BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

ENVIRONMENT

The Brampton Property Group Limited

Caernarfon Road, Bangor

Air Quality Assessment

MCP2161

www.bwbconsulting.com

The Brampton Property Group Limited

Caernarfon Road, Bangor

AIR QUALITY ASSESSMENT

Birmingham
Livery Place, 35 Livery Street, Colmore Business District, Birmingham, B3 2PB
T: 0121 233 3322

Cambridge
14-16 High Street, Histon, Cambridge
CB24 9JD
T: 01223 235 173

Leeds
Whitehall Waterfront, 2 Riverside Way, Leeds
LS1 4EH
T: 0113 233 8000

London
11 Borough High Street
London, SE1 9SE
T: 0207 407 3879

Manchester
11 Portland Street, Manchester, M1 3HU
T: 0161 233 4260

Market Harborough
12a Woodcock House, Compass Point Market Harborough, Leicestershire, LE16 9HW
T: 01858 455020

Nottingham
Waterfront House, Station Street, Nottingham NG2 3DQ
T: 0115 924 1100

February 2019

DOCUMENT ISSUE RECORD

Document Number:	CRB-BWB-ZZ-ZZ-RP-LA-0001_AQA_S0_P01
BWB Reference:	MCP2161-001

Revision	Date of Issue	Status	Author:	Checked:	Approved:
P01	20/02/2019	S0	E. Thomas BSc (Hons)	C. Meddings MSc, BSc (Hons), CSci, MIAQM, MIEnvSc	C. Meddings MSc, BSc (Hons), CSci, MIAQM, MIEnvSc

Notice

EXECUTIVE SUMMARY

BWB Consulting was appointed by The Brampton Property Group Limited to undertake an air quality assessment for a proposed foodstore at Caernarfon Road, Bangor.

The proposed development site is located within the administrative area of Gwynedd Council and lies adjacent to the A4087 Caernarfon Road. Gwynedd Council has not declared any Air Quality Management Areas within their administrative area.

A qualitative construction phase dust assessment was undertaken in accordance with Institute of Air Quality Management guidance and measures were recommended for inclusion in a Dust Management Plan to minimise emissions during construction activities. With the implementation of these mitigation measures the impact of construction phase dust emissions was considered to be 'not significant' in accordance with Institute of Air Quality Management guidance.

A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified existing receptor locations. Road traffic emissions were modelled using the dispersion model ADMS-Roads and concentrations of nitrogen dioxide and particulate matter (PM_{10} and $PM_{2.5}$) were predicted at identified sensitive receptor locations. The modelling assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance, Institute of Air Quality Management & Environmental Protection UK guidance.

CONTENTS

FIGURES

APPENDICES

1. INTRODUCTION

Appointment & Background

1.1 BWB Consulting was appointed by The Brampton Property Group Limited to undertake an air quality assessment for a proposed foodstore on Caernarfon Road, Bangor ('the site').

1.2 The assessment considers construction phase dust impacts and operational phase road traffic emissions. A qualitative construction phase dust assessment was undertaken in accordance with relevant guidance. A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified receptor locations.

1.3 This report is necessarily technical in nature, so to assist the reader, a glossary of air quality terminology can be found in **Appendix A.**

Site Setting

1.4 The site is located off the A4087 Caernarfon Road and is located within the administrative area of Gwynedd Council (GC). **Figure 1.1** details the location of the proposed development. The site currently comprises a vacant commercial building with car parking.

1.5 To the north of the site there are residential dwellings; to the east, south and west, there are commercial units with woodland and fields beyond, to the west there are also residential dwellings.

1.6 Principal air pollution sources in the vicinity of the development are likely to comprise road traffic emissions. The site is not within an Air Quality Management Area (AQMA), and GC has not declared any AQMAs within their administrative area.

Proposed Development

1.7 The proposed development comprises the demolition of the former cash and carry and erection of a foodstore (use class A1), car park, access and landscaping at former Blakemore Cash and Carry site; and reconfiguration of access and car park arrangements fronting the existing Dunelm store at Caernarfon Road, Bangor.

1.8 The proposed development masterplan is detailed in **Appendix B**.

Figure 1.1: Site Location

Figure 1.1 Site Location

Drawn by: ET
Date: 20/02/2019

BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

2. LEGISLATION AND PLANNING POLICY

National Legislation and Planning Policy

The UK Air Quality Strategy

2.1 European Union (EU) legislation forms the basis of air quality policy and legislation in the UK. The EU 2008 ambient Air Quality Directive[1] sets limits for ambient concentrations of air pollutants including nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). The air quality standards and objectives are prescribed through the Air Quality (Wales) Regulations 2010[2], as amended, for the purpose of the Local Air Quality Management Framework.

2.2 The UK Government are required under the Environment Act 1995[3] to produce a national Air Quality Strategy (AQS). The AQS was first published in 1997[4] and was most recently reviewed and updated in 2007[5]. The AQS provides an overview of the Government's ambient air quality policy and sets out the air quality standards and objectives to be achieved and measures to improve air quality.

2.3 Part IV of the Environment Act[3] requires local authorities in the UK to review local air quality within their administrative area and, if relevant air quality standards and objectives are likely to be exceeded, designate Air Quality Management Areas (AQMAs). Following the designation of an AQMA, local authorities are required to publish an Air Quality Action Plan (AQAP) detailing measures to be taken to improve local air quality and work towards meeting the relevant air quality standards and objectives.

National Planning Policy for Wales

2.4 The National Planning Policy for Wales[6] recognises air quality within Section 6.7 Air Quality and Soundscape and states:

> *"Framework for Addressing Air Quality and Soundscape*
>
> *The planning system should maximise its contribution to achieving the well-being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long-term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so.*
>
> *In taking forward these broad objectives the key planning policy principle is to consider the effects which proposed developments may have on air or soundscape quality and the effects which existing air or soundscape quality may have on proposed developments.*

[1] European Parliament (2008) Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe
[2] HMSO (2010) Statutory Instrument 2010 No. 1433, The Air Quality (Wales) Regulations 2010 (as amended), London: HMSO
[3] HMSO (1995) The Environment Act 1995, London: TSO
[4] Department of the Environment (DoE) (1997) The UK National Air Quality Strategy, London: HMSO
[5] Department of the Environment, Food and Rural Affairs (Defra) (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, London: HMSO
[6] Llywodraeth Cymru Welsh Government (2018) Planning Policy Wales Edition 10,

Air Quality and soundscape influence choice of location and distribution of development and it will be important to consider the relationship of proposed development to existing development and its surrounding area and its potential to exacerbate or create poor air quality or inappropriate soundscapes. The agent of change principle says that a business or person responsible for introducing a change is responsible for managing that change. In practice, for example, this means a developer would have to ensure that solutions to address air quality or noise from nearby pre-existing infrastructure, businesses or venues can be found and implemented as part of ensuring development is acceptable.

