Hydrock

Detailed Air Quality Assessment Report

Final Report for

Kingsley Development Limited and Westcountry Land (St Austell) Limited

January 2015

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Contents

1.0 INTRODUCTION

Hydrock has been commissioned by Kingsley Development Limited and Westcountry Land (St Austell) Limited to carry out a detailed air quality impact assessment for the development of land at Trewhiddle Farm, St Austell. The site location is identified in Figure 1.

The proposals are for an outline application for mixed use development comprising food and non food retail development, hotel and restaurant, residential development, public open space with associated road infrastructure, access, parking and other utilities and services. An indicative layout of the site is provided in Figure 2.

The Site is located in St Austell which is within the county of Cornwall. Cornwall Council (CC) has declared five Air Quality Management Area's (AQMA) within the borough due to exceedances of the annual mean nitrogen dioxide (NO_2) objective. One of these covers the while of St Austell and the Site falls within the boundary of the AQMA . An assessment of air quality impacts in relation to the development proposals has been undertaken to assess the suitability of the site for residential development and to assess the impact of traffic generated by the proposals on local air quality, including within the AQMA.

This report presents the findings of a detailed air quality assessment of the potential impacts of the proposed development on local air quality during the operational phase of the development. The type, source and significance of potential impacts are identified and the measures that should be employed to minimise these impacts are described.

Figure 1: Site Location Plan

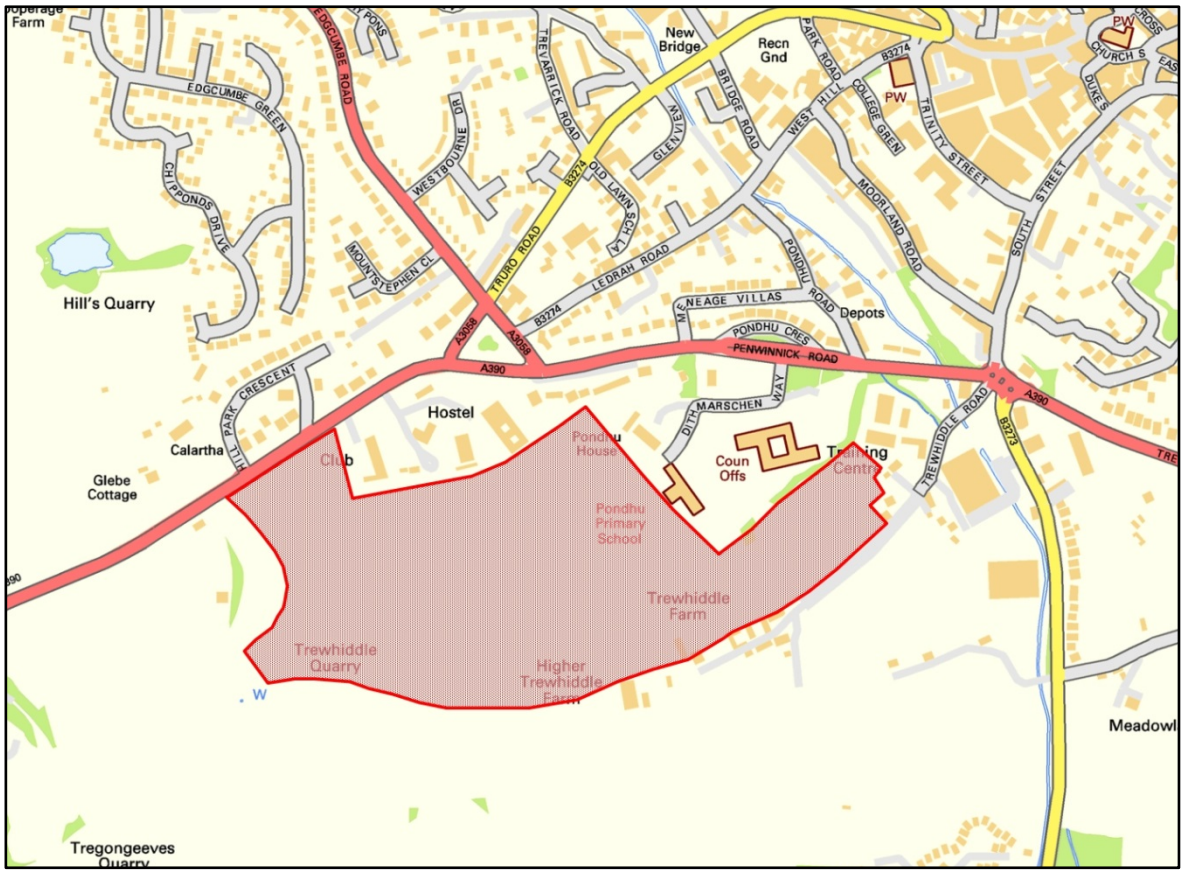

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Figure 2: Site Layout

2.0 POLICY CONTEXT

2.1 Air quality strategy for England, Scotland, Wales & Northern Ireland

The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007 (DEFRA 2007), pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed. The AQS sets standards and objectives to protect health, vegetation and ecosystems.

Table 1: Air Quality Standards (NO_2, and PM_{10})

Pollutant	Standard	Measured as	Objective	
			Annual exceedances allowed	Target Date
Nitrogen Dioxide (NO_2)	40µg/m^3	Annual mean	-	31.12.2005
	200µg/m^3	1 hour mean	18	31.12.2005
Particulate Matter (PM_{10})	40µg/m^3	Annual mean	-	31.12.2004
	50µg/m^3	24 hour mean	35	31.12.2004

The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

The air quality objectives are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.

For some pollutants there is both a long-term (annual mean) standard and a short-term standard. In the case of NO_2, the short-term standard is for a 1-hour averaging period, whereas for PM_{10} it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

Of the pollutants included in the AQS, NO_2 and PM_{10} are of particular relevance to this project, as they are the primary pollutants associated with road traffic.

The current statutory standard and objective for NO_2 and PM_{10} are set out in Table 1 above.

2.2 Local Air Quality Management (LAQM)

Part IV of the Environment Act 1995 requires local authorities to review and assess existing and predict future air quality in their areas as part of a rolling 'review & assessment' process. In areas where exceedances of one or more of the air quality objectives are predicted the local authority must designate an Air Quality Management Area (AQMA). Once designated; the local authority must then draw up an Air Quality Action Plan (AQAP) setting out the measures it intends to take in pursuit of achieving the air quality objectives in the AQMA.

The core guidance documents for use by persons involved in Local Air Quality Management (LAQM), or considering the impacts of a development with the potential to impact on air quality as covered by LAQM, are LAQM TG (09) (DEFRA 2009b) and LAQM PG (09) (DEFRA 2009a). Where the assessment involves the potential impact of traffic, the Design Manual for Roads and Bridges (DMRB) (Highways Agency, 2007) air pollutant screening tools may also be used.

2.3 National planning policy framework

Published on 27th March 2012, the National Planning Policy Framework (NPPF) (CLG 2012) sets out the Government's planning policies for England and how these are expected to be applied. It replaces Planning Policy Statement 23: Planning and Pollution Control (ODPM, 2004), which provided planning guidance for local authorities with regards to air quality.

At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the Framework with the objective of contributing to the achievement of sustainable development.

Current planning law requires that application for planning permissions must be determined in accordance with the relevant development plan (i.e. Local Plan or Neighbourhood Plan). The NPPF should be taken into account in the preparation of development plans and therefore the policies set out within the Framework are a material consideration in planning decisions.

The NPPF identifies 12 core planning principles that should underpin both plan-making and decision-taking, including a requirement for planning to *'contribute to conserving and enhancing the natural environment and reducing pollution'*.

