 and Drawing AQ1, there are ‘human receptors’ within 20m of the Application Site, but no habitat sites (which require assessment) within 50m of the site boundary or within 50m of the site access roads (assessed up to 500m from the site entrance, as a worst-case scenario).

Therefore, an assessment of construction dust on ecological receptors can be screened out from this assessment but an assessment of construction dust at human receptors is required.

5.1.2 Potential Dust Emission Magnitude

Demolition

In the majority, the land-use at the proposed development site is currently existing brown field land, used previously as the former Darwen Hollins Paper Mill. The majority of former buildings and structures of the Mill have been demolished and cleared.

The only structure that remains on the site is a single stack, located adjacent to the north-eastern boundary of the development site, in close proximity to Lower Eccleshill Road.

Therefore, based on the information above the dust emission class magnitude from demolition has been classified as 'small'.

Earthworks

Site earthworks are required over an area greater than 10,000m^2, with assumed clay soil types representing a high-risk potential for suspension when dry due to small particle size. The duration of the earthworks activities and the number of heavy moving vehicles active on-site at any one time are unknown. However, for the purpose of this assessment and to provide a worst-case assumption, it has been assumed that earthworks associated with site preparation and landscaping would run concurrently with construction works.

Therefore, based on the detailed information above the dust emission class magnitude from earthworks has been classified as 'large'.

Construction

The total building volume associated with the scheme is thought be to be greater than 100,000m^3. This includes the proposed 151 residential dwellings. As such, the building material required is likely to be potential dusty construction material for example, concrete and brick.

For the purposes of this assessment, the construction of the site is considered to occur over a period of greater than 1-year. This ensures that some construction activities will occur over 'summer' months, corresponding to lower periods of rainfall and reduced potential for natural dust suppression.

Based on the information above, the dust emission class magnitude from construction has been classified as 'large'.

Trackout

Construction vehicles are likely to access the site via the existing highway network (tarmacadam) onto Hollins Grove Street and further beyond. No details are available at the time of assessment on the number of additional HDV movements associated with construction phase works. However, due to the size of the site the potential length of unpaved road is considered to be greater than 100m.

Based on the information above, the dust emission class magnitude from trackout has been classified as 'large'.

Dust Emission Magnitude – Summary

A summary of the dust emission magnitude for each phase is presented within Table 5-1.

Table 5-1
Construction Phase Assessment Summary – Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	Small
Construction	Large
Earthworks	Large
Trackout	Large

5.1.3 Receptor Sensitivity

The Application Site is located in a residential area on the north-eastern edge of Darwen, in an area characterised by existing industrial buildings to the northwest, north and north-east, arable land to the east and areas of existing residential dwellings to the southwest.

Receptor sensitivity to 'dust soiling' and 'PM_{10} sensitivity' has been determined in accordance with Table AQ1-1 presented within Appendix AQ1 based upon the IAQM dust method, as detailed in the following subsections.

Dust Soiling Sensitivity

The area in which earthworks and construction activities would take place is considered to extend across the entire site, as a worst case assessment. The area where demolition activities would be undertaken is confined to the area of the remaining stack structure on the north-eastern boundary; the sensitivity of the area of demolition has been undertaken separately.

In terms of dust soiling sensitivity for earthworks and construction, there are between 10 - 100 residential properties within 20m of the site boundary, located to the southwest of the proposed development on Surrey Avenue and in the travellers' site to the northwest. These are residential dwellings, where users can reasonably expect enjoyment of a high level of amenity. Therefore, the sensitivity of the area is considered to be 'high'.

In terms of dust soiling sensitivity for demolition, there are between 1 - 10 residential properties within 50m of the site boundary, located to the northwest at the travellers' site off Lower Eccleshill Road. These are residential dwellings, where users can reasonably expect enjoyment of a high level of amenity. Therefore, the sensitivity of the area is considered to be 'low'.

In terms of trackout, there are a number of residential dwellings located within 100m of Hollins Grove Street potentially used by vehicles accessing the construction site. On this basis, the sensitivity of the area to trackout is considered to be 'high'.

PM_{10} Human Health Sensitivity

The surrounding area is mainly residential use. The residential areas are locations where members of the public may be present for large periods of the day. The industrial uses located to the north of the site are not locations of relevant exposure to the annual mean or 24-hour mean AQOs, as presented in Table 5-2.

DEFRA mapped background PM_{10} concentrations for 2013 (i.e. worst-case base year) for the 1km^2 grid squares containing the proposed development site and discrete dust sensitive receptors contain within Table 4-1, are presented in Table 5-2.

Table 5-2
Mapped Background PM_{10} Concentrations

Grid Square (NGR)	Receptors	Mapped PM_{10} Background Concentration ($\mu g/m^3$)
x368500, y423500	DR1 – DR3 & DR11(A)	14.0
x369500, y423500	DR4– DR11(A)	13.4

(A) DR11 relates to the Public Right of Way that is located across both grid squares.

As presented in Table 5-2, the maximum 2013 background PM_{10} concentration in relevant grid squares containing or surrounding the proposed development site is 14.0µg/m^3 and therefore considered to be 'well below', the annual mean Objective of 40µg/m^3, in accordance with EPUK and IAQM guidance[20]. It is considered highly unlikely that the construction operations would cause the annual objective to come close to an exceedence in the locality.

Therefore, in accordance with the IAQM guidance presented within Appendix AQ2, the sensitivity of the area to human health impacts is defined as 'low'.

Ecological Sensitivity

As discussed within Section 4.3.3, there are no ecological receptors which require assessment within 50m of the site boundary or within 50m of the site access roads (assessed up to 500m from the site entrance, as a worst-case scenario) of the Application Site. As such, impacts have not been considered within the assessment.

Sensitivity Summary

A summary of the sensitivity of the area to potential impacts from construction dust is presented within Table 5-3.

Table 5-3
Construction Phase Assessment Summary – Sensitivity of Surrounding Area

Potential Impact	Sensitivity of Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low	High	High	High
Human Health	Low	Low	Low	Low
Ecological	N/A	N/A	N/A	N/A

5.1.4 Assessment Summary

A summary of the determined risk category for each phase of the construction operation identified above is presented within Table 5-4.

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[20] Environmental Protection UK and Institute of Air Quality Management, 'Land-Use Planning and Development Control: Planning for Air Quality', 2015.

Table 5-4
Construction Phase Assessment Summary of Risk– Requirement for Site Specific Mitigation

Potential Impact	Risk			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust Soiling	Negligible	High Risk	High Risk	High Risk
Human Health	Negligible	Low Risk	Low Risk	Low Risk
Ecological	N/A	N/A	N/A	N/A

5.2 Construction Phase – Vehicular Pollutants

Road traffic emissions associated with vehicle movements, particularly HDV movements, during the construction phase of the development have the potential to result in increased concentrations of combustion related pollutants, such as NO_2 and PM_{10} in the vicinity of the development site.

The DMRB states that further assessment of potential air quality impacts should be undertaken if the following criteria are met on any link affected by a proposed development:

- increase in 24-hour AADT flow of more than 1,000-vehicles; and/or
- increase in 24-hour AADT flow of more than 200-HDV.

Further guidance[21] provided by EPUK and IAQM, states that a detailed assessment of potential air quality impacts should be undertaken if the following criteria are met on any link affected by a proposed development:

- change in 24-hour LDV flows of:
  - more than 100 AADT within or adjacent to an AQMA; or
  - more than 500 AADT elsewhere.
- change in 24-hour HDV flows of:
  - more than 25 AADT within or adjacent to an AQMA; or
  - more than 100 AADT elsewhere.

The Proposed Development site is located within close proximity of AQMA 3 and AQMA 5 and, therefore, the lower screening criterion (i.e. 100 LDV and 25 HDV) would apply.

Information on traffic movements anticipated during construction works was unavailable for the completion of the Air Quality Assessment. However, the development quantum is not anticipated to result in a significant increase in movements above the DMRB or the EPUK and IAQM criterion. The duration of movements will be short term in nature and are not considered further within the context of this assessment.

Therefore, in accordance with the criterion presented within EPUK and IAQM guidance, additional road vehicle trips during the construction phase of the scheme '*can be considered to have insignificant effects*' on air quality.

With regard to the DMRB criteria, the predicted increase in traffic on the surrounding road links is considered to be below the defined threshold (1,000 AADT or 200 HDV movements) for an 'affected road'. Therefore, in accordance with the DMRB Guidance, '*the impact of the*

[21] EPUK and IAQM, *'Land-Use Planning and Development Control: Planning for Air Quality'*, 2015.

scheme [from construction phase vehicle movements] *can be considered to be neutral in terms of local air quality and no further work is required*".

5.3 Construction Phase – Non-road Mobile Machinery

NRMM refers to mobile machines, transportable industrial equipment or vehicles which are fitted with an internal combustion engine and not intended for transporting goods or passengers on roads.

Pollutants emitted by NRMM that may have the most significant potential effects on local air quality are particulate matter (PM_{10} and $PM_{2.5}$), and NOx/NO_2. Typically NRMM is associated with construction sites and, therefore there is a potential for NRMM emissions to adversely affect local air quality as a result of the proposed development.

However, LAQM.TG(16) guidance states that[22], with the application of suitable control measures and site management, exhaust emissions from on-site NRMM are "*unlikely to make a significant impact on local air quality. In the vast majority of cases they will not need to be quantitatively assessed*".

[22] *Local Air Quality Management Technical Guidance* LAQM.TG(16), DEFRA, April 2016. Page 7-9.

6.0 OPERATIONAL PHASE ASSESSMENT – DISPERSION MODELLING INPUTS

This section presents inputs into the operational phase assessment, to determine potential air quality impacts arising from additional development trips.

6.1 Vehicular Pollutants

Additional vehicle movements associated with the development will generate additional emissions, such as NO_2 and PM_{10} on the local and regional road networks.

Traffic data presented in Appendix AQ3 illustrates that the trip generation for the proposed development are in excess of the EPUK and IAQM[23] on a number of road links. Trip generation for the proposed development are below the DMRB[24] screening criteria on all road links. However, to provide a quantitative assessment to support the planning application and address pre-application comments from BDBC Environmental Health, a detailed dispersion modelling assessment has been undertaken using the ADMS Roads v4.0 software package to quantitatively assess air quality impacts associated with additional vehicle trips. This model is routinely used in the UK for environmental assessment work.

