Welsh Government

M4 Corridor around Newport

Environmental Statement Volume 1

Chapter 7: Air Quality

M4CAN-DJV-EAQ-ZG_GEN--REP-EN-0001.docx

At Issue | March 2016

CVJV/AAR
3rd Floor
Longross Court,
47 Newport Road,
Cardiff
CF24 0AD

Contents

7 Air Quality

7.1 Introduction

7.1.1 This chapter examines the potential effect of the Scheme on local and regional air quality during both the construction and operational phases.

7.1.2 The Scheme would transfer approximately 30-45% of traffic from the existing M4, between Junctions 23A and 29, onto the new section of motorway to the south of Newport. Traffic related pollution in the urban areas adjacent to the existing M4 is therefore predicted to improve as a result of the Scheme. However, the Scheme has the potential to increase traffic related pollution along the proposed new section of motorway.

7.1.3 Emissions from motor vehicle exhausts contain a number of pollutants, including oxides of nitrogen (NO_x), nitrogen dioxide (NO_2), carbon monoxide (CO), hydrocarbons, carbon dioxide (CO_2) and fine particulate matter (PM). The quantities of each pollutant emitted depend on the type of vehicle, quantity and type of fuel used, engine size, speed of the vehicle and abatement equipment fitted. Once emitted, the pollutants are diluted and dispersed in the air.

7.1.4 The air pollutants of concern in the context of this assessment are NO_x, NO_2, fine particles (PM_{10}) and CO_2. The other pollutants mentioned above, namely CO and hydrocarbons have not been included in the assessment as they have not been identified as being at risk of exceeding relevant air quality standards at any location across the UK, as discussed in the Air Pollution in the UK (Defra, 2015) document published by Defra. The assessed pollutants are those which have been identified to be present at concentrations close to or above relevant air quality standards in areas where traffic emissions are the main source of air pollutants.

7.2 Legislation and Policy Context

Relevant Legislation

7.2.1 In Wales, objectives for specified air quality pollutants are set in national legislation. Additionally, limit values (pollutant concentrations not to be exceeded by a certain date) are set by the European Union and are used to determine the UK's compliance with EU legislation. Both national air quality objectives and EU limit values have been used within this assessment to inform the significance of effect.

EU Limit Values

7.2.2 In May 2008, Council Directive (2008/50/EC) on Ambient Air Quality and Cleaner Air for Europe (Air Quality Directive) came into force. The Directive sets 'limit values' and 'target values' for ambient concentrations of pollutants for both the protection of human health and vegetation. The limit values defined in the Directive are legal requirements and compliance with these is reported on an annual basis by the Department for Environment, Food and Rural Affairs (Defra). The Directive also covers the division of the UK into zones for the purpose of compliance reporting.

7.2.3 The EU Directive was transposed into national legislation in Wales by the Air Quality Standards (Wales) Regulations 2010.

7.2.4 The Scheme is located in the South Wales Zone (UK0041). An overview of air quality and recorded exceedences of the limit values in recent years is outlined in Defra's Air Quality Plan for South Wales (Defra *et al.,* 2015b). The Air Quality Plan outlines the exceedences of the limit value and future predictions to determine when the zone will be compliant with the EU Directive. It also outlines measures at a local level that are being considered to improve air quality. The Air Quality Plan indicated that the zone recorded an exceedence of the EU limit value in 2013. However, the report predicted that by 2020 the majority of the zone would be compliant with the EU Directive, including the existing M4 corridor. In 2020, the only road where an exceedence (41µg/m^3) of the EU limit value is predicted in The Air Quality Plan, is along the A48 Eastern Avenue, approximately 5 km south west of Junction 29 of the M4. By 2025, the entire zone is predicted to be compliant with the EU Directive. Assuming a linear rate of decrease between 2020 and 2025 predicted concentrations, the zone is also anticipated to be compliant by the opening year of the Scheme (2022). The Scheme itself is listed as an 'improvement measure' for air quality, in The Air Quality Plan.

7.2.5 The methodology set out in Interim Advice Note 174/13 (Highways Agency, 2013b) has been taken into account in considering the Scheme's impact upon EU limit values when assessing overall significance.

Welsh Objectives

7.2.6 The current Air Quality Strategy for England, Scotland, Wales and Northern Ireland was published in 2007 (Defra *et al*., 2007). This sets the strategy for meeting the air quality objectives. The Local Air Quality Management (LAQM) system, required to be undertaken by local planning authorities under the Environment Act 1995, assesses where the UK objectives may be exceeded. Where exceedences are recorded, an Air Quality Management Area (AQMA) must be declared by the local authority and an Air Quality Action Plan (AQAP) prepared to implement measures to improve air quality in these areas. The impact of the Scheme upon air quality concentrations in relation to the air quality objectives has been used to inform the overall significance of effect of the Scheme as set out in IAN 174/13 (Highways Agency, 2013b).

Air Quality Objectives and Limit Values

7.2.7 The air quality EU limit values and Welsh air quality objectives applicable to the Scheme are shown in Table 7.1. Some pollutants have standards expressed as annual mean concentrations due to the chronic way in which they affect health or the natural environment (i.e. effects occur after a prolonged period of exposure to elevated concentrations). Others have standards expressed as 24-hour, 1-hour or 15-minute mean concentrations due to the acute way in which they affect health or the natural environment (i.e. after a relatively short period of exposure). Some pollutants have standards expressed in terms of both long term and short term concentrations.

Table 7.1: Air Quality Standards

Pollutant	Averaging Period	EU Limit Value / Welsh Objective	Date for Compliance
Human Health			
Nitrogen Dioxide ($NO_{2)}$	Annual mean	40µg/m^3	Wales(a) 11 June 2010
			EU(b) 01 Jan 2010
	1-hour mean	200µg/m^3 not to be exceeded more than 18 times a year (99.8th percentile)	Wales(a) 11 June 2010
			EU(b) 01 Jan 2010
Fine Particulate Matter (PM_{10})	Annual mean	40µg/m^3	Wales(a) 11 June 2010
			EU(b) 01 Jan 2005
	24-hour mean	50µg/m^3 not to be exceeded more than 35 times a year (90. 4th percentile)	Wales(a) 11 June 2010
			EU(b) 01 Jan 2005
Designated Sites			
Nitrogen Oxide (NO_x) c)	Annual mean	30 µg/m^3	31 Dec 2000 Wales(a)
			19 July 2001 EU(b)
(a) The Air Quality Standards (Wales) Regulations 2010, No. 1433 (b) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (c) For the protection of vegetation only			

7.2.8 The limit values for the protection of vegetation apply to locations more than 20 km from towns with more than 250,000 inhabitants or more than 5 km from other built-up areas, industrial installations or motorways. As stated in the EU Directive, monitoring sites need to be representative of an area of 1,000 square kilometres, the limit value does not therefore have a statutory basis in micro-scale environments such as those close to a road or other pollution source.

7.2.9 The United Nations Economic Commission for Europe (UNECE) and the World Health Organisation (WHO) have set a critical level for NO_x, (30 µg/m^3) for the protection of vegetation. Therefore, the statutory nature conservation agency's (Natural Resources Wales) policy is to apply the 30 µg/m^3 criterion as a benchmark, on a precautionary basis, in internationally designated conservation sites and in nationally designated Sites of Special Scientific Interest (SSSIs) designated for the protection of vegetation.

7.2.10 In addition, critical loads for nitrogen deposition have been set that represent (according to current knowledge) the exposure below which there should be no significant harmful effects on sensitive elements of the ecosystem. Critical Loads are determined based on habitat and therefore vary between designated sites. Critical Loads for each of the designated sites assessed have been determined using the Air Pollution Information System (APIS) website (Centre for Ecology and Hydrology, 2014) and in discussion with the ecology specialists for the Scheme and Natural Resources Wales. Critical Loads applied to those

designated sites assessed are provided in Table 7.2 in Section 7.3 of this chapter.

7.2.11 The Welsh Government also has duties under Section 42 of the Natural Environment and Rural Communities Act to exercise its functions for the purpose of conserving biodiversity. In addition, for SSSIs, the Welsh Government under Section 28G of the Wildlife and Countryside Act has a duty to take reasonable steps, consistent with proper exercise of the authority's functions, to further the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which the site is of special scientific interest. Changes in air quality could impact on the conservation and enhancement of vegetation at SSSIs.

Planning Policy Context

National Planning Policy

7.2.12 Planning Policy Wales (Welsh Government, 2016a) sets out land use planning policies for Wales. One of the underlying aims is the protection of the environment, which includes air quality policies. Specific policies relating to air quality are provided by Planning Policy Wales, including the following.

- Policy 13.10 - Improving the Quality of Water and Air.
- Policy 13.11 - Development Plans and Improving the Quality of Water and Air.
- Policy 13.12 - Development Management and Improving the Quality of Water and Air.

7.2.13 Chapter 8 of Planning Policy Wales includes policies specifically related to transport, including the highway network which is more relevant for this Scheme, and it is noted that emissions from transport contribute significantly to climate change and air pollution, which can in turn affect human health. It also states that development plan policies and decisions on planning applications should take into account statutory air quality objectives, together with the results of air quality reviews and assessments and any air quality management plans or area action plans. Planning Policy Wales promotes the need to integrate the strategies and policies for both transport and air quality.