Under Section 11: Conserving and Enhancing the Natural Environment the Framework requires the planning system to *'prevent both new and existing developments from contributing to or being put at unacceptable risk or being adversely affected by unacceptable levels of air pollution'*.

In dealing specifically with air quality the Framework states that *'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'*.

2.4 Cornwall Local Plan

St Austell falls within the previous borough of Restormal Borough Council. The Restormal Local Plan (RBC, 1991) is the current document that guides planning decisions within the town.

Within the Plan policy 36 states that *'permission will not be granted for developments which would cause harm to health, the environment or property or offend human senses from pollution'* and that *'permission will not be granted for developments which surfer unavoidable harm to health or property or offence to human senses from pollution'*.

Cornwall Council published their Local Plan: Strategic Policies Proposed Submission Document (CC, 2014) in 2014 which sets out the draft policies to guide planning decisions within the county up until 2030. Once published the policies within the new Local Plan will replace those currently used within the Restormal Local Plan.

Within the Plan Policy 14 requires all new development to:

- *'avoid adverse impacts, either individually or cumulatively, resulting from dust, odour and pollution. Such adverse impacts should be avoided during the construction, operation and restoration stage of development';*
- *'include measures to reduce pollution within air quality management areas and meet the air quality objectives that are proposed by the Local Transport Plan and any Air Quality Action Plans'.*

3.0 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

3.1 Scope of assessment

The scope of the assessment has been determined in the following way:

- review of air quality data for the area surrounding the site, including data from the National Air Quality Information Archive (NAQIA) (www.airquality.co.uk); and
- review of the traffic flow data, which has been used as an input to the air quality modelling assessment.

There is the potential for impacts on local air quality during both the construction and operational phases of the Project. Details of the assessment methodology and the specific issues considered are provided below.

3.2 Prediction of Impacts – construction phase

3.2.1 Construction Traffic

During construction of the proposed development, lorries will require access to the Site to deliver and remove materials; earthmoving plant and other mobile machinery will work on site and generators and cranes will also be in operation. These machines produce exhaust emissions; of particular concern are emissions of NO_2 and PM_{10}.

Based on the size of the development proposals it is anticipated that there would be less than 200 additional HGV vehicles generated on the adjacent road network.

The Environmental Protection UK (EPUK) air quality guidance (EPUK 2010) sets out criteria to assist in establishing when an air quality assessment will be required. These criteria indicate that significant impacts on air quality are likely to occur where a development results in greater than 200 HGV movements per day during a construction period of a year or more. It is therefore anticipated that construction traffic generated by the proposed development would result in a negligible impact on local NO_2 and PM_{10} concentrations and has not been considered any further in this assessment.

3.2.2 Construction Dust

To assess the potential impacts associated with dust and PM_{10} releases during the construction phase and to determine any necessary mitigation measures, an assessment based on the latest guidance from the Institute of Air Quality Management (IAQM 2014) has been undertaken.

This approach divides construction activities into the following four categories:

- demolition;
- earthworks;
- construction; and

- trackout.

The assessment methodology requires consideration of dust effects arising from three potential impacts:

- annoyance due to dust soiling;
- harm to ecological receptors; and
- the risk of health effects due to a significant increase in exposure to PM_{10}.

The three impacts are assessed taking into account the sensitivity of the area likely to experience these effects, with the results of the assessment being used to define appropriate mitigation measures to prevent any significant effects at nearby receptors.

The IAQM guidance sets out the assessment into a number of steps. The first is an initial screening assessment to determine if there are any sensitive receptors (both human and ecological) within 350 m of the site boundary or within 100m of the proposed construction haulage routes, thus determining the requirement for a more detailed evaluation.

Step 2 of the methodology assesses the risk of dust impacts for each construction activity and takes account of:

- the scale and nature of the works, which determines the potential dust emission magnitude (step 2a); and
- the sensitivity of the area (step 2b).

Risks are described in terms of there being a low, medium or high risk of dust effects for each of the four separate potential activities. This assessment is based on both IAQM criteria and professional judgement.

The outcome of the above two steps are then combined (step 2c) to identify the risk of dust impacts, which are described in terms of there being a low, medium or high risk of dust effects for each of the four activity groups and assuming no mitigation measures are in place.

Based on the identified risk, appropriate mitigation measures are identified as set out in the IAQM guidance.

All construction sites are different and the potential for dust impacts are dependent on a number of local factors. The methodology set out in the IAQM guidance is therefore considered as a framework for assessing dust impacts and a certain level of professional judgement is required in determining the effects from each site.

The significance of identified effects is evaluated post mitigation using professional judgement and assuming that the mitigation measures identified and set out within the assessment are implemented by way of a Dust Management Plan (DMP).

3.3 Prediction of impacts - operational phase

The prediction of local air quality has been undertaken using the ADMS Roads dispersion model. This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

The model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. Meteorological data from Plymouth for 2013 has been used for the assessment.

The model has been used to predict road specific concentrations of oxides of nitrogen (NO_x) and Particulate Matter (PM_{10}). The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator available on the DEFRA air quality website (http://uk-air.defra.gov.uk).

Traffic data for use in the assessment has been provided by the Transport Consultants. Base traffic data has been provided for 2014, which has been used for the 2013 base scenario to allow verification of the model results with local monitoring data.

The base traffic data has been factored forward to provide the future year base scenario. Traffic generated by the proposed development and other committed developments in the area has then been added to the base flows to provide the future 'base + committed + development' scenario. As the data includes traffic generated by other committed developments in the area the predicted impacts on local air quality are considered to be worst-case.

A further assessment scenario has been included in the assessment which incorporated the change in traffic on the local road network as a result of the Pentewan Link road.

Based on the traffic data provided the following scenarios have been assessed:

- 2013 Base – for verification of the model only;
- Future Base;
- Future Base + Committed + Development; and
- Future Base + Committed + Development plus Pentewan Link.

A summary of the traffic data used in the assessment can be found in Appendix 1. The data includes details of annual average daily traffic flows (AADT), vehicle speeds and percentage HGV for the assessment years considered.

The emission factors released by DEFRA in July 2014, provided in the emissions factor toolkit EFT2014_6.0.1 and built into the ADMS model (Version 3.2, Updated September 2014) have been used to predict existing and future traffic related emissions. These are the latest emission factors available.

To predict local air quality, traffic emissions predicted by the model must be added to local background concentrations. Background concentrations of NO_2 and PM_{10} have been taken from the 2011 DEFRA background maps. The maps provide an estimate of background concentrations between 2011 and 2030. The data used for the modelling assessment for the 2013 are set out in Table 7. There is a local background monitoring site located at the council offices to the east of

the Site, however the background concentrations provided in the DEFRA maps are higher than recorded at the monitoring site. The use of the DEFRA data is therefore considered to provide a worst-case prediction of local concentrations.

It is recommended, following guidance set out in LAQM.TG(09), that the model results are compared with measured data to determine whether the model results need adjusting to more accurately reflect local air quality. This process is known as verification.

LAQM.TG(09) recommends that model predictions should be within 25% (preferably 10%) of monitored concentrations for the model to be predicting with any degree of accuracy. There are three monitoring sites located adjacent to the road network being considered within the modelling assessment. All three sites have been used to verify the model results. The results of the comparison are presented below in Table 1.

Table 2: Comparison of Modelled and Monitored NO_2 and PM_{10} Concentrations (µg/m^3)

Monitoring Locations	Measured Concentration	Modelled Concentration	% Difference
STA5	44.8	17.0	-62.1
STA2	55.9	18.7	-66.5
STA1	52.9	18.4	-65.2

The comparison of monitored and modelled concentrations indicates that the model is under-predicting annual mean NO_2 concentrations by an average of 62%. It is therefore considered necessary to adjust the model results to better represent local concentrations. The results of the modelling assessment have been adjusted using the methodology given in LAQM.TG(09). Full details of the verification and calculation of adjustment factors are provided in Appendix 2.

