



Persimmon Homes

TWYNYRODYN, MERTHYR TYDFIL

Air Quality Assessment





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Air Quality Assessment

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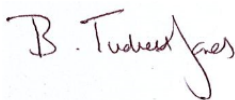
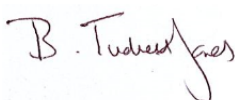
Cardiff

CF10 4BZ

Phone: +44 2920 769 200

WSP.com

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Signature				
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EXECUTIVE SUMMARY

WSP has been commissioned to undertake an air quality assessment for the Proposed Development of approximately 127 residential properties on land at Twynyrodyn, Merthyr Tydfil.

The assessment has considered the impacts of the construction and operation of the Proposed Development and has focussed on a qualitative assessment of dust generation during construction and a quantitative assessment of operation impacts using dispersion modelling.

Air quality within Merthyr Tydfil is currently good overall, with only limited pockets of poor air quality, most notably within the Twynyrodyn AQMA to the west of the development site. In 2019, there were, however, no monitored exceedances of air quality objectives for nitrogen dioxide or particulate matter.

There is a potentially high risk of dust impacts from the construction phase of the development, primarily due to the spatial extent of the development, and appropriate and proportionate mitigation measures have been proposed. With the rigorous application and monitoring of these measures, no significant effects should arise from dust or particulate matter during works.

The impacts of development-related traffic generation on local air quality will be generally negligible, but potentially slight adverse within the Twynyrodyn AQMA in the early years after opening. It will not, however, worsen existing or create new areas of exceedance and impacts will decrease over time. The development is built on a sustainable principle with good access by walking, cycling and public transport and a Travel Plan Welcome Pack will be provided to new residents to encourage Active Travel. These measures have the potential to reduce the modelled impacts.

Overall the assessment has demonstrated that air quality will not present a significant constraint to the proposed development, either offsite or onsite. It will not result in a material deterioration in air quality or harm to health as a result of its construction and occupation, and is compliant with national and local planning policies and guidance.

Contact name Bethan Tuckett-Jones

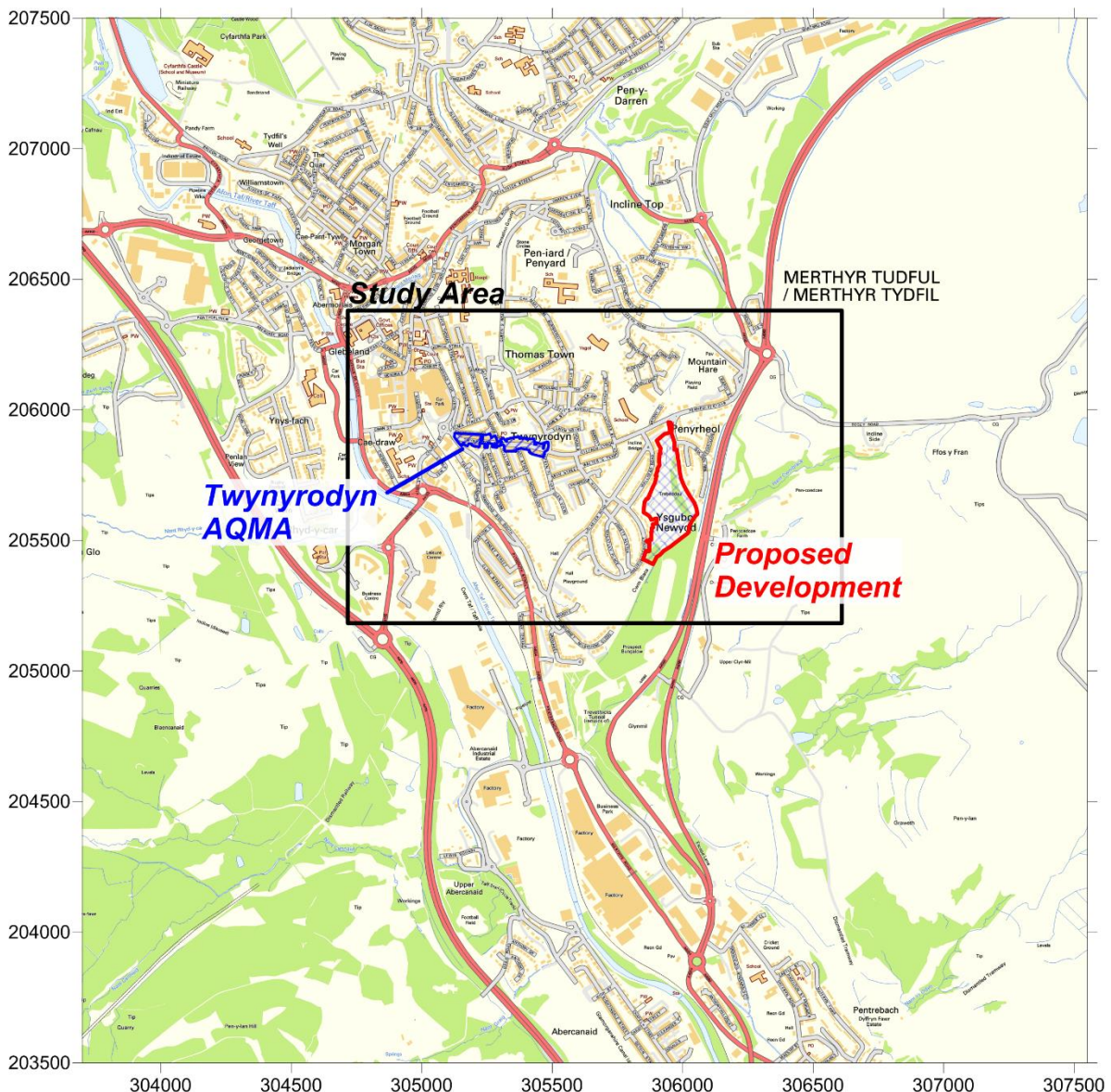
Contact details 02920769281 | Bethan.Tuckett-Jones@wsp.com

1 INTRODUCTION

1.1 PROPOSED DEVELOPMENT

- 1.1.1. WSP has been commissioned by Persimmon Homes to undertake an air quality assessment to support the planning application for the proposed development of land to the west of Elm Tree Grove, Twynyrodyn, Merthyr Tydfil.
- 1.1.2. The Proposed Development comprises approximately 127 residential dwellings.
- 1.1.3. The site, **Figure 1-1**, is currently undeveloped open space, but bounded by residential developments to the east, north and west. Vehicular access to the site will be via Elm Tree Grove.

Figure 1-1 - Twynyrodyn residential development: site location



1.2 SCOPE OF THE ASSESSMENT

- 1.2.1. This report presents the findings of the assessment of the potential air quality impacts of the development. It considers both the construction of the development and its occupation. For both phases, the type and source of potential impacts and the significance of effects are identified, and the measures that will be employed to minimise these described.
- 1.2.2. The potential air quality impacts that may arise due to the proposed development relate to:
- During construction:
 - Dust and particulate matter generated during demolition and construction works; and
 - Exhaust emissions including nitrogen oxides (NO_x) and particulate matter / dust from on and offsite construction vehicle movements and non-road mobile machinery;
 - During occupation:
 - Exhaust emissions including nitrogen oxides (NO_x) and particulate matter (PM₁₀ and PM_{2.5}) from development-related traffic on the local road network.
- 1.2.3. The assessment considers potential exposure to air quality impacts at existing properties alongside the local road network and at future residential properties on the site.

1.3 ABOUT THE AUTHORS

- 1.3.1. The report has been prepared by WSP's Air Quality Team, with lead author Dr. Bethan Tuckett-Jones, Head of Air Quality. Dr. Tuckett-Jones has over 25 years' experience in the provision of advice to public and private clients on pollution and its effects in the environment and is an experienced Expert Witness. She has undertaken well over a hundred air quality assessments, including various redevelopment schemes in Wales ranging in size from less than 100 to over one thousand residential units. She is a member of the Institute for Air Quality Management and a Chartered Environmentalist.

2 POLICY CONTEXT

2.1 AIR QUALITY LEGISLATION

- 2.1.1. Action to manage and improve air quality in Wales is driven by national legislation which sets thresholds for acceptable concentrations of pollutants in ambient air and the roles of local, devolved and national government in ensuring that these thresholds are met.
- 2.1.2. The UK's Air Quality Strategy (AQS) was first published in 1997 as a requirement of the Environment Act 1995, and underwent revisions in 2000 and 2007. The aim of the AQS is to improve and protect ambient air quality in the UK, and to protect people's health from the adverse effects of air pollution.
- 2.1.3. The AQS sets air quality 'objectives' for the concentrations of ten key pollutants, and outlines measures to be taken, in order to meet these objectives. The objectives comprise policy targets, expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale. The objectives have been derived from standards which represent minimum or zero risk levels. The standards are set purely with regard to scientific and medical evidence on the effects of the pollutants on health and or impacts on vegetation. The objectives take into account the costs, benefits, feasibility and practicality of achieving the standards, generally by imposing a time limit for achieving the standard.
- 2.1.4. The objectives for 7 of the pollutants considered in the AQS are set down in UK legislation in the Air Quality (Wales) Regulations 2000 and the Air Quality (Wales) (Amendment) Regulations 2002.
- 2.1.5. The Environment Act also set out the principles for Local Air Quality Management (LAQM) under which, Local Authorities are required to review current and future air quality within their area against the air quality objectives. Where the air quality objectives are not met, the Local Authority is required to declare an Air Quality Management Area (AQMA) and to produce an Action Plan in order to improve air quality and achieve the objective. Merthyr Tydfil County Borough Council (MTCBC) has declared an AQMA, on Twynyrodyn Road around 500m to the west of the site access (**Figure 1-1**), and published their Action Plan in 2018.
- 2.1.6. In addition to the Air Quality Regulations, the Air Quality Standards Regulations derived from the European Union Ambient Air Quality Directive, set thresholds for the concentration of pollutants in air for the protection of health and ecosystems. In the Standards Regulations (Air Quality Standards (Wales) Regulations 2010 and 2016 amendment), the thresholds are referred to as 'limit values'
- 2.1.7. The UK Government and Devolved Administrations are responsible for assessing current and future compliance with the limit values, and making annual compliance returns. The Air Quality Standards (Wales) Regulations place a duty on the Welsh Government to develop an Air Quality Plan that sets out measures to achieve compliance with the limit values in the shortest possible time. The Welsh Government's Plan was published in November 2018, targeted at 5 areas of exceedance of limit values on the strategic road network. In addition, the Welsh Government issued Air Quality Directions to Caerphilly County Borough Council and Cardiff City Council to draw up and implement Air Quality Plans to address exceedances of limit values within their districts. The focus of all of these Plans was on reducing roadside concentrations of NO₂. However, none of these Plans affected or considered roads within MTCBC.

- 2.1.8. The air quality objectives relevant to the assessment of the proposed development are set out in **Table 2-1**. For the pollutants of interest, the limit values are numerically identical to the objectives. With the exception of the UK's objective for PM_{2.5}, all dates by which compliance with these thresholds should have been achieved have passed.

Table 2-1 - Air quality thresholds relevant to the development

Pollutant	Limit Value / Air Quality Objective (µg/m ³)	Measured As	Number of Exceedances Allowed in a Calendar Year
<i>Set for the protection of human health</i>			
Nitrogen Dioxide (NO ₂)	40	Annual Mean	-
	200	Hourly Mean	18
Particulate Matter as PM ₁₀	40	Annual Mean	-
	50	Daily Mean	35
Particulate Matter as PM _{2.5}	25	Annual Mean	-

- 2.1.9. In August 2020, the Welsh Government published its Clean Air Plan for Wales, which sets out a 10 year plan to achieve cleaner air. The Clean Air Strategy runs alongside the various statutory Air Quality Plans but considers a broader range of emission sources, including domestic properties, farming, industry, and other forms of transport such as shipping and aviation.

2.2 NATIONAL PLANNING POLICY

- 2.2.1. Planning Policy Wales (PPW, Edition 10) sets the overarching planning policies for Wales. Section 6.7 of PPW sets out Welsh Government's priorities for air quality.
- 2.2.2. Para 6.75 states that 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*".
- 2.2.3. Para 6.76 places a requirement on developers to address any implications on air quality management areas, not create areas of poor air quality and seek to incorporate measures which reduce overall exposure to air pollution.
- 2.2.4. Decision makers should be provided with an appropriate level of information on air quality and the proposed development, and on mitigation measures. In particular, para 6.7.13 requires careful consideration of the impacts of increased transport activity associated with development activity.
- 2.2.5. Para 6.7.8 lists mitigation measures capable of being effectively implemented which include, inter alia:
- Traffic management;
 - Providing active travel infrastructure.
- 2.2.6. PPW states that care should be taken to avoid incremental development that exacerbates health and amenity inequalities through exposure to poor air quality and requires that development should

be designed to prevent adverse effects to the environment but, as a minimum, to limit or constrain any effects that do occur.

- 2.2.7. PPW Technical Advice Note 18: Transport acknowledges that links between road traffic and local air pollution and states that well designed and implemented traffic management measures can help to reduce pollution levels.

2.3 LOCAL POLICY

- 2.3.1. The Local Development Plan (LDP) for MTCBC was adopted in January 2020 and provides the framework for sustainable development within the Borough up to 2031.
- 2.3.2. Policy WnW4: Environmental Protection of the LDP states that development proposals will be required to demonstrate they will not result in an unacceptable impact on people, residential amenity, property and/or the natural environment from, inter alia, pollution of the air. Where impacts are identified, the Council will require applicants to demonstrate that appropriate measures have been incorporated to reduce or minimise the impacts to the lowest possible acceptable level.
- 2.3.3. Paragraph 6.6.34 of the LDP makes reference to the Air Quality Action Plan for the Twynyrodyn Road AQMA and states that *“Where further deterioration in air quality would be of significant concern within the AQMA, development proposals will need to demonstrate that appropriate mitigation measures can be implemented, or have been incorporated into the design of the development, to reduce or minimise the effects on existing and future population exposure.”*
- 2.3.4. Developers are encouraged to consult with the Council to confirm whether an air quality assessment would be required to support a planning application.
- 2.3.5. MTCBC has not developed any supplementary guidance dealing specifically with air quality.

Air Quality Action Plan

- 2.3.6. MTCBC Air Quality Action Plan was approved in 2018. The plan set out to reduce traffic movement within the Twynyrodyn Road AQMA by modifying the town centre transport infrastructure. Specifically, on May 28th 2019, MTCBC reversed the direction on traffic on Pontmorlais High Street and Church Street. In their 2020 Annual Progress Report, MTCBC reported that there was an improvement in air quality within the AQMA following the reversal of the traffic.
- 2.3.7. No further traffic management measures are currently planned for the AQMA.
- 2.3.8. MTCBC also promotes actions that are designed to encourage behaviour change and/or modal shift to active / low emission travel. In particular, walking and scooting to school initiatives, cycle training for school children and a cycle to work scheme are supported. At present, the impact of these measures on air quality has not been demonstrated.

3 METHODOLOGY & SIGNIFICANCE CRITERIA

3.1 ASSESSMENT METHODOLOGY

Guidance

- 3.1.1. The assessment methodology has been set with reference to the following guidance:
- Defra's and the Devolved Authorities Local Air Quality Management Review and Assessment Technical Guidance TG(16) (2018)
 - This comprehensive technical guidance, referred to throughout this document as LAQM.TG(16), has been published for use by local authorities in their air quality review and assessment monitoring and modelling work. In particular, the advice on the applicability of the UK's air quality objectives (Box 1.1), and the modelling of impacts from road traffic and the verification of the modelling against local monitoring data (Chapter 7) was applied throughout this assessment.
 - Institute of Air Quality Management's Land-use Planning & Development Control: Planning for Air Quality (2017)
 - This strategic guidance to local authority air quality officers, developers and their consultants, hereafter referred to as EPUK/IAQM planning guidance, has been jointly published by Environmental Protection UK and the Institute of Air Quality Management (IAQM). Of particular relevance to this assessment is the guidance provided in relation to the determination of the significance of air quality impacts associated with a development (Chapter 7 and Table 6.3 of the guidance) and the possible mitigation measures that may be implemented to minimise these impacts.
 - Institute for Air Quality Management's Guidance on the Assessment of Dust from Demolition and Construction (2016)
 - This document, hereafter referred to as IAQM dust guidance provides guidance to developers, consultants and air quality officers on how to assess the impacts arising from construction activities. It follows a risk-based approach to the identification of appropriate mitigation measures.