In proposing new development, planning authorities and developers must, therefore:

- *Address any implication arising as a result of its association with, or location within, air quality management area, noise action planning priority areas or areas where there are sensitive receptors;*
- *Not create areas of poor air quality or inappropriate soundscape; and*
- *Seek to incorporate measures which reduce overall air and noise pollution and create appropriate soundscapes.*

To assist decision making it will be important that the most appropriate level of information is provided and it may be necessary for a technical air quality and noise assessment to be undertaken by a suitably qualified and competent person on behalf of the developer.

Good design, for example setting back buildings from roads to avoid canyon effects and using best practice in terms of acoustic design to ensure the appropriate and intended acoustic environment of completed developments should be incorporated at an early consideration in the design and planning process. Other mitigation measures must be capable of being effectively implemented for their intended purpose, and could include those related to:

- *traffic management and road safety;*
- *ensuring progress towards a shift to low or zero emissions means of road transport, such as electrical charging points;*
- *supporting low or zero emissions public transport;*
- *providing active travel infrastructure; and*
- *incorporating green infrastructure, where it can improve air quality by removing air pollution and aiding its dispersal, reduce real or perceived noise levels by absorbing and scattering noise and introducing natural sounds to soften man-made noise, provide areas of relative tranquillity, and reduce exposure by putting a buffer between sources of pollution and receptors.*

[…]

Taking a sustainable approach will mean balancing short-term needs against long-term objectives to reduce public exposure to airborne pollution and giving

particular consideration to the presence of air quality management areas, noise action planning priority areas and areas with sensitive receptors when proposing new development and particularly when preparing development plans. It will be important to identify wider mitigation solutions to reduce air and noise pollution and to avoid exacerbating problems in existing air quality management areas or noise hotspots through the provision of green infrastructure identified as part of Green Infrastructure Assessments, by the provision of electric vehicle charging infrastructure or through promoting the need to consider effective design solutions. Planning Authorities should work closely with bodies such as the Public Service Boards in the preparation of their well-being plans and seek input from their own Environmental Health departments.

[…]"

Local Planning Policy

Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026

2.5 GC adopted the Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026[7] in 2017, which sets out policies and proposals for the use and development of land and buildings.

"Policy PCYFF 2: Development Criteria

[…]

Additionally planning permission will be refused where the proposed development would have an unacceptable adverse impact on:

7. The healthy, safety or amenity of occupiers of local residences, other land and property uses or characteristics of the locality due to increased activity, disturbance, noise, dust, fumes, litter, drainage, light pollution, or other forms of pollution or nuisance;

[…]"

2.6 The above policies were taken into consideration throughout the undertaking of the assessment.

[7] Isle of Anglesey County Council and Gwynedd Council (2017) Anglesey and Gwynedd Joint Local Development Plan 2011-2026

3. METHODOLOGY

Consultation with Gwynedd Council

3.1 Consultation was undertaken with the Public Protection Department at GC, in which the proposed assessment methodology was provided via email and a response was received with a telephone call on 12/02/2019[8].

3.2 The agreed assessment methodology is detailed below:

- Construction Phase - A construction phase assessment was undertaken and relevant measures to mitigate construction phase dust emissions were recommended. The assessment was undertaken in accordance with guidance provided by the Institute of Air Quality Management (IAQM)[9].
- Operational Phase – A detailed operational phase road traffic emissions assessment was undertaken to consider the impact of development-generated traffic on local air quality and predict pollutant concentrations at the proposed development site. The dispersion model ADMS-Roads was used to model concentrations of oxides of nitrogen (NOx) and particulate matter (PM_{10} and $PM_{2.5}$) at identified existing receptor locations for both without and with development scenarios. The change in pollutant concentrations as a result of development-generated traffic was then calculated. The assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance (LAQM.TG16)[10] and Institute of Air Quality Management and Environmental Protection UK (EPUK)[11].
- Full details of the methodology used in the assessment as agreed with GC is provided in paragraph 3.10 of this report.

Construction Phase Assessment

3.3 An assessment of the potential impacts arising from the construction of the proposed development was undertaken in accordance with IAQM Guidance[9]. The full assessment methodology is not reproduced within this report but a summary of the assessment steps are provided below:

- Step 1 – screen the requirement for a more detailed assessment. No assessment is required if there are no receptors within a certain distance of the works;
- Step 2 – assess the risk of dust impacts separately for each of the four activities considered (demolition, earthworks, construction and trackout).
    - Step 2A – determine the potential dust emission magnitude for each of the four activities;
    - Step 2B – determine the sensitivity of the area;
    - Step 2C – determine the risk of dust impacts by combining the findings of steps 2A and 2B.
- Step 3 – determine the site-specific mitigation for each of the four activities; and

[8] Consultation request issued to Gwynedd Council Public Protection Department on 24/01/2019 via email.
[9] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London
[10] Defra (2018) Local Air Quality Management Technical Guidance (LAQM.TG16), London: Defra
[11] Institute of Air Quality Management and Environmental Protection UK (2017) Land-Use Planning & Development Control: Planning for Air Quality, v1.2, London

- Step 4 – examine the residual effects and determine significance.

Road Traffic Emissions – Air Dispersion Modelling

3.4 The air dispersion model ADMS-Roads, version 4.1.1.0 was utilised in the assessment to predict concentrations of NOx, PM_{10} and $PM_{2.5}$ at existing and proposed receptor locations.

3.5 The assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance[10] and Institute of Air Quality Management and Environmental Protection UK guidance[11].

Assessment Scenarios and Traffic Data

3.6 The following scenarios were considered in the air dispersion modelling:

- Scenario 1: 2017 Base Year;
- Scenario 2: 2020 Opening Year 'without development'; and
- Scenario 3: 2020 Opening Year 'with development'.

3.7 Traffic data were obtained from Connect Consultants, the Transport Consultants for the project. 24-hour Annual Average Daily Traffic Data (AADT) and Heavy Duty Vehicle (HDV) proportions were provided for the following roads for use in the assessment:

- A4087 Caernarfon Road;
- Fordd Coer Mawr;
- Toronnen; and
- Site access.

3.8 Consideration was given to the speeds at which vehicles are likely to travel within the study area. Free-flowing traffic conditions were modelled at the speed limit. Queuing sections, including the junction the A4087 Caernarfon Road and Fordd Coer Mawr were modelled in accordance with Defra guidance[10].