6.1.1 Model Inputs

Predicted trip generation was provided by Bryan G Hall, transport consultants to the applicant. Traffic data utilised within the dispersion modelling assessment is presented within Appendix AQ3.

The 2022 development opening year was considered with appropriate 'do-minimum' and 'do-something' scenarios. The 'do-minimum' scenario included predicted traffic data should the development not occur. The 'do-something' scenario included predicted traffic data should the development be completed (i.e. the proposed residential development).

Speeds entered into the dispersion modelling assessment were assumed to accord with the national speed limit for each link. It is noted that paragraph 7.247 of LAQM.TG(16) recommends that to represent speeds within dispersion modelling for non-congested and motorway junctions and roundabouts, a speed reduction of 10kph slower than the average free-flowing speed should be applied, when local information with regards to congestion and associated speeds is not available. As emission factors are speed related slower speeds would be associated with higher emission factors and would therefore represent a worst-case assessment in terms of overall emissions and concentrations. It is noted that LAQM.TG(09), which was replaced by LAQM.TG(16) in April 2016, recommended a slow-down phase of 20kph for a 50m approach to roundabouts / junctions in order to represent the associated elevated emission. More detail on the modelled speeds and associated emissions factors is provided within Appendix AQ5.

Emission factors for NO_X and PM_{10} were determined for each scenario using the Emission Factor Toolkit (EFT) (v.7.0) as produced by DEFRA, based upon a 2022 development opening year.

A sensitivity assessment using emission factors corresponding to a 2015 opening year (matching the verification year) has also been undertaken, as detailed in Appendix AQ5.

[23] EPUK and IAQM, *'Land-Use Planning and Development Control: Planning for Air Quality'*, 2015.

[24] Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, HA 207/07 - Air Quality, Highways Agency, 2007.

These modelling assumptions and sensitivity on the dispersion modelling inputs, are in accordance with principles of the IAQM's Position Statement on *Dealing with Uncertainty in Vehicle NOx Emissions within Air Quality Assessments*[25].

6.1.2 Model Inputs: Background Concentrations

In accordance with discussions with BDBC, the background pollutant concentrations were taken from the DEFRA background maps, unless local background monitoring data is available and provides a higher concentration to ensure a conservative assessment. In the absence of local background monitoring data for PM_{10}, background concentrations from the DEFRA background maps have been used as presented in Table 4-5.

There are two diffusion monitoring sites; DT36 (NGR: 368371, 424195) and DT22 (NGR: 369157,422495) of an 'urban background' classification within the development locale, defined as *'urban locations away from major sources and broadly representative of town/city-wide background concentrations, e.g. urban residential areas'*.

DT36 is located approximately 0.6km to the northwest of the proposed development, in a location less than 200m from the surrounding major road network (70m from A666 Blackburn Road) in a residential area. DT22 is located approximately 1.0km to the south of the proposed development, in a location less than 200m from the surrounding major road network (90m from A666 Blackburn Road) in a residential area. Therefore, in accordance with the DMRB, an emission proportion will remain to be monitored from vehicles travelling on surrounding roads, and this cannot be considered a true background concentration.

However, it has been requested by the Environmental Health Officer of BDBC that the concentrations recorded in 2015 at the urban background site of DT36 be utilised within the model. The utilisation of monitored concentrations from DT36 is therefore considered a worst case scenario given that double counting of emissions from the A666 Blackburn Road would be likely.

6.1.3 Model Inputs: Meteorological Data

To calculate pollutant concentrations at identified receptor locations the model uses sequential hourly meteorological data, including wind direction, wind speed, temperature, cloud cover and stability, which exert significant influence over atmospheric dispersion.

As previously stated in Section 4.2.1 dispersion modelling has been undertaken using 2015 Manchester Airport meteorological data.

6.1.4 Model Inputs: Assessment Area

To In order to assess the impact of the proposed development on the two AQMAs in proximity to the Site, an output grid was also modelled covering AQMA No. 3 and AQMA No. 5. Both grids were input with a resolution of 5m utilising the 'intelligent gridding' option within the model.

Reference should be made to Drawing AQ3 for an illustration of the modelled concentration and contour of dispersion from road vehicle emissions at ground level (z=1.5m) from the proposed development.

[25] http://www.iaqm.co.uk/text/position_statements/vehicle_NOx_emission_factors.pdf - accessed December 2016.

6.1.5 Model Inputs: Surface Roughness Length

A roughness length z_0 of 0.5m was used within the assessment area of this dispersion modelling study. This value of z_0 is comparable to *'parkland, open suburbia'* and therefore considered appropriate for the morphology of the dispersion modelling assessment area.

6.1.6 Model Inputs: Monin-Obukhov Length

The minimum Monin-Obukhov (MO) length allows for the effect of heat production from the surrounding area. The larger the city, the larger the heat production (from buildings are traffic etc.) and the less stable the atmosphere. This effect is not taken into account within the meteorological data and therefore is input separately in to the model.

A minimum MO length of 30m was used within the assessment area of this dispersion modelling study. This value is considered to be appropriate for *'cities and large towns'*, and is therefore deemed to be representative of the immediate Darwen locale and the close proximity of other towns.

6.1.7 Model Inputs: Overview

The modelling parameters are summarised in Table 6-1.

Table 6-1
Summary of Modelling Inputs

Parameter	Description	Input Variable
Surface Roughness	Surface roughness of the modelling domain as a function of land use	z_0 = 0.5m
Minimum MO length	Minimum MO length of the modelling domain as a function of land use	MO length = 30m
Road Source Emissions	Source of the emission factors used	EFT v.7.0
Emission Year	Modelling year used to factor the traffic emissions	2015 Verification year 2022 for the expected development opening year (B)
Road Type	Road type within the EFT emission database	Urban (not London)
Elevation of Road	Height of the road link above ground level	0m for all road links.
Road Width	Width of the road link	Road width used depended on data obtained from OS map data for the specific road link
Road Speed	Road speed in km/h	Reference should be made to Appendix AQ3 for further information
Time Varied Emissions	Daily, weekly or monthly variations in emissions applied to road sources	None
Meteorology	Representative hourly sequential meteorological data	2015 Manchester Airport
Background	Background pollutant concentration considered during the modelling	NO_2: Local monitored data using DT36 2015 concentrations PM_{10}: Mapped backgrounds presented within Table 4-5

Output	Output as gridded or specified points	Specific points and grid of 5m resolution across AQMA No.3 and No.5 (with intelligent gridding option)
Pollutant Output	Pollutants modelled and averaging time	NO_2 and PM_{10} annual mean Derived NO_2 1-hour mean and PM_{10} 24-hour mean

Note:
(A) Scenario modelled as an assumed 2022 development opening year, with corresponding 2022 emission factors and 2013 mapped background pollutant concentrations (2015 local monitoring data for NO_2). A sensitivity analysis of dispersion modelling inputs, using 2015 emission factors (corresponding to the verification year) has been undertaken and presented in Appendix AQ5.

6.1.8 Vehicular Pollutant Assessment Sensitivity

Assessment sensitivities are discussed in Appendix AQ5.

7.0 OPERATIONAL PHASE ASSESSMENT – ASSESSMENT OF EFFECTS AND SIGNIFICANCE

This section presents the potential air quality impacts associated with the operational phase of the development, including any required mitigation options.

7.1 Dispersion Modelling Outputs

The baseline scenario for year 2015 has been used to verify the model by comparing modelled outputs against BDBC monitoring data, following the guidance in LAQM.TG(16).

Paragraph 7.508 of LAQM.TG(16) states that: '*The model used should have some form of published validation assessment available and/or should be recognised as being fit for purpose by the regulatory authorities*'. An adjustment factor has been calculated and applied to the modelling results for the assessment scenarios in line with this guidance. The calculated factor from an average of all considered monitoring locations is 2.39. The verification process is detailed within Appendix AQ4. The verification factor derived through the NOx study has also been applied to the modelled PM_{10} concentrations, as requested by the Environmental Team of BDBC.

ADMS Roads modelled NOx concentrations at each considered receptor location have been processed using DEFRA's NOx to NO_2 calculator version 5.1. The traffic mix within the calculator has been set to "All UK traffic" for a 2015 year (i.e. the baseline assessment year), which is considered suitable for the study area. 'Blackburn and Darwen Borough Council' was selected as the local authority. The calculator predicts annual mean NO_2 concentrations based on the verified road-NOx component and the background NO_2.

EPUK and IAQM guidance states that *'it is recommended that $PM_{2.5}$ is used to assess the impact of combustion sources (including road traffic) rather than PM_{10}'*. As such, while PM_{10} concentrations have been modelled, the results predicted have been assessed against the AQO for $PM_{2.5}$ in order to provide a worst-case assessment.

7.2 Operational Phase Impact Assessment

7.2.1 Nitrogen Dioxide Annual Mean Modelling Results

Predicted annual mean ground level NO_2 concentrations were assessed against the AQO of 40µg/m^3.

Table 7-1
Summary of Predicted Annual Mean NO_2 Concentrations: Road Vehicle Emissions

Receptor[(B)]	2022 (µg/m^3) [(A)]		Change (µg/m^3)	Change as a Percentage of the AQO (%)
	'Do-minimum'	'Do-something'		
R1	23.0	23.0	0.01	0.03%
R2	30.2	30.3	0.05	0.13%
R3	31.8	31.9	0.06	0.15%
R4	28.2	28.2	0.03	0.07%
R5	31.7	31.7	0.05	0.13%
R6	28.3	28.3	0.04	0.10%
R7	26.1	26.2	0.03	0.08%
R8	30.0	30.0	0.06	0.15%

R9	27.0	27.0	0.04	0.10%
R10	30.6	30.7	0.09	0.23%
R11	24.1	24.2	0.12	0.30%
R12	22.6	22.6	0.06	0.15%
R13	24.1	24.3	0.19	0.48%
R14	28.0	28.0	0.04	0.10%
R15	29.0	29.0	0.05	0.13%
R16	29.3	29.3	0.05	0.13%
PR1	-	22.8	-	-
PR2	-	23.4	-	-
PR3	-	23.0	-	-
PR4	-	23.2	-	-

NOTES:
(A) Scenario modelled as an assumed 2022 development opening year, with 2022 emission factors and locally monitored background concentration of 21.5µg/m^3 (DT36).
(B) As detailed in Table 4-2, some receptors have residential occupancy on the first floors, with other land use such as retail occupying the ground floor. As a worst case scenario, it is assumed that all ground floor levels are residential and therefore comparable to the annual mean AQO.