Study Area

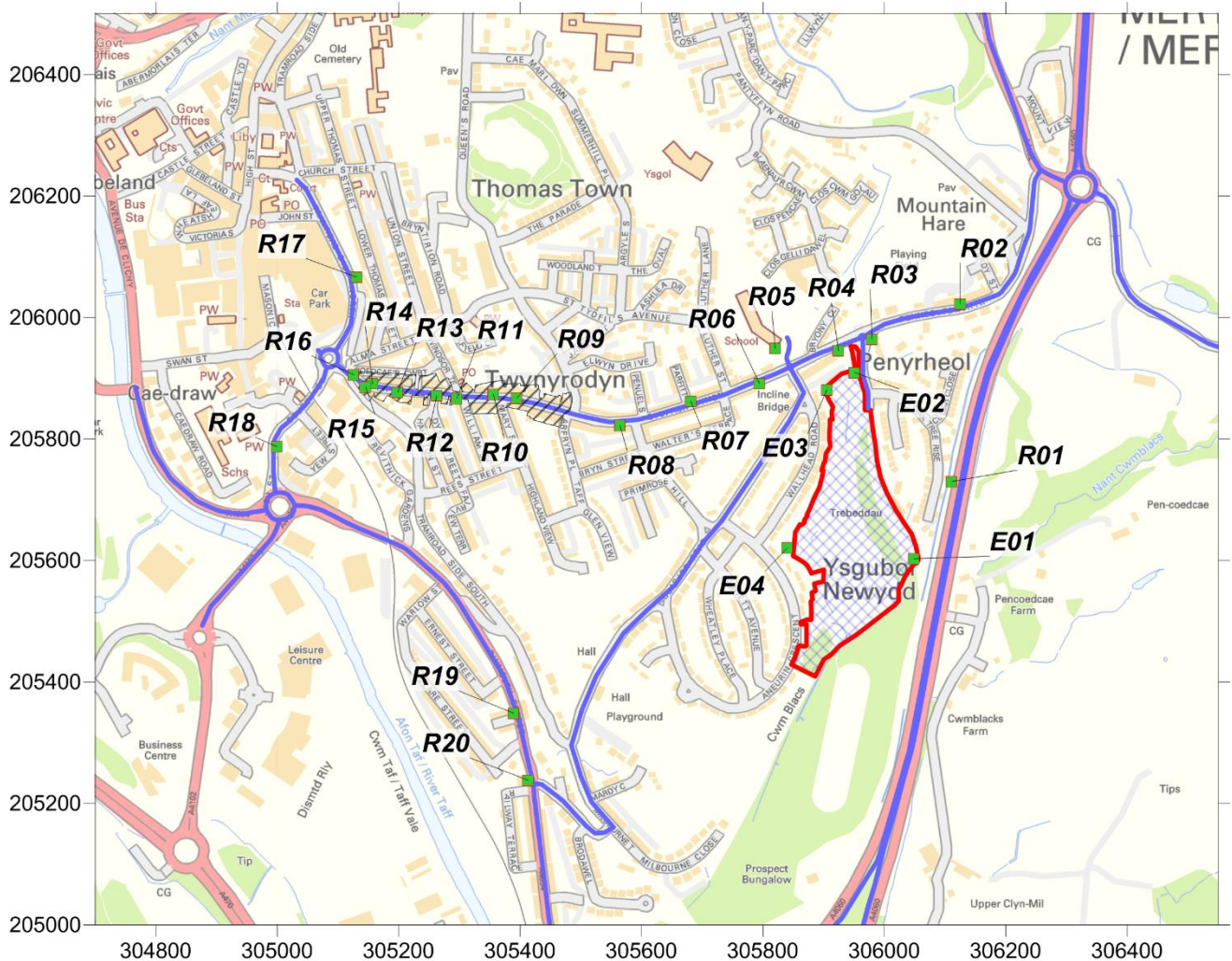
- 3.1.2. The study area for the air quality assessment was defined as follows:
- For construction, following the IAQM guidance (2016), the area within 350m of the site boundary or within 50m of the route(s) proposed for use by construction vehicles on the public highway up to 500m from the site entrance(s); and
 - For operation, the area within 200m of the road network affected by the development traffic. The use of a 200m corridor either side of the road network conforms to advice in the Design Manual for Roads and Bridges.
- 3.1.3. The overall study area is shown in **Figure 3-1**.
- 3.1.4. The EPUK/IAQM planning guidance sets criteria for requiring an air quality assessment. In relation to traffic generation, the criteria are:

- A change of light duty vehicle (LDV) flows of
 - more than 100 AADT (annual average daily traffic) within or adjacent to an AQMA
 - more than 500 AADT elsewhere
- A change of heavy duty vehicle (HDV) flows of
 - more than 25 AADT within or adjacent to an AQMA
 - more than 100 AADT elsewhere

3.1.5. The roads in the study meeting these criteria are:

- Within AQMA (>100 AADV LDV)
 - Court Terrace, Twynyrodyn Road, Alexandra Terrace
- Adjacent to AQMA (>100 AADV LDV)
 - Court Street, Giffach Cynon
- Elsewhere (>500 AADV LDV)
 - Elm Tree Grove, Penheolferthyr

Figure 3-1 - Air Quality Assessment Study Area



Construction Phase

- 3.1.6. Impacts during the construction phase of the proposed development have been assessed qualitatively, using the IAQM guidance (2016), available information provided by the developer, and professional judgement.
- 3.1.7. Dust comprises particles typically in the size range 1-75 micrometres (μm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials. The larger dust particles fall out of the atmosphere quickly after initial release and therefore tend to be deposited near to the source of emission. Dust, therefore, is unlikely to cause long-term or widespread changes to local air quality; however, its deposition on property and cars can cause 'soiling' and discolouration. This may result in complaints of nuisance through amenity loss or perceived damage caused, which is usually temporary.
- 3.1.8. The smaller particles of dust (less than $10\mu\text{m}$ in aerodynamic diameter) are known as particulate matter (PM_{10}) and represent only a small proportion of total mass of dust released; this includes a finer fraction, known as $\text{PM}_{2.5}$ (with an aerodynamic diameter less than $2.5\mu\text{m}$). As these particles are at the smaller end of the size range of dust particles they remain suspended in the atmosphere for a longer period of time than the larger dust particles, and can therefore be transported by wind over a wider area. PM_{10} and $\text{PM}_{2.5}$ are small enough to be drawn into the lungs during breathing, which in sensitive members of the public could have a potential impact on health. However, as set out in IAQM guidance, the majority of fugitive particulate emissions arising from construction sites relate to the coarser fractions (i.e. $\text{PM}_{2.5-10}$) with just 10-15% expected to comprise $\text{PM}_{2.5}$. The IAQM guidance therefore focusses on PM_{10} for the purposes of assessment.
- 3.1.9. The IAQM methodology assesses the risk of potential dust and PM_{10} impacts from the following four construction-related sources: demolition; earthworks; general construction activities and track-out. It takes into account the nature and scale of the activities undertaken for each source and the sensitivity of the area to an increase in dust and PM_{10} levels to assign a level of risk. Risks are described in terms of there being a low, medium or high risk of dust impacts. Once the level of risk has been ascertained, then site specific mitigation proportionate to the level of risk is identified, and the significance of residual effects determined.
- 3.1.10. In addition to impacts on local air quality due to on-site construction activities, exhaust emissions from construction vehicles and plant may have an impact on local air quality adjacent to the routes used by these vehicles to access the Proposed Development and in the vicinity of the Proposed Development itself. Taking into account the scale of the development, a qualitative assessment of their impact on local air quality has been undertaken using professional judgement.
- 3.1.11. The assessment of the likely impacts on local air quality due to the generation and dispersion of dust and PM_{10} during the construction phase and the significance of any effects has been undertaken using: the relevant assessment methodology published by the IAQM; the available information for this phase of the proposed development; and, professional judgement considering the following:
- The number and type of construction traffic and plant likely to be generated by this phase of the proposed development;
 - The number and proximity of sensitive receptors to the site and along the likely routes to be used by construction vehicles; and

- The likely duration of the construction phase (<5 years) and the nature of the construction activities undertaken

Operational Phase

- 3.1.12. The assessment of impacts during the occupation of the proposed development has been undertaken quantitatively using detailed dispersion modelling.
- 3.1.13. Of the pollutants included in the UK's air quality regulations, road traffic is a significant contributor to ambient concentrations of nitrogen dioxide (NO₂) and particulate matter (PM₁₀ and PM_{2.5}). This is evidenced by the fact that NO₂ and PM₁₀ are the only pollutants for which AQMA's are currently declared across the UK in relation to road transport (there are 6 AQMA's declared in relation to sulphur dioxide, but these do not relate to emissions from road transport). The assessment is therefore limited to NO₂, PM₁₀ and PM_{2.5}.
- 3.1.14. The modelling used ADMS-Roads (v 5), developed by CERC. This model uses detailed information on traffic flows on the local road network, which were provided by transport consultancy Lime Transport, and meteorological conditions to predict the road contribution to ambient pollutant concentrations at specific locations, termed 'receptors' that are determined by the user. For this assessment, 24 receptors were selected across Merthyr Tydfil (**Figure 3-1**), 8 of which were within the Twynyrodyn Road AQMA (termed R09 to R16, 4 representative of concentrations on the proposed development (E01 to E04) and 12 representative of concentrations at existing properties outside of the AQMA (R01 to R08, and R17 to R20). Further details are provided in **Appendix A**.
- 3.1.15. Meteorological data, such as wind speed, direction and cloud cover, were obtained for Sennybridge for 2019. This station provides the most appropriate observed meteorological data for use in the dispersion modelling of the proposed development traffic. The surface roughness parameter for the study area (a variable that determines the level of drag exerted as wind blows over the ground and which affects the level of turbulence generated) was set to 0.5m. This is the value recommended by the model developers for parkland and open suburbia, and representative of the environment in the town.

Scenarios Modelled

- 3.1.16. A summary of the traffic data used in the assessment can be found in **Appendix B**. It includes details of the annual average daily traffic, as a function of vehicle class (light duty vehicles, heavy duty vehicles), and the estimation of vehicle speeds for the local road network in all assessment years and scenarios.
- 3.1.17. The following Scenarios were modelled:
- Baseline 2019;
 - Future Baseline Scenarios for 2022 and 2032; and
 - With Proposed Development Scenarios 2022 and 2032
- 3.1.18. The daily average flows were modelled as hourly flows (for an average weekday, Saturday and Sunday) with a variation across the day based on profiles provided by Lime Transport for Court Street from July 2019 (**Table B-1**). No variation in speed was assumed over the day.
- 3.1.19. The development related traffic is modelled at full occupation rates in both 2022 and 2032. As such, the future assessment year of 2022 is a worst case, reflecting near immediate occupation of the

development following granting of planning permission. Assuming the granting of planning permission in spring 2021, and a realistic rate of construction of 40 units per year, the first full year of occupation is likely to occur at the earliest in 2025. With vehicle emissions anticipated to improve over time, the modelled impacts in years prior to 2025 are, therefore, conservative.

Vehicle Emissions

- 3.1.20. Defra's Emissions Factor Toolkit v10 was used for the assessment of impacts. This database reflects the latest understanding of future fleet composition and vehicle emissions.
- 3.1.21. Air pollutant emissions from vehicles are regulated by European Directives in the so-called Euro Emissions Standards. Over time, increasingly stringent standards have been specified, termed Euro 1 to 6 for cars and vans and Euro I to VI for heavy duty vehicles. However, for various reasons including well publicised actions involving particular vehicle manufacturers, in recent years the tightened emissions standards to Euro 5/V failed to bring about expected improvements in ambient air quality alongside roads.
- 3.1.22. However, on-road (real world) emissions testing undertaken by, amongst others, TU Graz, TNO, Transport for London, University of York and Emissions Analytics has demonstrated that:
- Euro 6 cars perform significantly better than earlier vehicles, achieving 50% to 70% reductions in comparison to Euro 5 cars; and
 - There is good evidence that Euro VI engine emissions for heavy duty vehicles are consistently better than those for Euro V and earlier vehicles.
- 3.1.23. Furthermore, European Union legislation has introduced improved and more stringent vehicle emissions testing (Real Drive Emissions, RDE) that is expected to make it much more difficult for manufacturers to distort the results of vehicle emissions testing than under existing procedures. Department for Transport consider it is reasonable to expect the introduction of Euro 6c/d (i.e. vehicles subject to RDE test cycle) will further reduce fleet average emissions from existing Euro 6 vehicles (termed Euro 6a/b vehicles).
- 3.1.24. It is important to note that, despite the improvement in emissions from Euro 6 vehicles in comparison to earlier technology, Defra's Emissions Factor Toolkit (EFT) makes allowance for the non-compliance of both existing and future diesel vehicles with emissions standards and does not assume that vehicles meet the standards.
- 3.1.25. Moreover, and importantly for the air quality assessment, any residual disparity between the emissions factors and the real-world emissions from all existing vehicles in the fleet (predominantly Euro 4 and Euro 5 type) is taken into account in the dispersion modelling through the verification of the baseline modelling against monitoring data. If emissions are underestimated, then the modelled pollutant concentrations at the roadside will also be underestimated. The verification process then generates a factor (greater than 1) by which all model results are scaled to achieve agreement between modelled and monitored concentrations. Whilst the verification is undertaken after the dispersion model has been run, the process is entirely equivalent to increasing the emissions from vehicles prior to modelling the dispersion.
- 3.1.26. Following current best practice, EFT v10 provides an appropriate representation of future improvements in vehicle emissions and all traffic scenarios are modelled with the year-specific emissions i.e. the baseline was modelled with EFT v10 emissions for 2019 and the 2022 future year was modelled with emissions for the projected fleet mix in 2022. Since the EFT provides emissions

to 2030 only, the 2032 future year was modelled with emissions from 2030. This is a conservative assumption since, in particular, the ingress of all electric vehicles into the fleet is likely to increase rapidly post 2030.

Street Canyons

- 3.1.27. The ADMS advanced street canyon model has been used to model the constrained dispersion conditions within the AQMA on Court Terrance, Twynyrodyn Road, and Gilfach-Cynon. Outside of this area, properties are set further back from the modelled roads and do not form street canyons.

Background Concentrations

- 3.1.28. The background concentrations used in the assessment were taken from the national maps provided on the Defra website with a baseline year 2018, where pollutant concentrations have been mapped at a grid resolution of 1x1km for the whole of the UK. Mapped concentrations are available for all years between 2018 and 2030.
- 3.1.29. The maps assume that background concentrations will improve (i.e. reduce) over time, in line with the predicted reduction in vehicle emissions and emissions from other sources.
- 3.1.30. The background maps present both the 'total' estimated background concentrations and the individual contributions from a range of emission sources (for example, motorways, aircraft, domestic heating etc.). When detailed modelling of an individual sector is required as part of an air quality assessment, the respective contribution can be subtracted from the overall background estimate to avoid the potential for 'double-counting' the effects of emission sources. For this assessment, given the limited extent of the modelled network, road sector contributions have been removed from the mapped background concentrations for trunk and primary A roads within the 1km x 1km square of the study area.
- 3.1.31. As for vehicle emissions, background concentrations from the specific assessment years were used i.e. maps for 2019 and 2022, and, to represent conditions in 2032, maps for 2030.

Model Verification and Data Processing

- 3.1.32. The ADMS Roads dispersion model has been widely validated for this type of assessment and is fit for purpose. However, model validation undertaken by the software developer will not have included validation in the vicinity of the proposed development.
- 3.1.33. Therefore, to determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out within the study area was undertaken. This process of verification aims to minimise modelling uncertainty and systematic error by adjusting modelled results by a factor, called the verification factor, to gain greater confidence in the final results. The verification process was carried out following the methodology specified in Chapter 7, Section 4, of Defra's LAQM.TG(16).
- 3.1.34. Details of the verification factor calculations are presented in **Appendix C**. The results of the comparison between modelled and monitored concentrations clearly demonstrated that, after verification, the model performance was good, both inside and outside the AQMA, and that a single verification factor of 2.37556 should be applied to the whole model domain.
- 3.1.35. The verification factors were applied to the model road- NO_x outputs prior to conversion to annual mean NO₂ concentrations utilising the NO_x to NO₂ calculator (version 8.1, released 2020) provided

by Defra. In the absence of data to verify the dispersion modelling of particulate matter, the NO_x verification factors were used for PM₁₀ and PM_{2.5}.

3.2 SIGNIFICANCE CRITERIA

Construction

- 3.2.1. The IAQM assessment methodology for construction dust recommends that significance criteria are only assigned to the identified risk of dust impacts occurring from a construction activity with appropriate mitigation measures in place. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.
- 3.2.2. For the assessment of the impact of exhaust emissions from plant used on-site and construction vehicles accessing and leaving the site on local concentrations of NO₂ and particulate matter, the significance of residual effects have been determined using professional judgement and the principles outlined in the EPUK/IAQM guidance.

Operation

- 3.2.3. The EPUK/IAQM guidance on air quality and planning sets out a recommended procedure for evaluating new developments, from an initial screening of whether an air quality assessment is required, through the determination of whether the air quality effects or exposure are significant, to the identification of the need for mitigation.
- 3.2.4. The EPUK/IAQM guidance provides a framework for describing the air quality impacts and effects of the operation of a proposed development. Their guidance recommends that the degree of an impact is described by expressing the magnitude of incremental change with the development as a proportion of the relevant assessment level and examining this change in the context of the new total concentration and its relationship with the assessment criterion. **Table 3-1** presents the suggested criteria for describing the impacts at individual receptors.
- 3.2.5. The EPUK/IAQM impact descriptors are used as the starting point to make a judgement on significance of effects, since other impacts / effects may be important. The EPUK/IAQM guidance states that the assessment of overall significance should be based on professional judgement, taking into account several factors, including:
 - The existing and future air quality in the absence of the development;
 - The extent of current and future population exposure to the impacts; and
 - The influence and validity of any assumptions adopted when undertaking the prediction of impacts.
- 3.2.6. The EPUK/IAQM guidance states that for most road transport related emissions, long-term average concentrations are the most useful for evaluating the severity of impacts.