3.9 Traffic data used in the air dispersion modelling are provided in **Appendix C.**

ADMS-Roads Model Inputs

3.10 The following model inputs were utilised in the assessment:

- Emission Factors – emission factors were utilised from the Defra Emission Factor Toolkit[12], version 8.0.1, for the years of assessment (2017 and 2020).
- Conversion of oxides of nitrogen – concentrations of NOx were predicted using the ADMS-Roads dispersion model. These concentrations were converted to nitrogen dioxide (NO_2) using the Defra NOx to NO_2 calculator[13], version 6.1.
- Meteorological Data – hourly sequential meteorological data for the base year of assessment (2017) were obtained for the Rhyl recording station. This is not the closest

[12] Defra (2018) Emission Factor Toolkit [https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html]
[13] Defra (2018) NOx to NO_2 Calculator [https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc]

recording station to the proposed development site but it was agreed with GC that this is more representative of conditions at the site. The nearest recording stations are:

  - Mona, Anglesey – exposed to offshore winds and not representative of the site
  - Valley, Anglesey - exposed to offshore winds and not representative of the site
  - Capel Curig, Snowdonia – wind direction is affected by the Snowdonia mountain range and therefore not representative of the site

- The wind rose for the Rhyl recording station in 2017 is provided in **Appendix D**.
- Surface roughness – a surface roughness of 0.5 was utilised in the dispersion model. This is representative of the open suburbia conditions of the study area.
- Monin-Obukhov length (MO) – a MO of 30 was utilised in the dispersion model. This is representative of the typical town conditions of the study area.
- Background pollutant concentrations – background concentrations of NO_2, PM_{10} and $PM_{2.5}$ for the study area were obtained from the pollutant concentrations maps[14] provided by Defra as a 1km x 1km grid of the UK, for the years of assessment (2017 and 2020).
- Model verification – model verification was undertaken using GC monitoring data available for the study area. Full details of the verification procedure are provided in **Appendix E.**
- Calculation of short term PM_{10} concentrations – the following calculation, as detailed in Defra guidance[10], was utilised to calculate the number of exceedance of the 24-hour mean PM_{10} air quality objective:

$$\text{Number of 24-Hour Mean Exceedance} = -18.5 + 0.00145 * \text{Annual Mean}^3 + (206 / \text{Annual Mean})$$

- The IAQM released a position statement in July 2018[15] regarding dealing with the uncertainty in vehicle NOx emissions within air quality assessments. This recommends that sensitivity analyses be undertaken and professional judgement be applied to consider the scenario where NOx emissions do not reduce as rapidly as shown by the EFT. As such a sensitivity analysis was undertaken and emission factors, NOx to NO_2 calculator inputs and background concentrations were kept at base year (2017) levels. Details of the sensitivity analysis are provided in **Appendix F**.

Assessment Criteria

3.11 Predicted pollutant concentrations were compared to the relevant air quality objectives. The current relevant air quality standards and objectives are detailed in **Table 3.1.**

Table 3.1: Air Quality Standards and Objectives (Wales)

Pollutant	Averaging Period	Air Quality Objective ($\mu g.m^{-3}$)	Date to Achieve by
NO_2	Annual Mean	40	31 December 2005

[14] Defra (2018) background pollutant concentration maps [https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015]
[15] Institute of Air Quality Management (2018) Position Statement: Dealing with Uncertainty in Vehicle NOx Emissions within Air Quality Assessments, Version 1.1

Pollutant	Averaging Period	Air Quality Objective (µg.m^{-3})	Date to Achieve by
	1-hour mean not to be exceeded more than 18 times per year	200	31 December 2005
PM_{10}	Annual Mean	40	31 December 2004
	24-hour mean not to be exceeded more than 35 times per year	50	31 December 2004
$PM_{2.5}$	Annual mean	25	2010 - 2020

3.12 Guidance is provided by the Institute of Air Quality Management and Environmental Protection UK[11] to determine the significance of the impact of development-generated road traffic emissions on local air quality. The impact descriptors at receptor locations are detailed in **Table 3.2.** These impact descriptors consider the predicted magnitude of change in pollutant concentrations and the concentration in relation to the relevant air quality objectives.

Table 3.2: Impact Descriptors for Individual Receptors

Long Term Average Concentration at Receptor in Assessment Year	% Change in Concentration Relative to Air Quality Assessment Level (AQAL)			
	1%	2 – 5%	6 – 10%	>10%
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 – 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 – 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Note: Figures rounded up to the nearest whole number, therefore any value less than 1% after rounding (effectively less than 0.5%) will be described as negligible.

4. BASELINE CONDITIONS

Local Air Quality Management

4.1 The proposed development is not within an AQMA designation. GC has not declared any AQMAs within the local authority area.

Local Air Quality Monitoring

Nitrogen Dioxide

4.2 GC undertakes monitoring within its administrative boundary using a network of diffusion tubes. The closest monitoring location to the proposed development site is situated at 453 Caernarfon Road, Bangor (G8).

4.3 The bias adjusted NO_2 monitoring results for the G8 diffusion tube within the study area is detailed in **Table 4.1.** The tube was first deployed in January 2017.

Table 4.1: Gwynedd Council NO_2 Monitoring Data in 2017

Location	Grid Reference		Monitoring Site Type	Monitored Annual Average Concentration ($\mu g.m^{-3}$)
				2017
453 Caernarfon Road, Bangor (G8)	256911	370613	Kerbside	23.3
Site type defined by the 2018 Air Quality Progress Report[16], the tube is 2m from the nearest kerb and therefore can be considered as Roadside and suitable to use for verification.				

4.4 The monitored annual mean NO_2 concentration in 2017, within the study area, was 'well below' the annual mean air quality objective of 40$\mu g.m^{-3}$.

Particulate Matter (PM_{10} and $PM_{2.5}$)

4.5 There is currently no PM_{10} or $PM_{2.5}$ monitoring undertaken by GC within their administrative area.

Background Pollutant Concentrations

4.6 No background air quality monitoring is undertaken by GC within the study area. Background pollutant concentrations were therefore obtained from the latest Defra background concentration maps[14], which are provided for the UK as a 1km x 1km grid network. The latest maps are based on 2015 monitoring and meteorological data. Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ were obtained for the grid squares

[16] North Wales Combined Authority (2018) 2018 Air Quality Progress Report

covering the study area for the years of assessment (2017 and 2020). The background concentrations used in the assessment are detailed in **Table 4.2**

Table 4.2: Background Pollutant Concentrations used in the Assessment

Pollutant	Grid Square	Receptors	Concentration (µg.m^{-3})	
			2017	2020
NO_2	256500 370500	R1-R7	7.3	6.5
PM_{10}			10.8	10.6
$PM_{2.5}$			7.4	7.2
NO_2	257500 370500	R8	6.5	5.9
PM_{10}			10.7	10.4
$PM_{2.5}$			7.2	7.0

4.7 2017 and 2020 background concentrations are below the relevant annual mean air quality objectives for NO_2, PM_{10} and $PM_{2.5}$.