As shown in Table 7-1, there are no predicted exceedances of the annual mean NO_2 AQO at any identified receptor in either scenario. It is considered that the low predicted marginal increase in absolute concentrations is a function of the low vehicle numbers generated by the proposed development.

Table 7-1 shows that the predicted concentrations of annual mean NO_2 at the receptor locations of the proposed development are 'well below' the AQO with the highest predicted concentration being 23.4µg/m^3 at receptor PR2. Predicted impacts on annual mean NO_2 concentrations are summarised in Table 7-2.

Table 7-2
Summary of Predicted Annual Mean NO_2 Impacts: Road Vehicle Emissions

Receptor	Concentration with Development	Percentage Change Relative to AQO (%)	Impact
R1	<75% of the AQO	<1% of the AQO	Negligible
R2	<75% of the AQO	<1% of the AQO	Negligible
R3	<75% of the AQO	<1% of the AQO	Negligible
R4	<75% of the AQO	<1% of the AQO	Negligible
R5	<75% of the AQO	<1% of the AQO	Negligible
R6	<75% of the AQO	<1% of the AQO	Negligible
R7	<75% of the AQO	<1% of the AQO	Negligible
R8	<75% of the AQO	<1% of the AQO	Negligible
R9	<75% of the AQO	<1% of the AQO	Negligible
R10	<75% of the AQO	<1% of the AQO	Negligible
R11	<75% of the AQO	<1% of the AQO	Negligible
R12	<75% of the AQO	<1% of the AQO	Negligible
R13	<75% of the AQO	<1% of the AQO	Negligible
R14	<75% of the AQO	<1% of the AQO	Negligible

R15	<75% of the AQO	<1% of the AQO	Negligible
R16	<75% of the AQO	<1% of the AQO	Negligible

As indicated in Table 7-2, the predicted percentage change on annual mean NO_2 concentrations is '<1% of the AQO'. The predicted concentrations with the development are '75% or less of AQO' at all receptors. The unmitigated impact is predicted negligible at all considered receptors in accordance with the stated assessment methodology.

7.2.2 Nitrogen Dioxide 1-hour Mean Modelling Results

A methodology is presented within LAQM.TG(16) to determine compliance with the hourly mean NO_2 objective. This Guidance states that:

> *'[…] exceedances of the NO_2 1-hour mean are unlikely to occur where the annual mean is below 60µg/m^3.'*

The maximum annual mean 'do-something' concentration is 31.9µg/m^3, predicted at receptor R3 – 553 Blackburn Road. Therefore, predicted concentrations are below the 60µg/m^3 indicative criteria and, in accordance with DEFRA guidance, exceedances of the 1-hour mean NO_2 AQO are considered unlikely.

7.2.3 Annual Mean Particulate Matter Modelling Results

Predicted annual mean ground level PM_{10} concentrations were assessed against the $PM_{2.5}$ AQO of 25µg/m^3.

Table 7-3
Summary of Predicted Annual Mean PM_{10} Concentrations: Road Vehicle Emissions

Receptor	2022 (µg/m^3)[A]		Change (µg/m^3)	Change as a Percentage of the AQO (%)
	'Do-minimum'	'Do-something'		
R1 [B]	16.1	16.1	0.00	0.01
R2 [B]	16.1	16.1	0.02	0.07
R3 [B]	18.3	18.3	0.02	0.07
R4 [B]	18.4	18.4	0.01	0.03
R5 [B]	17.1	17.1	0.01	0.05
R6 [B]	17.9	17.9	0.01	0.05
R7 [C]	18.0	18.0	0.01	0.04
R8 [C]	15.5	15.5	0.02	0.08
R9 [C]	16.6	16.7	0.01	0.05
R10 [C]	15.7	15.7	0.03	0.10
R11 [C]	16.8	16.9	0.04	0.16
R12 [C]	14.8	14.9	0.02	0.07
R13 [D]	14.3	14.4	0.06	0.25
R14 [E]	14.3	14.4	0.01	0.06
R15 [E]	18.3	18.3	0.02	0.07
R16 [E]	18.6	18.6	0.02	0.07
PR1 [D]	-	13.9	-	-
PR2 [D]	-	14.0	-	-
PR3 [C]	-	14.5	-	-
PR4 [C]	-	14.5	-	-

NOTES:
(A) Scenario modelled as an assumed 2022 development opening year, with 2022 emission factors and 2013 mapped background pollutant concentrations.
(B) Annual mean concentration inclusive of apportioned background concentration of 15.7µg/m^3.

(C) Annual mean concentration inclusive of apportioned background concentration of 14.0µg/m^3.
(D) Annual mean concentration inclusive of apportioned background concentration of 13.4µg/m^3.
(E) Annual mean concentration inclusive of apportioned background concentration of 16.1µg/m^3.

As shown in Table 7-3, there are not predicted to be any exceedances of the annual mean PM_{10} AQO, or the more stringent $PM_{2.5}$ AQO, at any identified receptor in either scenario.

Table 7-3, also shows that the predicted concentrations of annual mean PM_{10} at the receptor locations of the proposed development are 'well below' the AQO for PM_{10} and $PM_{2.5}$, with the highest predicted concentration being 14.5µg/m^3 at receptor PR4.

Predicted impacts on annual mean PM_{10} concentrations are summarised in Table 7-4.

Table 7-4
Summary of Predicted Annual Mean PM_{10} Impacts: Road Vehicle Emissions

Receptor	Concentration with Development	Percentage Change Relative to AQO (%)	Impact
R1	<75% of the AQO	<1% of the AQO	Negligible
R2	<75% of the AQO	<1% of the AQO	Negligible
R3	<75% of the AQO	<1% of the AQO	Negligible
R4	<75% of the AQO	<1% of the AQO	Negligible
R5	<75% of the AQO	<1% of the AQO	Negligible
R6	<75% of the AQO	<1% of the AQO	Negligible
R7	<75% of the AQO	<1% of the AQO	Negligible
R8	<75% of the AQO	<1% of the AQO	Negligible
R9	<75% of the AQO	<1% of the AQO	Negligible
R10	<75% of the AQO	<1% of the AQO	Negligible
R11	<75% of the AQO	<1% of the AQO	Negligible
R12	<75% of the AQO	<1% of the AQO	Negligible
R13	<75% of the AQO	<1% of the AQO	Negligible
R14	<75% of the AQO	<1% of the AQO	Negligible
R15	<75% of the AQO	<1% of the AQO	Negligible
R16	<75% of the AQO	<1% of the AQO	Negligible

As indicated in Table 7-4, the predicted percentage change of annual mean PM_{10} concentrations are predicted to be '<1% of the $PM_{2.5}$ AQO'. The predicted concentrations with the development are '<75% of the AQO' at all considered locations. The unmitigated impact is predicted to be negligible at all considered receptors in accordance with the stated assessment methodology.

7.2.4 24-hour Mean Particulate Matter Modelling Results

A methodology is presented within LAQM.TG(16) to determine compliance with the 24-hour mean PM_{10} objective, using the following relationship:

> No. 24-hour mean exceedances = -18.5 + 0.00145 × annual mean^3 + (206/annual mean)

Based upon the maximum predicted annual mean PM_{10} concentration of 18.7µg/m^3 modelled at receptor R16 – office and residential premises on 43 Green Street (Ground Floor Retail), this equates to a 1 exceedence of the 24-hour mean PM_{10} AQO. 35 exceedances of the 24-hour mean AQO are permitted and, therefore, the number of maximum exceedances is in compliance with the 24-hour mean AQO.

7.3 Impact on AQMAs

The impact of the proposed development on annual NO_2 concentrations within AQMAs No.3 and No.5 were assessed. Reference should be made to Drawing AQ3 for an illustration of the modelled concentration and contour of dispersion from road vehicle emissions at ground level (z=1.5m) from the proposed development.

As presented in Drawing AQ3, the Process Contribution on AQMA No.3 is less than 0.04 µg/m^3 and less than 0.05 µg/m^3 within AQMA No.5. Given the low predicted contributions, the development would not be considered to impact upon the future revocation of either AQMA.

7.4 Cumulative Assessment: Gas Generation Facility

As discussed in Section 4.4.5, a review of the potential cumulative effects of the proposed development and the gas generation facility on Goose House Lane has been undertaken.

The predicted NO_2 Process Contribution at each relevant receptor location has been included within the 'do-minimum' and 'do-something' scenarios when assessing the overall significance of the Proposed Development. PM_{10} concentrations were not predicted within the air quality assessment for the power plant, as such have not been assessed for cumulative impacts.

Predicted cumulative annual mean ground level NO_2 concentrations were assessed against the AQO of 40µg/m^3, as presented in Table 7-5.

Table 7-5
Summary of Predicted Cumulative Concentrations (Annual Mean NO_2)

Receptor	NGR (m) (x,y)	Process Contribution Power Station (µg/m^3)	2022 Annual Mean NO_2 (µg/m^3)	
			Adjusted Do Minimum	Adjusted Do Something
No.14 – Caravan Park	369110, 423777	4.47	27.0	27.1
No.18 – AQMA 3	369043, 422566	0.20	24.4	24.4
No.19 – AQMA 5	369314, 424137	0.13	24.9	25.0

Table 7-5 shows that when the predicted Process Contribution associated with the operation of the power plant is taken into account, predicted annual mean NO_2 concentrations at the receptor locations considered remain 'well below' the AQO with the highest predicted concentration being 27.1 µg/m^3 at receptor 14 (Caravan Park).