Table 3-1 – EPUK/IAQM guidance on describing the severity of an air quality impact at an individual receptor

Long term average concentration at receptors in assessment year	% Change in Concentration (Magnitude) 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

Notes

AQAL = Air Quality Assessment Level, which for this assessment related to the UK Air Quality Strategy objectives.

Where the %change in concentrations is <0.5%, the change is described as 'Negligible' regardless of the concentration.

When defining the concentration as a percentage of the AQAL, 'without scheme' concentration should be used where there is a decrease in pollutant concentration and the 'with scheme;' concentration where there is an increase.

Where concentrations increase, the impact is described as adverse, and where it decreases as beneficial

3.3 ASSUMPTIONS AND LIMITATIONS

- 3.3.1. In the absence of a detailed construction plan or methodology statement, it has been necessary to estimate the scale of impacts from construction dust based on experience at other sites. This does not place a significant constraint on the assessment since the IAQM methodology has been applied conservatively for the purpose of specifying indicative mitigation measures. The final dust management plan will be developed by the appointed contractor and agreed with MTCBC prior to the commencement of works.
- 3.3.2. The most important assumption made in relation to the assessment of operational impacts is that vehicle emissions and background concentrations decrease over time. This assumption has been managed by using Defra's latest vehicle emissions factor toolkit and by undertaking a conservative assessment in which the development is assumed to be fully occupied in 2022 when the potential for emissions reduction over time is minimised.
- 3.3.3. For the dispersion modelling, it is assumed that the same model verification factors apply in the 2019 baseline year and all future years. It has not been possible to identify a specific reason for the model underprediction. However, if the factors relate to the physical dispersion environment i.e street canyons, and in particular canyons alongside roads with significant gradients, then the use of the factor is robust in that the environment will not be affected by the proposed development and, given the modest levels of traffic generation associated with the proposed development, no significant changes to traffic conditions between baseline and future years are expected. If the factor relates to the vehicle fleet being older (and hence higher emitting) than the Wales average fleet on which the emissions have been based, then it is also reasonable to assume that this effect will continue to have impact in future years and it is appropriate to maintain the verification factor for future years.

- 3.3.4. As stated above, the assessment is based on a phasing of the operation of the Proposed Development that is based on an assumed build-out rate of all units completed in 2021 and a first full year of occupation of 2022. This assumption is highly conservative.
- 3.3.5. The modelling assessment is based, specifically, on the traffic generated by the occupation of 127 residential properties. As will be demonstrated, the conclusions of the report are not sensitive to minor changes to the detailed design of the site and/or to minor changes in the number of properties, either in relation to impacts during construction or operation.

4 BASELINE

4.1 OVERVIEW

4.1.1. The existing and future baseline air quality in the vicinity of the proposed development is described below with reference to the following resources:

- Ambient air quality monitoring data collected by MTCBC and reported annually; and
- National mapped projections of roadside and background air quality jointly provided by Defra and Department of Transport.

4.1.2. In addition, the results of the dispersion modelling of baseline and future traffic conditions without the proposed development are described.

4.2 EXISTING CONDITIONS

Merthyr Tydfil County Borough Council Data

4.2.1. The latest air quality data for Merthyr Tydfil were reported in MTCBC's 2020 Air Quality Progress Report, published in September 2020. **Table 4-1** shows the data for monitoring locations within the study area for 2014 to 2019. **Figure 4-1** shows the data for 2018 and 2019, the baseline year used for the air quality assessment.

Table 4-1 – Annual mean NO₂ for 2015 – 2019, taken from MTCBC diffusion tube monitoring (µg/m³)

ID	Location	Easting	Northing	2015	2016	2017	2018	2019
3	Twynnyroddyn Community Sch.	305832	205967	12.5	13	11.4	10.7	11.1
4	15 Lower High Street	305002	205763	26.5	25.3	26.9	29.3	24.9
5	1 Alma Street	305145	205942	19.7	19.8	18.5	18.1	22.3
6	11 Mardy Terrace	305424	205144	16.3	17	15.9	17.3	25.3
11	11 Alexandra Terrace post	305382	205869	42.5	40.9	40.5	40.3	35.0
14	55 Twynnyroddyn Road	305472	205850	44.6	43.2	40.7	39.6	33.2
18	91 Twynnyroddyn Road	305239	205882	28.5	25.9	26.2	26.3	24.1
19	40 William Street	305303	205862	22.2	21.5	21.9	20.3	19.1
20	17 Court Terrace	305149	205894	29.6	31.1	28.6	29.4	25.9
21	51 Twynnyroddyn Road	305394	205868	45.1	48.5	46.2	47.0	38.2
22	15 Arfryn Terrace	305506	205829	33.4	31.5	31.8	29.2	26.0
24	64 Gilfach Cynon	305414	205855	23.5	24.5	25.2	23.7	23.8
2	Civic Centre	304743	206261	16.4	18.1	17.9	15.2	16.6
13	110 High Street	304947	206261	-	-	-	-	21.7

ID	Location	Easting	Northing	2015	2016	2017	2018	2019
17	119 High Street Corner	304942	206204	-	-	-	-	18.9
23	98 Pontmorlais	304987	206411	-	-	-	-	18.3
27	4 Somerset Place	305182	206138	-	-	-	-	13.1
31	Caedraw Flat Downpipe	304782	205886	-	-	-	-	22.1

- 4.2.2. Nitrogen dioxide is the only pollutant of concentration in Merthyr Tydfil but, in 2019, concentrations were within the air quality objective at all locations, including within the AQMA. In 2018, concentrations at locations 11 and 21 within the AQMA exceeded the objective, by a considerable margin at location 21 ($47.0\mu\text{g}/\text{m}^3$).
- 4.2.3. The marked decrease in concentrations between 2018 and 2019 at these locations may be attributable to the change in traffic direction on Court Street implemented by MTCBC under their Air Quality Action Plan. As such, the declaration of the AQMA or, at least, the areal extent of the AQMA is conservative and declaration may be revoked in the future.
- 4.2.4. Concentrations away from the AQMA and at background locations (>50m from main roads) are well within the air quality objective e.g. Twynyrodyn Primary School, where annual mean NO_2 concentrations were $11.1\mu\text{g}/\text{m}^3$ in 2019. This site is representative of baseline conditions on the Proposed Development.
- 4.2.5. MTCBC also monitor particulate matter at Twynyrodyn Primary School (**Table 4-2**). Annual mean concentrations of both PM_{10} and $\text{PM}_{2.5}$ between 2015 and 2019 were well below their respective objectives ($40\mu\text{g}/\text{m}^3$ and $25\mu\text{g}/\text{m}^3$) and there were no exceedances of the daily mean standard for PM_{10} in any year. Notably, $\text{PM}_{2.5}$ concentrations are also well within the more stringent World Health Organisation guideline of $10\mu\text{g}/\text{m}^3$.

Table 4-2 – Annual mean PM_{10} and $\text{PM}_{2.5}$ for 2015 – 2019, taken from MTCBC TEOM ($\mu\text{g}/\text{m}^3$)

Location	Easting	Northing	Pollutant	2015	2016	2017	2018	2019
Twynyrodyn Community Sch.	305832	205967	PM_{10}	9.3	8.4	11.3	8.7	8.8
			$\text{PM}_{2.5}$	5.0	3.8	4.5	4.5	4.4

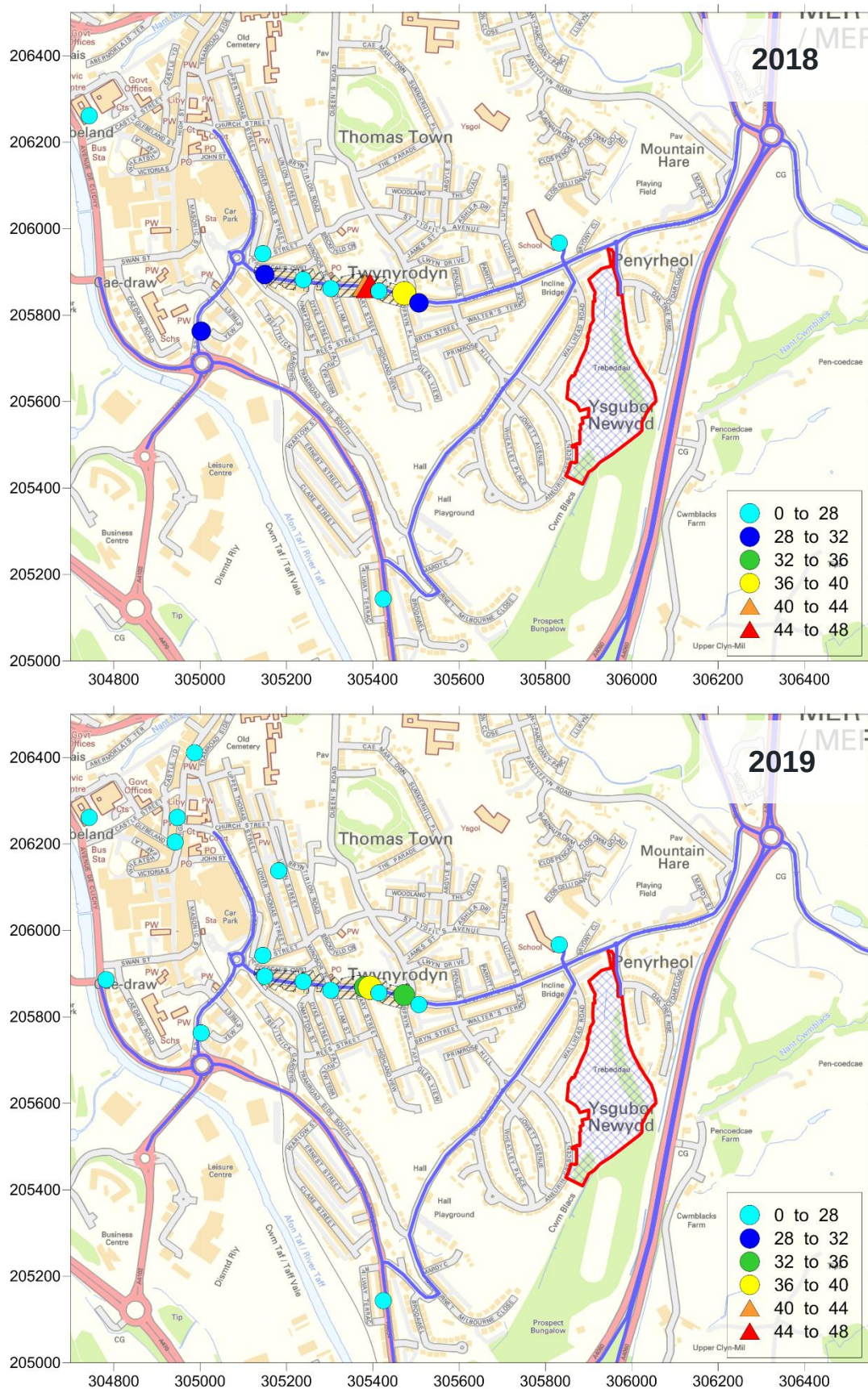


Figure 4-1 - Annual mean NO₂ from MTCBC monitoring 2018 and 2019 (µg/m³)

Defra Mapped Background Concentrations

- 4.2.6. Background concentrations within the study area have been taken from the relevant grid squares in Defra's 1km x 1km mapped data in each assessment year. All background concentrations are well below the air quality objectives and decrease over time.

Table 4-3 – Mapped background concentrations for Twynyrodyn ($\mu\text{g}/\text{m}^3$)

Pollutant	2019	2022	2030
NO ₂	7.4 – 8.6	6.5 - 7.4	5.1 - 5.9
NO _x	9.5 – 11.1	8.2 - 9.5	6.4 - 7.5
PM ₁₀	11.4 – 12.1	10.9 - 11.6	10.5 - 11.2
PM _{2.5}	7.5 – 8.1	7.0 - 7.7	6.7 - 7.3

4.3 FUTURE BASELINE

- 4.3.1. As stated above, NO₂ is the only pollutant of concern in Twynyrodyn and the only pollutant at risk of exceeding an air quality objective. As such the following discussion of the future baseline focusses on NO₂ only. PM₁₀ and PM_{2.5} concentrations are well below their air quality objectives and are provided in **Appendix D**.
- 4.3.2. **Table 4-4** provides the modelled annual mean NO₂ concentrations for the baseline and future baseline scenarios.
- 4.3.3. Exceedances of the air quality objective for annual mean NO₂ (40 $\mu\text{g}/\text{m}^3$) are modelled in 2019, but are limited to receptors R12, R14 and R15 within the AQMA (**Figure 4-2**). The maximum modelled concentration (44.1 $\mu\text{g}/\text{m}^3$, at R15) is, therefore, higher than any monitored concentrations in 2019 and potentially conservative. Elsewhere, pollutant concentrations are within the objective.
- 4.3.4. By 2022, concentrations at all receptors have decreased to within the air quality objective, such that the maximum concentration at any receptor is 36.3 $\mu\text{g}/\text{m}^3$ (R15). By 2030, concentrations have decreased further, to a maximum of 20.0 $\mu\text{g}/\text{m}^3$ (R15).
- 4.3.5. Modelled NO₂ concentrations at Twynyrodyn School decrease from 11.4 $\mu\text{g}/\text{m}^3$ in 2019, comparable with the monitored concentration of 11.1 $\mu\text{g}/\text{m}^3$, to 6.7 $\mu\text{g}/\text{m}^3$ in 2030.

Table 4-4 – Modelled baseline 2019 and future baseline (2022, 2032) annual mean NO₂ (µg/m³)

ID	Name	2019	2022	2030
R01	Oak Tree Rise	20.7	16.6	9.4
R02	Penheolferthyr	18.7	15.3	9.1
R03	Elm Tree Grove	20.7	17.0	10.1
R04	Penheolferthyr	21.4	17.6	10.5
R05	Twynyrodyn Community School	11.4	9.6	6.7
R06	Gilfach-Cynon	34.2	28.1	15.7
R07	Gilfach-Cynon	34.0	27.9	15.6
R08	Alexandra Terrace	31.8	26.1	14.7
R09	Alexandra Terrace	37.4	30.7	17.1
R10	Twynyrodyn Rd	36.2	29.7	16.6
R11	Twynyrodyn Rd	39.5	32.5	18.0
R12	Twynyrodyn Rd	41.1	33.8	18.7
R13	Twynyrodyn Rd	39.7	32.7	18.1
R14	Court Terrace	41.1	33.8	18.7
R15	Court Terrace	44.1	36.3	20.0
R16	Court Terrace	29.0	23.7	13.5
R17	Tramroadside N	15.2	12.7	8.1
R18	High Street	22.9	18.6	10.8
R19	Westbourne Place	27.3	21.9	12.5
R20	Plymouth St	24.0	19.3	11.2

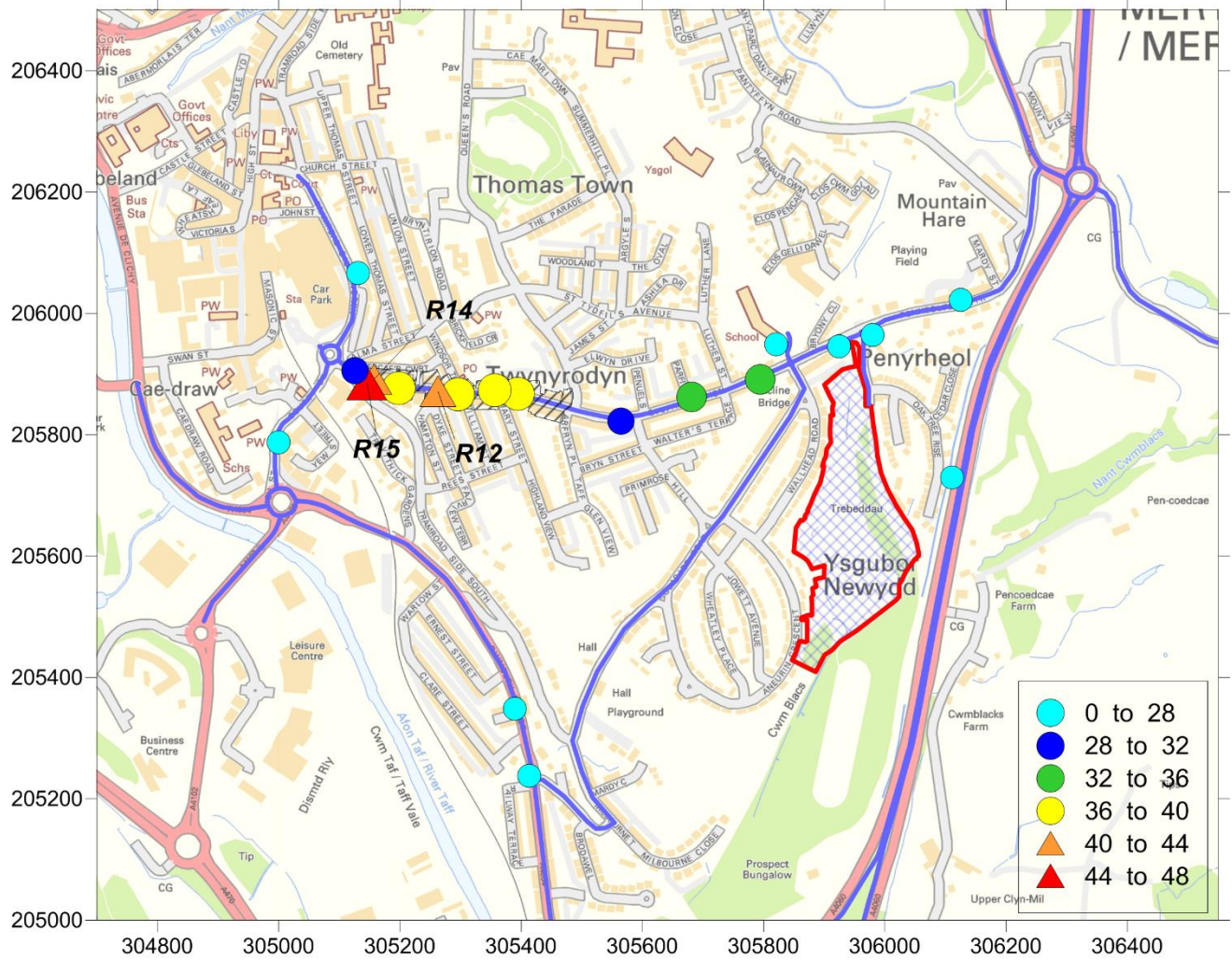


Figure 4-2 - Modelled baseline annual mean NO₂ for 2019 (µg/m³)

5 IMPACT ASSESSMENT

5.1 CONSTRUCTION PHASE

5.1.1. The IAQM methodology involves the following steps:

- Step 1 – Screen the need for a detailed assessment
- Step 2 – Assess the risk of dust impacts separately for demolition, earthworks, construction and trackout. This involves:
 - Step 2A – Define the potential dust emission magnitude
 - Step 2B – Define the sensitivity of the area
 - Step 2C – Define the risk of impacts
- Step 3 – Use the risk of impacts to determine site specific mitigation requirements
- Step 4 – Determine the significance of effects

5.1.2. Impacts during demolition are scoped out for the Proposed Development, since no buildings require demolition and works will begin with the earthworks phase.