7.2.14 In addition to the above, the Wales Transport Strategy (Welsh Government, 2008) aims to reduce the contribution of transport to air pollution and other harmful emissions. The strategy states that transport development which could increase air pollution levels in air quality management areas or lead to new areas being created will not normally be supported.

7.2.15 National planning policy has been considered when undertaking the assessment of the Scheme having particular regard to the need to take into account statutory air quality objectives.

Local Planning Policy

7.2.16 The study area for the air quality assessment, as discussed later in this chapter, covers a number of local authority areas. The Scheme is located within the administrative areas of Newport and Monmouthshire. However, changes in traffic across the network as a result of the Scheme are predicted in adjacent local

planning authorities. Planning policy relating to air quality for each of the local planning authorities within the study area is outlined below. Planning policy and AQMAs designated by local authorities has been considered when undertaking the assessment.

Newport

7.2.17 The Newport Local Development Plan 2011-2016 was adopted in January 2015 (Newport City Council, 2015).

7.2.18 Objective 9 of the Local Development Plan relates to health and well-being and states that planning and development should provide an environment that is safe and encourages healthy lifestyle choices and promotes well-being. This includes, among other factors, issues relating to air quality which should be taken into account during the planning process, such as whether the Scheme complies with the air quality objectives.

7.2.19 Policy GP7 states that development will not be permitted which would cause or result in unacceptable harm to health because of air pollution or any other identified risk to environment, local amenity or public health and safety. This policy relates to air pollution and any loss of amenity generated by the Scheme.

7.2.20 Policy SP14 relates to transport proposals and states that such proposals will be supported where they result in environmental improvements, including air quality.

7.2.21 Newport City Council has declared a number of AQMAs. As a result, Newport City Council has prepared an AQAP, as required under the Environment Act, which contains measures to improve local air quality in AQMAs across Newport. The AQAP for Newport is currently being updated. The existing plan was published in 2008 (Newport City Council, 2008) and made reference to the 'New M4 scheme' as a measure to target pollutant concentrations within AQMAs adjacent to the existing M4.

Monmouthshire

7.2.22 The Monmouthshire Local Development Plan 2011-2021 was adopted in February 2014 (Monmouthshire County Council, 2014).

7.2.23 Policy EP1 states that development proposals that would result in unacceptable risk or harm due to air, light, noise or water pollution, contamination or land instability will not be permitted. The supporting text requires that:

'Where it is considered that a development proposal may impact upon an AQMA, or exacerbate an existing problem, developers will be required to provide an assessment of air quality impact, together with proposals for mitigation.'

7.2.24 Monmouthshire County Council has identified two AQMAs, located on the A48 in Chepstow and at Bridge Street, Usk. AQAPs have been prepared for these locations. However, the documents do not include any measures relating directly to the existing M4 or the Scheme.

Cardiff

7.2.25 The Local Development Plan for Cardiff was adopted in January 2016 (Cardiff City Council, 2016). In relation to air quality the following policies are included.

- Policy KP18: Natural Resources – (iii) minimising air pollution from industrial, domestic and road transport sources and managing air quality.
- Policy EN13: Air, Noise, Light Pollution and Land Contamination – Development will not be permitted where it would cause or result in unacceptable harm to health, local amenity, the character and quality of the countryside, or interests of nature conservation, landscape or built heritage importance because of air, noise, light pollution or the presence of unacceptable levels of land contamination.
- Policy T2: Strategic Rapid Transit and Bus Corridors – Improvements to the cities bus network.
- Policy KP8: Sustainable Transport – Improvements will be made across the wider Cardiff area to improve sustainable transport.

7.2.26 Cardiff City Council has declared a number of AQMAs. AQAPs have been prepared for these locations. However, the documents do not include any measures relating directly to the existing M4 or the Scheme.

Torfaen

7.2.27 The Local Development Plan for Torfaen was adopted in December 2013 (Torfaen County Borough Council, 2013). This includes a borough wide general policy relating to development proposals (BW1).

'All development proposals will be considered favourably providing they comply with the following criteria where they are applicable:-

The proposal does not result in unacceptable adverse effects in respect of land contamination, instability or subsidence; air, heat, noise or light pollution; landfill gas; water pollution; or flooding, from or to the proposal;…'

7.2.28 There are no AQMAs declared for the Torfaen administrative area.

Forest of Dean

7.2.29 Forest of Dean District Council adopted their Core Strategy in February 2012 (Forest of Dean District Council, 2012). The Core Strategy is an overall vision setting out how the district and places within it should evolve. Policy CSP.1, Design and Environmental Protection, requires the potential for development to cause pollution to be considered and, where existing problems occur, mitigation should be implemented. Where the development does not accommodate this it will not be permitted.

7.2.30 An AQMA has been declared by the Forest of Dean District Council in Lydney. However, this is located outside of the study area for the assessment.

South Gloucestershire

7.2.31 South Gloucestershire Council's Core Strategy was adopted in December 2013 (South Gloucestershire Council, 2013). The document sets out the spatial vision and strategic objectives as well as a delivery strategy. The following objectives and policies are relevant to air quality.

- Objective: Reducing congestion and air pollution by improving accessibility by means other than the private car.

- Policy CS9 - 11. Protecting land, air, aqueous environments, buildings and people from pollution.

7.2.32 South Gloucestershire Council has declared a number of AQMAs. However, these lie outside of the study area for the assessment.

7.3 Assessment Methodology

7.3.1 The following three assessments have been undertaken to determine the likely significant air quality effects arising as a result of the Scheme.

- A local air quality assessment for the existing M4, the proposed new section of motorway and any other roads which are included in the affected road network (defined below in 'Study Area' section of this chapter).
- A dust and assessment of air quality impacts from traffic for the construction phase.
- A regional assessment, which involves a calculation of the total change in NO_x, PM_{10} and CO_2 pollutant emissions that would result from the Scheme.

7.3.2 The following potential air quality effects have been scoped out of the air quality assessment.

7.3.3 The operation of site equipment, vehicles and machinery during the construction of the Scheme would result in emissions to the atmosphere of exhaust gases, but such emissions are unlikely to be significant, particularly in comparison to levels of similar emissions from vehicle movements on the local road network. Mitigation would reduce any impacts, including equipment meeting recent emission control standards, operating well-maintained vehicles and planning to reduce trip generation. As such, the impacts of site equipment have been scoped out of this assessment.

Relevant Guidance

7.3.4 The method for assessing the likely air quality effects of the Scheme has followed the detailed assessment methodology guidance described in DMRB Volume 11, Section 3, Part 1: HA 207/07 (Highways Agency *et al.,* 2007), hereafter referred to as the DMRB HA207/07.

7.3.5 In addition to the DMRB, the construction dust assessment has followed guidance on the assessment of dust from demolition and construction published by the Institute of Air Quality Management (IAQM), as this provides a more detailed assessment methodology and significance criteria and in doing so represents environmental best practice.

7.3.6 The operational assessment has considered the associated IANs, including the following.

- IAN 174/13 (Highways Agency, 2013b) Updated Advice for Evaluating Significant Local Air Quality Effects for DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA 207/07).
- IAN 170/12v3 (Highways Agency, 2013c) Updated Air Quality Advice on the Assessment of Future NO_x and NO_2 Projections for Users of DMRB Volume 11, Section 3, Part 1 'Air Quality'.IAN 185/15 (Highways Agency, 2015)

Updated Traffic, Air Quality and Noise Advice on the Assessment of Link Speeds and Generation of Vehicle Data into 'Speed-bands' for Users of DMRB Volume 11, Section 3, Part 1 'Air Quality' and Volume 11, Section 3, Part 7 Noise.

7.3.7 The IANs listed above have not yet been adopted in Wales. However, it is considered that these IANs reflect current best practice guidance and, as there is no suitable Welsh equivalent guidance, these have been used to inform the proposed method of assessment. It is acknowledged that references to the National Planning Policy Framework (NPPF) set out in the above IANs are not relevant in the Welsh context. Welsh policy is as discussed in Section 7.2.

7.3.8 It has been noted that Highways England have produced IAN 175/13 (Highways Agency, 2013a) to assess compliance with the EU Directive. IAN175/13 has been withdrawn and is currently pending update. Therefore, no assessment has been undertaken following the IAN175/13 assessment methodology.

Study Area

7.3.9 The study area for the air quality assessment of the Scheme is shown on Figure 7.1.

7.3.10 The construction dust assessment study area includes a 350 metre buffer around any construction works, including haul routes, compound areas, soil storage areas and borrow pits, within which effects on local air quality would be anticipated from construction works.

7.3.11 For the local air quality assessment, the Affected Road Network (ARN) is defined in the DMRB HA207/07 (Highways Agency *et al*., 2007) as those roads within the study area of the traffic model that meet any of the criteria set out below. The criteria are change based, where the change is based on the difference in traffic data or highway design between the do-minimum (without Scheme) and do-something (with Scheme) scenarios for both the opening and future assessment/design year (opening year +15 years).

- Road alignment will change by 5 metres or more.
- Daily traffic flows (two way) will change by 1,000 Annual Average Daily Traffic (AADT) or more.
- Heavy Duty Vehicle (HDV) flows (two way) will change by 200 AADT or more.
- Daily average speed (two way) will change by 10 km/hr or more.
- Peak hour speed will change by 20 km/hr or more.