5. CONSTRUCTION PHASE ASSESSMENT

5.1 The construction phase of the proposed development will involve a number of activities which have the potential to impact on local air quality. These include emissions of dust generated through demolition, excavation, construction, earthworks and trackout activities, exhaust pollutant emissions from construction traffic on the local highways network, and exhaust emissions from non-road mobile machinery (NRMM) within the construction site itself.

5.2 The location of sensitive receptors in relation to construction activities will affect the potential for such construction activities to cause dust soiling, nuisance and local air quality impacts. Meteorological conditions and the use of control measures will also contribute to the effects experienced.

Step 1: Screen the Need for a Detailed Assessment

5.3 Step 1 of the IAQM guidance[9] involves a screening assessment to consider whether a more detailed construction phase dust assessment is required.

5.4 In accordance with the guidance, a detailed assessment is required if:

- Human receptors are located within 350m of the boundary of the site or 50m of routes used by construction vehicles on the public highways, up to 500m from the site entrances; or
- Ecological receptors are located within 50m of the boundary of the site or 50m of routes used by construction vehicles on the public highways, up to 500m from the site entrances.

5.5 From a review of the Multi Agency Geographic Information for the Countryside (MAGIC) website[17], no ecological designations were identified within 50m of the proposed development and therefore the impact on ecological designations was not considered further. However human receptors are located within 350m of the site boundary, with the closest of these receptors located off Trehwfa. A construction phase assessment was therefore undertaken.

Step 2: Assess the Risk of Dust Impacts

Step 2A: Define the Potential Dust Emission Magnitude

5.6 The dust emission magnitudes for the construction activities were defined using the criteria detailed in the IAQM guidance[9]. The criteria and the dust emission magnitude defined for the proposed development are detailed in **Table 5.1**.

[17] Defra, Multi Agency Geographic Information for the Countryside (MAGIC) [http://magic.defra.gov.uk/]

Table 5.1: Dust Emission Magnitude Criteria and Definition

Activity	IAQM Dust Emission Magnitude	IAQM Dust Emission Magnitude Criteria	Project Defined Dust Emission Magnitude
Demolition	Large	Total building volume >50,000m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20m above ground level.	Small: Total building volume to be demolished is less than 20,000m^3.
	Medium	Total building volume 20,000m^3 – 50,000m^3, potentially dusty construction material, demolition activities 10 - 20m above ground level.	
	Small	Total building volume <20,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.	
Earthworks	Large	Total site area >10,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes.	Medium: Total site area is between 2,500m^2 – 10,000m^2.
	Medium	Total site area 2,500m^2 – 10,000m^2, moderately dusty soil type (e.g. silt), 5 - 10 heavy earth moving vehicles active at any one time, formation of bunds 4m - 8m in height, total material moved 20,000 tonnes – 100,000 tonnes.	
	Small	Total site area <2,500m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <20,000 tonnes, earthworks during wetter months.	
Construction	Large	Total building volume >100,000m^3, on site concrete batching, sandblasting.	Small: Total building volume is less than 25,000m^3.
	Medium	Total building volume 25,000m^3 – 100,000m^3, potentially dusty construction material (e.g. concrete), on site concrete batching.	
	Small	Total building volume <25,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).	
Trackout	Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m.	Small: Less than 10 HDV movements anticipated per day.
	Medium	10 - 50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m.	
	Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50m.	

Step 2B: Define the Sensitivity of the Area

5.7 The sensitivity of the study area takes into account the specific receptors in the vicinity of the site, the proximity and number of those receptors, the local background concentration of PM_{10} and site-specific factors. The assessment requires the determination of the sensitivity of the area for the purposes of dust soiling, human health and ecological impacts and these are presented in **Table 5.2**.

Table 5.2: Determination of the Sensitivity of the Area

Potential Impact	Justification	Sensitivity			
		Demolition	Earthworks	Construction	Trackout
Dust Soiling	There are 10-100 highly sensitive receptors within 20m of the proposed development.	High	High	High	High
Human Health	There are 10-100 highly sensitive receptors within 20m of the proposed development. The 2017 background concentration of PM_{10} is less than 24µg.m^{-3}.	Low	Low	Low	Low

Step 2C: Define the Risk of Impacts

5.8 The dust emission magnitude determined in Step 2A is then combined with the sensitivity of the area determined in Step 2B to define the risk of dust impacts with no mitigation applied. The results of this assessment are detailed in **Table 5.2.**

Table 5.3: Summary Dust Risk Table to Define Site Specific Risk

Activity	Step 2A: Dust Emission Magnitude	Step 2B: Sensitivity of the Area	Step 2C: Risk of Dust Impacts
Dust Soiling Effects on People and Property			
Demolition	Small	High	Medium Risk
Earthworks	Medium	High	Medium Risk
Construction	Small	High	Low Risk
Trackout	Small	High	Low Risk
Human Health Impacts			

Activity	Step 2A: Dust Emission Magnitude	Step 2B: Sensitivity of the Area	Step 2C: Risk of Dust Impacts
Demolition	Small	Low	Negligible
Earthworks	Medium	Low	Low Risk
Construction	Small	Low	Negligible
Trackout	Small	Low	Negligible

Step 3: Site-Specific Mitigation

5.9 The risk of dust impacts defined in Step 2C is used to determine the measures required to mitigate construction phase dust impacts. The mitigation measures are detailed in **Section 7** of this report.

Step 4: Determine Significant Effects

5.10 In accordance with IAQM guidance[9], with the implementation of the mitigation measures detailed in **Section 7**, the residual impacts from the construction phase are considered to be 'not significant'.

6. OPERATIONAL PHASE ROAD TRAFFIC EMISSIONS ASSESSMENT

Existing Receptor Locations

6.1 Existing receptor locations were identified within close proximity of the road links detailed in paragraph 3.7 and considered in the operational phase road traffic emissions assessment. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at the identified existing receptor locations for the assessment scenarios detailed in paragraph 3.6. Where possible the closest receptors to those road links were considered, as these receptors are likely to experience the greatest change in pollutant concentrations as a result of the proposed development. Receptors heights were modelled at 1.5m with the exception of R2, which was modelled at 1.0m to account for situation of the residential dwelling at a height below road level.