Following application of the calculated adjustment factors the model results are showing no overall tendency to under or over predict at the monitoring locations and the predicted annual mean NO_2 at each site is within 2% of monitored concentrations.

There is no suitable monitoring of PM_{10} data to allow verification of the PM_{10} model results. However, LAQM.TG(09) suggests applying the NO_x adjustment factor to modelled road-PM_{10} where no appropriate verification against PM_{10} data can be carried out. Therefore, the adjustment applied to predicted NO_x concentrations has also been applied to the modelled PM_{10} concentrations.

LAQM.TG(09) does not provide a method for the conversion of annual mean NO_2 concentrations to 1-hour mean NO_2 concentrations. However, research (Laxen and Marner 2003) has concluded that exceedances of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m^3. Care has been taken to ensure that locations where the 1-hour mean objective is relevant are included in the assessment.

Quantitative assessment of the impacts on local air quality from road traffic emissions associated with the operation of the development have been completed against the current statutory standards and objectives set out in Table 1 for NO_2 and PM_{10}.

3.4 Significance Criteria

The guidance issued by EPUK (EPUK 2010) relates to Air Quality considerations within the planning process and sets criterion which identify the need for an Air Quality Assessment, the type of Air Quality assessment required, and the significance of any predicted impact.

The guidance also sets out criteria for assessing air quality impact magnitude and places significant emphasis on judging overall impacts by means of professional judgement, whilst taking into account the impact magnitude descriptors.

The determination of impact significance within this assessment has considered both the impact descriptors and the professional judgement of the author. Tables 3 and 4 identify the assessment criteria from this guidance.

These criteria have been deemed suitable for use in this appraisal, as there are currently no standards or statutory significance criteria available for this purpose.

Table 3: Definition of Impact magnitude for Changes in Ambient Annual Mean NO_2 and PM_{10}

Magnitude of Change	Annual Mean
Large	Increase/decrease > 40 µg/m^3
Medium	Increase/decrease 2-4 µg/m^3
Small	Increase/decrease 0.4 – 2 µg/m^3
Imperceptible	Increase/decrease < 0.4 µg/m^3

Once the magnitude of the impact is known, the next step is to describe the impact. The EPUK guidance therefore presents a set of descriptors as a means of describing impacts. These are identified in Table 4 below.

Table 4: Air Quality Impact Descriptors for Changes to Annual Mean NO_2 and PM_{10} Concentrations at a Receptor

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with development			
Above Objective/ Limit Value *With* Scheme (>40 µg/m^3)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/ Limit Value *With* Scheme (36-40 µg/m^3)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/ Limit Value *With* Scheme (30-36 µg/m^3)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/ Limit Value *With* Scheme (<30 µg/m^3)	Negligible	Negligible	Slight Adverse
Decrease with Development			
Above Objective/ Limit Value *Without* Scheme (>40 µg/m^3)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/ Limit Value *Without* Scheme (36-40 µg/m^3)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/ Limit Value *Without* Scheme (30-36 µg/m^3)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/ Limit Value *Without* Scheme (<30 µg/m^3)	Negligible	Negligible	Slight Beneficial

Other factors taken into account in determining the significance of the impacts predicted are summarised in Table 5 below.

Table 5: Factors Taken into Account in Determining Air Quality Significance

Factors
The number of properties affected by slight, moderate or major air quality impacts.
The number of people exposed to levels above the objective or limit value.
The magnitude of the changes and the description of the impacts at relevant receptors.
Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before, or an exceedence area is substantially increased.
Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced.
Uncertainty, including the extent to which worst-case assumptions have been made.
The extent to which an objective or limit value is exceeded, e.g. an annual mean NO_2 of 41 µg/m^3 should attract less significance than an annual mean of 51 µg/m^3.

3.5 Sensitive receptors

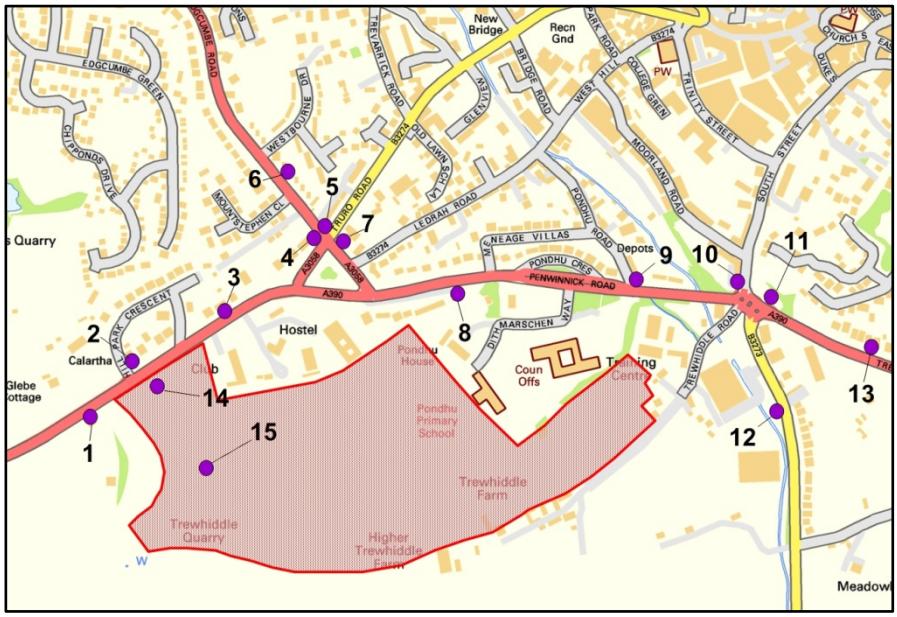
LAQM.TG(09) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations 'where members of the public are regularly present' should be considered. At such locations, members of the public will be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

For instance, on a footpath, where exposure will be transient (for the duration of passage along that path) comparison with short-term standard (i.e. 15 minute mean or 1 hour mean) may be relevant. In a school, or adjacent to a private dwelling, however, where exposure may be for longer periods, comparison with long-term (such as 24 hour mean or annual mean) standards may be most appropriate. In general terms, concentrations associated with long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

For the completion of this assessment, concentrations of NO_2 and PM_{10} have been predicted at a number of residential properties located adjacent to the road links in the traffic data set provided by the transport consultants. The receptors have been selected to represent worst-case exposure to local traffic emissions. Receptors have also been selected to represent the proposed development site to assess its suitability for residential development.

The receptor locations used in the modelling assessment are presented below in Figure 3. Further details of each receptor are provided in Appendix 3.