7.3.12 The local assessment encompasses a 200 metre corridor (Highways Agency *et al.,* 2007) either side of the roads included in the ARN. Two types of receptors have been considered within this corridor.

- Residential properties and other sensitive receptors (such as schools, nursing homes, hospitals etc.).
- Ecological sites designated at international or national level as required by DMRB HA207/07.

7.3.13 DMRB HA207/07 states that only roads within 200 metres of a receptor need to be considered. The assessment of construction traffic has also been undertaken based on the study area for the local air quality assessment.

7.3.14 For the regional air quality assessment, the road network to be considered is defined in DMRB HA207/07 as those links within the study area, which in the Scheme opening year or future year (+15 years) meet any of the criteria below.

- Daily traffic flows (two way) will change by 10% AADT or more.
- HDV flows (two way) will change by 10% AADT or more.
- Daily average speed (two way) will change by 20km/hr or more.

7.3.15 This regional air quality assessment considers the change in pollutant emissions on a regional basis rather than locally therefore no receptors are assessed.

7.3.16 The study area of the local and regional assessment has been determined based on the criteria above applied to data resulting from the traffic forecasts reported in the traffic forecasting report (Welsh Government, 2016b).

Approach to Identification of Baseline Conditions

7.3.17 Existing or baseline ambient air quality refers to the concentration of relevant substances that are already present in the environment – these are present from various sources, such as industrial processes, commercial and domestic activities, traffic and natural sources.

7.3.18 A desk-based review of the following data sources has been undertaken to determine baseline air quality conditions in this assessment for both human and ecological receptors.

- Local authority review and assessment reports and local air quality monitoring data.
- The Welsh Air Quality Forum website.
- The Defra website.
- The Air Pollution Information System (APIS) website.
- Natural Resources Wales website.

7.3.19 In addition to air quality information available from the above sources, a Scheme specific air quality monitoring survey has been undertaken using automatic and passive monitoring methods at 24 locations across Newport. Details of the monitoring locations are shown in Appendix 7.2 and on Figure 7.2. Air quality monitoring has been undertaken for a period of two years (September 2013 - September 2015), monitored data for a full calendar year in 2014 have been used within this assessment. Monitoring has been used to aid in establishing baseline air quality conditions and has been used to verify the air quality modelling undertaken to determine the effects of the Scheme on local air quality.

7.3.20 Detailed modelling of NO_x and PM_{10} emissions has been undertaken using the ADMS Roads (version 3.4.2.0) atmospheric dispersion model from Cambridge Environmental Research Consultants (CERC) to predict baseline pollutant concentrations and verify the air quality model to provide confidence in opening

and future year predictions. Details relating to model inputs, including traffic data, receptors and meteorological data are described in more detail below.

7.3.21 Modelling has been used to predict annual mean NO_2 and PM_{10} concentrations for all human receptors selected in the operational assessment for the baseline assessment year 2014. These have been compared with the annual mean limit values to determine locations currently exceeding the EU limit values. Annual mean NO_x concentrations have also been calculated for designated sites for comparison with the annual mean NO_x limit value.

Approach to Construction Phase Dust Assessment

7.3.22 Fugitive dust emissions arising from construction and demolition activities are likely to be variable in nature and would depend upon the type and extent of activity, soil type and moisture, road surface conditions and weather conditions.

7.3.23 Construction, demolition and earthwork activities as a result of the Scheme may all have an impact on local air quality. Trackout of material onto local roads where it can be re-suspended may also affect air quality. Trackout refers to the transport of dust and PM_{10} from construction areas onto the road network.

7.3.24 To ensure that a reasonable worst case has been assessed for construction impacts, it has been assumed that dust-generating activities as a result of the Scheme could arise concurrently at any time during the period of construction for the Scheme.

7.3.25 A qualitative assessment of the impacts of nuisance dust arising during construction has been undertaken, using guidance on the assessment of dust from demolition and construction produced by the Institute of Air Quality Management (IAQM, 2014). This guidance has been produced since the publication of the DMRB (HA207/07) (Highways Agency *et al.,* 2007) and provides a more detailed assessment methodology.

7.3.26 For each of the dust-generating activities identified, the guidance considers three separate effects: annoyance due to dust soiling; harm to ecological receptors; and the risk of health effects due to a significant increase in PM_{10} exposure. The receptors can be human or ecological and are chosen based on their sensitivity to dust soiling and PM_{10} exposure.

7.3.27 The methodology takes into account the scale at which the above effects are likely to be generated (classed as small, medium or large), along with the levels of background PM_{10} concentrations and the distance to the closest receptor, in order to determine the sensitivity of the area. This is then taken into consideration when deriving the overall risk for the site. Suitable mitigation measures are proposed to reduce the risk where necessary.

7.3.28 There are five steps in the assessment process described in the IAQM guidance. These are summarised in Figure 7.3 and a brief description is provided below.

Step 1: Need for Assessment

7.3.29 The first step is the initial screening for the need for a detailed dust assessment. According to the IAQM guidance, an assessment is required where there are sensitive receptors within 350 metres of the site boundary and/or within

50 metres of the route(s) used by construction vehicles on the public highway and up to 500 metres from the site entrance(s). The guidance states that ecological receptors should only be assessed up to 50 metres from the site boundary. However, Natural Resources Wales noted in their scoping response that ecological receptors should be assessed within 200 metres of the outer edge of the working corridor of the entire new section of motorway. Therefore, the 350 metre study area has also been applied to ecological receptors.

Step 2: Assess Risk of Dust Impacts

7.3.30 This step is split into three sections as follows.

- 2A. Define the potential dust emission magnitude.
- 2B. Define the sensitivity of the area.
- 2C. Define the risk of impacts.

7.3.31 Further details are provided in the 'Assessment Criteria and Assignment of Significance' section of this chapter below.

Step 3: Determine the Site Specific Mitigation

7.3.32 Once each of the activities is assigned a risk rating, appropriate mitigation measures are identified within the IAQM guidance document. Where the risk is negligible, no mitigation measures beyond those required as best practice are necessary.

Step 4: Determine any Significant Residual Effects

7.3.33 Once the risk of dust impacts has been determined and the appropriate dust mitigation measures identified, the final step is to determine whether there are any residual significant effects. The IAQM guidance indicates that in most cases, once mitigation measures are applied, dust effects will be reduced to negligible levels and will not be significant.

Step 5: Prepare a Dust Assessment Report

7.3.34 The last step of the assessment is the preparation of a Dust Assessment Report outlining the results of the assessment of construction dust effects. This is provided within this chapter (see Sections 7.6, 7.8 and 7.10).

Approach to Construction Traffic Assessment

7.3.35 The construction phase of the Scheme would generate Heavy Goods Vehicle (HGV) movements across the local road network as a result of deliveries to and from the various site compounds and work areas. It is anticipated that a maximum volume of 1,000 m^3 of material would be moved per day. This would generate 239 HGV movements over a 10 hour day. At this stage, final routing is to be confirmed and therefore to assess a worst case scenario it has been assumed that the construction phase would result in an additional 239 HGV movements per day across the road network included in the study area assessed for the local air quality assessment (see Figure 7.1).

7.3.36 The assessment of construction traffic has been undertaken using ADMS-Roads detailed dispersion modelling, following the approach outlined below in the

'Approach to Local Air Quality Assessment' section. The assessment of effects from construction traffic has been undertaken for an assessment scenario of 2018, which is the likely start of the construction phase. The additional HGV movements have been added to the 2014 existing scenario traffic data in the absence of traffic forecasts for 2018. This scenario has also used emission factors and background pollutant concentrations for 2018 as inputs to the dispersion modelling.

7.3.37 By using the study area of the local air quality assessment this ensures that an assessment is undertaken at those locations where predicted concentrations are close to or exceeding the relevant air quality objectives. It is likely that prior to construction of the haul route, HGVs would also travel along local roads within the vicinity of the proposed new section of motorway. Existing pollutant concentrations in these areas are low and therefore emissions from additional HGVs are unlikely to have a significant effect. The assessment has been undertaken for those receptors included on Figures 7.4 and 7.5.

Approach to Local Air Quality Assessment

7.3.38 Detailed dispersion modelling of NO_x and PM_{10} emissions has been undertaken using the ADMS-Roads dispersion model. The inputs to the model are as follows.

- Affected road network.
- Receptor locations.
- Meteorological data.
- Traffic data and associated vehicle pollutant emission rate.

Assessment Scenarios

7.3.39 This assessment has been undertaken for the following scenarios.

- 2014 existing scenario (for verification of the air quality model against monitoring data and IAN 170/12 methodology).
- 2014 projected base year with opening and future year emission factors and background pollutant concentrations (for use in IAN 170/12 methodology)[1].
- 2022 (opening year) without the Scheme (do-minimum).
- 2022 (opening year) with completed Scheme (do-something).
- 2037 (future year) without the Scheme (do-minimum).
- 2037 (future year) with completed Scheme (do-something).

7.3.40 With regard to local air quality, the opening year of the Scheme (2022) is likely to be the worst case scenario as vehicle emission factors and background pollutant concentrations are anticipated to decrease over time due to improvements in fuel technologies as discussed in Local Air Quality Management Technical Guidance (LAQM TG(09)) (Defra, 2009).