6.2 The existing receptor locations are detailed in **Table 6.1** and **Figure 6.1.**

Table 6.1: Existing Sensitive Receptor Locations

Receptor	Grid Reference		Details
	X	Y	
R1	256794	370540	Residential Dwelling on Caernarfon Road
R2	256913	370669	Residential Dwelling on Caernarfon Road
R3	256924	370643	Residential Dwelling on Caernarfon Road
R4	256972	370705	Residential Dwelling on Caernarfon Road
R5	256933	370695	Residential Dwelling on Caernarfon Road
R6	256852	370742	Residential Dwelling on Ffordd Coed Mawr
R7	256829	370725	Residential Dwelling on Ffordd Coed Mawr
R8	257062	370827	Residential Dwelling on Caernarfon Road

Figure 6.1: Existing Receptor Locations

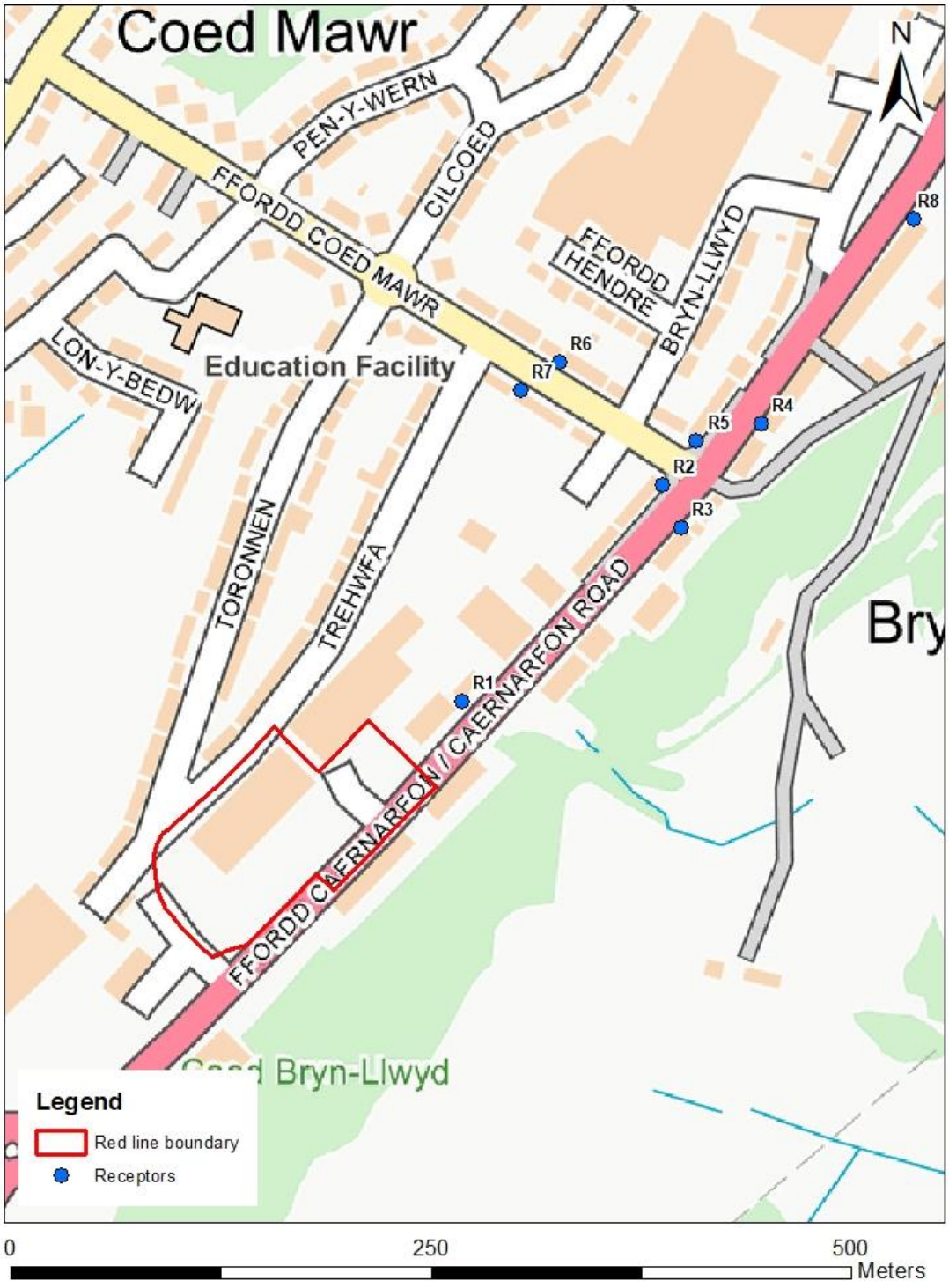


Figure 6.1 Existing Receptors

Drawn by: ET
Date: 20/02/2019

BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

Baseline Assessment

6.3 Pollutant concentrations were predicted at the identified existing sensitive receptor locations using the dispersion model ADMS-Roads. Predicted pollutant concentrations for Scenario 1: 2020 Base Year and Scenario 2: 2020 Opening Year 'without development' are detailed in **Table 6.3.**

Table 6.3: Predicted Annual Mean Pollutant Concentrations for Scenario 1: 2020 Base Year and Scenario 2: 2020 Opening Year Without Development at Existing Receptor Locations

Receptor	Scenario 1: 2017 Base Year (µg.m^{-3})			Scenario 2: 2020 Opening Year Without Development (µg.m^{-3})		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	20.2	13.2	8.8	17.5	13.0	8.5
R2	23.7	13.8	9.1	20.6	13.5	8.8
R3	23.2	13.8	9.1	20.2	13.5	8.8
R4	25.6	13.9	9.2	22.2	13.6	8.9
R5	24.3	13.7	9.0	21.1	13.4	8.7
R6	16.5	12.3	8.2	14.3	12.0	7.9
R7	11.9	11.6	7.8	10.4	11.3	7.6
R8	21.6	13.1	8.6	18.9	12.8	8.3

6.4 The baseline assessment for Scenario 1 and Scenario 2 indicates that predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ are below the respective annual mean air quality objectives at receptors considered.

6.5 With regard to short term air quality objectives for NO_2 and PM_{10}, the predicted annual mean NO_2 concentrations are less than 60µg.m^{-3} and therefore in accordance with Defra guidance[10] it may be assumed that exceedance of the 1-hour mean objective are unlikely. The calculation detailed in paragraph 3.10 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

Impact Assessment

Detailed Operational Phase Road Traffic Emissions Assessment

6.6 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at identified existing receptor locations for Scenario 3: 2020 Opening Year with development, to consider the impact of development-generated vehicles on local air quality.