Figure 3: Receptor Locations



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4.0 BASELINE CONDITIONS

4.1 Cornwall Council review and assessment of air quality

CC have carried out detailed assessments of air quality and as a result have declared five AQMA's due to exceedances of the annual mean NO_2 objective of 40 µg/m^3. The five AQMAs are:

•Bodmin;

•Camborne-Pool-Redruth;

•Tideford;

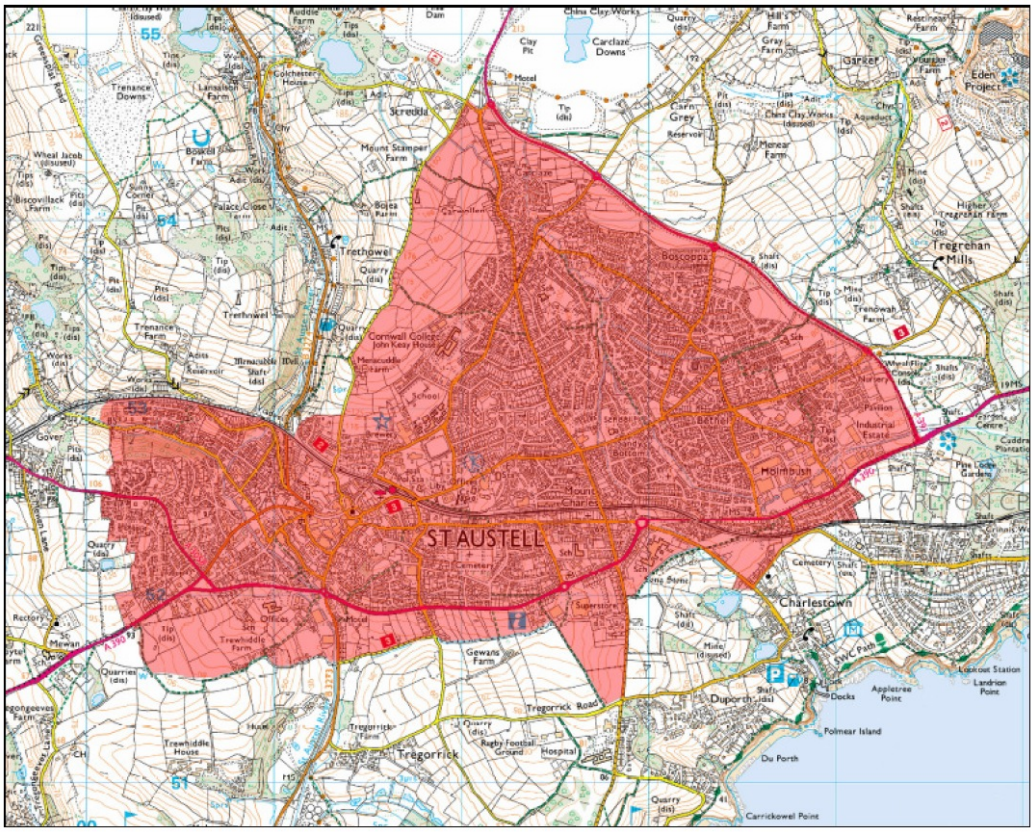
•Gunislake; and

•St Austell.

The St Austell AQMA covers the majority of the town as shown in Figure 4. The development site and road network considered within the assessment fall within the AQMA.

The remaining four AQMA and the Truro AQMA, which CC are in the process of declaring for exceedences adjacent to the A390, are over 15 km from St Austell and therefore air quality within these areas are not considered relevant to this assessment.

Figure 4: Location of Bath AQMA (CC 2013)



4.2 Automatic monitoring data

CC currently operates seven automatic monitoring sites within the county. These are located within the declared AQMA's including adjacent to Holmbush Road, St Austell and were installed in late 2013. Data from these sites is currently unavailable.

4.3 Non-automatic monitoring

CC also measures NO_2 concentrations across the county using diffusion tubes, a number of which are located within St Austell. Details of the monitoring sites of most relevance to this assessment are presented in Table 6 and their locations shown in Figure 5.

The data provided has been adjusted using bias adjustment factors presented in the National Bias Adjustment Spread Sheet available on the DEFRA website (http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html) . A factor of 0.95 was applied to the 2013 monitoring data.

Figure 5: Location of Monitoring Sites relevant to this Assessment

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Table 6: Diffusion Tube Monitoring Results (µg/m^3)

Site	Site Type	OS Grid Ref[1]	Years				
			2009	2010	2011	2012	2013
STA5	Kerbside	201269, 52112	-	-	-	-	44.8
STA3	Urban background	200968, 51883	7.1	9.3	6.4	7	7.8
STA2	Kerbside	200617, 52133	-	44.6	42.0	47.1	55.9
STA1	Kerbside	200606, 52145	-	43.2	42.8	43.0	52.9
STA6	suburban	201324, 51858	-	-	-	-	24.2

The data presented in Table 6 indicates annual mean NO_2 concentrations above the objective at three of the monitoring locations; the two on Edgcumbe Road (STA2 and STA1) and the site located on South Street (STA5). All three of these sites are located at kerbside locations and therefore are not representative of relevant exposure, however they show that concentrations close to the main road network are exceeding the 40 µg/m^3 objective limit.

Concentrations recorded on Pentewan Road were 'well below' (<30 µg/m^3, Table 4) the objective during 2013. The site is a suburban location, set back from the roadside and therefore more representative of relevant exposure.

Data recorded at the Council Offices shows that background concentrations in the vicinity of the Site are 'well below' the objective.

The data recorded at all the monitoring sites presented in Table 6 shows no overall trend in concentrations with a decline in concentrations recorded between 2010 and 2011 followed by an increase during 2012 and 2013.

It is not possible to monitor short-term NO_2 concentrations using diffusion tubes, however, as discussed previously, research has concluded that exceedences of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m^3. Based on the monitoring data presented in Table 6, exceedence of the short-term objective is unlikely to occur within St Austell.

4.4 Defra background maps

Additional information on background concentrations in the vicinity of the Development Site has been obtained from the DEFRA background pollutant maps. The average concentration from the following grid squares has been extracted from the maps which includes the development site and road links included in the modelling assessment:

- 200500, 51500;
- 200500, 52500;
- 201500, 51500;
- 201500, 52500;

The 2011 DEFRA background maps, which provide estimated background concentrations between 2011 and 2030, have been used to obtain concentrations for 2013 (the base year). The data is set out in Table 10 below.

Table 7: Estimated Background Concentrations (µg/m^3)

Pollutant	2013
NO_x	16.7
NO_2	11.9
PM_{10}	14.7

The data presented in Table 7 shows that estimated annual mean background concentrations of NO_2 and PM_{10} are below the annual average objective of 40 µg/m^3.

5.0 POTENTIAL EFFECTS

5.1 Construction Impacts

5.1.1 Site and Surroundings

The Site is currently occupied by Higher Trewhiddle Farm and mainly consists of agricultural fields which form part of the farm. The site comprises of a series of predominantly single storey buildings. All the buildings associated with Higher Trewhiddle Farm would be demolished as part of the construction process. Trewhiddle Farm lies within 50 m of the buildings that will be demolished, therefore an assessment of impacts associated with demolition activities has been included in this assessment.

There are a number of sensitive receptors located within 350 m of the site boundary including residential properties to the north and west, Pondu primary School to the east and residential properties to the east. An assessment of construction related impacts in relation to human receptors is therefore considered necessary.