1 The projected base year is produced as part of the future year NO_x and NO_2 sensitivity testing carried out for IAN 170/12v3 (Highways Agency, 2013c). It has the base year traffic modelled using the opening and future year vehicle emission factors and opening and future year background concentrations.

Road Network

7.3.41 The road network for input to the model has been developed using GIS software ArcMap. The design drawings of the Scheme were converted from computer aided design software and used to create the road network in ArcMap.

7.3.42 Details such as road widths and heights, where there are flyovers and bridges, have been incorporated into the model. Terrain has been included in the model using Ordnance Survey data to ensure the effect of the changes in terrain height surrounding the existing M4 is accounted for within the assessment of effects.

Receptors

Human Health Receptors

7.3.43 In accordance with IAN 174/13 (Highways Agency, 2013b) this assessment includes sensitive human receptors within 200 metres of the ARN that have a reasonable risk of exceeding an air quality threshold. IAN 174/13 does not require modelling of every receptor, rather worst case locations and those areas where the impact of the Scheme is likely to be greatest can be selected. IAN 174/13 indicates that, if the assessment results in exceedances of a limit value, the assessment should be expanded to include all receptors that are at a reasonable risk of exceeding the relevant limit values. Table 7.1.1 of Appendix 7.1 and Figure 7.4 show the locations of receptors included within this assessment.

7.3.44 Receptor locations across the study area were taken from GIS data and were screened for receptors which are sensitive to air quality as defined in LAQM TG(09) (Defra, 2009). Receptor locations have been selected based on changes in traffic as a result of the Scheme, existing air quality conditions and their sensitivity to changes in local air quality, in areas that are likely to be the most affected as a result of the Scheme. All receptors were modelled at a height of 1.5 metres above ground level, which is representative of a human receptor.

Ecological Receptors

7.3.45 Ecological receptors, which are designated for nature conservation importance internationally, as Ramsar sites, Special Areas of Conservation (SAC) and Special Protection Areas (SPA), and nationally, as Sites of Special Scientific Interest (SSSI), have been included where they are located within 200 metres of the ARN. This is a requirement of the DMRB HA207/07 (Highways Agency *et al.,* 2007).

7.3.46 Effects at ecological receptors relating to NO_x concentrations and nitrogen deposition have been assessed in accordance with Annex F of DMRB HA207/07 (Highways Agency *et al.,* 2007). Road traffic is not a significant source of other pollutants that vegetation may be sensitive to, such as ammonia (NH_3) and sulphur dioxide (SO_2), and as such an assessment of these pollutants has been scoped out of this assessment. Ecological sites that have been assessed within the study area are listed in Table 7.1.2 of Appendix 7.1 and shown on Figure 7.5.

7.3.47 Receptor transects for each of the assessed designated sites up to 200 metres from the source, in this case any road included in the ARN, have been included to allow assessment of the drop off in emissions and deposition at increasing

distances from the road. All ecological receptor locations were modelled at a height of 0 metres representative of vegetation growing at ground level.

7.3.48 Elevated levels of NO_x can have an adverse effect on vegetation, including leaf or needle damage and reduced growth. Deposition of pollutants derived from NO_x emissions can contribute to acidification and/or eutrophication of sensitive habitats leading to loss of biodiversity. The APIS website (Centre for Ecology and Hydrology, 2014) contains critical loads for nitrogen deposition for those habitats considered sensitive to nitrogen and average nitrogen deposition rates for all designated sites in the UK. Critical loads, as well as existing nitrogen deposition rates and sensitive habitats at each of the designated sites assessed are presented in Table 7.2. The DMRB HA207/07 (Highways Agency *et al.,* 2007) indicates that nitrogen deposition rates should be reduced by 2% per year to obtain appropriate levels for assessment of the opening year and future year.

Table 7.2: Nitrogen Deposition Critical Loads for Assessed Ecological Receptors

Designated Site	Habitat	Nitrogen Deposition (kgN/ha/yr)			
		Background N Deposition (2014)	Background N Deposition (2022)	Background N Deposition (2037)	Critical Load
Fforestganol a Chwm Nofydd SSSI	Valley mires, poor fens and transition mires	16.9	14.3	10.6	10-15 kgN/ha/yr
St Brides SSSI	Marshy Grassland	9.4	8.0	5.9	10-20 kgN/ha/yr
River Usk SAC/SSSI	Pioneer, low-mid, mid-upper saltmarshes	15.1	12.8	9.5	20-30 kgN/ha/yra)
Nash & Goldcliff SSSI	Marshy Grassland	14.0	11.9	8.8	10-20 kgN/ha/yr
Whitson SSSI	Marshy Grassland	14.0	11.9	8.8	10-20 kgN/ha/yr
Langstone - Llanmartin Meadows	Low and medium altitude hay meadows/improved grassland	14.5	12.4	9.1	20-30 kgN/ha/yr
Redwick & Llandevenny	Marshy Grassland	14.8	12.6	9.3	10-20 kgN/ha/yr
Magor and Undy	Low and medium altitude hay meadows/ improved grassland	14.8	12.6	9.3	20-30 kgN/ha/yr
Nedern Brook Wetlands	Low and medium altitude hay meadows/improved grassland	14.0	11.9	8.8	20-30 kgN/ha/yr
Severn Estuary SAC/Ramsar/ SPA/SSSI	Pioneer, low-mid, mid-upper saltmarshes	11.3	9.6	7.1	20-30 kgN/ha/yr

Designated Site	Habitat	Nitrogen Deposition (kgN/ha/yr)			
		Background N Deposition (2014)	Background N Deposition (2022)	Background N Deposition (2037)	Critical Load
River Wye SAC/SSSI	Pioneer, low-mid, mid-upper saltmarshes	18.1	15.4	11.4	20-30 kgN/ha/yr
a) Saltmarshes at River Usk SSSI have been assessed against the lower critical load of 20kgN/ha/yr following discussion with Natural Resources Wales					

Contour Plots

7.3.49 In addition to discrete receptor locations, contours have been produced to show predicted annual mean NO_2 and PM_{10} concentrations within 200 metres of the roads across the operational study area. Within 20 metres of a road, the resolution of the grid has been derived using the intelligent gridding option available within the ADMS-Roads dispersion model. Between 20 and 100 metres from a road a grid resolution of 25 x 25 metres has been modelled and greater than 100 metres from the road, the grid resolution has been modelled as 50 x 50 metres. As the opening year of the Scheme is predicted to be the worst year for local air quality, contour plots have been produced for the do minimum and do something scenarios in 2022 only.

Meteorological Data

7.3.50 Hourly sequential meteorological data for the latest year of complete data (2014) from the Met Office station at Rhoose Airport, located approximately 28 km south west of the Scheme, were used in this assessment.

7.3.51 A wind rose derived from data obtained from the Rhoose Airport meteorological station area is shown in Diagram 7.1 in Appendix 7.1.

7.3.52 Sensitivity testing of the meteorological data used was undertaken. Modelled concentrations have also been determined using data available from Filton meteorological station, located approximately 26 km to the east of the Scheme. The results of this sensitivity testing can be found in Table 7.1.3 of Appendix 7.1 and these indicate that although the use of different meteorological data would result in higher total pollutant concentrations it would not change the conclusions of the air quality assessment and no exceedences of the limit values for human health are predicted. The wind rose derived from data at Filton meteorological station is shown in Diagram 7.2 of Appendix 7.1, this indicates a predominant south westerly wind direction compared with a predominantly westerly wind direction at Rhoose Airport.

7.3.53 Although sensitivity testing has shown that meteorological data from Filton results in higher modelled concentrations compared with Rhoose Airport, data from Rhoose Airport is considered to be most representative of conditions across the study area and has therefore been used in the assessment.

Traffic Data

7.3.54 Traffic data were provided for a large area around the Scheme. Traffic data were provided for AM period, Inter-Peak (IP) period, PM period and Off-Peak (OP) period and for a full day as annual average daily traffic (AADT) data along with vehicle class breakdown (car, light goods vehicles, rigid HGV, Articulated HGV

and buses/coaches) and average speeds. The AM, IP, PM and OP periods were modelled for the following periods of the day.

- AM Period - 7:00 -10:00.
- IP period - 10:00 - 16:00.
- PM period - 16:00 - 19:00.
- OP period - 19:00 - 7:00.

7.3.55 Emissions for each of the road sources have been determined using emission rates for Light Duty Vehicles (LDVs) and Heavy Duty Vehicles (HDVs) provided in Annex C of IAN 185/15 (Highways Agency, 2015). As IAN 185/15 (Highways Agency, 2015) only provides emission rates for LDVs and HDVs, for the purposes of this assessment, cars and LGVs have been considered as LDVs, while Rigid HGV, Articulated HGV and buses/coaches have been considered as HDVs.

7.3.56 The emission rates have been selected for each link by classifying the road type (motorway, urban or rural) and applying a speed band, which is based on the average speed of the road link. Emission rates are provided up to 2030 within IAN 185/15. It is anticipated that emission rates would continue to improve beyond 2030 with the development of research and new technology to reduce emissions from vehicles further, however, the extent of this is currently unknown. Therefore emissions have been held constant at 2030 rates for the assessment of the future year assessment of the Scheme (2037) to represent a worst case assessment.