6.7 Predicted pollutant concentrations are detailed in **Tables 6.4**, **6.5** and **6.6** for NO_2, PM_{10} and $PM_{2.5}$ respectively together with Scenario 2: 2020 Opening Year without development concentrations for comparison purposes. The predicted change in pollutant concentrations resulting from development-generated traffic, and the associated impact are also provided.

Table 6.4: Predicted Annual Mean NO_2 Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted NO_2 Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2020 Without Development	Scenario 3: 2020 With Development	Change*	
R1	17.5	17.8	+0.3	Negligible
R2	20.6	20.8	+0.3	Negligible
R3	20.2	20.4	+0.3	Negligible
R4	22.2	22.5	+0.3	Negligible
R5	21.1	21.3	+0.3	Negligible
R6	14.3	14.5	+0.1	Negligible
R7	10.4	10.5	+0.1	Negligible
R8	18.9	19.1	+0.2	Negligible

***** *Discrepancies in change calculations are a result of rounding effects*

Table 6.5: Predicted Annual Mean PM_{10} Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted PM_{10} Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2020 Without Development	Scenario 3: 2020 With Development	Change*	
R1	13.0	13.0	+0.1	Negligible
R2	13.5	13.6	+0.1	Negligible
R3	13.5	13.6	+0.1	Negligible
R4	13.6	13.7	+0.1	Negligible

Receptor	Predicted PM_{10} Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2020 Without Development	Scenario 3: 2020 With Development	Change*	
R5	13.4	13.5	+0.1	Negligible
R6	12.0	12.0	0.0	Negligible
R7	11.3	11.3	0.0	Negligible
R8	12.8	12.9	0.0	Negligible

** Discrepancies in change calculations are a result of rounding effects*

Table 6.6: Predicted Annual Mean $PM_{2.5}$ Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted $PM_{2.5}$ Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2020 Without Development	Scenario 3: 2020 With Development	Change*	
R1	8.5	8.5	0.0	Negligible
R2	8.8	8.8	0.0	Negligible
R3	8.8	8.8	0.0	Negligible
R4	8.9	8.9	0.0	Negligible
R5	8.7	8.8	0.0	Negligible
R6	7.9	8.0	0.0	Negligible
R7	7.6	7.6	0.0	Negligible
R8	8.3	8.4	0.0	Negligible

** Discrepancies in change calculations are a result of rounding effects*

6.8 The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for Scenario 2: 2020 Opening Year without development and Scenario 3: 2020 Opening Year with development are below the relevant annual mean air quality objectives for all the receptors.

6.9 The proposed development does not lead to any exceedances of the annual mean air quality objectives.

6.10 Predicted changes in NO_2, PM_{10} and $PM_{2.5}$ concentrations are less than 0.5% of the relevant annual mean air quality objectives and therefore considered to be negligible in accordance with IAQM and EPUK guidance[11].

6.11 With regard to short term air quality objectives for PM_{10} at the existing receptor locations, the calculation detailed in paragraph 3.10 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

Impact Significance Summary

6.12 Relevant guidance and legislation and professional judgement was utilised to determine the significance of the air quality assessment. The air quality assessment was supervised by a full member of the Institute of Air Quality Management. A summary of the impact significance and justification of this are provided below.

6.13 The impact of the proposed development on air quality is considered to be 'negligible':

- Consideration was given to local planning policy[7] and the development proposals are considered to be in accordance with this policy with regard to air quality.
- Existing concentrations of NO_2, PM_{10} and $PM_{2.5}$ in the study area are predicted to be below the relevant air quality objectives.
- The air quality assessment undertaken utilised robust model inputs including slowing traffic sections at junctions, appropriate meteorological data and surface roughness and cumulative traffic flows.
- The impact of development-generated road traffic on local air quality is defined as negligible in accordance with IAQM and EPUK guidance[11].
- In addition, a sensitivity analysis was undertaken and provided in **Appendix F** considering the conservative scenario of NOx concentrations not decreasing from baseline levels in line with projected emission factors. The findings of this sensitivity analysis also predict the impact of development-generated road traffic on local air quality as negligible in accordance with IAQM and EPUK guidance[11].

7. MITIGATION

Construction Phase Assessment

Step 3: Site-specific Mitigation

7.1 The risk of dust impacts, defined in Step 2C of the assessment, are used to determine the mitigation measures required to minimise the emission of dust during construction phase activities. The IAQM guidance[9] provides details of highly recommended and desirable mitigation measures which are commensurate with the risk of dust impacts defined in Step 2C for construction, earthworks and trackout activities. Where the mitigation measures are general in nature, the highest risk category was applied in accordance with the guidance[9]. The highest risk category identified was 'Medium Risk' and the recommended mitigation taken from the IAQM guidance[9] is detailed in **Table 7.1** and **Table 7.2**.

Table 7.1: Mitigation Measures for a Medium Risk Site

Category	Mitigation Measures	
	Highly Recommended	**Desirable**
Communication	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	None
	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager.	
	Display the head or regional office contact information.	
	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.	
Site Management	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken.	None
	Make the complaints log available to the local authority when asked.	
	Record any exceptional incidents that cause and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.	

Category	Mitigation Measures	
	Highly Recommended	**Desirable**
Monitoring	Carry out regular site inspections to monitor compliance with the DMP, record inspections results, and make an inspection log available to the local authority when asked.	Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of the site boundary, with cleaning to be provided as necessary.
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	
Preparing and maintaining the site	Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	None
	The site should be suitably enclosed with solid hoarding.	
	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extended period.	
	Avoid site runoff of water or mud.	
	Keep site fencing, barriers and scaffolding clean using wet methods.	
	Remove materials that have a potential to produce dust from site as soon as possible. Unless being re-used on site. If they are being re-used on-site cover as described below.	
	Cover, seed or fence stockpiles to prevent wind whipping.	
Operating vehicle/ machinery and sustainable travel	Ensure all vehicles switch off engines when stationary – no idling vehicles.	Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable control measures provided, subject to the approval of the nominated undertaker with the agreement of the local authority, where appropriate).
	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	
	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	Implement an operational phase Travel Plan that supports and encourages sustainable travel

Category	Mitigation Measures	
	Highly Recommended	Desirable
		(public transport, cycling, walking, and car-sharing).
Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	None
	Ensure an adequate water supply on site for effective dust/particulate matter suppression/mitigation, using non-portable water where possible and appropriate.	
	Use enclose chutes and conveyors and covered skips.	
	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	
	Ensure equipment is readily available on site to clean and dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	
Waste Management	Avoid bonfires and burning of waste materials.	None

Table 7.2: Mitigation Measures Specific to Demolition, Earthworks, Construction and Trackout

Category	Mitigation Measures	
	Highly Recommended	Desirable
Demolition (Medium Risk Site)	Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
	Avoid explosive blasting, using appropriate manual or mechanical alternatives.	