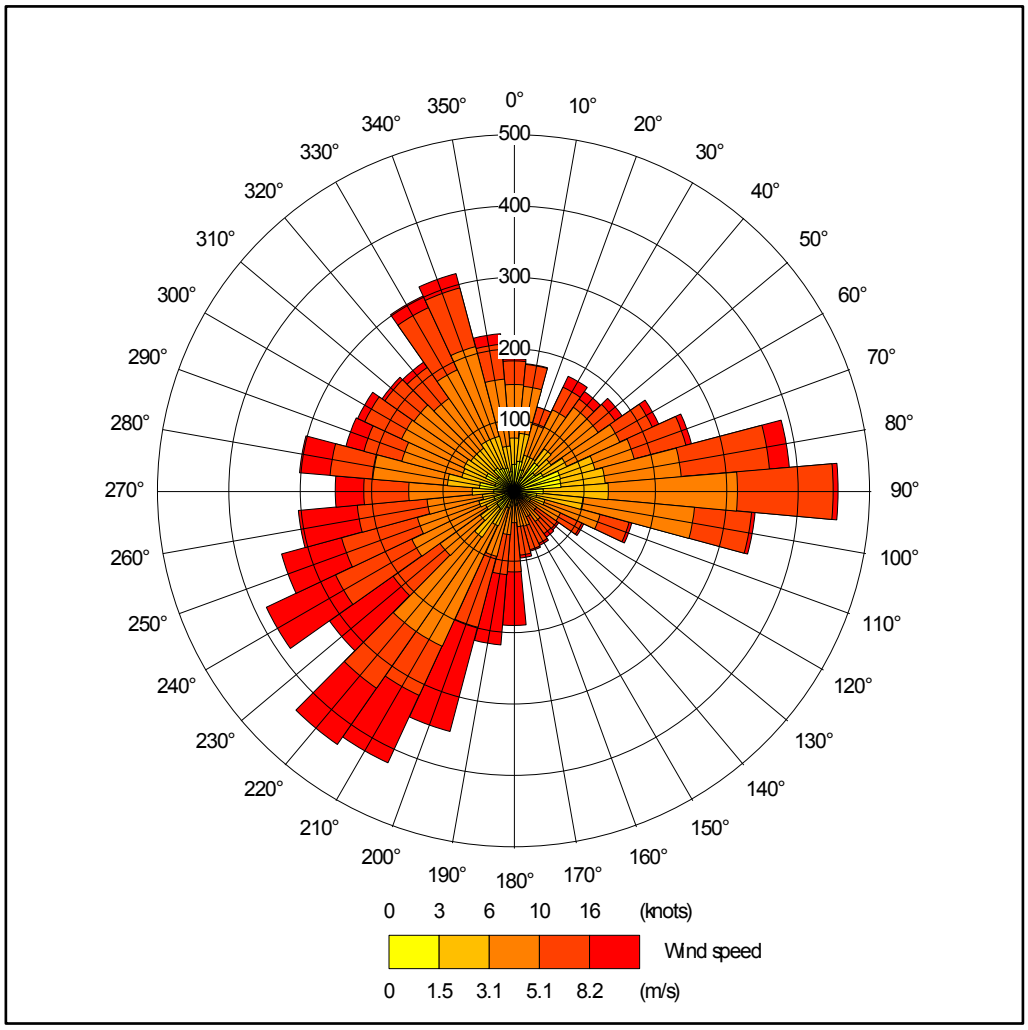
Dust emissions from construction activities are unlikely to result in significant impacts on ecologically sensitive receptors beyond 50 m from the site boundary. There are no nationally or locally designated sites for wildlife within 2 km of the Site therefore impacts on ecologically sensitive receptors have not been considered any further within the assessment.

As previously discussed, there is no monitoring of PM_{10} carried out within the borough. Based on the data presented in Table 7, annual mean background concentrations in the vicinity of the Site are expected to be in the region of 15 µg/m^3. Therefore, based on professional judgement PM_{10} concentrations within the assessment area are unlikely to exceed 20 µg/m^3.

The precise behaviour of the dust, its residence time in the atmosphere, and the distance it may travel before being deposited would depend upon a number of factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.) that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

A windrose from Plymouth Meteorological Station (2013) is provided below in Figure 6, which shows that the prevailing wind is from the south-west, although there were also strong winds from the east. Receptors located to the north-east and west of any construction activities are therefore most at risk of experiencing impacts, which includes the adjacent primary school, residential properties adjacent to the A392 and the two residential properties located to the west of the Site.

Figure 6: Windrose for Plymouth Meteorological Site (2013)



5.1.2 Potential Dust Magnitude

The dust emission magnitude is based on the scale of anticipated works at the Site and has been defined as small, medium or large for each of the three activities; earthworks, construction and trackout. A summary of the dust emission magnitude for each activity is set out in Table 8.

Demolition

Dust emissions from demolition can arise from a number of activities including the de-construction of buildings, on-site crushing and screening and general disturbance of potentially dusty materials.

The existing buildings located on the Site lie adjacent to the southern boundary and would require demolition prior to any construction works being undertaken. The buildings have a total volume of less than 15,000 m^3 and are less than 10 m in height. The Site is therefore considered to be 'small' in relation to dust emissions generated by demolition activities.

Earthworks

Earthworks are those activities involved in preparing the Site for construction such as excavation of material, haulage, tipping, stockpiling and leveling.

The Site covers an area of approximately 19 Ha and the proposals include for a mix of residential, commercial and retail uses. During the earthwork activities it is anticipated that there would be more than 10 earth moving vehicles on the site at any given time and the potential for storage bunds of between 4-8m in height. The Site is therefore considered to have a dust emission class of 'large' with regards to earthwork activities.

Construction

There are a number of issues that can impact the dust emission class during construction activities including the size of the building, materials used for construction, the method of construction and the duration of the build.

The proposed development is at outline planning stage therefore detailed information is not available on the construction process. Based on the current design layout the total building volume proposed for the Site would be more than 100,000 m^3, and a significant proportion of the construction materials would be brick and concrete, which can be significant sources of dust emissions. The Site is therefore considered to have a dust emission class of 'large' with regards to construction activities.

Trackout

The risk of impacts occurring during trackout is predominantly dependent on the number of vehicles accessing the Site on a daily basis. However, vehicle size and speed, the duration of activities and local geology are also factors which are used to determine the emission class of the Site as a result of trackout.

Given the size of the proposed development it is expected that there would be more than 50 Heavy Duty Vehicles (HDV) accessing the Site each day, with the vehicles travelling on site over unpaved roads of more than 100 m in length. The Site is therefore classed as 'large' with regards to trackout activities.

Table 8: Summary of Dust Emission Magnitude for Each Activity

Source	Magnitude
Demolition	Small
Earthworks	Large
Construction	Large
Trackout	Large

5.1.3 Sensitivity of Surrounding Area

The sensitivity of the surrounding area takes account of the following factors:

- the specific sensitivities of receptors in the area;

- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentrations; and
- site-specific factors i.e. whether there are natural shelters such as trees, to reduce the risk of wind-blown dust.

The main sensitive receptors adjacent to the Site are residential dwellings, educational facilities and places of work. Based on the IAQM guidance residential dwellings and schools are considered as a high sensitivity receptors in relation to both dust soiling and health effects of PM_{10}, while places of work have a medium sensitivity. As there are less than 10 high sensitivity receptors within 20 m of the site boundary, but over 10 within 50 m, the overall sensitivity of the surrounding area is considered to be 'medium' in relation to dust soiling.

As detailed above, PM_{10} concentrations in the vicinity of the Site are expected to be less than 24 $\mu g/m^3$. Based on the proximity of the residential receptors to the site boundary (i.e. between <10 within 20 m of the suite boundary) and the local concentrations of PM_{10} the sensitivity of the surrounding area is considered to be 'low' with regards human health impacts.

However, there is only one property located within 50 m of the buildings requiring demolition therefore the sensitivity of the surrounding area in relation to impacts from demolition are considered to be ‘low’.

In relation to trackout, it is anticipated that vehicles accessing the Site will travel along the A392 to the site access road opposite Hill park Crescent. As a general guidance, significant impacts from trackout may occur up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. There are residential properties located within 20 m of the roadside along the A392 within 500 m of the site access road. The sensitivity of receptors in relation to dust soiling are therefore considered to be ‘high’ and in relation to human health ‘low’ as a result of trackout.

A summary of the sensitivity of the area surrounding the Site in relation to each activity is provided below in Table 9.

Table 9: Summary of Sensitivity of Surrounding Area

Source	Sensitivity of Surrounding Area	
	Dust Soiling	Human health
Demolition	Low	Low
Earthworks	Medium	Low
Construction	Medium	Low
Trackout	High	Low

5.1.4 Defining the Risk of Impacts

The dust emission magnitude as set out in Table 8, is combined with the sensitivity of the area (Table 9) to determine the risk of both dust soiling and human health impacts, assuming no mitigation measures have been applied at site. The risk of impacts associated with each activity

is provided in Table 10 below and has been used to identify specific mitigation measures, which are set out later in this chapter.