7.3.57 Research undertaken by Defra (Defra, 2012) has shown that there is a gap between projected vehicle emission reductions for NO_x and the observed annual rate of air quality improvement. Highways England (formerly the Highways Agency) has therefore provided a set of guidance for carrying out sensitivity analysis for future year NO_x and NO_2 concentrations to determine a range of likely NO_2 concentrations for the future years of assessment.

7.3.58 This guidance is provided in IAN 170/12v3 (Highways Agency, 2013c). This note provides long term annual projection factors for NO_x and NO_2. Research (Highways Agency, 2014) has shown that the projection factors provided in this document are likely to be conservative from 2017 onwards and as such an interim set of projection factors (Long Term Trends Euro 6) has been provided by Highways England to reflect the introduction of vehicles manufactured to Euro 6 emission standards into the fleet. This set of future projections has been used to determine likely future NO_x and NO_2 concentrations.

7.3.59 Modelling predictions for the opening year and future years using both the IAN185/15 and IAN170/12v3 methodologies have been reported, as required by IAN170/12v3. As IAN170/12v3 represents a more pessimistic future scenario prediction, these results have been used in the assessment of significance.

7.3.60 Emissions from vehicles travelling through the Brynglas Tunnels have been modelled using the Ginzburg and Schattanek (1997) methodology, which divides the tunnel portal emissions into three categories for the road sources exiting the tunnel. Within 0-70 metres from the exit of the tunnel, 57% of the tunnel emissions are applied, within 70-140 metres of the tunnel exit, 30% of tunnel

emissions are applied and 140 – 210 metres from the tunnel exit, 13% of tunnel emissions have been applied.

7.3.61 The traffic data provided include traffic associated with other committed developments in the area in both the opening and future year do-minimum scenarios.

NO_x to NO_2 Conversion

7.3.62 The model predicts NO_x roadside concentrations, which comprise principally nitric oxide (NO) and NO_2. The emitted NO reacts with ozone in the atmosphere to form more NO_2 whilst NO_2 breaks down in sunlight to form NO. Since only NO_2 is associated with effects on human health, the limit values for the protection of human health are based on NO_2 rather than NO_x or NO. Therefore, the amount of NO_2 needs to be calculated taking into account the atmospheric chemistry and the background concentrations of pollutants.

7.3.63 The approach for calculating the roadside conversion of NO_x to NO_2 has followed the guidance in LAQM TG(09) (Defra, 2009) and the LAQM website (Defra, 2014). This approach allows the calculation of NO_2 from NO_x concentrations, taking into account the difference between ambient NO_x concentrations with and without the Scheme, the concentrations of ozone and the different proportions of primary NO_2 emissions in different years. This approach is available as a spreadsheet calculator, with the most recent version having been released in June 2014 (v4.1).

Calculation of Short Term Statistics

7.3.64 For NO_2, the hourly mean objective is 200 µg/m^3, not to be exceeded more than 18 times per year. Analysis of UK continuous NO_2 monitoring data has shown that it is unlikely that the 1-hour mean objective would be exceeded where the annual mean objective is below 60 µg/m^3 (Defra, 2009). Therefore, potential exceedances of the 1-hour mean objective have been identified based on this criterion.

7.3.65 For PM_{10}, the daily mean objective is 50 µg/m^3, not to be exceeded more than 35 times per year. The number of 24-hour means exceeding 50 µg/m^3 has been estimated using the following relationship, as detailed in LAQM TG(09) (Defra, 2009):

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

7.3.66 This relationship indicates that where the annual mean is above 32 µg/m^3, it is possible that daily mean concentrations greater than 50 µg/m^3 could occur more than 35 times in a calendar year.

Model Verification

7.3.67 As part of the assessment, a comparison of estimated and measured NO_2 concentrations has been undertaken for the baseline year (2014). This process is known as model verification. Verification has been undertaken using the principles laid out in Section A3.223 of LAQM TG(09) (Defra, 2009). Additional receptor points have been included within the baseline modelling to represent the

location of air quality monitoring locations within 200 metres of the ARN to provide information for the verification exercise.

7.3.68 The objectives of the model verification are to evaluate model performance, determine whether model adjustment is required and to provide confidence in the assessment of opening and future years.

7.3.69 LAQM TG(09) (Defra, 2009) suggests that if the majority of modelled annual mean NO_2 concentrations are within ±25% and preferably within ±10% of the monitored concentration and there is no systematic under or over prediction, then model adjustment is not considered necessary to further improve modelled results. IAN 174/13 (Highways Agency, 2013b) notes the desirability of achieving ±10% verification where concentrations are close to or above the limit values.

7.3.70 Modelled results may not compare as well at some locations for a number of reasons including the following.

- Errors/uncertainties in traffic flow and speed data estimates.
- Model setup (including street canyons, road widths, receptor locations).
- Model limitations (treatment of roughness and meteorological data).
- Uncertainty in monitoring data (notably diffusion tubes, e.g. bias adjustment factors).
- Uncertainty in emissions/emission factors.

7.3.71 The above factors were investigated as part of the model verification process to minimise the uncertainties as far as practicable.

7.3.72 Some monitoring locations are not suitable for model verification purposes as there may be specific local influences or they are located too close to the road where LAQM TG(09) (Defra, 2009) advises they should not be used. Therefore each site was examined and consideration was given to whether it was suitable for use in the verification study.

7.3.73 Using the selected model verification locations, the modelled annual mean NO_2 concentrations were compared to local monitoring data within the ARN at 34 monitoring locations. Monitoring sites used for verification are detailed in Table 7.1.4 of Appendix 7.1. The sites used are located across the whole ARN area and are representative of roadside, urban background and background locations.

7.3.74 Following this approach, it was determined that the model was under predicting results in Newport city centre to a large extent compared with other areas of the study area where comparison between modelled and monitored concentrations was much closer. It was concluded that a separate verification factor should be used for the urban routes within Newport city centre to address the under prediction. Eight sites were available for the Newport city centre verification, which provided a verification factor of 3.11. The area where this verification factor was applied is provided in Figure 7.6. With this factor applied to the modelled results, the modelling indicates a good relationship with monitored concentrations, with all locations adjacent to the ARN within 15% with no significant under prediction where monitored concentrations are above the annual mean NO_2 standard. After adjustment, the model continues to under predict results at two locations (222 Corporation Road and 48 Chepstow Road) however the road adjacent to these monitoring locations has not been included in

the ARN as the change in traffic as a result of the Scheme is negligible. A summary of verification results in Newport city centre is provided in Table 7.3 and the full results are in Table 7.1.5 of Appendix 7.1. Graphs comparing unadjusted and adjusted NO_2 modelled concentrations in comparison with monitored concentrations are shown in Diagram 7.3 and 7.4 in Appendix 7.1.

7.3.75 The rest of the study area (with 26 verification points along the existing M4 and the surrounding areas of the proposed new section of motorway in the ARN) produced a separate verification factor of 1.17. This has been applied to all results within the rest of the ARN. A good agreement was reached with the majority of sites being within ±25% of the monitored results. The exception to this was the continuous monitor at Junction 25A of the existing M4 where concentrations are under predicted by 28% and at 158 Bassaleg Road where concentrations are over predicted by 28%. The continuous monitor is not representative of relevant public exposure therefore the under prediction of results is not a concern and the nearby monitoring location at Badminton Road, which is considered to be more representative of relevant exposure, is within 2% of monitored concentrations. The over prediction at Bassaleg Road is considered to be worst case, in addition other monitoring locations within the Bassaleg Road area indicate a good relationship with three locations within 15% of monitored concentrations. A summary of results of this verification is provided in Table 7.3, which shows the number of monitoring locations and the percentage difference between monitored and modelled concentrations, the full results are in Table 7.1.6 of Appendix 7.1. Graphs comparing unadjusted and adjusted NO_2 modelled concentrations in comparison with monitored concentrations are shown in Diagram 7.5 and 7.6 in Appendix 7.1.

7.3.76 The only area where monitored concentrations are above the annual mean NO_2 standard and where the adjusted model concentration was found to be under predicting is at Buckland Cottage, within Royal Oak AQMA. However, the model under predicts by only 12% at this location. This has been taken into consideration when assessing the significance of effects in this area and in determining compliance with the EU Directive at this location in the opening and future years.

7.3.77 Verification of modelled PM_{10} concentrations has not been undertaken due to limited monitoring locations within the ARN, it is also not considered appropriate to apply the verification factor for NO_2 due to the difference in how these pollutants behave in the atmosphere and difference in emission rates for each pollutant. As shown in the assessment of baseline conditions, monitoring of PM_{10} concentrations across the study area indicates levels below the PM_{10} objectives.

Table 7.3: Summary of Verification

Comparison of Modelled and monitored data bands	Newport City Centre Verification Monitoring Locations	Remainder of Study Area Monitoring Locations
Within +10%	2	6
Within -10%	2	7
Within +10 to 25%	0	3
Within -10 to 25%	2	6
Over +25%	0	1
Under -25%	2	3
Within ±25%	6	22
Total	8	26

Approach to Regional Air Quality Assessment

7.3.78 The regional assessment has calculated the total emissions and the change in NO_x, PM_{10} and CO_2 emissions with and without the Scheme in the opening year and the future assessment year in accordance with guidance provided in DMRB HA207/07 (Highways Agency *et al.,* 2007). The mass emissions were calculated using the pollutant emission rates provided in IAN 185/15 (Highways Agency, 2015).