Step 1 – Need for Assessment

5.1.3. In accordance with the screening criteria in the IAQM guidance, an assessment is required as there are multiple potential ‘human receptors’, i.e. residential properties, within 350m of the boundary of the site and also properties within 50m of routes to be used by construction vehicles (up to 500m from the site entrance).

Step 2A – Define Potential Dust Emission Magnitude

5.1.4. The dust emission magnitudes for the relevant construction activities are shown in **Table 5-1**.

Table 5-1 – Dust emission magnitude

Activity	Dust emission magnitude
Earthworks	Large
Construction	Medium
Trackout	Medium

5.1.5. The site is over 53ha in size and, using IAQM criteria, this indicates that the potential for dust emissions during earthworks will be large. Earthworks will include general profiling, foundation preparations and clearance activities over the entire site. The volume of buildings to be constructed onsite will be less than 100,000m³ (irrespective of the exact numbers of properties to be built) and, even with onsite concrete batching, the potential for dust emissions is medium for construction works. There will typically be fewer than 50 outward HGV movements on any given day but potentially more than 10 HGV which, with limits on unpaved road length on site, will have medium potential for dust emissions.

Step 2B – Define Area Sensitivity

- 5.1.6. The sensitivity of the surrounding area to potential impacts during construction is shown in **Table 5-2**.

Table 5-2 – Area sensitivity to dust effects

Potential Impact	Earthworks	Construction	Trackout
Dust soiling	High	High	High
Human Health	Low	Low	Low
Ecology	N/A	N/A	N/A

- 5.1.7. The area sensitivity for dust soiling is high. This is due to:
- the proximity and number of properties immediately to the west of the site on Wallhead Road and Aneurin Crescent, to the east of the site on Oak Tree Rise, and to the north of the site on Penheolferthyr, and
 - the number of receptors in proximity to potential construction traffic routes on Penheolferthyr i.e. more than 10 receptors within 20m of the dust generating activities.
- 5.1.8. In relation to human health, the low background PM₁₀ concentration of 12.1µg/m³ (**Table 4-3**) results in low area sensitivity, despite the number of properties in proximity to works. There are no sites designated for nature conservation in the vicinity of the site and, therefore, the assessment of ecological impacts is not required.

Step 2C – Define Risk of Impacts

- 5.1.9. The resulting risk of dust impacts for the construction activities is summarised in **Table 5-3**. The assessment takes into account both the dust emission magnitude and area sensitivity. The assessment results show that the risk of impacts on human health will be low, whereas the risk of impacts in relation to dust soiling will be medium to high.
- 5.1.10. It should be noted, however, that whilst the risk of impacts during earthworks is high, the level of risk will not be high throughout the entire construction period. Activities in proximity to receptors will be temporary and meteorological conditions will provide mitigation at times, particularly with relatively high rainfall amounts in the county. Notwithstanding this, the risk grading is used to define appropriate mitigation measures for the construction phase (as set out in Section 6 of this report).

Table 5-3 – Summary of risk from dust impacts

Activity	Dust soiling risk	Human health risk
Earthworks	High	Low
Construction	Medium	Low
Trackout	Medium	Low

Step 3 – Specify mitigation

- 5.1.11. Mitigation will be required during the construction phase of the development. Appropriate measures are set out in Section 6. The efficacy of the mitigation will be ensured by the implementation of a rigorous monitoring regime.

Step 4 – Assessment of Significance

- 5.1.12. The IAQM guidance on construction dust states that:

"For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'."

- 5.1.13. There are no site-specific characteristics for the development that would render dust suppression or other mitigation measures ineffective at the site and, therefore, it can be concluded that the residual effects from the generation of dust during the construction of the proposed development will be negligible.

Construction traffic and Plant

- 5.1.14. IAQM guidance states:

"Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur. For site traffic on the public highway, if it cannot be scoped out (for example by using the IAQM's criteria), then it should be assessed using the same methodology and significance criteria as operational traffic impacts. The impacts of exhaust emissions from on-site plant and site traffic are not considered further in this Guidance"

- 5.1.15. Detailed information on construction traffic is not available at present. However, taking into account the good baseline and future baseline air quality at the site itself and the ability to route construction traffic away from the Twynyrodyn AQMA, it is unlikely that significant effects will arise from construction traffic and plant. That is to say, it is highly unlikely that daily construction traffic volumes will exceed 500 light duty vehicles or 100 heavy duty vehicles and the assessment of such effects can be scoped out of the assessment using EPUK/IAQM planning criteria.

5.2 OPERATION PHASE

- 5.2.1. Impacts on annual mean NO₂ from the operation of the proposed development were modelled at 20 roadside receptors in Twynyrodyn and surrounding areas. The receptors represent residential properties and schools alongside the road network. MTCBC's monitoring demonstrated that, away from the roadside, pollutant concentrations are low and, therefore, these 20 receptors are sufficient to fully evaluate the potential impacts of the Proposed Development on air quality,
- 5.2.2. The full set of modelled concentrations, including particulate matter are provided in **Appendix D**. The impacts of the Proposed Development are assessment against, on in relation to, the future baseline scenarios set out in the Section 4.

5.2.3. **Table 4-4** shows the modelled concentrations for 2022 with and without the Proposed Development, including concentrations on the site itself and the impact of the development.

Table 5-4 – Modelled future year, 2022 concentrations of annual mean NO₂ (µg/m³) and impact assessment

ID	Name	Future Baseline	With Development	Impact	EPUK/IAQM Descriptor
R01	Oak Tree Rise	16.6	16.8	0.2	Negligible
R02	Penheolferthyr	15.3	15.8	0.4	Negligible
R03	Elm Tree Grove	17.0	17.8	0.8	Negligible
R04	Penheolferthyr	17.6	18.0	0.4	Negligible
R05	Twynyroddyn Community School	9.6	9.7	0.1	Negligible
R06	Gilfach-Cynon	28.1	28.9	0.8	Negligible
R07	Gilfach-Cynon	27.9	28.7	0.8	Negligible
R08	Alexandra Terrace	26.1	26.8	0.7	Negligible
R09	Alexandra Terrace	30.7	31.6	0.9	Slight Adverse
R10	Twynyroddyn Rd	29.7	30.6	0.9	Slight Adverse
R11	Twynyroddyn Rd	32.5	33.4	0.9	Slight Adverse
R12	Twynyroddyn Rd	33.8	34.8	1.0	Slight Adverse
R13	Twynyroddyn Rd	32.7	33.6	0.9	Slight Adverse
R14	Court Terrace	33.8	34.7	0.9	Slight Adverse
R15	Court Terrace	36.3	37.3	1.0	Slight Adverse
R16	Court Terrace	23.7	24.3	0.5	Negligible
R17	Tramroadside N	12.7	12.7	0.0	Negligible
R18	High Street	18.6	18.9	0.3	Negligible
R19	Westbourne Place	21.9	21.9	0.0	Negligible
R20	Plymouth St	19.3	19.4	0.0	Negligible
E01	SE Corner of Site	-	11.0	-	No risk of exceedance
E02	NE Corner of Site	-	11.3	-	No risk of exceedance
E03	NW Corner of Site	-	10.4	-	No risk of exceedance
E04	SW Corner of Site	-	8.5	-	No risk of exceedance

- 5.2.4. There are no modelled exceedances of the air quality objective for annual mean NO₂ at any receptor in 2022, whether or not the Proposed Development is operational and irrespective of the number of properties occupied on site.
- 5.2.5. In the absence of exceedances of the objective for annual mean NO₂, following the guidance in LAQM.TG(16) (which states that exceedances of the mean standard are unlikely where annual mean concentrations are below 60µg/m³), it is highly unlikely that there will be any exceedances of the hourly mean objective for NO₂ as well.
- 5.2.6. The maximum modelled concentration occurs at R15 on Court Terrace within the Twynyrodyn Road AQMA. Without the Proposed Development, concentrations in 2022 will be 36.3µg/m³, increasing slightly to 37.3µg/m³ with the full occupation of the Proposed Development. This is a small impact, but using the EPUK/IAQM criteria, classed as a slight adverse impact. Indeed, slight adverse impacts are modelled at 7 of the indicative receptors within the AQMA (R09 – R15, **Figure 5-1**), albeit where there are small impacts from the Proposed Development, but not modelled exceedances of the objective.

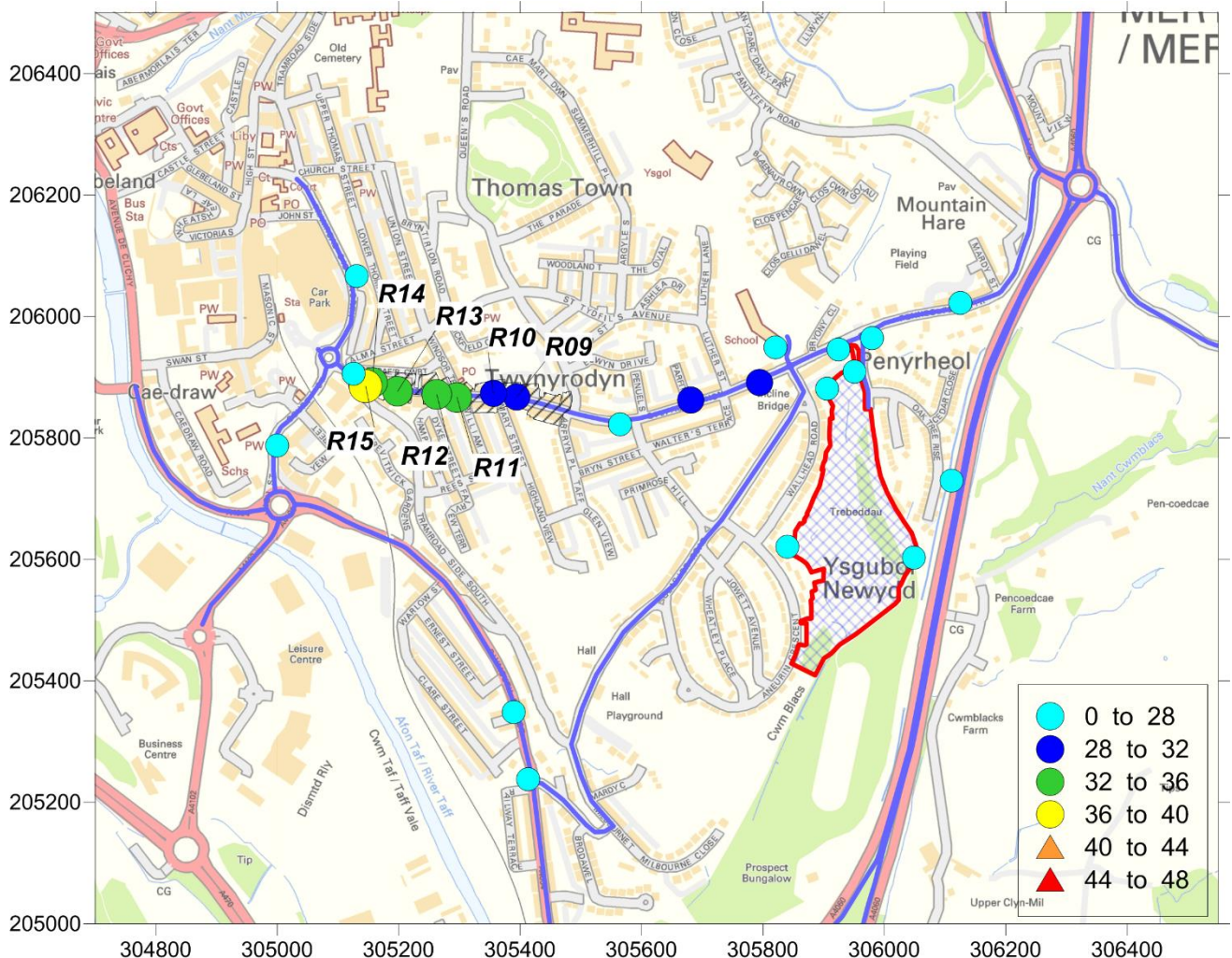


Figure 5-1 - Annual mean NO₂ concentrations in 2022 with the Proposed Development (ug/m3). Receptors with slight adverse impacts are labelled

- 5.2.7. Modelled concentrations on site (E01 – E04) are all well within the air quality objective (maximum 11.3µg/m³ at the closest point of the site to the junction of Elm Tree Grove and Penheolferthyr) and do not place a constraint on the development or require mitigation.
- 5.2.8. **Table 5-5** and **Figure 5-2** show the model results for 2032. The impacts of the Proposed Development are negligible at all receptors. The maximum modelled concentration with the Proposed Development is 20.5µg/m³ (R15), and the maximum on-site concentration is 7.4µg/m³. These impacts will not give rise to significant effects.