Table 10: Summary of Dust Risk Effects to Define Site Specific Mitigation

Source	Risk of Impact	
	Dust Soiling	Human health
Demolition	Negligible	Negligible
Earthworks	Medium Risk	Low Risk
Construction	Medium Risk	Low Risk
Trackout	High Risk	Low Risk

5.2 Operational Impacts

5.2.1 NO_2 concentrations

The annual mean NO_2 concentrations predicted at the existing receptors are set out in Table 11 and concentrations predicted at the development site are provided in Table 12.

The modelling assessment shows that predicted annual mean NO_2 concentrations are 'well below' the annual mean objective at all the selected existing receptors. The highest concentrations are predicted at receptors 4 and 5 which lie adjacent to Edgcumbe Road at the junction with Truro Road, however concentrations at both receptors remain 'well below' the objective under all three assessment scenarios.

Traffic generated by the proposed development and other committed developments in the vicinity of the Site is predicted to result in a maximum increase in annual mean NO_2 of 3.7 $\mu g/m^3$. An increase in concentrations of between 2-4 $\mu g/m^3$ is classed as a medium change in air quality based on the criteria set out in the IAQM guidance (Table 3). A medium change in concentrations is predicted at two receptors, receptors 4 and 5, however, as concentrations at both locations remain 'well below' the objective this is considered to be a negligible impact. With the addition of the Pentewan Link Road, the change in concentrations at both these receptors is also predicted to be medium, resulting in a negligible impact in NO_2.

At eight receptors the predicted additional traffic on the road network is predicted to result in a 'small' change in NO_2 concentrations (between 0.4 – 2 $\mu g/m^3$, Table 3). This is also considered to be of negligible significance due to NO_2 concentrations remaining 'well below' the objective. At the remaining three receptors the change in concentrations is imperceptible and therefore negligible.

The change in traffic as a result of the link road is also predicted to be of negligible significance at the rest of the receptor locations although at four receptors the change is predicted to be a decline in concentrations of up to 1.4 $\mu g/m^3$, a positive impact but of negligible significance.

Table 11: Predicted Annual Mean NO_2 Concentrations at Existing Receptor Locations (µg/m^3)

Receptor	Future Base	Future Base + Committed + Development	Increase due to All Development	Significance of Impact	Future Base + Committed + Development + Link Rd	Increase due to All development plus link road	Significance of Impact
1	20.9	21.6	0.7	Negligible	21.6	0.7	Negligible
2	18.3	19.5	1.2	Negligible	17.8	-0.5	Negligible
3	16.3	17.0	0.7	Negligible	16.1	-0.2	Negligible
4	25.6	29.4	3.7	Negligible	29.4	3.8	Negligible
5	26.1	29.8	3.7	Negligible	29.5	3.4	Negligible
6	15.8	17.8	2.0	Negligible	17.8	2.0	Negligible
7	25.7	26.7	0.9	Negligible	26.0	0.3	Negligible
8	22.5	23.5	1.0	Negligible	21.1	-1.4	Negligible
9	21.2	22.5	1.3	Negligible	20.0	-1.2	Negligible
10	27.4	28.5	1.1	Negligible	28.3	0.9	Negligible
11	24.7	25.0	0.3	Negligible	25.3	0.5	Negligible
12	20.7	20.6	-0.1	Negligible	19.1	-1.6	Negligible
13	17.8	17.6	-0.2	Negligible	18.5	0.7	Negligible

Table 12: Predicted Annual Mean NO_2 Concentrations at the Development Site (µg/m^3)

Receptor	Future Base + Proposed Development	Future Base + Committed + Development + Link Rd
14	18.4	17.2
15	13.0	12.9

The ADMS model is predicting annual mean NO_2 concentrations 'well below' the objective at receptors 14 and 15 (Table 12). Receptor 14 does not represent relevant exposure at the Site, being at the façade of the proposed new restaurant, however it is the closest point on the site adjacent to the A392 and proposed new roundabout. Receptor 15 has been selected to represent the closest residential receptor within the Site to the A392. As concentrations at both receptors are 'well below' the objective it can be concluded that concentrations across the whole Site and at all proposed sensitive receptors will be below the annual mean objective.

Exceedence of the 1-hour objective for NO_2 is also unlikely based on the predicted annual mean concentrations. Guidance referred to earlier in the report indicates that exceedence of the 1-hour objective is unlikely where the annual mean concentration is below 60 µg/m^3.

Future occupants of the Site would not be exposed to elevated NO_2 concentrations therefore the impact of the development with regards new exposure to air quality is considered to be negligible.

5.2.2 PM_{10} concentrations

Predicted annual mean PM_{10} concentrations at the selected existing receptors are presented below in Table 13, while concentrations predicted at the development site are set out in Table 14.

The predicted annual mean PM_{10} concentrations are 'well below' the 40 µg/m^3 objective at all the selected existing receptor locations under all three assessment scenarios. Annual mean concentrations are also predicted to be 'well below' the objective across the development site based on concentrations predicted at receptors 14 and 15 (Table 13).

The proposed development and committed developments are predicted to result in a maximum increase in annual mean PM_{10} concentrations of 1.0 µg/m^3. This is a 'small' change in air quality but with a negligible significance as concentrations remain 'well below' the objective. With the addition of the proposed link road, the predicted change in PM_{10} concentrations remains at 1.0 µg/m^3 or less, therefore the impact under this scenario is also of negligible significance.

The number of exceedances of 50 µg/m^3, as a 24-hour mean PM_{10} concentration, has been calculated from the annual mean following the approach set out by DEFRA in LAQM.TG(09):

A = -18.5 + 0.00145 x annual mean3 + (206/annual mean)

where A is the number of exceedances of 50 µg/m^3 as a 24-hour mean PM_{10} concentration.

Based on the approach set out above, the maximum number of days >50 µg/m^3 PM_{10} is predicted to be between 1-3 at all locations with an increase of less than 1 as a result of the the proposed and committed developments. The impact of the development on 24-hour PM_{10} concentrations is therefore considered to be negligible. Furthermore, the objective for this pollutant permits up to 35-days per annum and therefore exceedence of this objective is highly unlikely at any location across the development site.

Future occupants of the Site would not be exposed to elevated PM_{10} concentrations therefore the impact of the development with regards new exposure to air quality is considered to be negligible.

Table 13: Predicted Annual Mean PM_{10} Concentrations at Existing Receptor Locations (µg/m^3)

Receptor	Future Base	Future Base + Committed + Development	Increase due to All Development	Significance of Impact	Future Base + Committed + Development + Link Rd	Increase due to All development plus link road	Significance of Impact
1	18.4	18.7	0.3	Negligible	18.7	0.3	Negligible
2	17.2	17.7	0.5	Negligible	17.0	-0.2	Negligible
3	16.4	16.7	0.3	Negligible	16.4	-0.1	Negligible
4	18.3	19.3	1.0	Negligible	19.3	1.0	Negligible
5	18.4	19.4	1.0	Negligible	19.3	0.9	Negligible
6	16.2	17.0	0.8	Negligible	17.1	0.8	Negligible
7	18.5	18.8	0.2	Negligible	18.5	0.0	Negligible
8	19.1	19.5	0.5	Negligible	18.5	-0.6	Negligible
9	18.4	19.0	0.6	Negligible	17.9	-0.5	Negligible
10	18.7	19.0	0.3	Negligible	19.0	0.3	Negligible
11	17.8	17.9	0.1	Negligible	18.0	0.1	Negligible
12	18.2	18.1	0.0	Negligible	17.5	-0.7	Negligible
13	17.0	16.9	-.01	Negligible	17.3	0.3	Negligible

Table 14: Predicted Annual Mean PM_{10} Concentrations at the Development Site (µg/m^3)

Receptor	Future Base + Proposed Development	Future Base + Committed + Development + Link Rd
14	17.3	16.8
15	15.1	15.1

5.3 Cumulative Impacts

The future with development scenario has included impacts associated with other committed developments in the vicinity of the Site. The assessment has predicted a negligible impact from all developments therefore the cumulative impact would be negligible.