7.3.79 The results of the assessment have been expressed as the mass emissions of pollutants (tonnes per year) for each scenario. The difference in emissions (expressed in tonnes per year) between the do-minimum and do-something scenarios has been calculated to determine the impacts of the Scheme on regional emissions.

Consultation

7.3.80 A summary of consultation with stakeholders or consultees is provided in the table below.

Table 7.4: Consultation Responses Relevant to this Chapter

Date	Consultee and Issue Raised	How/Where Addressed
August 2014	Public responses to Draft Plan consultation. Effects on existing air quality problems (locally and overall emissions). Potential health implications from air quality.	The Assessment of Operational Effects section (Section 7.12) of this chapter includes air quality effects on both a local and regional basis considering air quality concentrations in relation to air quality standards and mass emissions from vehicles using the road.
August 2014	Newport City Council response to Draft Plan consultation. Locations of junctions can play a critical role in local air quality. Particulate matter (construction) should be considered within air quality assessment.	The locations of junctions along the new section of motorway in relation to air quality have been considered during the design process. An assessment of the operation of junctions has been included in the Assessment of Operational Effects section (Section 7.12) of this chapter. The Assessment of Construction Effects section of this chapter (Section 7.11) outlines the assessment of air quality during the construction phase of the Scheme. This includes an assessment of dust and particulate matter.
August 2014	Public Health Wales response to Draft Plan consultation. Assessment of air quality effects in relation to health is required. Air quality is a 'huge issue' along the M4 and a key reason for trying to mitigate for all traffic congestion in the area.	Air quality has been assessed in relation to air quality standards which are health based standards. The outcome of the assessment is shown in the Assessment of Operational Effects section (Section 7.12) of this chapter.

Date	Consultee and Issue Raised	How/Where Addressed
August 2014	CTC Cymru/ Sustrans Cymru/ Natural Resources Wales responses to Draft Plan consultation. Potential changes in air quality in relation to cycle routes. Assessment should consider air quality in detail.	A detailed air quality assessment has been undertaken, the outcome of which is included in this chapter. Cycle routes have not been included as receptors as users of these routes would be transient and would not be present for periods of time consistent with the standards.
July 2015	Newport City Council (Environmental Liaison Group meeting). Potential effects on air quality on Southern Distributor Road.	The Southern Distributor Road is included in the study area of the air quality assessment, changes in local air quality along the Southern Distributor Road are included in the Assessment of Operational Effects (Section 7.12) of this chapter.
August 2015	Natural Resources Wales (NRW): Scoping Response Assessment of air pollutants at designated sites should be assessed within 200 m of the outer edge of the working corridor of the entire road scheme during the construction phase. During the operational phase, assessment should be undertaken 200 m from the operational area of the new motorway. NRW would be satisfied if deposition levels can be kept below a generic threshold for nuisance of 200 mg/m^2/day.	The effects on ecological receptors during the construction phase are included in the Assessment of Construction Effects section of this chapter (Section 7.11) and include all receptors within 350 m of construction works. Mitigation measures have been recommended (Section 7.9) to be implemented during the construction phase, these are generally effective in minimising deposition to below 200mg/m^2/day. The Assessment of Operational Effects section of this chapter (Section 7.12) contains the effect of the Scheme on ecological receptors and include receptors within 200 metres of the ARN.
September 2015	Newport City Council: Scoping Response Confirmation of what will happen to the AQMAs. Monitoring along the existing M4 is currently undertaken by Welsh Government. If AQMAs remain along this route once downgraded to an A road, NCC will expect Welsh Government to fund continued monitoring in addition to any proposed AQMA along the new M4.	The Assessment of Operational Effect section of this chapter (Section 7.12) outlines the effect of the Scheme on all AQMAs potentially affected, including those along the existing M4 corridor. Predicted pollutant concentrations are also predicted along the proposed new section of motorway in relation to the air quality standards.
November 2015	Discussion undertaken with NRW to confirm critical loads to be applied to each of the designated sites assessed within the assessment.	Critical loads have been applied as requested by NRW, these are shown in Table 7.2.

Assessment Criteria and Assignment of Significance

7.3.81 The significance of air quality effects as a result of dust impacts during the construction phase has been assessed using professional judgement having regard to guidance published by the Institute of Air Quality Management (IAQM) on the assessment of dust from demolition and construction (Institute of Air Quality Management, 2014).

7.3.82 Evaluation of the significance for the local air quality assessment has been undertaken in accordance with IAN 174/13 (Highways Agency, 2013b). This requires evaluation of significance for NO_2 and PM_{10} concentrations (human health) and for NO_x concentrations (limit value for vegetation).

7.3.83 Evaluation of the significance of the regional air quality assessment has been undertaken using professional judgement by comparing mass emissions of pollutants as a result of the Scheme with national emissions for the transport sector in Wales. National emissions of CO_2, NOx and PM_{10} associated with the transport sector in Wales are shown in Table 7.5.

Table 7.5: National Emissions for Wales

Pollutant	Total Transport Sector Emissions (Tonnes)
CO_2 [a)]	5,700,000
Nox [b)]	22,300
PM_{10} [b)]	1,380
Source: a) Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland 1990-2013, June 2015 b) Air Quality Pollutant Inventories for England, Scotland, Wales and Northern Ireland: 1990-2013, September 2015	

Receptor Sensitivity

Construction Dust

7.3.84 The construction dust assessment has considered all receptors both for human health and ecologically designated sites within 350 metres of dust generating activities during construction. The sensitivity of receptors has been assessed following the IAQM guidance as shown in Table 7.6.

Table 7.6: Receptor Sensitivity (IAQM, 2014)

Sensitivity	People to Dust Soiling Effects	People to the Health Effects of PM_{10}	Ecological Effects
High	Users can reasonably expect enjoyment of a high level or amenity; The appearance, aesthetic or value of their property would be diminished by soiling; Indicative examples include dwellings, museums and other culturally important	Locations where members of the public are exposed over a time period relevant to the air quality standards for PM10.	Locations with an international or national designation and the designated features may be affected by dust soiling; Locations where there is a community of a particularly dust sensitive species

Sensitivity	People to Dust Soiling Effects	People to the Health Effects of PM_{10}	Ecological Effects
	collections, medium and long term car parks and car showrooms.		included in the Red Data List for Great Britain.
Medium	Users would expect to enjoy a reasonable level of amenity but would not expect to enjoy the same level of amenity as in their home; The appearance, aesthetic or value of their property could be diminished by soiling; Indicative examples include parks and places of work	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality standards for PM10.	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; Locations with a national designation where the features may be affected by dust deposition. For the purpose of consistency between assessments, Sites of Importance for Nature Conservation (SINC) have been considered as being of medium sensitivity.
Low	The enjoyment of amenity would not reasonably be expected; Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; Indicative examples include playing fields, farmland (unless commercially sensitive), footpaths, short term car parks and roads.	Locations where human exposure is transient.	Locations with a local designation where the features may be affected by dust deposition.

7.3.85 The sensitivity of the surrounding area has then been determined for each dust effect from the above dust-generating activities, based on the proximity and number of receptors, their sensitivity to dust, the local PM_{10} background concentrations and any other site-specific factors. Tables 7.7, 7.8 and 7.9 show the criteria for defining the sensitivity of the area to different dust effects.

Table 7.7: Sensitivity of the Area to Dust Soiling Effects on People and Property (IAQM, 2014)

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

Table 7.8: Sensitivity of the Area to Human Health Impacts (IAQM, 2014)

Background PM_{10} Concentrations (annual mean)	Number of Receptors	Distance from the source (m)				
		<20	<50	<100	<200	<350
High receptor sensitivity						
>32 µg/m^3	> 100	High	High	High	Medium	Low
	10 -100			Medium	Low	
	< 10		Medium	Low		
28 - 32 µg/m^3	> 100	High	High	Medium	Low	Low
	10 - 100		Medium	Low		
	< 10					
24 - 28 µg/m^3	> 100	High	Medium	Low	Low	Low
	10 - 100					
	< 10	Medium	Low			
<24 µg/m^3	> 100	Medium	Low	Low	Low	Low
	10 - 100	Low				
	< 10					
Medium receptor sensitivity						
-	> 10	High	Medium	Low	Low	Low
	< 10	Medium	Low			
Low receptor sensitivity						
-	> 1	Low	Low	Low	Low	Low

Table 7.9: Sensitivity of the Area to Ecological Impacts (IAQM, 2014)

Receptor Sensitivity	Distance from the source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Local Air Quality Assessment

7.3.86 As discussed above, the receptors assessed as part of the local air quality assessment have been included as a result of these being sensitive to changes in air quality. Therefore, the environmental sensitivity of receptors included in the air quality assessment, both human health and designated sites, is 'Very High' to 'High' based on criteria provided in DMRB HA205/08 (Highways Agency *et al.,* 2008) (see Table 7.10).