Table 7-6
Summary of Predicted Cumulative Impacts (Annual Mean NO_2)

Receptor	Concentration with Development	Percentage Change Relative to AQO (%)	Impact
No.14	<75% of the AQO	<1% of the AQO	Negligible

No.18	<75% of the AQO	<1% of the AQO	Negligible
No.19	<75% of the AQO	<1% of the AQO	Negligible

As indicated in Table 7-6, the predicted percentage change on annual mean NO_2 concentrations in the cumulative assessment scenario remains '<1% of the AQO'. The predicted concentrations with the development remains '75% or less of AQO' at all relevant modelled receptors. The unmitigated cumulative impact is predicted negligible at all considered receptors in accordance with the stated assessment methodology.

The maximum predicted annual mean 'do-something' concentration in the cumulative assessment scenario is 26.9µg/m^3, predicted at receptor R14 – the Caravan Park. Using the methodology stated in Section 7.2.2 to determine compliance with the hourly mean NO_2 objective, exceedances of the 1-hour mean NO_2 AQO are considered unlikely.

7.5 Significance of Air Quality Impacts

The EPUK and IAQM guidance[26] considers a number of factors for the determination of significance of predicted air quality impacts. Such factors include:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the worst case assumptions adopted when undertaking the prediction of impacts; and
- the extent to which the proposed development has adopted best practice to eliminate and minimise emissions.

In relation to the Darwen Hollins scheme, the unmitigated impacts associated with the scheme have been predicted in accordance with the stated methodology. The following factors have been taken into account.

- the marginal change as a percentage of annual mean NO_2 and PM_{10} concentrations is predicted to be <1% of the AQO at all of the considered receptors;
- the annual mean NO_2 and PM_{10} concentrations with the development is predicted to be '75% or less of the AQO' at all considered receptors;
- a negligible impact is predicted at all considered receptors;
- exceedences of the 1-hour mean NO_2 and 24-hour mean PM_{10} AQOs are considered unlikely, based upon the marginal change in concentrations and absolute concentrations predicted through the dispersion modelling study; and
- a series of worst-case assumptions have been applied as part of the assessment, including sensitivity assessment on the dispersion modelling inputs.

Therefore, on the basis of the above, the overall effect on air quality as a result of the additional development trips is considered to be 'not significant' in accordance with the EPUK and IAQM guidance.

[26] EPUK and IAQM, *'Land-Use Planning and Development Control: Planning for Air Quality'*, 2015.

8.0 MITIGATION MEASURES

This section presents any mitigation measures required during the construction and operational phases of the development in order to reduce the potential impact of the predicted effect.

This section presents any mitigation measures required during the construction and operational phases of the development in order to reduce the potential impact of the predicted effect.

8.1 Construction Dust Phase

An assessment of the significance of impacts associated with construction phase dust has been undertaken in accordance with the IAQM methodology. A summary of the risk category associated with each identified source of construction phase dust is presented within Table 5-4, for the purposes of identifying mitigation requirements.

The risk of dust soiling effects is assessed as high risk from the earthworks, construction and trackout activities, and negligible from the demolition activities.

The risk of human health effects from PM_{10} is assessed as low risk for earthworks, construction and trackout activities, and negligible from the demolition activities.

In accordance with the IAQM guidance, no additional mitigation beyond that required by legislation is required for demolition activities. Best practise control measures for demolition are however recommended. For earthworks, construction and trackout activities measures listed as 'highly recommended' within the IAQM guidance document should be implemented in order to mitigate potential dust effects.

In order to control potential impacts, the mitigation measures presented within Table 8-1 are proposed.

Table 8-1
Construction Dust Mitigation Measures

Site Application	Mitigation Measure
General dust management	Record all dust and air quality complaints and take appropriate measures to reduce emissions
	Record any exceptional; incidents that cause dust off site.
	Undertake daily visual inspection of dust soiling and dust generation and record in site log (available for the local authority if requested)
	Ensure an adequate supply of water is available onsite for effective dust suppression
	Use enclosed chutes and conveyors and cover skips
	Minimise drop heights from conveyors, loading shovels and other material handling equipment
	Impose a site speed limit of 10mph on unpaved haul roads
	Ensure all vehicles engines are switched off when stationary
	Plan site layout so machinery is located away from receptors as far as possible
	Erect solid barriers around dusty activities or the site boundary
	Enclose specific operations where there is a high potential for dust production
	Avoid site runoff of water or mud
	Keep site fencing , barriers and scaffolding clean using wet methods

Site Application	Mitigation Measure
	Remove material that have the potential to produce dust from the site as soon as possible
Demolition	Ensure effective water suppression is used during the demolition operations Avoid explosive blasting
Earthworks	Re-vegetate earthworks and soil stockpiles to stabilise surfaces as soon as practicable
	Cover stockpiles if not vegetated and only remove in small areas during work
	Avoid Double Handling of material
	Cease operations during high winds in the direction of sensitive receptors
Construction	Avoid scabbling (roughing of concrete surfaces) if possible
	Ensure sand and other aggregates are stored in bunded areas and are not allow to dry out
Trackout	Use water assisted dust sweepers on the access and local roads to removed tracked out material is necessary
	Avoid dry sweeping large areas
	Ensure vehicles entering and leaving sire are covered to prevent escape of materials during transport
	Implementation of wheel washing system with hard surfacing between facility and public road
	Access gates to be located at least 10m from receptors where possible

Potential dust effects during the construction phase are considered to be temporary in nature. The impacts are determined to be temporary as they will only potentially occur throughout the construction phase and short-term because these will only arise at particular times when certain activities and meteorological conditions for creating the level of magnitude predicted combine.

However, with the application of the above dust control and mitigation measures, it is considered that impacts at all receptors will be 'not significant' in accordance with the IAQM guidance.

8.2 Construction Phase Road Traffic Emissions

Potential air quality impacts associated with construction phase road traffic emissions (principally HDV movements) have been screened out for further assessment with associated impacts on air quality predicted to result in an 'insignificant' effect. Therefore, mitigation measures are not considered to be required.

8.3 Construction Phase NRMM Emissions

NRMM and plant should be well maintained. If any emissions of dark smoke occur then the relevant machinery should stop immediately and any problem rectified. In addition, the following controls should apply to NRMM:

- all NRMM should use fuel equivalent to ultralow sulphur diesel;
- all NRMM should comply with either the current or previous EU Directive Staged Emission Standards;
- all NRMM should be fitted with Diesel Particulate Filters (DPF) conforming to defined and demonstrated filtration efficiency (load/duty cycle permitting);
- the on-going conformity of plant retrofitted with DPF, to a defined performance standard; and

- implementation of fuel conservation measures including instructions to throttle down or switch off idle construction equipment; switch off the engines of trucks while they are waiting to access the site and while they are being loaded or unloaded, ensure equipment is properly maintained to ensure efficient fuel consumption.

Successful implementation of the above mitigation measures would ensure that emissions from the construction phase and NRMM used during construction are 'not significant'.

8.4 Operational Phase Road Traffic Emissions

An assessment of exhaust emissions associated with the operation of the scheme determined a negligible impact at all considered receptors, in accordance with the stated EPUK and IAQM assessment methodology. Therefore mitigation measures are not required.

In accordance with the principles of good practice from the EPUK/IAQM guidance, however, the provision of a Travel Plan[27] with measures to encourage sustainable means of transport (i.e. public transport, cycling and walking) has included the following measures:

- footways will be provided within the Site, linking to the existing footway on Eastgate;
- a travel guide available within the Site office and provided to all new residents within their welcome pack, the guide will include:
    - the range of sustainable travel options available;
    - links to public transport timetables and route maps for local services;
    - a cycle map showing the strong local links;
    - links to further useful sources of information;
- an annual newsletter to residents detailing any news on travel changes, planned road works and tickets offers;
- marketing of the benefits of walking and cycling through resident engagement techniques;
- the layout of the development will take into consideration the specific needs of cyclists and storage requirements;
- cycling parking provision will be provided prior to occupations of individual units; and
- residents will be made aware of the benefits of electric vehicles, together with locations of charging points.

[27] Westgate Consulting, 2016. Proposed Development at Former Hollins Paper Mill, Darwen. Travel Plan, December 2016.

9.0 CONCLUSIONS

SLR Consulting has undertaken an assessment of potential air quality impacts associated with the operation of a proposed residential development on land off Hollins Grove Road, Darwen (land of the Former Darwen Hollins Paper Mill).

A qualitative assessment of the potential dust impacts during the construction of the proposed development has been undertaken. Through good practice and implementation of appropriate mitigation measures, it is expected that the release of dust would be effectively controlled and mitigated, with resulting impacts considered to be 'not significant'. All dust impacts are considered to be temporary and short-term in nature.

Due to the low additional number of HDV trips during the construction phase of the development, there is predicted to be a 'not significant' impact on air quality from road vehicle exhaust emissions. Furthermore, emissions from plant / NRMM on-site is predicted to result in a 'not significant' impact on air quality

Potential air quality impacts associated with development traffic were quantified using the ADMS Roads v4.0 dispersion model. Additional development trips arising during the scheme are predicted to result in a negligible impact on annual mean NO_2 and PM_{10} concentrations at all receptors. There is no predicted risk of exceendence of the 1-hour mean NO_2 or 24-hour mean PM_{10} AQOs as a result of the development proposals.

Concentrations predicted through the dispersion modelling assessment are considered to be worst-case, and the proposed scheme is proposed to result in an increase in concentrations of <1% of the AQO of the annual mean NO_2 AQO, with a maximum marginal change of 0.16µg/m^3 at discrete receptors. It is noted that no exceedences of the annual mean NO_2 or PM_{10} AQOs were predicted. Therefore, the potential air quality impact of additional development trips can be considered not significant in accordance with the stated guidance.

As such, it is not considered that air quality represents a material constraint to the development proposals, which conform to the principles of National Planning Policy Framework, Planning Practice Guidance and the BDBC Local Plan.

10.0 CLOSURE

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of Gleeson Developments; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Appendix AQ1 – Construction Dust Assessment Methodology

Predicting Risk

The assessment of risk is determined by considering the predicted change in conditions as a result of the proposed development. The risk category for potential dust effects arising from site works is defined into 4No. potential activities:

- demolition;
- earthworks;
- construction; and
- trackout.