Table 5-5 – Modelled future year, 2032 concentrations of annual mean NO₂ (µg/m³) and impact assessment

ID	Name	Future Baseline	With Development	Impact	EPUK/IAQM Descriptor
R01	Oak Tree Rise	9.4	9.5	0.1	Negligible
R02	Penheolferthyr	9.1	9.2	0.2	Negligible
R03	Elm Tree Grove	10.1	10.5	0.4	Negligible
R04	Penheolferthyr	10.5	10.7	0.2	Negligible
R05	Twynyroddyn School	6.7	6.7	0.1	Negligible
R06	Gilfach-Cynon	15.7	16.1	0.4	Negligible
R07	Gilfach-Cynon	15.6	16.0	0.4	Negligible
R08	Alexandra Terrace	14.7	15.1	0.3	Negligible
R09	Alexandra Terrace	17.1	17.5	0.4	Negligible
R10	Twynyroddyn Rd	16.6	17.0	0.4	Negligible
R11	Twynyroddyn Rd	18.0	18.4	0.4	Negligible
R12	Twynyroddyn Rd	18.7	19.2	0.5	Negligible
R13	Twynyroddyn Rd	18.1	18.5	0.4	Negligible
R14	Court Terrace	18.7	19.1	0.4	Negligible
R15	Court Terrace	20.0	20.5	0.5	Negligible
R16	Court Terrace	13.5	13.7	0.2	Negligible
R17	Tramroadside N	8.1	8.1	0.0	Negligible
R18	High Street	10.8	10.9	0.1	Negligible
R19	Westbourne Place	12.5	12.5	0.0	Negligible
R20	Plymouth St	11.2	11.3	0.0	Negligible
E01	SE Corner of Site	-	6.9	-	No risk of exceedance

ID	Name	Future Baseline	With Development	Impact	EPUK/IAQM Descriptor
E02	NE Corner of Site	-	7.4	-	No risk of exceedance
E03	NW Corner of Site	-	7.0	-	No risk of exceedance
E04	SW Corner of Site	-	6.1	-	No risk of exceedance

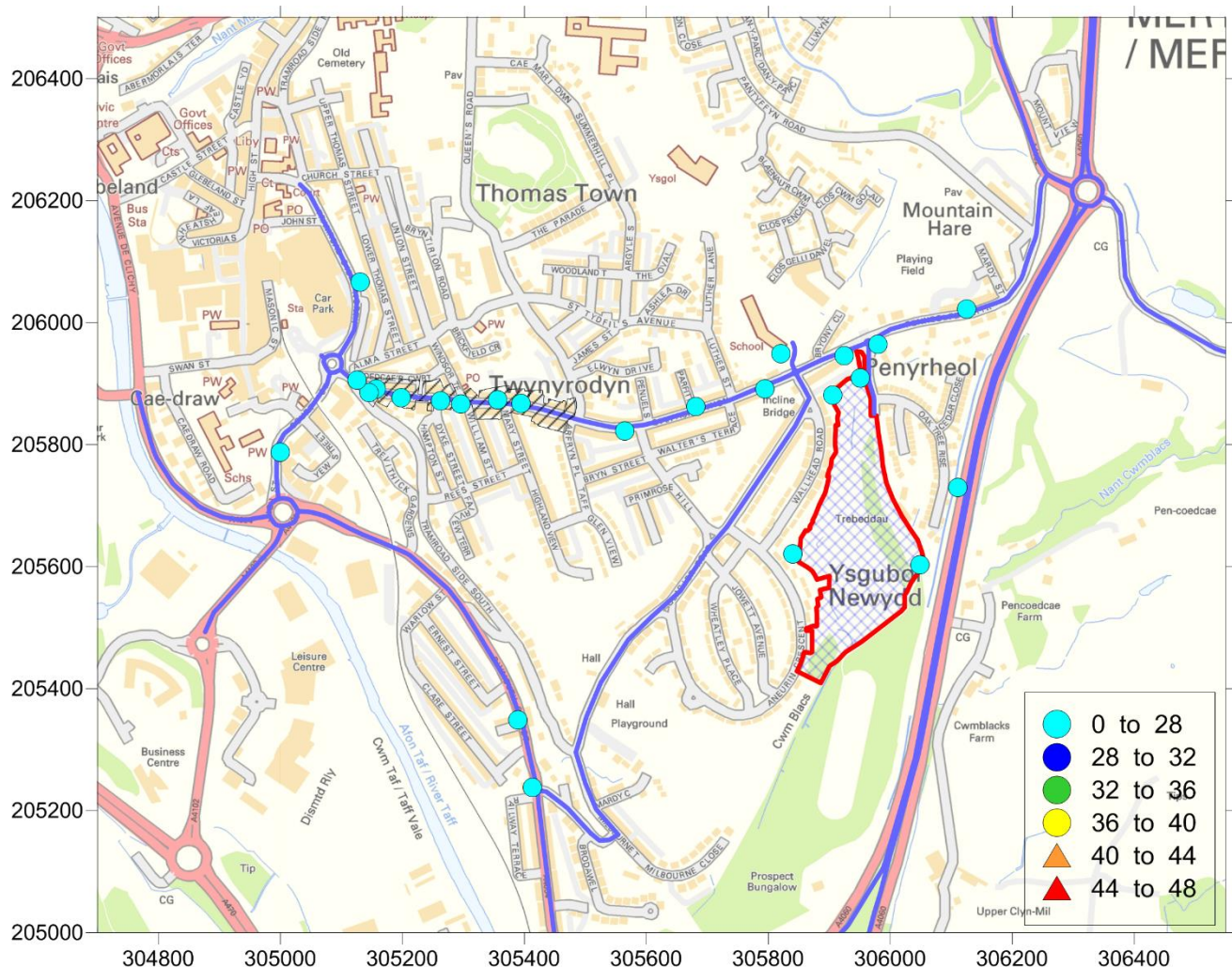


Figure 5-2 - Annual mean NO₂ concentrations in 2032 with the Proposed Development (ug/m³)

- 5.2.9. Modelled impacts on PM₁₀ and PM_{2.5} concentrations are negligible everywhere and no exceedances of the objectives are modelled in any year.

Sensitivity to Number of Properties Occupied

- 5.2.10. As previously stated, the dispersion modelling has been based on the traffic generated for 127 properties. The generation of traffic, and the growth in emissions from that traffic, is approximately

linearly related to the number of properties occupied. Consequently, and notwithstanding some limited non-linearity associated with effects such as NO_x to NO₂ conversion, vehicle turbulence and changes in general vehicle speeds, it is realistic to consider the modelled impact of the development traffic on air quality as being linearly related to the number of properties occupied.

- 5.2.11. The maximum modelled impact of the occupation of 127 properties in 2022 is 1µg/m³ at R15.
- 5.2.12. If only 50% of the properties were occupied by this time, the impact would be reduced to approximately 0.5µg/m³ (=1.0µg/m³ x 50%) and the total concentration at the receptor would be 36.8µg/m³. Using the EPUK/IAQM guidance, this would be a negligible impact. This is the rationale behind statements that the assumption of full development in 2022 results in a conservative assessment.
- 5.2.13. If, on the other hand, traffic generation is greater than assumed, by say 10%, then the impact would be increased to 1.1µg/m³ (=1.0µg/m³ x 110%) and the total concentration at R15 would be 37.4µg/m³. Under EPUK/IAQM guidance, this would remain a slight adverse impact and concentrations would remain within the air quality objective. That is to say, there would be no substantive change from the main assessment. This increase could occur either as a result of an increase in property numbers or an increase in vehicle trips per property.
- 5.2.14. Overall, this sensitivity testing demonstrates that the assessment is robust and not sensitive to minor changes in the Proposed Development design parameters.

Significance of Effects

- 5.2.15. The EPUK/IAQM guidance states that the assessment of overall significance should be based on professional judgement, taking into account several factors, including:
 - The existing and future air quality in the absence of the development;
 - The extent of current and future population exposure to the impacts; and
 - The influence and validity of any assumptions adopted when undertaking the prediction of impacts.
- 5.2.16. Specifically, the guidance states that whilst it may be that there are 'slight', 'moderate' or 'substantial' impacts at one of more receptors, the overall effect may not necessarily be judged as being significant in some circumstances" or where moderate or substantial effects are confined to "a very small area" or, where adverse, it is "*not obviously a cause of harm to human health*".
- 5.2.17. Air quality in Twynyrodyn is expected to improve in the future, whether or not the Proposed Development is in place. In the opening year, the impact of the development is, in relation to the Future Baseline, small and slight adverse at a number of receptors (7) within the AQMA but no new exceedances are created or existing exceedances worsened. In the completion year, the impacts are adverse but negligible at all receptors and, again, no new exceedances are created.
- 5.2.18. The assessment of impacts has been based on modelling at sensitive, worst case, roadside receptors in the Twynyrodyn AQMA, using conservative assumptions i.e. full development by 2022 and worst case verification, and has been demonstrated to be insensitive to minor changes to the development design parameters.

5.2.19. In relation to the Future Baseline Scenario, this modelling shows

- Potential slight adverse impacts within the AQMA with rapid development (full occupation by 2022), but which are unlikely to be realised with realistic build-out rates and unlikely to be perceptible in terms of effects on human health due to the lack of exceedances of the objective, and
- Negligible impacts at all receptors at full development 2032.

5.2.20. Therefore, it is concluded that, without consideration of measures designed to reduce emissions during the occupation of the development, overall air quality effects resulting from the operation of the proposed development will be minor and 'not significant'. Furthermore, the future occupants of the Proposed Development will not be exposed to poor air quality.

6 MITIGATION

6.1 REQUIREMENTS FOR MITIGATION

- 6.1.1. The overall conclusion of the air quality assessment is that there is a risk of dust effects during construction, but that, with appropriate mitigation, no significant effects are likely. Recommended construction phase mitigation measures for the Proposed Development, for which the risk level is medium to high, are set out below.
- 6.1.2. During operation, impacts will be minor adverse decreasing to negligible over time, but no significant effects are anticipated and, as such, no mitigation is required.

6.2 DURING CONSTRUCTION

Overarching Measures to Reduce Pollution and Communications Strategy

- 6.2.1. During construction, best practice measures to reduce dust and particulate matter emissions will be secured through the Construction Environmental Management Plan (CEMP) that will be agreed with MTCBC prior to works.
- 6.2.2. Examples of such measures include:
 - General Communication
 - A **stakeholder communications plan** that includes community engagement before work commences on site should be developed and implemented.
 - The name and contact details of person(s) accountable for air quality and dust issues should be displayed on the site boundary. This may be the environment manager/engineer or the site manager. The head or regional office contact information should also be displayed.
 - General Dust Management
 - A **Dust Management Plan (DMP)**, which may include measures to control other emissions, in addition to the dust and PM₁₀ mitigation measures given in this report, should be developed and implemented, and approved by MTCBC.
 - Site Management
 - All dust and air quality complaints should be recorded and causes identified. Appropriate remedial action should be taken in a timely manner with a record kept of actions taken including of any additional measures put in-place to avoid reoccurrence.
 - The complaints log should be made available to the local authority on request.
 - Any exceptional incidents that cause dust and/or air emissions, either on- or offsite should be recorded, and then the action taken to resolve the situation recorded in the log book.
 - Monitoring
 - **Daily on-site and off-site inspections** should be undertaken at nearby receptors and roads. The inspection results should be recorded and made available to MTCBC when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.
 - Regular site inspections to monitor compliance with the DMP should be carried out, inspection results recorded, and an inspection log made available to MTCBC when asked.

- The frequency of site inspections should be increased when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- **Dust deposition or dust flux monitoring** and locations should be agreed with MTCBC. Baseline monitoring should start at least three months before work commences on site.
- 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 practicable.
 - Where practicable, erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
 - Where practicable, fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
 - Avoid site runoff 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 appropriately.
 - Where practicable, cover, seed or fence stockpiles to prevent wind whipping.
- Operating vehicle/machinery and sustainable travel
 - Ensure all vehicle operators 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.
 - A maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas should be imposed.
 - A **Construction Logistics Plan** should be produced to manage the sustainable delivery of goods and materials.
 - A **Travel Plan** that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing) should be considered.
- 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.
 - Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
 - Use enclosed chutes and conveyors and covered skips.
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
 - Ensure equipment is readily available on site to clean any dry spillages, 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. (highly recommended for all sites)

Measures Specific to Earthworks

- 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.
- Where practicable, only remove the cover in small areas during work and not all at once.
- Stockpile surface areas should be minimised (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) to reduce area of surfaces exposed to wind pick-up.
- Where practicable, windbreak netting/screening should be positioned around material stockpiles and vehicle loading/unloading areas, as well as exposed excavation and material handling operations, to provide a physical barrier between the site and the surroundings.
- Where practicable, stockpiles of soils and materials should be located as far as possible from sensitive properties, taking account of the prevailing wind direction.
- During dry or windy weather, material stockpiles and exposed surfaces should be dampened down using a water spray to minimise the potential for wind pick-up.

Measures Specific to Construction

- 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.
- 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.
- For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
- All construction plant and equipment should be maintained in good working order and not left running when not in use.

Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being in frequent use during major construction activities close to the site access points.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Where practicable, hard surfaced haul routes should be installed, 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 prior to leaving the site where reasonably practicable).
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.

- 6.2.3. The CEMP will incorporate a Construction Traffic Management Plan to reduce the requirement for construction traffic use on local roads and seek to minimise the impact of construction traffic on local air quality. Specifically, the proposed development will commit to a requirement that construction-related HDVs will avoid roads within the Twynyrodyn AQMA. The CEMP will also include a robust system for monitoring the application and effectiveness of the traffic management plan.

6.3 OPERATION MITIGATION

- 6.3.1. With slight adverse impacts at worst within the Twynyrodyn AQMA, assessed using a highly conservative methodology, and negligible impacts elsewhere, it is unnecessary to apply any mitigation methods beyond the emission minimisation measures implicit within the development design and Transport Implementation Strategy (Lime Transport, Transport Assessment Twynyrodyn, Merthyr Tydfil).
- 6.3.2. Specifically, the Strategy sets out the following measures with potentially air quality positive outcomes:-
- Encouraging Active Travel models through
 - Ensuring the provision of a network of pedestrian routes between the site and the surrounding network of footpaths,
 - Providing secure cycle parking spaces
 - Providing a Travel Plan Welcome Pack for new residents that sets out route information for Active Travel modes and actions that can be taken by individuals to reduce personal exposure to pollution.
 - Providing information on public transport within the Travel Plan
- 6.3.3. The Travel Plan will set mode share targets and make allowance for on-going monitoring of its efficacy and it is envisaged that the Travel Plan will be a condition of any planning consent, with details submitted to and approved in writing by MTCBC.
- 6.3.4. The potential air quality benefits from these measures have not been explicitly modelled and, as such, they have the potential to reduce the magnitude of the impacts presented in the previous section of this report.

7 CONCLUSIONS

7.1 SUMMARY

- 7.1.1. The air quality assessment for the Proposed Development has considered the impacts of its construction and operation.
- 7.1.2. It has focussed on a qualitative assessment of dust generation during construction and a quantitative assessment of operation impacts using dispersion modelling.
- 7.1.3. Air quality within Merthyr Tydfil is currently good overall, with only limited pockets of poor air quality, most notably within the Twynyrodyn AQMA to the west of the development site. In 2019, there were no monitored exceedances of air quality objectives for nitrogen dioxide or particulate matter.
- 7.1.4. There is a potentially high risk of dust impacts from the construction phase of the development and appropriate and proportionate mitigation measures have been proposed in Section 6. With the rigorous application and monitoring of these measures, no significant effects should arise from dust or particulate matter during works.
- 7.1.5. The impacts of development-related traffic generation on local air quality will be generally negligible, but potentially slight adverse within the Twynyrodyn AQMA in the early years after opening. The development is built on a sustainable principle with good access by walking, cycling and public transport and a Travel Plan Welcome Pack will be provided to new residents to encourage Active Travel. The impact of these mitigation measures has not been taken into account in the dispersion modelling but, taking into account the conservatism in the air quality assessment, the measures have the potential to reduce impacts to negligible everywhere.

7.2 POLICY ASSESSMENT

- 7.2.1. The proposals are compliant with key national and local policies:
 - In relation to national air quality standards and regulations, the Proposed Development will not create new or worsen existing exceedances of air quality standards and future residents will not be exposed to elevated pollution levels. Taking into consideration the forthcoming Environment Bill, this conclusion would continue to apply, even if a new objective for annual mean PM_{2.5} were set at the level of the current WHO guidelines.
 - In relation to Planning Policy Wales, the impacts of the Proposed Development have been set out in this report with an appropriate level of information to allow the planning authority to assess its potential impacts and the mitigation required, and the provision of Travel Planning and inherent promotion of Active Travel have the potential to limit the impacts of its operation.
 - In relation to the Local Development Plan, the Proposed Development will not result in unacceptable impacts on people and residential amenity etc due to pollution of the air. The proposed mitigation measures are implementable and are proven methods to reduce impacts from construction works and traffic generation during occupation.
 - In relation to the MTCBC Air Quality Action Plan for the Twynyrodyn AQMA, the Proposed Development will not interfere with actions within the Plan and will not result in a worsening of exceedances of the air quality objective within the AQMA, necessitate an extension of the spatial extent of the AQMA or delay any future revocation of the AQMA.

7.3 OVERALL CONCLUSIONS

- 7.3.1. **Table 7-1** provides a summary of the effects of the Proposed Development. With mitigation, no significant adverse air quality effects are likely during the construction or operational phases of development.
- 7.3.2. The assessment has demonstrated that air quality will not present a significant constraint to the proposed development, either offsite or onsite. It will not result in a material deterioration in air quality or harm to health as a result of its construction and occupation, and is compliant with national and local planning policies and guidance.
- 7.3.3. Furthermore, the assessment has demonstrated that these conclusions are not sensitive to minor changes to the Proposed Development design parameters.