Table 7.10: Descriptors of Environmental Value (or Sensitivity) as outlined by DMRB HA205/08

Value (Sensitivity)	Typical Descriptors
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low (or Lower)	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Magnitude of Impact

Construction Dust

7.3.87 Each of the dust-generating activities has been given a dust emission magnitude depending on the scale and nature of the works based on the criteria shown in Table 7.11.

Table 7.11: Categorisation of Dust Emission Magnitude (IAQM, 2014)

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

Local and Regional Air Quality Assessment

7.3.88 For the quantitative assessments of local and regional air quality impacts, the magnitude of impact has been presented as the change in pollutant

concentrations/ emissions between the do minimum and do something scenarios in the opening and future year of assessment.

7.3.89 For the local air quality assessment of human health impacts, this takes into account the guidance in Table 2.1 of IAN 174/13 (Highways Agency, 2013b), based on the change in annual mean NO_2 and PM_{10} concentrations (see Table 7.12). The terminology provided in IAN 174/13 (Highways Agency, 2013b) has been adjusted to be equivalent with the terminology outlined in DMRB HA205/08 (Highways Agency *et al*., 2008) in assessing the magnitude of impacts which is major, moderate, minor and negligible, respectively.

Table 7.12: Descriptors for Magnitude of NO_2 and PM_{10} Impacts on Human Health

Magnitude of Impact	Change in Annual Mean NO_2 and PM_{10} Concentrations
Major (large)	>4 µg/m^3
Moderate (medium)	>2 to 4 µg/m^3
Minor (small)	>0.4 to 2 µg/m^3
Negligible (imperceptible)	<0.4 µg/m^3

7.3.90 The local air quality assessment of ecological impacts also takes account of IAN 174/13 (Highways Agency, 2013b), which applies the magnitude of change based on the annual mean limit values for NO_x (see Table 7.13). As above the terminology has been adjusted to be equivalent to that outlined in DMRB HA205/08 (Highways Agency *et al.,* 2008).

Table 7.13: Descriptors for Magnitude of Impact of Change in NO_x on Ecological Receptors

Magnitude of Impact	Change in Annual Mean NO_x concentrations
Major (large)	>3 µg/m^3
Moderate (medium)	>1.5 to 3 µg/m^3
Minor (small)	>0.3 to 1.5 µg/m^3
Negligible (imperceptible)	<0.3 µg/m^3

7.3.91 For the regional air quality assessment, the magnitude of impact has been considered based on the change in pollutant emissions in tonnes per year. No specific guidance exists that indicates what change in pollutant emissions constitutes a major, moderate, minor or negligible change. Where the change in emissions as a result of the Scheme is small (<5%) compared to national emissions, the effect can be considered to be insignificant.

Significance of Effect

Dust

7.3.92 The overall risk for each dust-generating activity has been determined prior to the application of any mitigation measures (Table 7.14) and an overall risk for the site derived.

Table 7.14: Risk of Dust Impacts

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High risk site	Medium risk site	Medium risk site
Medium	High risk site	Medium risk site	Low risk site
Low	Medium risk site	Low risk site	Negligible
Earthworks			
High	High risk site	Medium risk site	Low risk site
Medium	Medium risk site	Medium risk site	Low risk site
Low	Low risk site	Low risk site	Negligible
Construction			
High	High risk site	Medium risk site	Low risk site
Medium	Medium risk site	Medium risk site	Low risk site
Low	Low risk site	Low risk site	Negligible
Trackout			
High	High risk site	Medium risk site	Low risk site
Medium	Medium risk site	Low risk site	Negligible
Low	Low risk site	Low risk site	Negligible

7.3.93 The IAQM guidance states that the aim should be to prevent significant effects on receptors through the use of effective mitigation. Mitigation measures have been recommended where the risk of dust impacts has been determined as high, medium or low.

7.3.94 The IAQM guidance indicates that in most cases, once mitigation measures are applied, dust effects will be reduced to negligible levels. Therefore, where mitigation measures are implemented the residual effect would be not significant.

Local and Regional Air Quality Assessment

7.3.95 For the local air quality assessment, the predicted levels of pollution in the do-minimum and do-something scenarios of the opening and future year of assessment have been compared with the air quality standards described in Table 7.1. It should be noted that no scale of significance, as discussed in DMRB HA205/08 (Highways Agency *et al*., 2008), has been applied to the air quality assessment.

7.3.96 Where appropriate, the guidance set out in Section 2.4 and Table 2.3 of IAN 174/13 (Highways Agency, 2013b) has been used to consider the significance in relation to public exposure.

7.3.97 Section 3 of IAN 174/13 (Highways Agency, 2013b) describes the approach to evaluation of significant local air quality effects. The guidance in Section 3 and Table 3.1 of IAN174/13 has been taken into account within the assessment (see Table 7.15).

Table 7.15: Overall Evaluation of Local Air Quality Significance

Key Criteria Questions	Yes/No
Is there a risk that environmental standards will be breached?	
Will there be a large change in environmental conditions?	
Will the effect continue for a long time?	
Will many people be affected?	
Is there a risk that designated sites, areas, or features will be affected?	
Will it be difficult to avoid, or reduce or repair or compensate for the effect?	
On balance is the overall effect significant?	
Evidence in support of the professional judgement:	

7.3.98 The evaluation of effects on designated sites has taken into account the guidance in Section 2.6 of IAN 174/13 (Highways Agency, 2013b), which indicates that changes in annual mean NO_x concentrations should form the basis for evaluating significant effects. Where no exceedence of the annual mean NO_x limit values is predicted no significant effect is likely. Where the assessment identified a potential significant effect at a designated site as a result of changes to annual mean NO_x concentrations, the assessment of nitrogen deposition rates has been used as supporting information to determine whether the Scheme results in a significant effect at designated sites.

Limitations of the Assessment

7.3.99 There are a number of limitations and uncertainties associated with air quality modelling predictions. The model is required to simplify real world conditions based upon a series of algorithms and is dependent on input data chosen. Predictions for the opening and future assessment years are based on best available information and forecasts available at the time of writing.

7.3.100 There are limitations in the traffic model and therefore the data which have been provided for use in the air quality assessment. These limitations have been overcome as far as possible by verifying the modelled concentrations against monitoring results in appropriate locations.

7.3.101 As discussed above, there is uncertainty regarding predictions of future emission factors used within the air quality assessment. Sensitivity testing of opening and future year predictions has been undertaken using the IAN170/12v3 assessment methodology, the results of which are reported and used as part of this assessment to determine the significance of effect.

7.3.102 The air quality assessment has been undertaken using national standards appropriate for EIA assessment and therefore the limitations do not affect the robustness of the air quality assessment for EIA purposes.

7.4 Baseline Environment

7.4.1 This section of the chapter describes the baseline air quality conditions in the study area. Baseline ambient air quality refers to the concentrations of relevant substances that are already present in the atmosphere – these are present from various sources, such as industrial processes, commercial and domestic activities, agriculture, traffic and natural sources.

Industrial Processes

7.4.2 Industrial air pollution sources are regulated through a system of operating permits or authorisations, requiring stringent emission limits to be met and ensuring that any releases are minimised or rendered harmless. Regulated (or prescribed) industrial processes are classified as Part A or Part B processes. Part A processes are regulated through the Pollution Prevention and Control (PPC) system (EC Directive 96/91/EC on Pollution Prevention and Control originally implemented into law via the Pollution Prevention and Control Act (1999). This was superseded in 2007 by the Environmental Permitting Regulations (EPR), these were updated in 2015. Generally, the larger, more polluting processes are regulated by Natural Resources Wales (NRW) and smaller, less polluting ones by the local planning authorities. Local planning authorities also regulate only for emissions to air whereas NRW regulate emissions to air, water and land.

7.4.3 There are a number of regulated Part A and Part B processes within the vicinity of the Scheme, primarily within the industrial areas of Newport Docks, Stephenson Street and Corporation Road. Emissions to air from these processes affect ambient air quality in these areas. However, their contributions are included in monitored data and background pollutant concentrations used in this assessment.

Review and Assessment

7.4.4 All local planning authorities are required by the Environment Act 1995 Part IV to carry out a review and assessment of air quality. This involves examining current pollutant concentrations and comparing the concentrations with the objectives in the NAQS (Defra *et al.,* 2000).

7.4.5 Where the objectives are not likely to be achieved in all relevant locations, the authority must designate these areas as AQMAs. Relevant locations where objectives apply are defined in LAQM TG(09) (Defra, 2009). Locations are based on the objective averaging period. For example, the annual mean applies at all locations where members of the public might be regularly exposed (building facades of residential properties, schools, hospitals, care homes, etc.). The 24 hour objectives would apply at all locations where the annual mean is applied as well as hotels and gardens. The one hour objectives would apply at any outdoor locations where members of the public are likely to spend one hour or longer.

7.4.6 The Scheme is likely to affect air quality within the administrative areas of six local planning authorities, Newport City Council, Monmouthshire County Council, Cardiff Council, Torfaen County Borough Council, South Gloucestershire Council and Forest of Dean District Council. Of these authorities, only Newport City Council has designated AQMAs as a result of the existing M4 corridor. Newport City Council has also designated AQMAs within the city centre, which have the potential to be affected by the Scheme. Monmouthshire County Council has designated AQMAs in Chepstow and Usk. However, these are not located within the ARN and are therefore unlikely to be affected by the Scheme. It should be noted that the AQMA in Chepstow is at the edge of the ARN. However, a review of traffic data in this location shows a decrease in vehicle movements as a result of the Scheme and therefore no adverse effect would be anticipated. AQMAs within the administrative areas of the other local planning authorities do not lie within the ARN and would not therefore be affected by the Scheme.