Category	Mitigation Measures	
	Highly Recommended	Desirable
	Bag and remove any biological debris or damp down such material before demolition.	
Earthworks (Medium Risk Site)	None	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
		Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
		Only remove the cover in small areas during work and not all at once.
Construction (Low Risk Site)	None	Avoid scabbling (roughening of concrete surfaces) if possible.
		Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
Trackout (Low Risk Site)	None	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any materials tracked out of the site. This may require the sweeper being continuously in use.
		Avoid dry sweeping of large areas.
		Ensure vehicles entering and leaving the sites are covered to prevent escape of materials during transport.
		Record all inspections of haul routes and any subsequent action in a site log book.
		Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

Operational Phase Road Traffic Emissions

7.2 The development will result in minimal increases in pollutant concentrations and no new exceedances of the relevant air quality objectives are predicted. No mitigation measures are therefore required to minimise development-generated road traffic emissions.

8. CONCLUSIONS

8.1 An air quality impact assessment was undertaken for the proposed foodstore on Caernarfon Road in Bangor.

8.2 A qualitative construction phase assessment was undertaken and measures were recommended for inclusion in a DMP to minimise emissions during construction activities. With the implementation of these mitigation measures the impact of construction phase dust emissions is considered to be 'not significant' in accordance with IAQM guidance[9].

8.3 A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified existing receptor locations. Road traffic emissions were modelled using the dispersion model ADMS-Roads and concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at identified sensitive receptor locations. The modelling assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance[10]. The development was not predicted to result in any exceedances of the relevant air quality objectives and the impact of the development on local air quality was predicted to be 'negligible' in accordance with IAQM and EPUK guidance[11].

APPENDICES

APPENDIX A: GLOSSARY OF TERMS

Term	Definition
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	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 the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between two years, which is useful for pollutants that have higher concentrations during the winter months.
AQAP	Air Quality Action Plan.
AQMA	Air Quality Management Area.
AQS	Air Quality Strategy.
Defra	Department for Environment, Food and Rural Affairs.
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
HDV	Heavy Duty Vehicles, (HGVs + buses)
HGV	Heavy Goods Vehicles.
IAQM	Institute of Air Quality Management.
LAQM	Local Air Quality Management.
LDV	Light Duty Vehicles (motorbikes, cars, vans and small trucks)
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O_3	Ozone.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
micrograms per cubic metre ($\mu g.m^{-3}$)	A measure of concentration in terms of mass per unit volume. A concentration of $1 \mu g.m^{-3}$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UK-AIR	UK Air Information Resource – A source of air quality information provided by Defra.
UKAQS	United Kingdom Air Quality Strategy.

APPENDIX B: PROPOSED DEVELOPMENT MASTERPLAN

Proposed Site Plan - 1:200 scale

SCALE 1:200

CAD FILE REFERENCE

Please note Proposed Levels taken from engineers details, dwg ref; 12500972-GHD-DR-C-5603 P03 Proposed Levels (2019.02.19)

Application Area = 12,520sqm / 3.09 acre

Rev	Date	Description	Rev By	Chk'd By
D	20.02.19	Title Block updated.	EBA	SSR
C	19.02.19	Client Title updated. GHD additional levels added.	MM	SSR
B	13.02.19	Drawing updated to removed foul pumping station as advised by Drainage engineer, 1no. car parking space removed from Dunelm Car park to improve pedestrian route.	SSR	SSR
A	11.02.19	Drawing updated to co-ordinate Highway consultant comment, tree locations updated and additional topographical survey information added to Dunelm Car park.	SSR	SSR

Project Title	PROPOSED DEVELOPMENT FORMER BLAKEMORE CASH AND CARRY SITE CAERNARFON ROAD BANGOR
Client	BAMPTON PROPERTY GROUP
Status	PLANNING
Scale	1:200 — Drawing Size A0
Date	JAN 19 — Drawn By SSR — Checked SSR
Drawing Title	PROPOSED SITE PLAN
Job-Dwg No	15252 - 101 — Rev D

2 St. Johns North, Wakefield, WF1 3QA t. 01924 291800

Carvers Warehouse, 77 Dale Street, Manchester, M1 2HG t. 0161 2388555

The Old Rectory, 79 High Street, Newport Pagnell, MK16 8AB t. 01908 211577

101 London Road, Reading, RG1 5BY t. 0118 9507700

10 Gees Court, St Christophers Place, London, W1U 1JJ t. 0207 4091215

THE HARRIS PARTNERSHIP ARCHITECTS www.harrispartnership.com

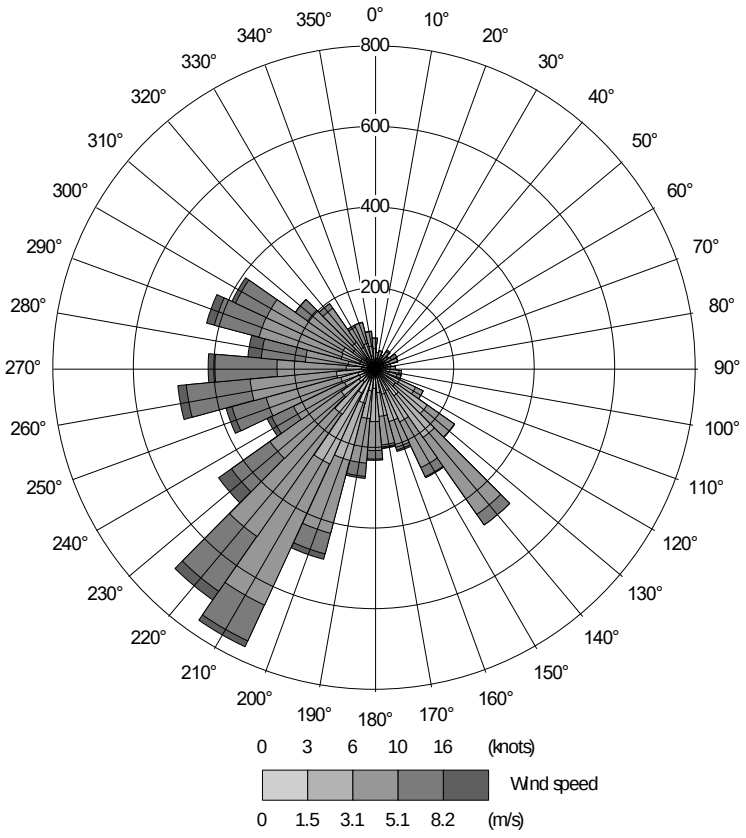
APPENDIX C: TRAFFIC DATA UTILISED IN THE AIR QUALITY ASSESSMENT

Traffic Data Utilised in the Air Dispersion Modelling Assessment

Road Link	Speed	Scenario 1: 2017 Base/Verification Year		Scenario 2: 2020 Opening Year without development		Scenario 3: 2020 Opening Year without development	
	kph	24 hour AADT Total Flow	HDV Flow	24 hour AADT Total Flow	HDV Flow	24 hour AADT Total Flow	HDV Flow
Site Access	32	724	0	752	0	2237	0
A4087 Caernarfon Road (South)	64	17,481	323	18,153	336	18,683	338
A4087 Caernarfon Road (North)	64	17,258	321	17,921	333	18,286	336
Fordd Coed Mawr	32	4610	78	4,787	81	4,852	82
Toronnen	48	320	14	332	14	338	20
A4087 Caernarfon Road (Far North)	48	14,955	267	15,529	278	15,829	280