6.0 MITIGATION MEASURES

6.1 Construction Phase

The control of dust emissions from construction site activities relies upon management provision and mitigation techniques to reduce emissions of dust and limit dispersion. Where dust emission controls have been used effectively, large-scale operations have been successfully undertaken without impacts to nearby properties.

A high risk of impacts is predicted at adjacent sensitive receptors during construction of the proposed development. Appropriate mitigation measures for the Site have been identified following the IAQM guidance and based on the risk effects presented in Table 10. It is recommended that the 'highly recommended' measures set out in Appendix 4 are incorporated into a DMP and approved by CC prior to commencement of any work on site:

The LAQM guidance recommends that where there is a medium/high risk of impacts at nearby residential receptors that monitoring of dust or PM_{10} is carried out throughout the construction period. The requirement for monitoring should be discussed and agreed with CC and if required baseline monitoring should commence at least three months before construction work commences on site.

In addition to the 'recommended' measures, the IAQM guidance also sets out a number of 'desirable' measures which should also be considered for inclusion within the DMP. These are also set out in Appendix 4.

Following implementation of the measures recommended for inclusion within the DMP the impact of emissions during construction of the proposed development would be negligible.

6.2 Operational Phase

The proposed development is predicted to have a negligible impact on local air quality therefore no mitigation measures are considered necessary.

7.0 RESIDUAL EFFECTS

7.1 Construction Phase

The greatest potential for dust nuisance problems to occur will generally be within 200m of the construction site perimeter. There may be limited incidences of increased dust deposited on property beyond this distance.

By following the mitigation measures outlined within this appraisal the impact would be substantially minimised. Residual impacts are therefore considered to be negligible.

7.2 Operational Phase

The proposed development is predicted to have a negligible impact on NO_2 and PM_{10} concentrations. Residual impacts are therefore considered to be negligible.

8.0 SUMMARY AND CONCLUSIONS

An air quality impact assessment has been carried out to assess both construction and operational impacts of the proposed development.

An assessment of the potential impacts during the construction phase has been carried out. This has shown that during this phase of the proposed development releases of dust and PM_{10} are likely to occur during site activities. Through good site practice and the implementation of suitable mitigation measures, the impact of dust and PM_{10} releases may be effectively mitigated and the resultant impacts are considered to be negligible.

ADMS Roads dispersion modelling has been carried out to assess the operational impacts associated with the proposed development and other committed developments in the vicinity of the Site. The assessment has shown that the cumulative impact of all developments including the proposed Pentewan link road would result in a negligible impact on local NO_2 and PM_{10} concentrations.

The modelling assessment has predicted both NO_2 and PM_{10} concentrations at the development site 'well below' the relevant air quality objectives and therefore the proposals would not result in exposure of future occupants to poor air quality.

Based on the above information, it is considered that air quality does not pose a constraint to redevelopment of the site as proposed. .

9.0 ABBREVIATIONS

- ADMS – Air Dispersion Modelling Software
- AQMA – Air Quality Management Area
- AQMS – Air Quality Monitoring Site
- DEFRA – Department for Environment, Food and Rural Affairs
- EPUK – Environmental Protection UK
- LAQM – Local Air Quality Management
- NO_2 – Nitrogen dioxide
- $\mu g/m^3$ micrograms per cubic metre - A measure of concentration in terms of mass per unit volume. A concentration of 1ug/m3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
- WHO – World Health Organisation

10.0 REFERENCES

DEFRA (2009a), Local Air Quality Management Policy Guidance

DEFRA (2009b), Local Air Quality Management Technical Guidance LAQM TG(09)

DEFRA (2007), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – July 2007.

Communities and Local Government (CLG) (2012) National Planning Policy Framework – March 2012.

Office of the Deputy Prime Minister (ODPM) (2004) Planning Policy Statement 23: Planning and Pollution Control.

Restormal Borough Council (RBC) (1991) Restormal Local Plan

Cornwall Council (CC) (2014) The Cornwall Local Plan: Strategic Policies Proposed Submission Document

EPUK (April 2010), Development Control: Planning for Air Quality (2010 Update).

IAQM (2014) Guidance on the Assessment of Dust from Demolition and Construction.

D. Laxen and B Marner (2003) Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites.

Cornwall Council (2013) 2013 Air Quality Progress Report

APPENDIX 1 – TRAFFIC DATA

Road Link	2014 Base	Future Base	Future Base + Committed + Development	Future Base + Committed + Development Plus Link	HGV (%)	Speed (km/h)
A390 West of Site Access	14542	18955	20485	20941	6.5	40 (20 at new roundabout)
A390 East of Site Access	14447	18842	23173	16758	4.2	40 (20 at new roundabout)
Hill park Crescent	359	449	450	450	4.2	40 (20 at new roundabout)
A390 West of Edgcombe Triangle	14447	18842	23173	16758	0.0	40
Penwinnick Road	15353	18296	23830	14467	4.2	40 (10 at junction)
A390 East of Edgcombe Triangle	20926	25203	27559	21606	4.2	40
A3058 Edgcombe Road north of A392	6187	9141	9434	10010	4.6	20
A3058 Edgcome Road north of triangle	10029	15373	15466	15847	5.3	40 (10 at junction)
Truro Road north of A392	3910	5200	3996	5561	4.2	20
Truro Road north-east of triangle	3494	8147	8488	7334	3.4	40 (10 at junction)
A390 west of Pentewan Road	27205	28469	30843	24925	1.9	40 (10 at junction)
South Street	15995	12611	13793	15663	4.2	40 (10 at junction)
A390 East of Pentewan Road	19612	16510	15695	19372	3.3	40 (10 at junction)
Pentewan Road	10136	13245	12933	9991	5.2	40 (10 at junction)

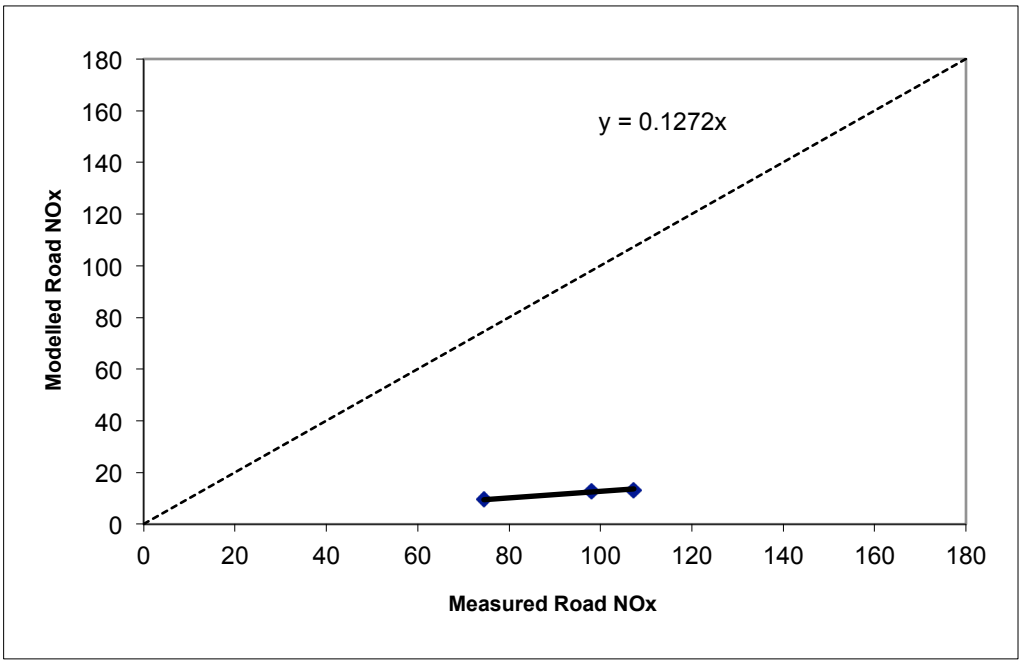
APPENDIX 2 – ROADS MODELLING VERIFICATION

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions.