The determination of risk categories presented above are based upon the descriptors presented within IAQM: *Guidance on the assessment of dust from demolition and construction*.

Sensitivity of Receptor

To determine the significance of dust effects associated with the construction phase of the proposed development, an evaluation of the sensitivity of the surrounding area is required. Receptors can demonstrate different sensitivities to changes in their environment, and are classified as detailed within Table AQ1-1.

Quoted distances to the nearest receptor are from the dust emission sources. Where this is not known, receptor distances are determined from the site boundary. The risk category is based upon the distance of site works to the nearest receptor.

Table AQ1-1
Methodology for Defining Sensitivity to Dust Effects

Sensitivity of Area	Examples		
	Human Receptors		Ecological Receptors (A)
	Dust Soiling Effects	Health Effects of PM_{10}	
High	• users can reasonably expect an enjoyment of a high level of amenity; or • the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. • indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.	• locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	• locations with an international or national designation and the designated features may be affected by dust soiling; or • locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain. • indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.
Medium	• users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • the appearance, aesthetics or value of their property could be diminished by soiling; or • the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. • indicative examples include parks and places of work.	• locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health • and Safety at Work legislation.	• locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or • locations with a national designation where the features may be affected by dust deposition. • indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.

Low	• the enjoyment of amenity would not reasonably be expected; or • property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal • pattern of use of the land. • indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.	• locations where human exposure is transient. • indicative examples include public footpaths, playing fields, parks and shopping streets.	• locations with a local designation where the features may be affected by dust deposition. • indicative example is a local Nature Reserve with dust sensitive features.

Notes:
(A) Only applicable if ecological habitats are present which may be sensitive to dust effects.

Assessment of Impact Significance – Dust Effects

Table AQ1-2 to Table AQ1-4 illustrate how the sensitivity of the area may be determined for dust soiling, human health and ecosystem impacts, respectively. The highest level of sensitivity from each table should be recorded.

Table AQ1-2
Sensitivity of Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10 – 100	High	Medium	Low	Low
	1 – 10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	<1	Low	Low	Low	Low

Table AQ1-3
Sensitivity of Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32µg/m^3 (>18µg/m^3 in Scotland)	>100	High	High	High	Medium	Low
		10 – 100	High	High	Medium	Low	Low
		1 – 10	High	Medium	Low	Low	Low
	28 – 32µg/m^3 (16-18µg/m^3 in Scotland)	>100	High	High	Medium	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 – 10	High	Medium	Low	Low	Low
	24 – 28µg/m^3 (14-16µg/m^3 in Scotland)	>100	High	Medium	Low	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 – 10	Medium	Low	Low	Low	Low
	<24µg/m^3 (<14µg/m^3 in Scotland)	>100	Medium	Low	Low	Low	Low
		10 – 100	Low	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low	Low
Medium	>32µg/m^3 (>18µg/m^3 in Scotland)	>10	High	Medium	Low	Low	Low
		1 – 10	Medium	Low	Low	Low	Low
	28 – 32µg/m^3 (16-18µg/m^3 in Scotland)	>10	Medium	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low	Low
	24 – 28µg/m^3 (14-16µg/m^3 in Scotland)	>10	Low	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low	Low
	<24µg/m^3 (<14µg/m^3 in Scotland)	>10	Low	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low	Low
Low	-	1	Low	Low	Low	Low	Low

Table AQ1-4
Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m) [A]	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

NOTE:
(A) For trackout, the stances should be measured from the side of the roads used by construction traffic.

Defining the Risk of Impact

Table AQ1-5 to Table AQ1-8 illustrates how the dust emission magnitude should be combined with the sensitivity of the area to determine the risk of impacts with no mitigation measures applied.

Table AQ1-5
Risk of Dust Impacts – Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table AQ1-6
Risk of Dust Impacts – Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table AQ1-7
Risk of Dust Impacts – Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table AQ1-8
Risk of Dust Impacts -–Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	High Risk	Low Risk
Medium	Medium	Low Risk	Negligible
Low	Low	Low Risk	Negligible

Appendix AQ2 – Traffic Related Emissions Assessment Methodology

The EPUK and IAQM guidance provides a two stage approach to determining the need to assess development impacts in an Air Quality Assessment. Stage 1 is used to screen out smaller developments which are likely to have an insignificant effect. Stage 2 relates to the likelihood of air quality impacts with regards to more site specific details.

Stage 1, shown in Table AQ2-1, provides the criteria used to assess the need to proceed to Stage 2. If any of the criteria under (A) coupled with any of the criteria under (B) are met then Stage 2 should be undertaken.

Table AQ2-1
Stage 1 Assessment Criteria

Criteria to Proceed to Stage 2	
A	• 10 or more residential units or a site area of more than 0.5ha • more than 1,000m^2 of floor space for all other uses or a site area greater than 1ha
B	• the development has more than 10 parking spaces • the development will have a centralised energy facility or other combustion process

The Stage 2 site specific criteria, stated in Table AQ2-2, should be reviewed to determine if a full Air Quality Assessment is required. If none of these criteria are met, then there is no requirement to undertake a full Air Quality Assessment and impacts can be considered insignificant.

Table AQ2-2
Stage 2 Assessment Criteria

The Development Will:	**Indicative Criteria to Proceed to an Air Quality Assessment**
Cause a significant change in LDV traffic flows on local roads with relevant receptors	A change of LDV flows of: • more than 100 AADT within or adjacent to an AQMA; or • more than 500 AADT elsewhere.
Cause significant change HDV flows on local roads with relevant receptors	A change of HDV flows of • more than 25 AADT within or adjacent to an AQMA; or • more than 100 AADT elsewhere.
Realign roads, i.e. changing the proximity of receptors to traffic lanes	Where the change is 5m or more and the road is within the AQMA
Introduce a new junction or remove an existing junction near to relevant receptors	Applies to junctions that cause traffic to significantly change vehicle accelerate/decelerate, e.g. traffic lights, or roundabouts
Introduce or change a bus station	Where bus flows will be: • more than 25 AADT within or adjacent to an AQMA; or • more than 100 AADT elsewhere.
Have an underground car park with extraction system	The ventilation extract for the car par will be within 20m of a relevant receptor. Coupled with the car park having more than 100 movement per day (total in and out)
Have one or more substantial combustion processes	Where the combustion unit is: • Any centralised plant using biomass fuel; or • Any combustion plant with single or combined thermal input >300kWh; and • A standby emergency generator associated with a centralised energy centre (if likely to be tested/used >18 hours a year)

Have a combustion process of any size	Where the pollutants are exhausted from a vent or stack in a location and at a height that may give rise to impacts at receptors through insufficient dispersion.

Assessment of Impact Significance

The Air Quality Assessment should demonstrate likely changes in air quality as a result of the proposals. These changes should be quantified and the overall significance of the impact should be determined. Impacts should be assessed at individual relevant receptors and then professional judgement used to determine the overall impact.

Table AQ2-3 illustrates how to describe the impact at each receptor location. The term Air Quality Assessment Level (AQAL) is used to include all Air Quality Objectives and/or limit values. The assessment matrix uses the overall pollutant concentration, with the scheme in place and the %change relative to the AQAL.

It should be noted that in Table AQ2-3 if the scale of the impact magnitude is negative then the resulting effect is adverse. If the scale of the impact magnitude is positive then the resulting effect is beneficial.

Table AQ2-3
Impact Significance Matrix

Concentration with development	**Percentage Change in Air Quality Relative to AQAL (%)**			
	<1	**1-5**	**5-10**	**>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	Substantial	Substantial	Substantial

Appendix AQ3 – Traffic Data

Road traffic data for the Darwen Hollins residential development was provided by Bryan G Hall for use within the Air Quality Assessment, as presented within Table AQ3-1 and Table AQ3-2.

An initial screening assessment of operational phase road traffic movements was undertaken in order to determine whether development trips associated with the scheme are considered 'significant' and thus require an assessment to determine the potential air quality impact. Guidance presented within the EPUK and IAQM: *Land Use Planning and Development Control – Planning for Air Quality* (2015) stipulates a threshold of a 500 LDV increase in traffic flow (100 LDV within an AQMA) to require a detailed assessment. Further guidance is presented within the DMRB which stipulates an 'affected road' which has the potential to impact upon ambient air quality at surrounding receptors as being one which illustrates a change of 1,000 AADT as a result of the operation of a development.

The traffic data provided by Bryan G Hall illustrates that development related flows are significant in terms of the EPUK and IAQM on a number of links. Development related flows on all links are below the DMRB thresholds. However, in order to provide a robust assessment of potential air quality impacts associated with the operation of the development and address pre-application comments from the BDBC Environmental Health officer, an assessment has been made for all links for which development related flows were provided as a worst-case scenario.

Traffic data for the operational phase assessment presented below.

Table AQ3-1
Traffic Data used within the Dispersion Modelling Assessment

Link[C]		24-hour AADT (total flow)		Marginal Change AADT[B]	Marginal Change (%)[B]
		2022 DM [A]	2022 DS [A]		
L1	Hollins Grove Street Site Access	0	712	712	-
L2	Hollins Grove Street (west of Site Access)	3509	3745	236	6.7
L3	Hollins Grove Street (east of Site Access)	3509	3992	483	13.8
L4	Lower Eccleshill Road (north Hollins Grove St)	5204	5623	419	8.1
L5	Goose House lane	3943	4007	64	1.6
L6	Blackburn Road (north of Earcroft Way)	14480	14594	114	0.8
L7	Earcroft Way	15446	15446	0	0.0
L8	Blackburn Road (south of Earcroft Way)	14490	14604	114	0.8
L9	Blackburn Road (north Hollins Grove Street)	17417	17531	114	0.7
L10	Hollins Grove Street (east of Blackburn Road)	3627	3862	235	6.5
L11	Blackburn Road (south of Hollins Grove Street	16274	16395	121	0.7
L12	Earnsdale Road	2957	2957	0	0.0

DM = 'do-minimum'
DS = 'do-something'

(A) Scenario modelled as an assumed 2022 development opening year, with corresponding 2022 emission factors and 2013 background pollutant concentrations (2015 locally monitored data for NO_2.