APPENDIX D: WIND ROSE FOR 2017 FOR RHYL METEOROLOGICAL RECORDING STATION

Meteorological data for 2017 Base Year scenario for the Rhyl recording station was obtained for use in the air dispersion modelling assessment. The wind rose for 2017 is detailed below and illustrates a predominant wind direction from the south west.



APPENDIX E: MODEL VERIFICATION

Whilst ADMS-Roads is widely validated for use in this type of assessment, model verification for the area around the site will not have been included. To determine model performance at a local level, a comparison of modelled results with monitored results in the study area was done in accordance with the methodology provided by Defra[10]. This process of verification aims to minimise modelling uncertainty by correcting modelled results by an adjustment factor to give greater confidence to the results.

The model was run for Scenario 1: 2017 Verification Year to predict the 2017 annual mean road contributions of NOx and PM_{10} at the monitoring locations in the study area. The model NOx outputs at this location were compared to the 2017 monitored concentrations to provide adjustment factors. **Table E1** presents the verification process for NOx.

No monitoring of PM_{10} or $PM_{2.5}$ is undertaken within the study area. Therefore the adjustment factor calculated during the NO_2 verification process was utilised to adjust predicted concentrations of PM_{10} and $PM_{2.5}$.

Table E1: NOx Verification Process

Model Verification Steps	G8 - 453 Caernarfon Road, Bangor
2017 monitored total NO_2 ($\mu g.m^{-3}$)	23.3
2017 background NO_2 concentration ($\mu g.m^{-3}$)	7.3
Monitored road contribution NOx ($\mu g.m^{-3}$)	30.4
Modelled road contribution NOx ($\mu g.m^{-3}$)	8.2
Ratio of monitored road NOx to modelled road NOx	3.7
Adjustment factor for modelled road contribution NOx	**3.7257**
Adjusted modelled road contribution NOx ($\mu g.m^{-3}$)	30.4
Modelled total NO_2 concentration ($\mu g.m^{-3}$)	23.3
Monitored total NO_2 concentration ($\mu g.m^{-3}$)	23.3
% difference between modelled and monitored total NO_2 concentration	0

** Road-NOx component, determined from NOx to NO_2 calculator*

A road-NOx factor of **3.7257** was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero. This factor was then applied to the modelled road-NOx concentration at each receptor, before conversion to NO_2 concentrations using the NO_x to NO_2 calculator[13] provided by Defra and the adjusted NO_2 background concentration.

APPENDIX F: SENSITIVITY ANALYSIS

SENSITIVITY ANALYSIS

A sensitivity analysis was undertaken to consider a scenario where pollutant background concentrations do not decrease with future years. Therefore base year (2017) background concentrations, NOx to NO_2 calculator inputs and emission factors were utilised for the 2020 Opening Year with development and the 2020 Opening Year without development scenario. The results of the assessment for the existing receptor locations identified are provided in **Tables F1 – F4**.

Table F1: Predicted Annual Mean NO_2 Concentrations and Development Impact at Existing Receptor Locations

Existing Receptor	Predicted NO_2 Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2020 Without Development	Scenario 3: 2020 With Development	Change*	
R1	20.7	21.0	+0.3	Negligible
R2	24.3	24.6	+0.3	Negligible
R3	23.8	24.1	+0.3	Negligible
R4	26.3	26.6	+0.3	Negligible
R5	24.9	25.2	+0.3	Negligible
R6	16.8	17.0	+0.1	Negligible
R7	12.1	12.2	+0.1	Negligible
R8	22.2	22.5	+0.3	Negligible

** Discrepancies in change calculations are a result of rounding effects*

Table F2: Predicted Annual Mean PM_{10} Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted PM_{10} Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2020 Without Development	Scenario 3: 2020 With Development	Change*	
R1	13.3	13.4	+0.1	Negligible
R2	13.9	14.0	+0.1	Negligible
R3	13.9	14.0	+0.1	Negligible

Receptor	Predicted PM_{10} Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2020 Without Development	Scenario 3: 2020 With Development	Change*	
R4	14.0	14.1	+0.1	Negligible
R5	13.8	13.9	+0.1	Negligible
R6	12.3	12.3	0.0	Negligible
R7	11.6	11.6	0.0	Negligible
R8	13.2	13.2	0.0	Negligible

** Discrepancies in change calculations are a result of rounding effects*

Table F3: Predicted Annual Mean $PM_{2.5}$ Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted $PM_{2.5}$ Concentrations ($\mu g.m^{-3}$)			Impact
	Scenario 2: 2020 Without Development	Scenario 3: 2020 With Development	Change*	
R1	8.8	8.8	0.0	Negligible
R2	9.2	9.2	0.0	Negligible
R3	9.1	9.2	0.0	Negligible
R4	9.2	9.3	0.0	Negligible
R5	9.1	9.1	0.0	Negligible
R6	8.2	8.3	0.0	Negligible
R7	7.8	7.8	0.0	Negligible
R8	8.7	8.7	0.0	Negligible

** Discrepancies in change calculations are a result of rounding effects*

The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for Scenario 2: 2020 Opening Year without development and Scenario 3: 2020 Opening Year with development are below the relevant annual mean air quality objectives at all receptors.

With regard to short term air quality objectives for NO_2 and PM_{10} at the development, the predicted annual mean NO_2 concentrations are less than 60$\mu g.m^{-3}$ and therefore in

accordance with Defra guidance[10] it may be assumed that exceedances of the 1-hour mean objective are unlikely. The calculation detailed in paragraph 3.10 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

No mitigation is therefore required to minimise road traffic emissions from the development and the Site is considered to be suitable for the proposed commercial use with regard to air quality.

BWB

BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

www.bwbconsulting.com