Table 7-1 – Summary of Effects

Receptor / Impact	Effects	Mitigation	Residual Effects
During Construction			
Residential properties and schools / Dust Soiling	Minor Adverse	Best practice dust suppression measures applied through CEMP	Negligible
Residential properties and schools / Human Health	Negligible		Negligible
Ecology / Dust/alkaline deposition	Negligible		Negligible
Residential properties and schools / Exposure to roadside pollution from construction traffic	Negligible	Construction environmental management plan inc routing advice for HGVs	Negligible
During Operation			
Residential properties and schools / Exposure to roadside pollution from development-related traffic	Negligible at majority of receptors; Slight adverse in Twynyrodyn AQMA	Development-related Travel Plan; design for links with surrounding Active Travel and public transport route networks	Negligible at majority of receptors; Slight adverse in Twynyrodyn AQMA in early years after opening

Appendix A

SELECTED RECEPTORS

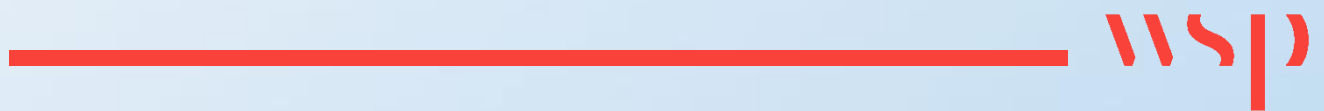


Table A-1 – Selected Receptors for Air Quality Impact Assessment

ID	Name	Easting	Northing	Height	In AQMA
Existing Receptors					
R01	Oak Tree Rise	306110.4	205729.9	1.5	
R02	Penheolferthyr	306124.9	206022.7	1.5	
R03	Elm Tree Grove	305979.5	205964.7	1.5	
R04	Penheolferthyr	305924.6	205945.7	1.5	
R05	Twynyrodyn Community School	305820.4	205949.5	1.5	
R06	Gilfach-Cynon	305794.1	205891.5	1.5	
R07	Gilfach-Cynon	305680.8	205862.6	1.5	
R08	Alexandra Terrace	305564.5	205822.3	1.5	
R09	Alexandra Terrace	305394.6	205867.6	1.5	Y
R10	Twynyrodyn Rd	305355.7	205873.7	1.5	Y
R11	Twynyrodyn Rd	305295.9	205867.0	1.5	Y
R12	Twynyrodyn Rd	305262.7	205871.6	1.5	Y
R13	Twynyrodyn Rd	305198.3	205876.8	1.5	Y
R14	Court Terrace	305156.9	205891.2	1.5	Y
R15	Court Terrace	305145.5	205885.2	1.5	Y
R16	Court Terrace	305125.9	205905.9	1.5	Y
R17	Tramroadside N	305130.8	206066.3	1.5	
R18	High Street	304999.8	205787.2	3.0	
R19	Westbourne Place	305388.9	205348.6	1.5	
R20	Plymouth St	305413.3	205238.2	1.5	
Future Receptors					
E01	SE Corner of Site	306048.5	205603.1	1.5	
E02	NE Corner of Site	305950.8	205909.5	1.5	
E03	NW Corner of Site	305905.3	205881.0	1.5	
E04	SW Corner of Site	305840.4	205620.9	1.5	



Appendix B

TRAFFIC DATA





Traffic data, as daily average flows, provided by Lime Transport, for:

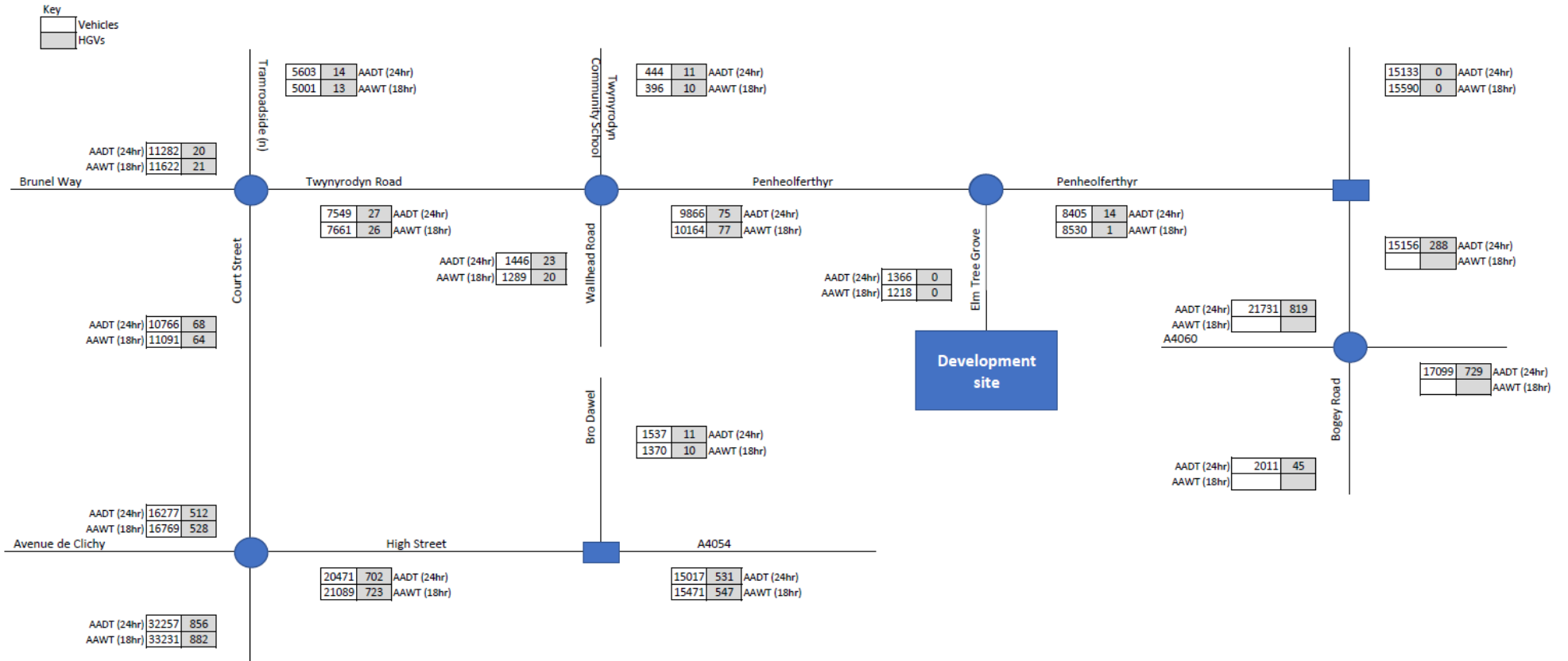
- Baseline 2019
- Future Baseline 2022
- With Proposed Development 2022
- Future Baseline 2032
- With Proposed Development 2032

Daily average traffic speeds were estimated using:

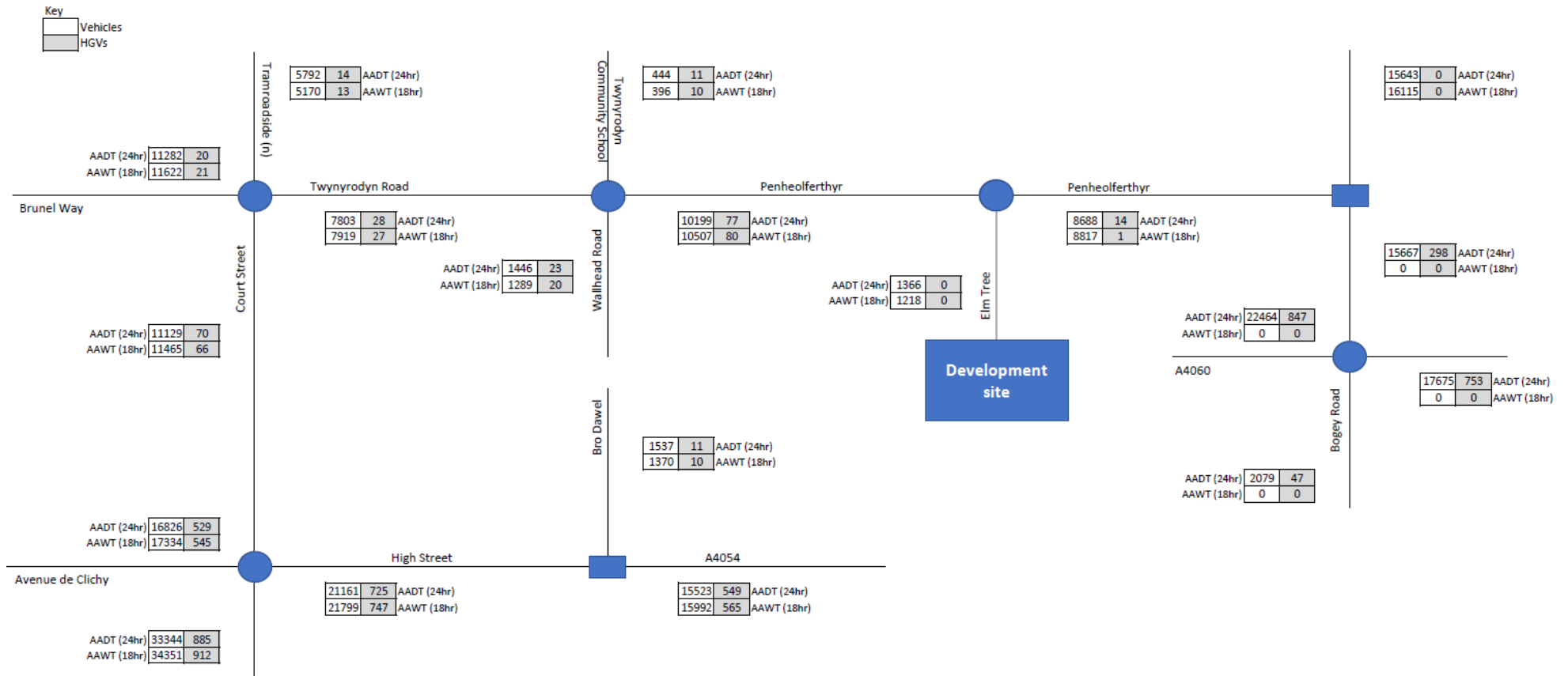
- Court Road traffic survey data (from Lime Transport)
- Speed Limits
- LAQM guidance (Chapter 7)
- Department for Transport speed limit compliance data for UK

Air quality modelling based on AADT flows only, with flows scaled on an annual basis by the factors in **Table B-1**.

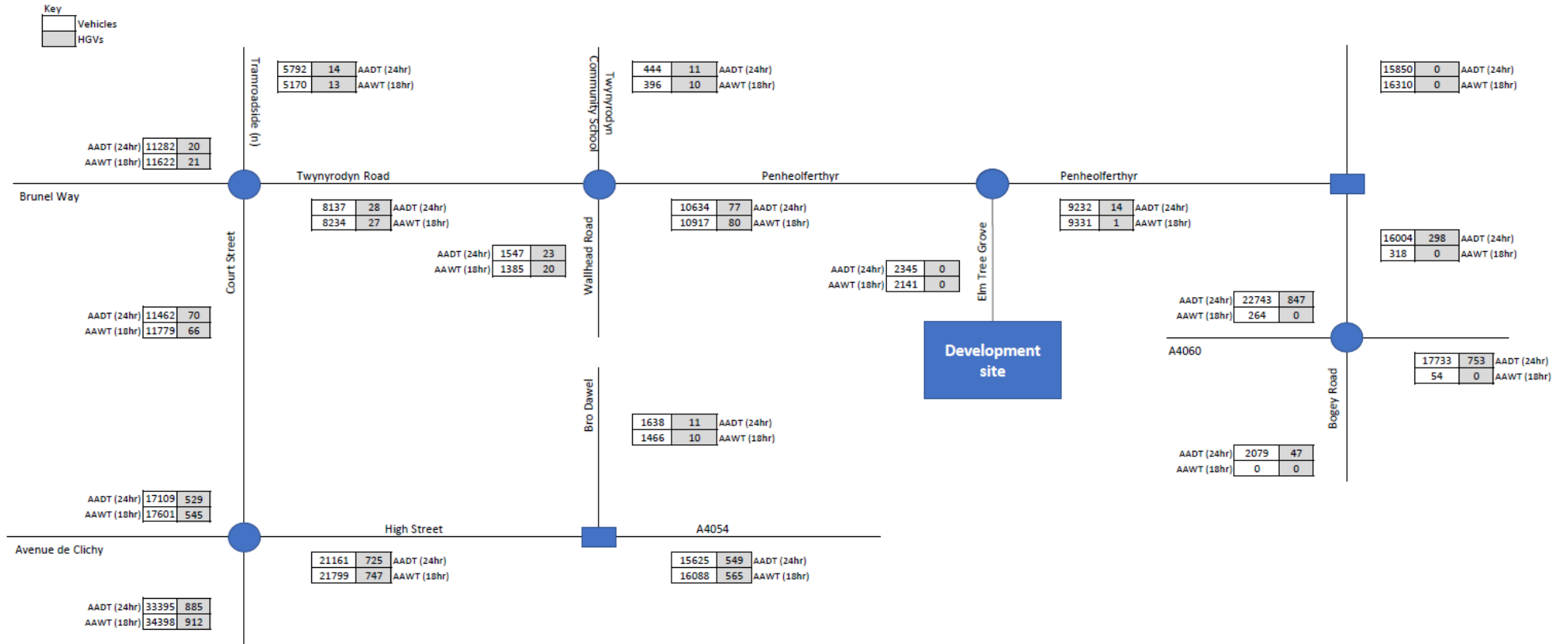
2019 Baseline



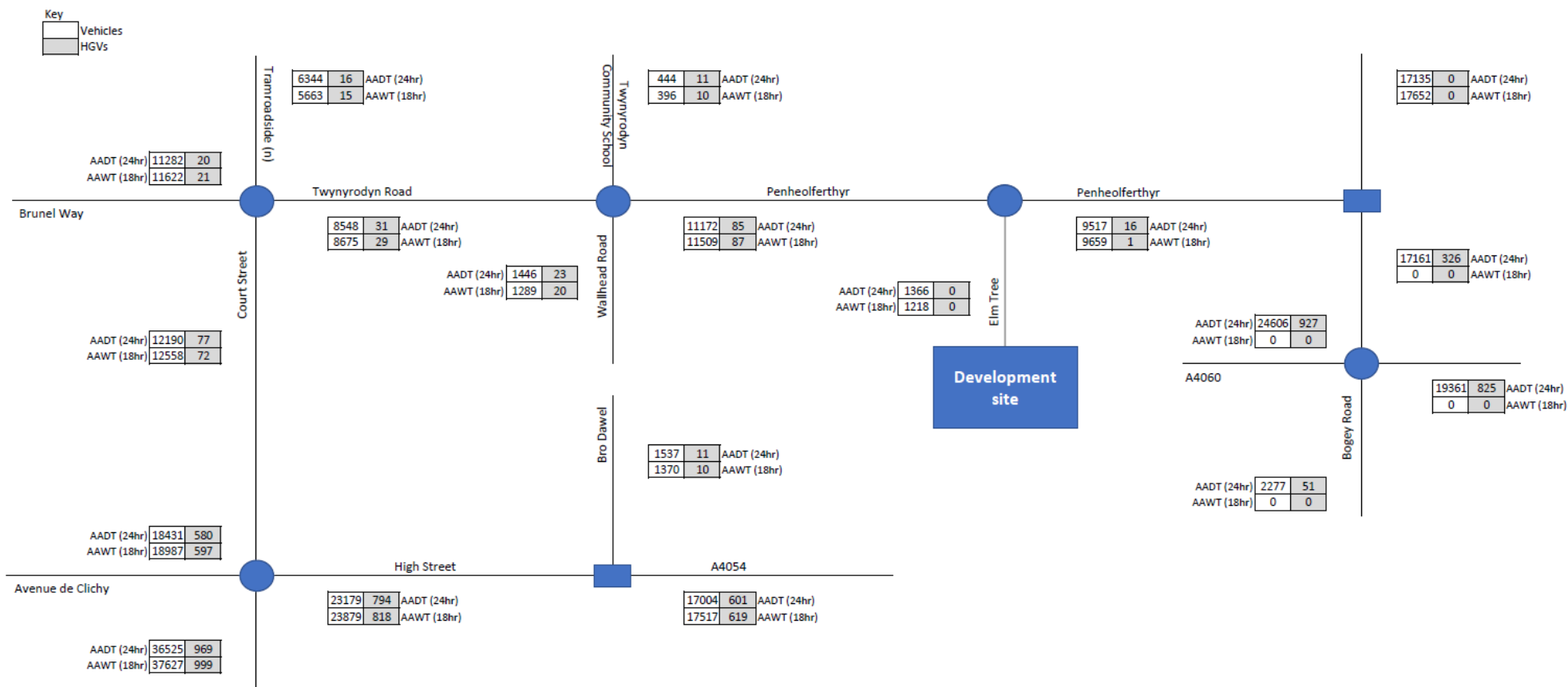
2022 Future Baseline



2022 With Proposed Development



2032 Future Baseline



2032 With Proposed Development

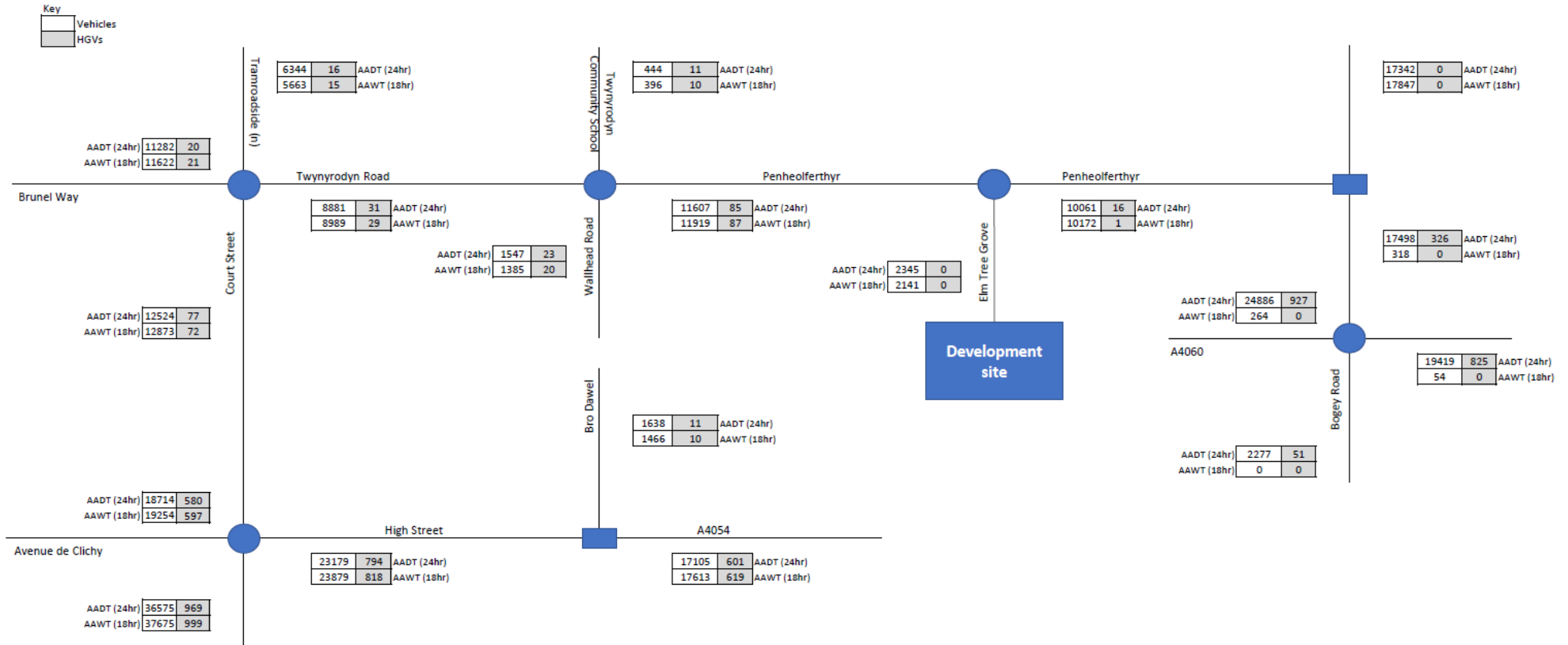


Table B-1 - Hourly factors used to scale annual average daily traffic over the days of the week