(B) Marginal changed assessed between the 2022 DM and DS scenarios, reflecting the opening year

(C) .Links were modelled with a 20km/h corresponding 'slow-down' phase prior to all roundabouts and junctions, in accordance with guidance presented within LAQM.TG(09).

HDV percentage flows and vehicle speeds utilised as part of the dispersion modelling is presented in Table AQ3-2.

HDV percentages were assumed to be constant between those monitored from a period of traffic surveys in 2016 and those considered for the 2022 opening year of the development, as 'do-minimum' and 'do-something' scenarios. This represents a worst-case assessment as HDVs emissions are higher – in accordance with the National Transport Model (NTM), actual HDV vehicle trips are projected to decrease between 2016 and 2022, which would result in a proportional reduction of emissions.

Table AQ3-2
Traffic Data used within the Dispersion Modelling Assessment

Link		DM and DS HDV Proportion (%)	Speed (km/h) [A]
L1	Hollins Grove St. Site Access	0	48.2
L2	Hollins Grove St. (west of Site Access)	0	48.2
L3	Hollins Grove St. (east of Site Access)	0	48.2

L4	Lower Eccleshill Rd (north Hollins Grove St)	0.38	48.2
L5	Goose House lane	0.50	48.2
L6	Blackburn Rd (north Earcroft Way)	4.29	48.2
L7	Earcroft Way	4.15	64.4
L8	Blackburn Rd (south of Earcroft Way)	4.08	48.2
L9	Blackburn Rd (north Hollins grove St.)	2.83	48.2
L10	Hollins Grove St (east Blackburn Rd)	0	48.2
L11	Blackburn Rd (south Hollins Grove St	2.97	48.2
L12	Earnsdale Rd	0.33	48.2

Note:
DM = 'do-minimum' DS = 'do-something'
(A) Links were modelled with a 20km/h corresponding 'slow-down' phase prior to all roundabouts and junctions, in accordance with guidance presented within LAQM.TG(09).

Appendix AQ4 – Detailed Dispersion Modelling of Vehicle Emissions: Verification Methodology

Introduction

The potential error in the raw model outputs from the ADMS Roads v4.0 dispersion modelling study has been assessed through a model verification study whereby model outputs for the site suitability assessment were compared with NO_2 diffusion tube monitoring undertaken by BDBC as part of their commitment to LAQM. This is detailed in the following sections.

Potential Sources of Error

Sources of error in the dispersion modelling of road traffic exhaust emissions may include the following:

- omission of other local pollutant sources due to lack of appropriate data;
- uncertainties in traffic flow model input data (e.g. actual vehicle flow data; vehicle fleet composition and percentage HDV; average vehicle speed);
- simplifications in emission factors used and their suitability for the for actual vehicle fleet within the modelling area, particularly in regard to engine size, age and type and the overall maintenance of the vehicle;
- simplifications in building topography and the under-representation of the reduced ventilation effects in street canyons;
- uncertainties and suitability in meteorological data used in modelling study, including model input parameters, such as roughness length, for example; and
- general limitations and assumptions contained within the dispersion model algorithms.

Model Verification Study

A model verification study was undertaken for the year 2015. This corresponds to the 2015 pollutant monitoring results supplied by BDBC, the 2015 Manchester Airport meteorological dataset and the 2015 baseline traffic dataset provided by Bryan G Hall

No AQMAs have been declared for annual mean PM_{10} concentrations within the development locale, nor is any PM_{10} monitoring undertaken in the development locale. The maximum 2013 DEFRA mapped background PM_{10} concentration for the 1km grid squares containing the Proposed Development and surrounding considered receptors is 15.8µg/m^3, as presented within Table 4-5. On this basis, it is considered that the immediate locale surrounding the Proposed Development site is less sensitive to increases of PM_{10} in comparison to NO_2, given that the DEFRA mapping study predicts that background concentrations are 'below' the Objective. However, as a worst-case the derived NOx verification factor has been applied to the modelled PM_{10} concentrations.

Model inputs were as previously described within Section 6.0 of the main body of the report. The verification study included four diffusion tube monitoring locations (DT21, DT31, DT33 & DT34) undertaken by BDBC as presented in Table 4-4 within the main body of the report.

Assessment Verification – NO_2 Monitoring Results

The model output of road-NOx (i.e. the component of total NOx coming from road traffic emissions) has been compared with the 'calculated' road-NOx from 2015 diffusion tube data (with >75% data capture). The calculated road-NOx was calculated from the monitored NO_2 concentrations and the Defra 2015 mapped NO_2 backgrounds using the NOx from NO_2 calculator (Version 5.1, June 2016) available on the DEFRA LAQM Support website.

Table AQ4-2 displays the diffusion tube monitoring results for 2015 and the calculated road NO_X contribution using the methodology contained within LAQM.TG(16).

Table AQ4-2
Monitored Annual Mean NO_2 for 2015 Converted to NO_X

Monitoring Location	NGR (m)		Monitored NO_2 Concentration ($\mu g/m^3$)	Calculated Roadside NO_X Contribution ($\mu g/m^3$) (A)
	X	Y		
DT21 (AQMA 3)	369244	422192	25.0	10.4
DT31	368552	423366	28.7	24.7
DT33 (AQMA 5)	368231	424376	30.0	22.9
DT34 (AQMA 5)	368240	424299	31.7	26.6

Note:
(A) Calculated in accordance with LAQM.TG(16) and DEFRA NO_X to NO_2 calculator version 5.1, assuming a the DEFRA mapped background NO_2 concentration for each grid square, as per Table 4-5.
(B) Data from DT20 was omitted from the verification assessment due to insufficient data on the adjacent road links (i.e. Sudell Road); DT29 was omitted due to its proximity to the motorway to which the traffic data did not extend to.

The calculated annual mean NOx road contribution has been predicted at the monitoring locations, through the dispersion modelling study as presented in Table AQ4-3.

Table AQ4-3
NOx Verification Data 2015

Monitoring Location	Modelled NO_X Road Contribution ($\mu g/m^3$)	Calculated NO_X Roadside Contribution ($\mu g/m^3$)	Ratio
DT21 (AQMA 3)	6.89	10.4	1:1.50
DT31	8.62	24.7	1:2.86
DT33 (AQMA 5)	11.7	22.9	1:1.95
DT34 (AQMA 5)	8.13	26.6	1:3.27
		Average	**1:2.39**

The relationship between modelled and calculated NO_X roadside contributions at the monitoring locations were graphed following the procedure outlined in LAQM.TG(16) and the ratio found to be 1:2.39. All raw modelling results have subsequently been corrected by a factor of 2.39.

In accordance with LAQM.TG(16), *'the majority of results should be within 25% of the monitored concentrations, as a minimum'.* This provides more confidence in the model. As such, the percentage difference has been calculated so that any locations under or over predicting can be removed from the verification process. This stage is detailed in Table AQ4-4. As stated with LAQM.TG(16), refinements have been made to the model performance without '*providing unreasonable data inputs in order to reduce model adjustment factors is not an acceptable approach'*.

Table AQ4-4
Comparison of Monitored Vs Modelled NO_2 Concentrations

Monitoring Location	Modelled NO_X Roadside Contribution ($\mu g/m^3$)	Adjusted Modelled NO_X Road Contribution ($\mu g/m^3$)	Calculated NO_2 Concentration ($\mu g/m^3$)	Monitored NO_2 Concentration ($\mu g/m^3$)	Difference (%)

DT21 (AQMA 3)	6.89	16.5	28.0	25.0	+12.0
DT31	8.62	20.6	26.8	28.7	-6.6
DT33 (AQMA 5)	11.7	28.0	32.4	30.0	+7.9
DT34 (AQMA 5)	8.13	19.5	28.4	31.7	-10.4

Table AQ4-4 illustrates that the relationship between modelled and calculated NO_2 concentrations for all monitoring locations considered within the verification study is within 25%. Therefore, the dispersion modelling is considered to be performing satisfactorily and is representing the modelling domain with accuracy, in accordance with LAQM.TG(16).

As requested by the Environmental Team of BDBC, the NOx verification factor has also been applied to the modelled PM_{10} concentrations.

Appendix AQ5 – Assessment Sensitivities

Year Adjustment

In regards to background levels of air pollutants, LAQM.TG(16) states:

> *'Background concentrations are expected to decline in future years as a result of Government and EU polices and legislation to reduce pollutant emissions.'*

In regard to recent increases in NO_2 concentrations, rather than the predicted decreases, LAQM.TG(16) states:

> *'Background concentrations of nitrogen dioxide are expected to decline, in the future, despite the recent increasing proportion of primary nitrogen dioxide in nitrogen oxides emissions. This increase in primary nitrogen dioxide has had a greater impact at roadside locations, but even here concentrations of nitrogen dioxide are expected to resume a downward trend.'*

This is shown in the national background maps provided by the UK National Air Quality Archive, which predict a year-on-year decrease in all pollutant concentrations. However, a 2011 research project[28] published on behalf of the Department for the Environment, Food and Rural Affairs (DEFRA) found that trends in ambient concentrations of NO_X and NO_2 have not decreased by as much as suggested by current UK emission factors. UK trends in the fraction of primary NO_2 emitted from vehicle exhausts, *f*-NO_2, have illustrated an increase of around 9% over the years 1996 – 2009. As such, there is considered to be a disparity between observed and modelled / background concentrations for assessment against compliance with air quality limit values for NO_2.

Mapped background concentrations were revised by DEFRA in 2016, to update previous 2011 emission projections to a new 2013 base-year. The 2013 update includes forecast projections to 2030 based upon projected emission reductions due to technological advances and improvements to the vehicle fleet-mix. The 2013 mapping projections provide an update to those of 2011 incorporating updated meteorological data, ambient monitoring, vehicle fleet composition, emission factors, including NO_x emissions from road vehicles and updated information on fuel quality. The 2013 mapping projections are based upon and verified against monitored concentrations from 2013, as monitored at a large number of automatic monitoring stations across the Country.

It has been requested by the Environmental Health Officer of BDBC that the concentrations recorded in 2015 at the urban background site of DT36 be utilised within the model. Given the proximity of DT36 to the A666 road network, it is possible that a significant emission proportion will be monitored from vehicles travelling along the A666. The utilisation of monitored concentrations from DT36 is therefore considered a worst case scenario given that double counting of emissions from the A666 Blackburn Road would be likely.