The model has been run to predict annual mean road-NO_x concentrations at three monitoring sites located adjacent to the road network considered within the modelling assessment.

The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NO_x (Figure A2.1). The 'measured' road NO_x has been calculated from the measured NO_2 concentrations, by first converting the measured NO_2 into an equivalent measured NO_x using the NO_x from NO_2 DEFRA calculator[1], then subtracting the background value.

Figure A2.1: Comparison of Modelled Road NOx to 'Measured' Road NOx



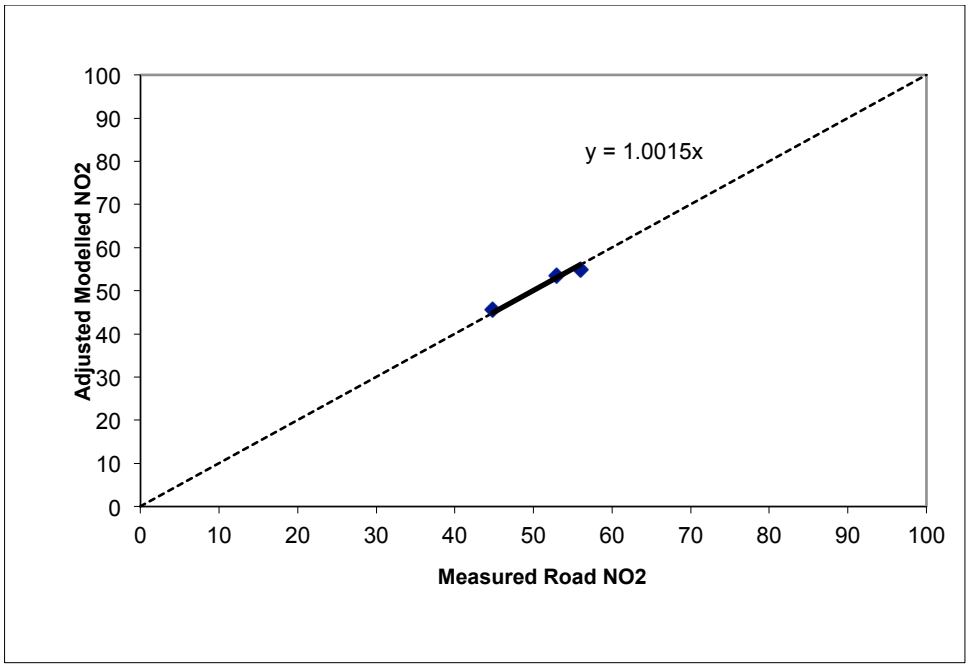
A primary adjustment factor was then determined as the ratio between the measured road-NOx contribution and the model derived road-NOx contribution, forced through zero (1/0.1272 = 7.86). This factor was then applied to the modelled road-NO_x concentration for each monitoring location to provide an adjusted modelled road-NO_x concentration. The background concentration was then added to these concentrations to determine the adjusted total modelled NO_x concentration.

The road contribution to the total annual mean NO_2 concentration was then determined using the DEFRA NO_x:NO_2 calculator tool.

The total nitrogen dioxide concentration was then determined by adding the background NO_2 concentration to this calculated road contribution. Figure A2.2 shows the adjusted modelled total NO_2 vs monitored NO_2. There is good agreement, with the best fit line forced through zero therefore no secondary adjustment factor has been calculated.

[1] http://laqm1.defra.gov.uk/review/tools/index.php

Figure A2.2: Comparison of Modelled NO_2 with Measured NO_2 before Secondary Adjustment.



Following application of the calculated adjustment factors the model results are showing no overall tendency to under or over predict at the monitoring locations and the predicted annual mean NO_2 at each site is within 2% of monitored concentrations.

The adjustment factor of 7.86 has been applied to the modelled NO_x-road concentrations predicted at the selected proposed and existing receptors. The predicted NO_2-road concentrations, calculated using the NO_x-NO_2 converter tool, have subsequently been added to background NO_2 concentrations to provide the final predicted annual mean NO_2 concentrations at each receptor.

This method was also applied to the predicted PM_{10} concentrations.

APPENDIX 3 – RECEPTOR LOCATIONS

Receptor Number	Receptor Location	OS Grid Reference		Receptor Height (m)
		x- co-ordinate	y-co-ordinate	
1	Residential adjacent to A392	200257	51842	1.5
2	106 Truro Road	200459	52010	1.5
3	1 Hill Park Crescent	200319	51930	1.5
4	88 Truro Road	200608	52123	1.5
5	Holy House B&B	200622	52133	1.5
6	11 Edgcumbe Road	200551	52229	1.5
7	81 Truro Road	200638	52133	1.5
8	Penwinnick Road	200823	52039	1.5
9	Pen House	201099	52052	1.5
10	74 South Street	201258	52049	1.5
11	Trevanian Lodge Guest House	201302	52028	1.5
12	8 Pentewan Road	201323	51853	1.5
13	25 Trevanion Road	201466	51949	1.5
14	Proposed restaurant	200354	51891	1.5
15	Proposed residential	200456	51766	1.5

APPENDIX 4 – CONSTRUCTION MITIGATION MEASURES

It is recommended that the 'highly recommended' measures set out below are incorporated into a DMP and approved by CC prior to commencement of any work on site:

- develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- display the name and contact details of the person accountable for air quality and dust issues on the site boundary (i.e. the environment manager/engineer or site manager);
- display the head or regional office contact information on the site boundary;
- record all dust and air quality complaints, identify cause, take appropriate measures to reduce emissions in a timely manner and record the measures taken;
- make the complaints log available to the local authority when asked;
- record any exceptional incidents that cause dust and/or air emissions, either on- or off-site and the action taken to resolve the situation in the log book;
- hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate emissions are minimised;
- undertake daily on-site and off-site inspection, where receptors area nearby, to monitor, 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 100 m of the site boundary, with cleaning provided if necessary;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results and make inspection log available to CC when asked;
- increase frequency of site inspection 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 periods of dry or windy conditions;
- plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles;
- fully enclose site or specific operations where there is a high potential for dust production and the activities are being undertaken for an extensive 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 being re-used on site, cover as detailed below;
- cover, seed or fence stockpiles to prevent wind whipping;
- ensure all vehicles switch off engines when stationary - no idling vehicles;
- avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable;
- produce a construction logistic plan to manage the sustainable delivery of goods and materials;
- implement a travel plan that supports and encourages sustainable travel;
- 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;
- ensure an adequate water supply on site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use enclosed chutes and conveyors and covered skips;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods;
- avoid bonfires and burning of waste materials;
- 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;
- use water-assisted dust sweepers on the access and local roads, to remove, as necessary, any material tracked out of the site;
- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving the site are covered to prevent the escape of materials during transport;
- inspect on-site haul routes for integrity and instigate necessary repairs to the surfaces as soon as reasonably practicable;
- record all inspections of haul routes and any subsequent action in a site log book;

- install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud);
- ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit;
- access gates to be located at least 10 m from receptors where possible.

The following 'desirable' measures should also be considered for inclusion within the DMP:

- for smaller supplied of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust;
- impose and signpost a maximum speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas;
- re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- use hessian, mulches or trackifiers 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;
- avoid scabbling (roughening of concrete surfaces) if possible; and
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.

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