Hour	Weekdays	Saturdays	Sundays
1	0.03	0.10	0.23
2	0.02	0.08	0.11
3	0.02	0.05	0.08
4	0.04	0.05	0.04
5	0.15	0.09	0.06
6	0.42	0.18	0.12
7	0.78	0.49	0.22
8	1.56	1.08	0.32
9	1.63	1.61	0.61
10	1.63	1.94	1.24
11	1.75	2.00	1.59
12	1.89	2.00	1.65
13	1.81	1.95	1.58
14	1.79	1.83	1.52
15	2.00	1.82	1.55
16	1.96	1.76	0.85
17	2.02	1.66	0.92
18	1.66	1.52	0.90
19	1.33	1.36	0.86
20	1.05	1.11	0.85
21	0.86	0.83	0.67
22	0.57	0.68	0.34
23	0.26	0.30	0.17
24	0.09	0.24	0.29

Appendix C

MODEL VERIFICATION



This appendix considers the verification of the ADMS Road dispersion model using the monitoring data available from Merthyr Tydfil County Borough Council. The monitoring data and locations are provided in Table C-1 and Figure C-1. The verification is based on monitored data for 2019 and modelling undertaken using Defra's Emission Factor Toolkit v10 and associated NO_x to NO₂ calculator (v8.1).

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. The following are examples of potential causes of such discrepancy:

- Estimates of background pollutant concentrations;
- Meteorological data uncertainties;
- Traffic data and emissions uncertainties;
- Model input parameters, such as 'roughness length'; and
- Overall limitations of dispersion modelling

Most nitrogen dioxide is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of the primary pollutant emissions of nitrogen oxides (NO_x = NO + NO₂), in line with the guidance provided within Chapter 7 of Defra's LAQM.TG(16).

After conversion of modelled NO_x concentrations to NO₂ concentrations (using Defra's NO_x to NO₂ calculator v8.1), a second verification step may then be applied, if appropriate, based on comparison of monitored and modelled total NO₂ concentrations.

Table C-1 – Monitored and modelled concentrations for model verification

Monitoring Location	Monitored Total NO ₂ 2019	Background NO _x	Monitored Road NO _x	Modelled Road NO _x	Ratio Monitored / Modelled NO _x or Reason for Exclusion	Verified Modelled Road NO _x	Verified Modelled Total NO ₂
ID03	11.1	10.2	6.79	2.87	2.36	6.82	11.11
ID04	24.9	10.2	33.38	16.28	2.05	38.67	27.46
ID06	25.3	10.2	34.20	8.86	3.86	21.06	18.70
ID11	35.0	10.2	54.95	21.65	2.54	51.44	33.42
ID14	33.2	10.2	50.96	22.35	2.28	53.09	34.16
ID21	38.2	10.2	62.21	23.78	2.62	56.48	35.68
ID22	26.0	10.2	35.64	19.26	1.85	45.75	30.81

Monitoring Location	Monitored Total NO ₂ 2019	Background NO _x	Monitored Road NO _x	Modelled Road NO _x	Ratio Monitored / Modelled NO _x or Reason for Exclusion	Verified Modelled Road NO _x	Verified Modelled Total NO ₂
ID18	24.1	10.2	31.75	25.89	Removed for conservatism	61.49	37.89
ID20	25.9	10.2	35.43	25.85	Removed for conservatism	61.40	37.85
ID24	23.8	10.2	31.15	25.50	Removed for conservatism	60.57	37.48
ID05	22.3	10.2	28.13	6.16	Outside street canyon	14.63	15.33
ID19	19.1	10.2	21.84	3.51	Outside street canyon	8.35	11.95
					RMSE	3.44	
					Fractional Bias	0.01	

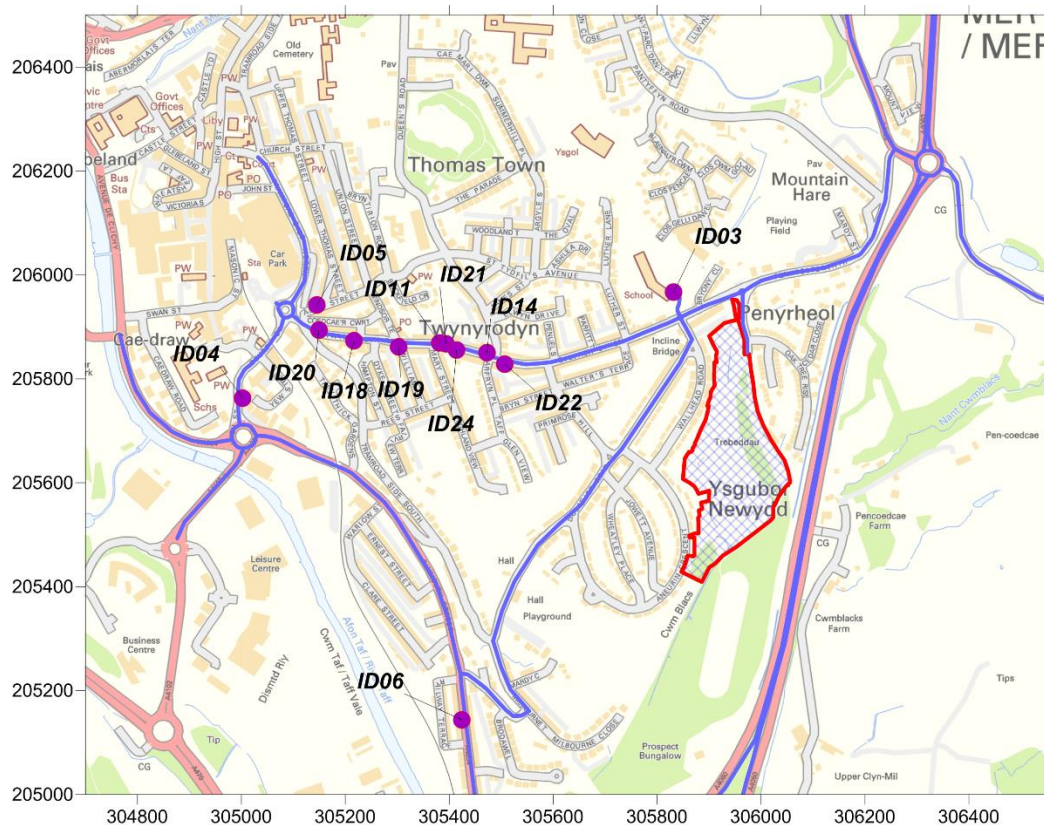


Figure C-1 - Monitoring Locations for Verification

The relationship between monitored and modelled road contribution to NO_x prior to verification (Figure C-2) clearly demonstrated that the Twynnyroddyn model was underpredicting concentrations. The verification factor needed to adjust the model results was 2.3756.

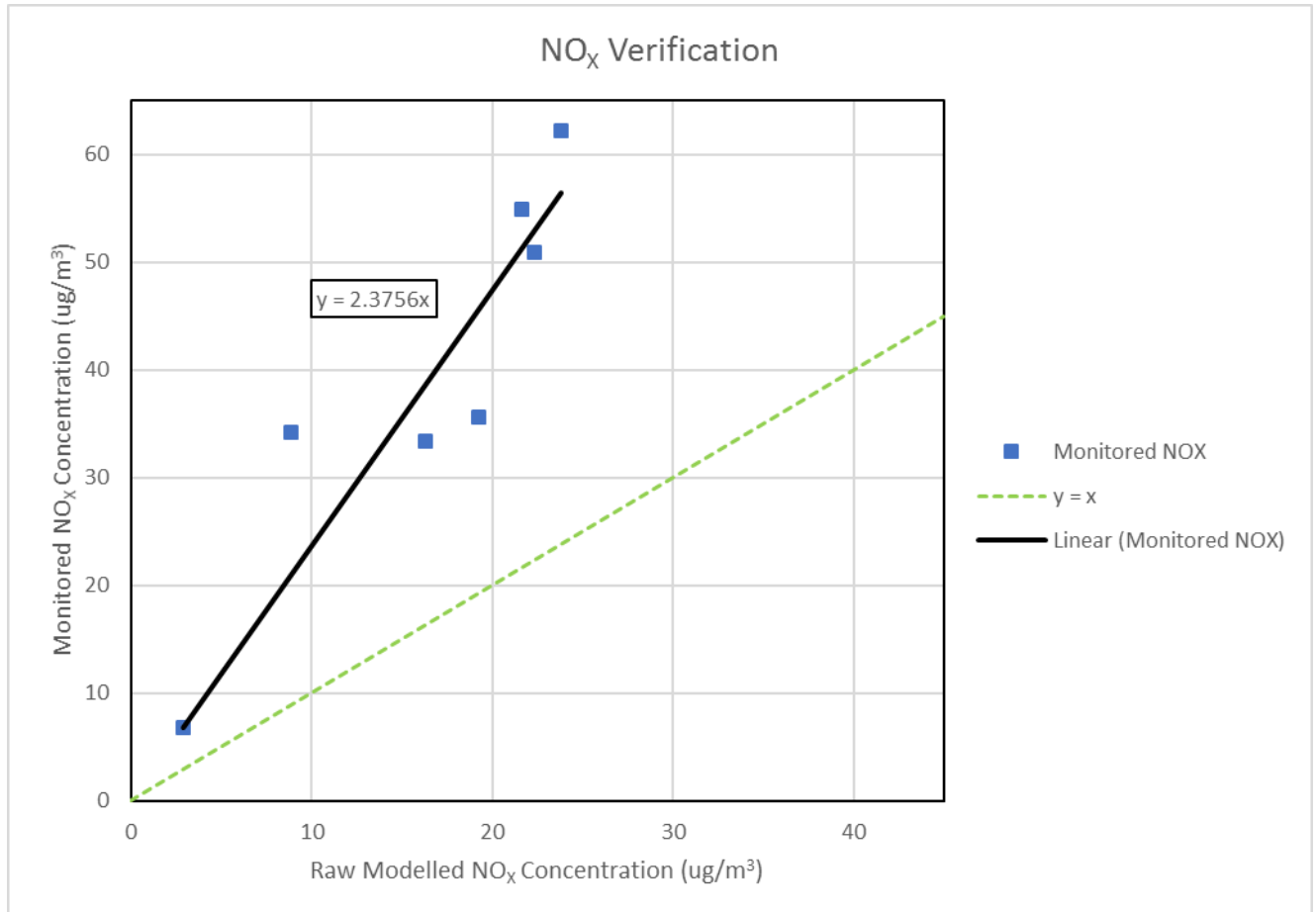


Figure C-2 - Comparison of modelled and monitored road contribution to NO_x prior to verification

Following verification on the basis of the road contribution to NO_x, the total modelled and monitored concentrations of NO₂ were compared (Figure C-3). The figure shows that the 5 out of the 7 data points used for model verification lie within the optimal +/-10% accuracy limits (LAQM TG.16), with all except 1 data point lying within the +/-25% accuracy limits. The straight line fit between monitored and modelled total NO₂ has a gradient of 1.00, and, as such, no model adjustments for NO₂ were necessary. The root mean square (RMS) error is 3.4µg/m³, which is less than 10% of the standard. The fractional bias is 0.01, indicating that, post-verification, the model is neither significantly over or underestimating concentrations.

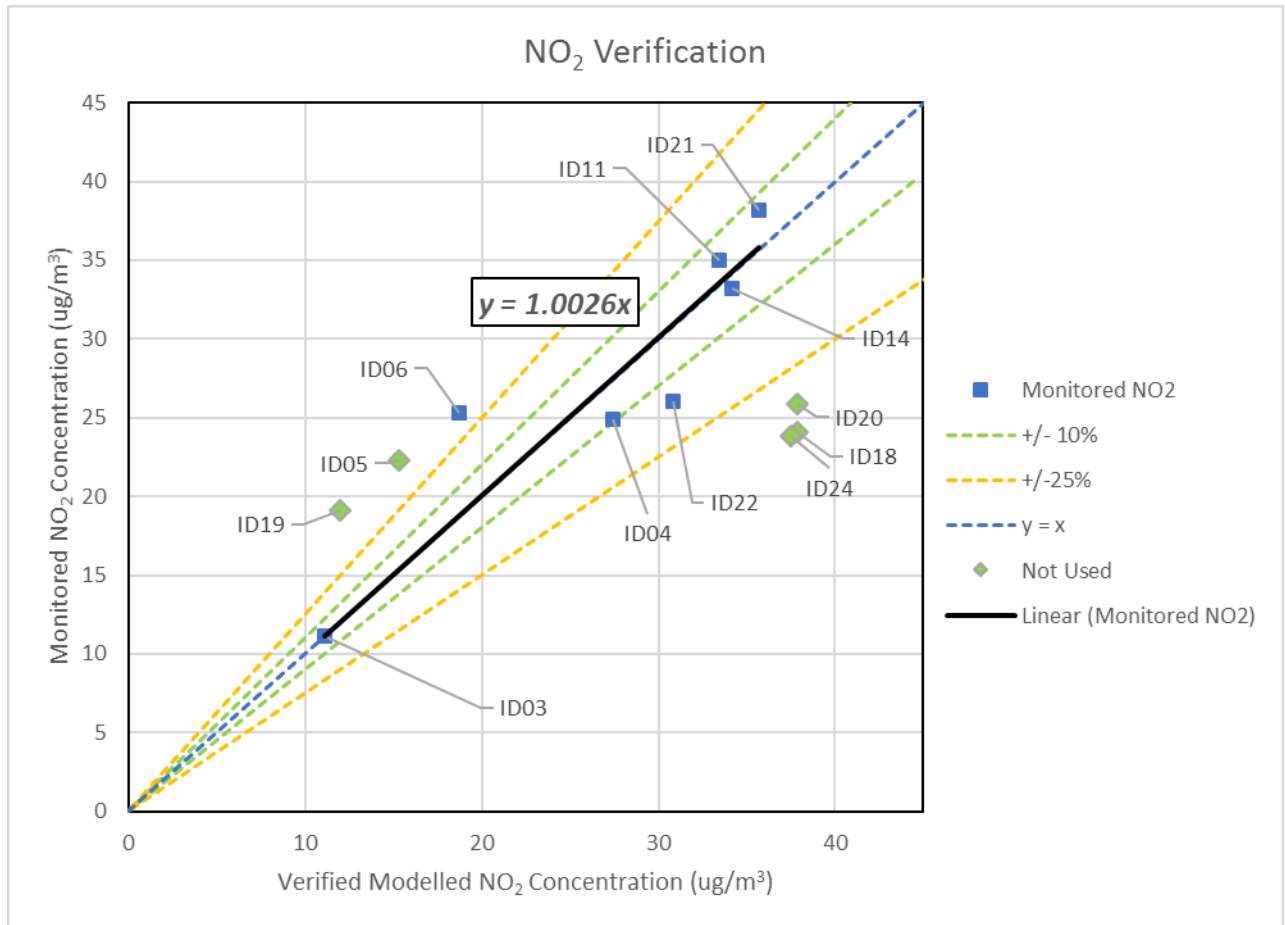


Figure C-3 - Comparison of modelled and monitored road contribution to NOX after to verification

A number of monitoring locations, as set out in Table C-1, were excluded from the verification process. Of these, locations ID18, ID20 and ID24 lie within the AQMA but, due to the model representation of the street canyon, were located somewhat closer to the roadside than the actual monitoring. Were they to be included in the calculation of the verification factor, they would have decreased the verification factor and led to a potential underestimate of total pollutant concentrations and impacts. With them excluded from the factor calculation, the verified concentrations at these receptors significantly overestimate the monitored concentrations and, therefore, the model results are highly conservative (>25% overestimates) for some receptors within the AQMA.

Conversely, locations ID05 and ID19 are on an side streets, outside of the main street canyon, that are not represented in the traffic data. At these receptors the verified model underestimates concentrations. However, the monitored concentrations at these receptors are well within the air quality standard and the model underprediction does not place a constraint on the assessment.