On the basis that the 2015 monitored NO_2 concentration at location DT36 of 21.5µg/m^3 is greater than the mapped DEFRA background concentrations within the development locale (15.8 µg/m^3 to 21.4µg/m^3) the utilisation of the monitored background provides a worst case assessment and confidence in the modelled predictions.

Emission Factors

Road vehicle exhaust emission factors were previously projected to decrease year-on-year due to technological advances and improvements to the fleet mix. This was reflected in

[28] Trends in NO_x and NO_2 emissions and ambient measurements in the UK, DEFRA, 2011.

future year emission factor projections. However, there is current uncertainty over NO_2 concentrations within the UK, with roadside levels not reducing as previously anticipated due to the implementation of new vehicle emission standards. The DEFRA report concludes that actual emission estimates for vehicles are higher than suggested by currently used emission factors.

DEFRA released v7.0 of the EFT in July 2016 and this has been used throughout the assessment. The new version of the tool uses updated NOx and PM_{10} emission coefficient equations for Euro 5 and 6 vehicles (applies to LDVs only) which reflect '*more recent evidence on the real-world emission performance of these vehicles'.*

The impact of road vehicle exhaust emissions has been undertaken for a 2022 opening year of the development. However, in order to provide further assessment and sensitivity of the assessment inputs, an additional scenario has been considered using 2015 emission factors (i.e. an opening year scenario matching that of the verification assessment year). All other assessment inputs remain unchanged. The sensitivity assessment has concentrated upon concentrations of NO_2, given that this is the principal pollutant of concern within BDBC and a greater emission factor in comparison to PM_{10}.

Nitrogen Dioxide Modelling Results – Sensitivity Assessment

Predicted annual mean ground level NO_2 concentrations were assessed against the AQO of 40µg/m^3, with emissions factors calculated using a worst-case 2015 opening year.

For completeness, predicted annual mean concentrations are presented at the relevant NO_2 diffusion tube monitoring location from within the development locale and dispersion modelling domain, based upon those monitoring locations detailed within Table 4-4 of the main body of the report.

Predicted concentrations are presented within Table AQ5-1.

Table AQ5-1
Summary of Predicted Annual Mean NO_2 Concentrations: Road Vehicle Emissions

Receptor	2022 (µg/m^3) [A]		Change (µg/m^3)	Change as a Percentage of the AQO (%)
	'Do-minimum'	'Do-something'		
R1	24.8	24.8	+0.01	0.03
R2	39.6	39.7	+0.08	0.20
R3	43.0	43.1	+0.09	0.23
R4	36.1	36.2	+0.05	0.12
R5	43.2	43.3	+0.08	0.20
R6	35.3	35.4	+0.06	0.15
R7	31.0	31.1	+0.05	0.13
R8	38.1	38.2	+0.09	0.23
R9	32.3	32.4	+0.07	0.18
R10	39.1	39.3	+0.14	0.35
R11	26.1	26.3	+0.21	0.53
R12	23.5	23.6	+0.1	0.25
R13	26.2	26.5	+0.33	0.83
R14	34.3	34.4	+0.07	0.18
R15	36.2	36.3	+0.08	0.20
R16	36.7	36.8	+0.08	0.20

NOTES:
(A) Scenario modelled as an assumed 2022 development opening year, with 2015 emission factors and 2015 locally monitored background concentrations of 21.5µg/m^3 at DT36.
(B) Receptors R3, R15 and R16 are retail / office use at ground floor elevations to which the model has predicted concentrations for retail and office use would not be comparable against the NO_2 annual mean objective.

Table AQ5-1 illustrates that there are exceedences of the NO_2 annual mean AQO at two receptor locations, R3 and R5. The exceedances are however, within both the 'Do-minimum' and 'Do-something' scenarios; demonstrating that they are a result of the background levels input into the sensitivity model as opposed to the impacts from the proposed development.

Predicted impacts on annual mean NO_2 concentrations are summarised in Table AQ5-2.

Table AQ5-2
Summary of Predicted Annual Mean NO_2 Impacts: Road Vehicle Emissions

Receptor	Concentration with Development	Percentage Change Relative to AQO (%)	Impact
R1	<75% of AQO	<1%	Negligible
R2	95 - 102% AQO	<1%	Slight Adverse
R3	103 – 109% AQO	<1%	Moderate Adverse
R4	76 - 94% AQO	<1%	Negligible
R5	103 – 109% AQO	<1%	Moderate Adverse
R6	76 - 94% AQO	<1%	Negligible
R7	76 - 94% AQO	<1%	Negligible
R8	95 - 102% AQO	<1%	Slight Adverse
R9	76 - 94% AQO	<1%	Negligible
R10	95 - 102% AQO	<1%	Slight Adverse
R11	<75% of AQO	<1%	Negligible
R12	<75% of AQO	<1%	Negligible
R13	<75% of AQO	<1%	Negligible
R14	76 - 94% AQO	<1%	Negligible
R15	76 - 94% AQO	<1%	Negligible
R16	76 - 94% AQO	<1%	Negligible

As indicated in AQ5-2, the predicted percentage change from the development on annual mean NO_2 concentrations remains to be '<1% of the AQO'. The predicted concentrations with the development ranges from '<75% of the AQO' to '103-109% of the AQO'.

The highest concentration predicted is at R5 with an annual mean NO_2 concentration of 43.3µg/m^3. The process contribution from the proposed development at this receptor is 0.09µg/m^3, representing 0.23% of the AQO.

The unmitigated impact is considered to be 'Moderate Adverse' at two receptor locations; R3 and R5, in accordance with the stated methodology. This is however due to the predicted baseline concentrations as opposed to the impact of the proposed development.

It is noted that this worst-case 2015 assessment assumes that road traffic exhaust emission factors will remain at the 2015 base year level. DEFRA projections and the basis for future

year road traffic exhaust emission factor reductions are based upon a number of assumptions, including the following:

- improvements in the fleet composition based on European emission factor standards from pre-Euro I/1 to Euro VI/6, resulting in lower exhaust emissions, particularly from September 2014 when all new vehicles are required to be Euro VI compliant (HDVs only);
- improvements in the quality of fuel and some degree of retrofitting, resulting in lower exhaust emissions; and
- improvements and conversions in the technology of National fleet vehicles, resulting in lower exhaust emissions.

It is understood that the construction of the residential units would commence in 2021 and would be built to market demand until all proposed 151 units are built and sold off plot. Therefore, it is considered that the 2015 modelling predictions presented in Table AQ5-1 and Table AQ5-2 are worst-case reflections to provide confidence in the modelling predictions, and do not reflect likely concentrations and impacts predicted in the development locale, arising from road traffic emissions, in the 2022 opening year.

Actual concentrations and impacts predicted through the sensitivity modelling for the development opening year are likely to be lower than those predicted in Table AQ5-1 and Table AQ5-2, given the projected road traffic exhaust emission factor improvements.

Drawings

NOTES

LEGEND

- APPLICATION BOUNDARY
- POTENTIAL TRACKOUT ROUTE (500M FROM SITE ACCESS)
- RECEPTOR LOCATION
- PUBLIC RIGHT OF WAY

N

0 50 100 150 200m 300 400 500

Metres 1:5000

homes by gleeson

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DARWEN HOLLINS PAPER MILL

AIR QUALITY ASSESSMENT

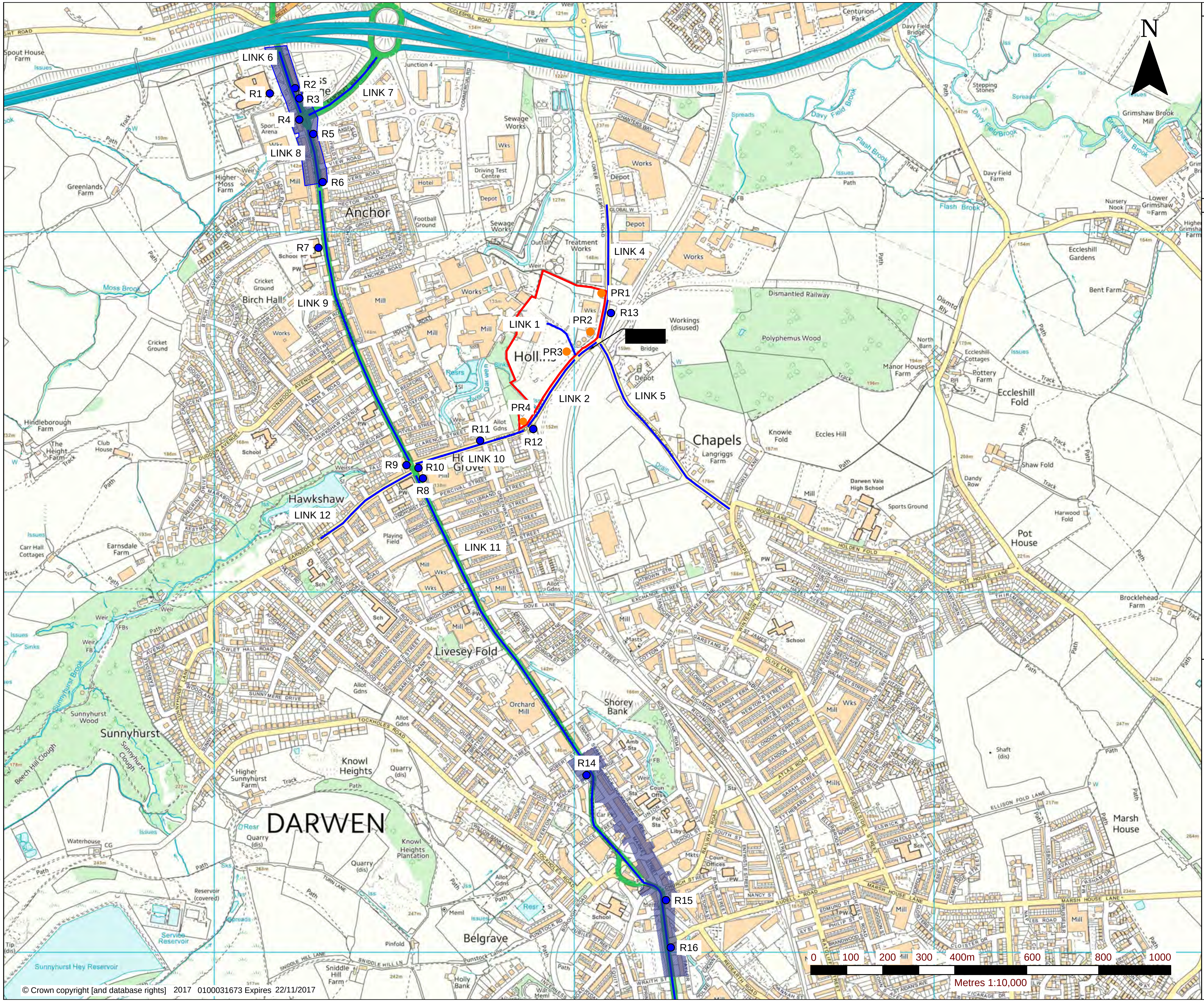
CONSTRUCTION PHASE SENSITIVE RECEPTORS

AQ1

Scale: 1:5,000@A3

Date: DECEMBER 2016

3044.00059.023.01.AQ1.0.dwg



3044.00059.023.01.AQ1.0.dwg

NOTES

LEGEND

- APPLICATION BOUNDARY
- MODELLED ROAD LINK
- RECEPTOR LOCATION
- PROPOSED RECEPTOR LOCATION
- AQMA LOCATION

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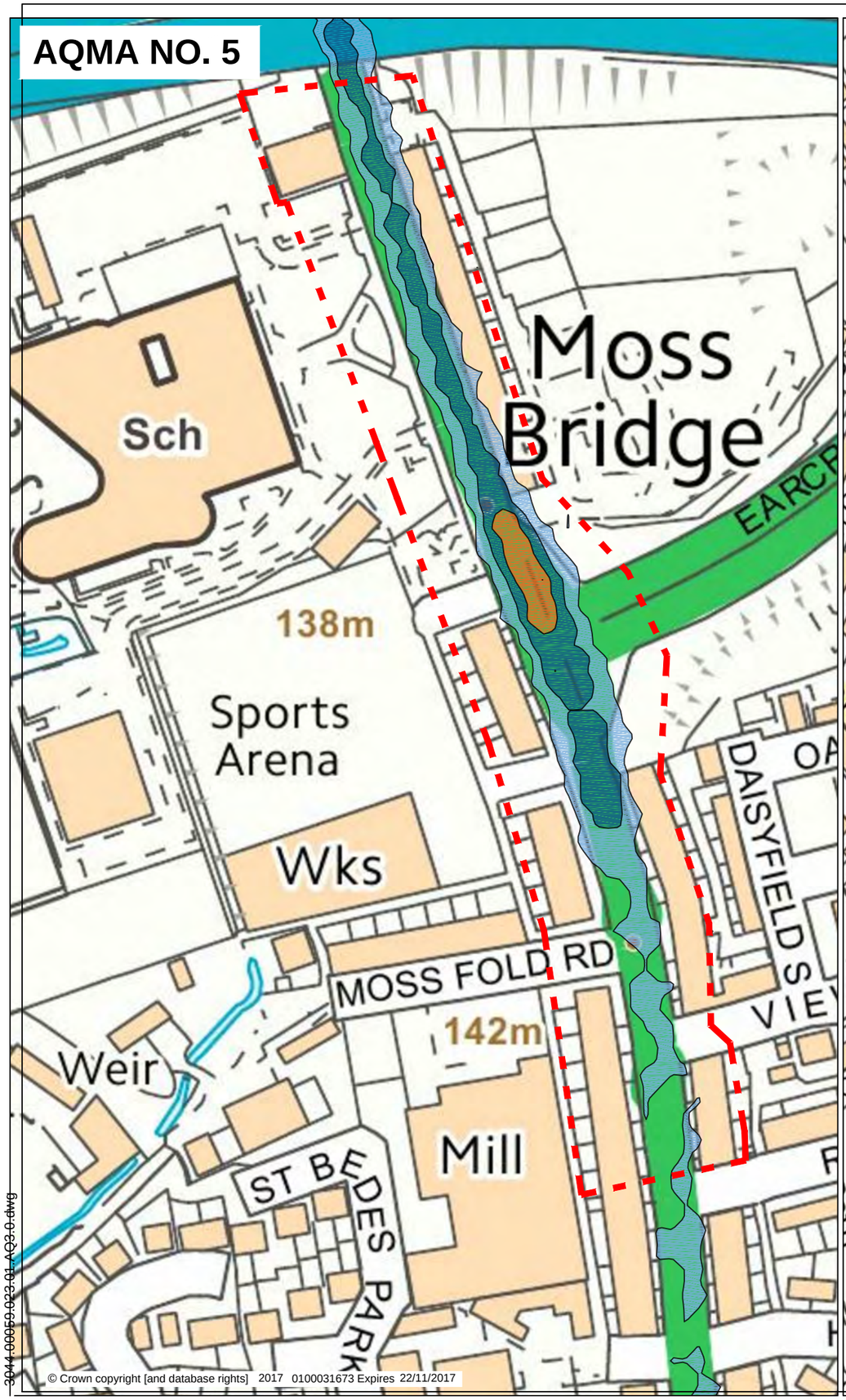
DARWEN HOLLINS PAPER MILL

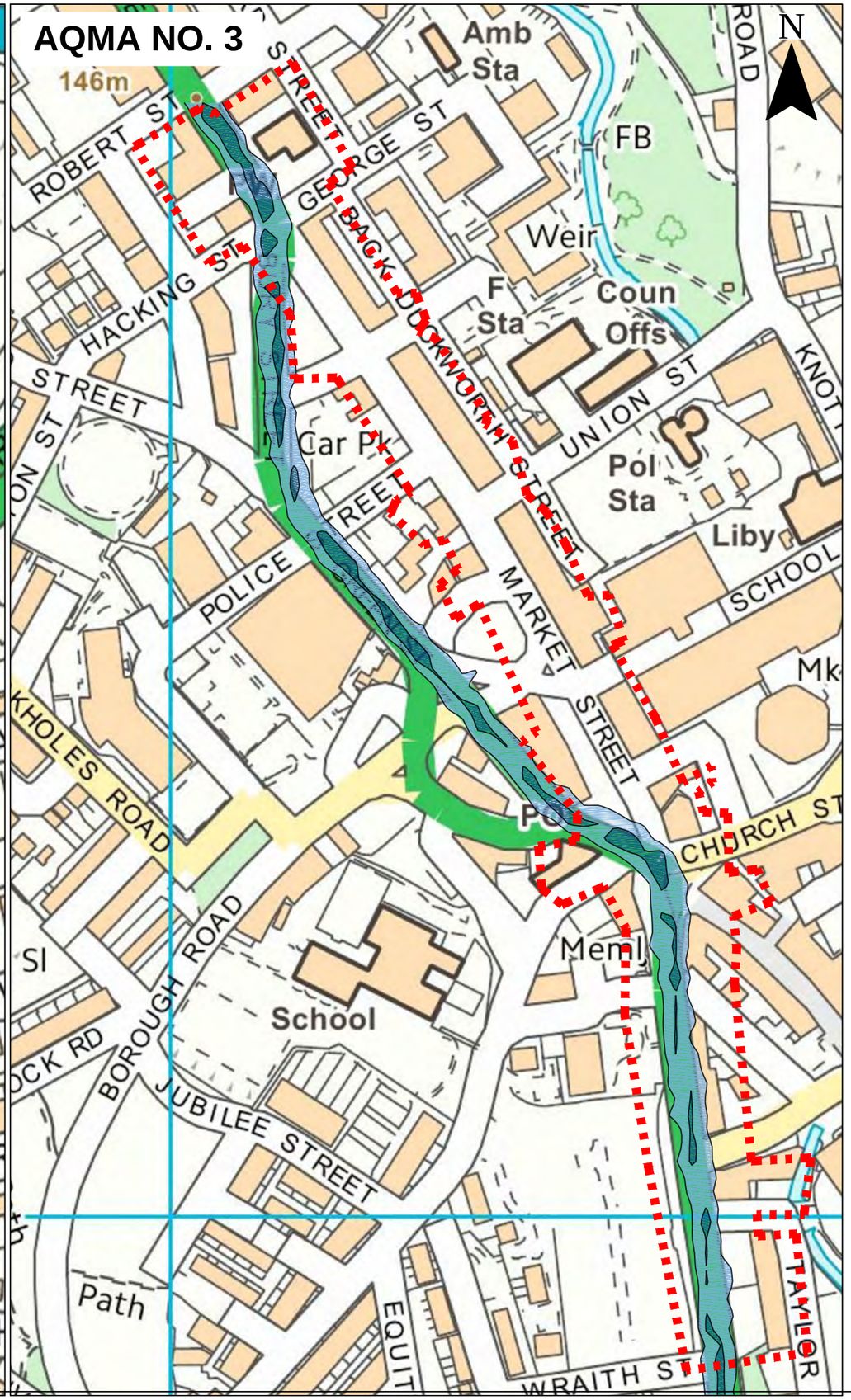
AIR QUALITY ASSESSMENT

MODELLED ROAD LINKS & SENSITIVE RECEPTORS

AQ1

Scale	Date
1:10,000@A3	DECEMBER 2016





NOTES

MAXIMUM MODELLED CHANGE IN ANNUAL MEAN NO_2 WITHIN AQMA NO.3 WAS 0.04 µg/m³ AND 0.05µg/m³ WITHIN AQMA NO.5.

LEGEND

AQMA BOUNDARY

NO_2 ANNUAL MEAN CONCENTRATION CHANGE

0.02 - 0.03 µg/m³

0.03 - 0.04 µg/m³

0.04 - 0.05 µg/m³

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DARWEN HOLLINS PAPER MILL

AIR QUALITY ASSESSMENT

MODELLED CHANGE IN NO2 ANNUAL ANNUAL MEAN CONCENTRATIONS

AQ3

Scale	Date
NTS	DECEMBER 2016

2044.0005.023.01.v.AQ3.0.dwg

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