Importantly, at locations ID4, ID11 and ID21, where monitored concentrations are the highest within the Twynyrodyn Road AQMA, the model represents the observed data well (within +/-10%).



Overall, therefore, the verified dispersion model is appropriate for the assessment of impacts of the Proposed Development.

Appendix D

MODEL RESULTS





Full set of verified model results provided overleaf.

Data presented to 2dp to allow illustration of negligible effects. In general, no more than 1 decimal place should be assigned any significance. Impacts as a percentage of the objective have been rounded to 0dp for compatiability with the EPUK/IAQM guidance

Table D-1 – Modelled (verified) annual mean nitrogen dioxide, 2022 (µg/m³)

ID	Name	2019 Baseline	2022 Future Baseline	2022 With Development	2022 Impact	2022 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R01	Oak Tree Rise	20.67	16.61	16.76	0.15	0%	Imperceptible	Negligible
R02	Penheolferthyr	18.69	15.32	15.76	0.44	1%	Very Small	Negligible
R03	Elm Tree Grove	20.67	16.95	17.79	0.84	2%	Small	Negligible
R04	Penheolferthyr	21.42	17.56	18.00	0.44	1%	Very Small	Negligible
R05	Twynyrodyn School	11.44	9.62	9.72	0.10	0%	Imperceptible	Negligible
R06	Gilfach-Cynon	34.24	28.11	28.93	0.82	2%	Small	Negligible
R07	Gilfach-Cynon	33.96	27.88	28.69	0.81	2%	Small	Negligible
R08	Alexandra Terrace	31.78	26.08	26.81	0.73	2%	Small	Negligible
R09	Alexandra Terrace	37.37	30.70	31.59	0.89	2%	Small	Slight Adverse
R10	Twynyrodyn Rd	36.20	29.72	30.57	0.85	2%	Small	Slight Adverse
R11	Twynyrodyn Rd	39.51	32.47	33.40	0.93	2%	Small	Slight Adverse
R12	Twynyrodyn Rd	41.10	33.79	34.76	0.97	2%	Small	Slight Adverse
R13	Twynyrodyn Rd	39.74	32.65	33.57	0.92	2%	Small	Slight Adverse
R14	Court Terrace	41.10	33.77	34.71	0.94	2%	Small	Slight Adverse
R15	Court Terrace	44.09	36.27	37.28	1.01	3%	Small	Slight Adverse
R16	Court Terrace	29.04	23.73	24.25	0.52	1%	Very Small	Negligible

ID	Name	2019 Baseline	2022 Future Baseline	2022 With Development	2022 Impact	2022 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R17	Tramroadside N	15.20	12.68	12.70	0.02	0%	Imperceptible	Negligible
R18	High Street	22.92	18.64	18.90	0.26	1%	Very Small	Negligible
R19	Westbourne Place	27.25	21.86	21.88	0.02	0%	Imperceptible	Negligible
R20	Plymouth St	24.03	19.32	19.36	0.04	0%	Imperceptible	Negligible
E01	SE Corner of Site			10.95				No risk of exceedance
E02	NE Corner of Site			11.26				No risk of exceedance
E03	NW Corner of Site			10.4				No risk of exceedance
E04	SW Corner of Site			8.45				No risk of exceedance

Table D-2 – Modelled (verified) annual mean nitrogen dioxide, 2032 ($\mu\text{g}/\text{m}^3$)

ID	Name	2019 Basline	2032 Future Baseline	2032 With Development	2032 Impact	2032 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R01	Oak Tree Rise	20.67	9.43	9.50	0.07	0%	Imperceptible	Negligible
R02	Penheolferthyr	18.69	9.05	9.24	0.19	0%	Imperceptible	Negligible
R03	Elm Tree Grove	20.67	10.13	10.50	0.37	1%	Very Small	Negligible
R04	Penheolferthyr	21.42	10.45	10.65	0.20	1%	Very Small	Negligible
R05	Twynyrodyn School	11.44	6.66	6.72	0.06	0%	Imperceptible	Negligible
R06	Gilfach-Cynon	34.24	15.73	16.13	0.40	1%	Very Small	Negligible
R07	Gilfach-Cynon	33.96	15.63	16.01	0.38	1%	Very Small	Negligible
R08	Alexandra Terrace	31.78	14.72	15.06	0.34	1%	Very Small	Negligible
R09	Alexandra Terrace	37.37	17.08	17.50	0.42	1%	Very Small	Negligible
R10	Twynyrodyn Rd	36.2	16.58	16.98	0.40	1%	Very Small	Negligible
R11	Twynyrodyn Rd	39.51	18.00	18.44	0.44	1%	Very Small	Negligible
R12	Twynyrodyn Rd	41.1	18.69	19.15	0.46	1%	Very Small	Negligible
R13	Twynyrodyn Rd	39.74	18.09	18.53	0.44	1%	Very Small	Negligible
R14	Court Terrace	41.1	18.67	19.12	0.45	1%	Very Small	Negligible
R15	Court Terrace	44.09	19.97	20.46	0.49	1%	Very Small	Negligible
R16	Court Terrace	29.04	13.49	13.72	0.23	1%	Very Small	Negligible

ID	Name	2019 Basline	2032 Future Baseline	2032 With Development	2032 Impact	2032 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R17	Tramroadside N	15.2	8.09	8.10	0.01	0%	Imperceptible	Negligible
R18	High Street	22.92	10.79	10.91	0.12	0%	Imperceptible	Negligible
R19	Westbourne Place	27.25	12.47	12.48	0.01	0%	Imperceptible	Negligible
R20	Plymouth St	24.03	11.23	11.25	0.02	0%	Imperceptible	Negligible
E01	SE Corner of Site			6.94				No risk of exceedance
E02	NE Corner of Site			7.40				No risk of exceedance
E03	NW Corner of Site			7.01				No risk of exceedance
E04	SW Corner of Site			6.10				No risk of exceedance

Table D-3 – Modelled (verified) annual mean PM₁₀, 2022 (µg/m³)

ID	Name	2019 Baseline	2022 Future Baseline	2022 With Development	2022 Impact	2022 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R01	Oak Tree Rise	13.60	13.08	13.11	0.03	0%	Imperceptible	Imperceptible/Negligible
R02	Penheolferthyr	13.80	13.33	13.43	0.11	0%	Imperceptible	Imperceptible/Negligible
R03	Elm Tree Grove	14.46	13.95	14.13	0.18	0%	Imperceptible	Imperceptible/Negligible
R04	Penheolferthyr	14.66	14.16	14.26	0.10	0%	Imperceptible	Imperceptible/Negligible
R05	Twynyrodyn School	12.77	12.27	12.29	0.02	0%	Imperceptible	Imperceptible/Negligible
R06	Gilfach-Cynon	16.73	16.21	16.40	0.19	0%	Imperceptible	Imperceptible/Negligible
R07	Gilfach-Cynon	16.69	16.17	16.36	0.19	0%	Imperceptible	Imperceptible/Negligible
R08	Alexandra Terrace	16.28	15.76	15.93	0.17	0%	Imperceptible	Imperceptible/Negligible
R09	Alexandra Terrace	17.36	16.83	17.04	0.21	1%	Very Small	Negligible
R10	Twynyrodyn Rd	17.13	16.60	16.80	0.20	0%	Imperceptible	Imperceptible/Negligible
R11	Twynyrodyn Rd	17.78	17.25	17.47	0.22	1%	Very Small	Negligible
R12	Twynyrodyn Rd	18.10	17.56	17.80	0.24	1%	Very Small	Negligible
R13	Twynyrodyn Rd	17.81	17.27	17.49	0.22	1%	Very Small	Negligible
R14	Court Terrace	18.03	17.49	17.71	0.23	1%	Very Small	Negligible
R15	Court Terrace	18.62	18.07	18.32	0.25	1%	Very Small	Negligible
R16	Court Terrace	15.39	14.85	14.95	0.10	0%	Imperceptible	Imperceptible/Negligible

ID	Name	2019 Baseline	2022 Future Baseline	2022 With Development	2022 Impact	2022 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R17	Tramroadside N	13.43	12.93	12.94	0.01	0%	Imperceptible	Imperceptible/Negligible
R18	High Street	14.27	13.77	13.83	0.05	0%	Imperceptible	Imperceptible/Negligible
R19	Westbourne Place	16.00	15.49	15.49	0.00	0%	Imperceptible	Imperceptible/Negligible
R20	Plymouth St	15.33	14.82	14.83	0.01	0%	Imperceptible	Imperceptible/Negligible
E01	SE Corner of Site			11.97				No risk of exceedance
E02	NE Corner of Site			12.65				No risk of exceedance
E03	NW Corner of Site			12.45				No risk of exceedance
E04	SW Corner of Site			12.06				No risk of exceedance

Table D-4 – Modelled (verified) annual mean PM₁₀, 2032 (µg/m³)

ID	Name	2019 Basline	2032 Future Baseline	2032 With Development	2032 Impact	2032 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R01	Oak Tree Rise	13.60	12.76	12.79	0.03	0%	Imperceptible	Negligible
R02	Penheolferthyr	13.80	13.04	13.14	0.10	0%	Imperceptible	Negligible
R03	Elm Tree Grove	14.46	13.64	13.81	0.17	0%	Imperceptible	Negligible
R04	Penheolferthyr	14.66	13.87	13.97	0.10	0%	Imperceptible	Negligible
R05	Twynyrodyn School	12.77	11.87	11.89	0.02	0%	Imperceptible	Negligible
R06	Gilfach-Cynon	16.73	16.03	16.22	0.19	0%	Imperceptible	Negligible
R07	Gilfach-Cynon	16.69	16.00	16.18	0.18	0%	Imperceptible	Negligible
R08	Alexandra Terrace	16.28	15.57	15.73	0.16	0%	Imperceptible	Negligible
R09	Alexandra Terrace	17.36	16.70	16.90	0.20	1%	Very Small	Negligible
R10	Twynyrodyn Rd	17.13	16.46	16.65	0.19	0%	Imperceptible	Negligible
R11	Twynyrodyn Rd	17.78	17.14	17.36	0.22	1%	Very Small	Negligible
R12	Twynyrodyn Rd	18.10	17.47	17.70	0.23	1%	Very Small	Negligible
R13	Twynyrodyn Rd	17.81	17.16	17.38	0.21	1%	Very Small	Negligible
R14	Court Terrace	18.03	17.38	17.60	0.22	1%	Very Small	Negligible
R15	Court Terrace	18.62	18.00	18.24	0.24	1%	Very Small	Negligible
R16	Court Terrace	15.39	14.57	14.66	0.10	0%	Imperceptible	Negligible

ID	Name	2019 Basline	2032 Future Baseline	2032 With Development	2032 Impact	2032 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R17	Tramroadside N	13.43	12.58	12.58	0.01	0%	Imperceptible	Negligible
R18	High Street	14.27	13.48	13.53	0.05	0%	Imperceptible	Negligible
R19	Westbourne Place	16.00	15.27	15.27	0.00	0%	Imperceptible	Negligible
R20	Plymouth St	15.33	14.56	14.57	0.01	0%	Imperceptible	Negligible
E01	SE Corner of Site			11.59				No risk of exceedance
E02	NE Corner of Site			12.26				No risk of exceedance
E03	NW Corner of Site			12.06				No risk of exceedance
E04	SW Corner of Site			11.65				No risk of exceedance

Table D-5 – Modelled (verified) annual mean PM_{2.5}, 2022 (µg/m³)

ID	Name	2019 Baseline	2022 Future Baseline	2022 With Development	2022 Impact	2022 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R01	Oak Tree Rise	8.79	8.34	8.36	0.02	0%	Imperceptible	Imperceptible/Negligible
R02	Penheolferthyr	8.86	8.44	8.50	0.06	0%	Imperceptible	Imperceptible/Negligible
R03	Elm Tree Grove	9.56	9.11	9.22	0.11	0%	Imperceptible	Imperceptible/Negligible
R04	Penheolferthyr	9.68	9.23	9.29	0.06	0%	Imperceptible	Imperceptible/Negligible
R05	Twynyrodyn School	8.52	8.11	8.13	0.01	0%	Imperceptible	Imperceptible/Negligible
R06	Gilfach-Cynon	10.95	10.45	10.56	0.11	0%	Imperceptible	Imperceptible/Negligible
R07	Gilfach-Cynon	10.93	10.43	10.54	0.11	0%	Imperceptible	Imperceptible/Negligible
R08	Alexandra Terrace	10.68	10.18	10.28	0.10	0%	Imperceptible	Imperceptible/Negligible
R09	Alexandra Terrace	11.34	10.82	10.94	0.12	0%	Imperceptible	Imperceptible/Negligible
R10	Twynyrodyn Rd	11.20	10.68	10.80	0.12	0%	Imperceptible	Imperceptible/Negligible
R11	Twynyrodyn Rd	11.60	11.07	11.20	0.13	1%	Very Small	Negligible
R12	Twynyrodyn Rd	11.79	11.25	11.39	0.14	1%	Very Small	Negligible
R13	Twynyrodyn Rd	11.61	11.08	11.21	0.13	1%	Very Small	Negligible
R14	Court Terrace	11.75	11.21	11.34	0.13	1%	Very Small	Negligible
R15	Court Terrace	12.11	11.55	11.70	0.15	1%	Very Small	Negligible
R16	Court Terrace	10.13	9.64	9.70	0.06	0%	Imperceptible	Imperceptible/Negligible

ID	Name	2019 Baseline	2022 Future Baseline	2022 With Development	2022 Impact	2022 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R17	Tramroadside N	8.98	8.56	8.56	0.00	0%	Imperceptible	Imperceptible/Negligible
R18	High Street	9.19	8.75	8.78	0.03	0%	Imperceptible	Imperceptible/Negligible
R19	Westbourne Place	10.50	10.02	10.02	0.00	0%	Imperceptible	Imperceptible/Negligible
R20	Plymouth St	10.09	9.62	9.63	0.01	0%	Imperceptible	Imperceptible/Negligible
E01	SE Corner of Site			7.68				No risk of exceedance
E02	NE Corner of Site			8.34				No risk of exceedance
E03	NW Corner of Site			8.22				No risk of exceedance
E04	SW Corner of Site			7.99				No risk of exceedance

Table D-6 – Modelled (verified) annual mean PM_{2.5}, 2032 (µg/m³)

ID	Name	2019 Basline	2032 Future Baseline	2032 With Development	2032 Impact	2032 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R01	Oak Tree Rise	8.79	8.01	8.03	0.02	0%	Imperceptible	Imperceptible/Negligible
R02	Penheolferthyr	8.86	8.14	8.20	0.06	0%	Imperceptible	Imperceptible/Negligible
R03	Elm Tree Grove	9.56	8.79	8.89	0.10	0%	Imperceptible	Imperceptible/Negligible
R04	Penheolferthyr	9.68	8.92	8.98	0.06	0%	Imperceptible	Imperceptible/Negligible
R05	Twynyrodyn School	8.52	7.77	7.79	0.01	0%	Imperceptible	Imperceptible/Negligible
R06	Gilfach-Cynon	10.95	10.16	10.27	0.11	0%	Imperceptible	Imperceptible/Negligible
R07	Gilfach-Cynon	10.93	10.14	10.25	0.10	0%	Imperceptible	Imperceptible/Negligible
R08	Alexandra Terrace	10.68	9.90	9.99	0.09	0%	Imperceptible	Imperceptible/Negligible
R09	Alexandra Terrace	11.34	10.54	10.66	0.12	0%	Imperceptible	Imperceptible/Negligible
R10	Twynyrodyn Rd	11.20	10.41	10.52	0.11	0%	Imperceptible	Imperceptible/Negligible
R11	Twynyrodyn Rd	11.60	10.80	10.92	0.12	0%	Imperceptible	Imperceptible/Negligible
R12	Twynyrodyn Rd	11.79	10.99	11.12	0.13	1%	Very Small	Negligible
R13	Twynyrodyn Rd	11.61	10.81	10.93	0.12	0%	Imperceptible	Imperceptible/Negligible
R14	Court Terrace	11.75	10.94	11.06	0.13	1%	Very Small	Negligible
R15	Court Terrace	12.11	11.29	11.43	0.14	1%	Very Small	Negligible
R16	Court Terrace	10.13	9.32	9.38	0.06	0%	Imperceptible	Imperceptible/Negligible

ID	Name	2019 Basline	2032 Future Baseline	2032 With Development	2032 Impact	2032 Impact as % of Objective	EPUK/IAQM Magnitude	EPUK/IAQM Descriptor
R17	Tramroadside N	8.98	8.24	8.24	0.00	0%	Imperceptible	Imperceptible/Negligible
R18	High Street	9.19	8.43	8.46	0.03	0%	Imperceptible	Imperceptible/Negligible
R19	Westbourne Place	10.50	9.72	9.73	0.00	0%	Imperceptible	Imperceptible/Negligible
R20	Plymouth St	10.09	9.32	9.32	0.01	0%	Imperceptible	Imperceptible/Negligible
E01	SE Corner of Site			7.34				No risk of exceedance
E02	NE Corner of Site			8.00				No risk of exceedance
E03	NW Corner of Site			7.88				No risk of exceedance
E04	SW Corner of Site			7.65				No risk of exceedance





1 Capital Quarter
Tyndall Street
Cardiff
CF10 4BZ

wsp.com

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