7.4.7 The locations of AQMAs are shown on Figure 7.7 and the AQMAs of relevance to the Scheme are described in Table 7.16.

Local Air Quality Monitoring

7.4.8 Measurements of pollutant concentrations in the local area are undertaken using both continuous monitoring instruments and passive monitoring diffusion tubes. Results of local monitoring are available from the Welsh Air Quality Forum website and from local authority air quality reports. Monitoring is carried out for all of the pollutants of concern for this assessment (NO_2 and PM_{10}). Monitoring of these pollutants was also specifically undertaken for the purposes of this assessment. Available monitoring data from Newport City Council and Scheme specific monitoring are discussed below. No air quality monitoring is undertaken within the study area by other local planning authorities.

Newport City Council

Continuous Monitoring

7.4.9 Continuous monitoring in the vicinity of the Scheme is carried out at two sites operated by Newport City Council located at St Julian's School and the existing M4 Junction 25A. A further site was installed specifically to gather baseline data for the Scheme near to Newport Athletic Stadium. Further details of these sites are provided in Table 7.2.1 and Table 7.2.5 of Appendix 7.2. The locations of these sites are shown in Figure 7.2 (scheme specific monitoring) and Figure 7.8 (sites operated by Newport City Council). Monitoring of NO_2 is undertaken at all locations, PM_{10} concentrations are also measured at the St Julian's School site. The continuous monitor at St. Julian's School is part of the UK automatic urban and rural air quality monitoring network (AURN). The continuous monitor at the existing M4 Junction 25A was commissioned by Welsh Government in 2012 as a result of national pollution climate mapping indicating that this area would exceed the annual mean NO_2 objective into the future. It should be noted that the nature of the M4 Junction 25A monitor, which is located in a roadside area not accessible by members of the public, means that it is not suitable for the purposes of local air quality management and declaring AQMAs.

7.4.10 Monitored results for NO_2 and PM_{10} for recent years (2010-2014), for the continuous monitoring locations operated by Newport City Council (NCC), are shown in Table 7.2.2 of Appendix 7.2.

7.4.11 The relevant air quality standards are met at the urban background location of St. Julian's School, with monitored annual mean concentrations of 22 $\mu g/m^3$ and 16 $\mu g/m^3$ for NO_2 and PM_{10} respectively in 2014. A review of monitoring results in recent years has shown that NO_2 concentrations have remained fairly stable between 2011 and 2014 (22 - 23 $\mu g/m^3$ as an annual mean) and that there is no clear trend for PM_{10} concentrations at this location.

7.4.12 Exceedences of the annual mean NO_2 standard have been recorded at the roadside monitoring location at Junction 25A of the existing M4 in 2013 and 2014 following its installation. No exceedences of the hourly mean NO_2 objective have been recorded at this location. As set out above this monitoring station is not considered a relevant location (for the purposes of identifying AQMAs) according to LAQM PG(09) (Welsh Assembly Government, 2009).

Table 7.16: AQMAs in the Vicinity of the Scheme

AQMA Name	Description	Summary of Latest Results
AQMA adjacent to Existing M4		
Glasllwch AQMA	An area extending either side of the M4 encompassing two properties, located south of Junction 27 of the M4 along Bassaleg Road.	Newport City Council (NCC) undertakes NO_2 diffusion tube monitoring either side of the M4. Monitored annual mean NO_2 concentrations in 2013 were just above the standard to the east of the M4 (41µg/m^3) and just below the objective to the west of the M4 (39µg/m^3). No exceedences were recorded in 2014. The prevailing wind direction, south westerly, explains the difference in concentrations to the west and east of the motorway.
Shaftesbury/ Crindau AQMA	An area around Junction 26 of the M4, encompassing three properties, including part of Malpas Road.	NCC undertakes NO_2 diffusion tube monitoring to the north and south of the M4. Monitored annual mean NO_2 concentrations in 2013 were above the objective (42.5µg/m^3). No exceedences were recorded in 2014.
St. Julians AQMA	An area at the north end of Denbigh Street immediately adjacent to the slip road at Junction 25 of the M4, encompassing three properties.	NCC undertakes NO_2 diffusion tube monitoring at the north end of Denbigh Road. Monitored annual mean NO_2 concentrations in 2013 were above the objective (41µg/m^3). No exceedences were recorded in 2014.
Royal Oak Hill AQMA	A single property adjacent to the M4 motorway just west of where Royal Oak Hill crosses the motorway.	NCC undertakes NO_2 diffusion tube monitoring within the Royal Oak Hill AQMA. Monitored annual mean NO_2 concentrations have been above the objective, between 40µg/m^3 and 45µg/m^3, since 2011 at this location.
AQMA elsewhere in Newport		
Malpas Road South AQMA	A number of houses along both sides of Malpas Road in the vicinity of the junction with Redland Street.	NO_2 diffusion tube monitoring undertaken in the AQMA indicated that pollutant concentrations exceeded the objective in 2014 (41µg/m^3).
Caerleon Road AQMA	A number of houses on the western side of Caerleon Road between the junctions with Durham Road and York Road.	NO_2 diffusion tube monitoring undertaken in the AQMA indicated that pollutant concentrations are close to the objective, and exceeded the objective in 2013 (42.1µg/m^3). No exceedence was recorded in 2014.
Chepstow Road AQMA	Area incorporating sections of these roads: Caerleon Rd, Chepstow Rd, Clarence Place, Church Rd, Eve's Well Court	NCC undertake NO_2 diffusion tube monitoring in the AQMA at six separate locations, the majority of locations exceed the objective with a maximum annual mean NO_2 concentration of 46µg/m^3.

7.4.13 The continuous monitoring results indicate that pollutant concentrations in close proximity to the existing M4 have the potential to exceed the annual mean NO_2 objective at roadside locations. All other relevant air quality standards are likely to be met.

Diffusion Tubes

7.4.14 NO_2 is monitored by NCC using diffusion tubes at 55 locations across Newport. Monitoring locations are predominantly at roadside and kerbside monitoring locations with co-located diffusion tubes at both continuous monitoring locations. Details of diffusion tube monitoring locations in the vicinity of the Scheme are shown in Table 7.2.3 and Table 7.2.7 of Appendix 7.2 and on Figure 7.2 (Scheme specific monitoring) and Figure 7.8 (monitoring locations operated by NCC).

7.4.15 Data for 2010-2014 at diffusion tube sites within close proximity to the Scheme and surrounding local road network have been reviewed and are summarised in Table 7.2.4 of Appendix 7.2.

7.4.16 Between 2010 and 2014, NCC has recorded exceedences of the annual mean NO_2 objective at a number of diffusion tube locations along the existing M4 corridor and nearby urban areas. As shown in Table 7.16, monitored concentrations in the majority of designated AQMAs continue to exceed the annual mean NO_2 objective. The highest annual mean NO_2 concentrations (68 µg/m^3) across Newport are actually measured approximately 1.5 km to the north of the existing M4 in the Caerleon High Street AQMA.

7.4.17 Monitored results at diffusion tube locations within 200 metres of the existing M4 (NCC 14, 18, 4, 7, 6, 14, 17, 19, 25, 55) indicate an overall increasing trend in annual mean NO_2 concentrations over recent years. At all of these locations, monitored annual mean NO_2 concentrations are well below 60 µg/m^3. Therefore, it is likely that the hourly mean NO_2 objective is met (Defra, 2009) within 200 metres of the existing M4, which is supported by the hourly continuous monitoring data as discussed above.

7.4.18 Due to the existing rural nature of the area proposed for the new section of motorway there is no monitoring undertaken by NCC in this area.

Scheme Specific Monitoring

7.4.19 Scheme specific monitoring was undertaken across Newport and Monmouthshire in the vicinity of the Scheme, to supplement the monitoring data available from NCC.

Continuous Monitoring

7.4.20 The continuous monitor was located at Newport Athletic Stadium approximately 2.1 km south of the existing M4, adjacent to the A48 Southern Distributor Road. A full calendar year of data was available for 2014. Monitored data for 2014 are shown in Table 7.2.6 of Appendix 7.2. Results indicated that all relevant NO_2 and PM_{10} objectives were met at this location.

Diffusion Tubes

7.4.21 NO_2 was monitored using diffusion tubes at 24 locations as part of the Scheme specific monitoring survey. One of these locations was co-located with the continuous monitor at Newport Athletic Stadium to allow bias adjustment of monitored concentrations to be undertaken, which reduces the uncertainty inherent in the use of diffusion tubes.

7.4.22 The results are shown in Table 7.2.8 of Appendix 7.2 and indicate that annual mean NO_2 concentrations in the area surrounding the proposed new section of motorway (Sites 4, 5, 7, 8, 9, 11 and 13) are well below the annual mean NO_2 objective with monitored concentrations of less than 20 µg/m^3. The annual mean NO_2 objective was met at all monitoring locations in 2014, the highest concentration (36.3 µg/m^3) was recorded at Badminton Road. This location is close to the existing M4 corridor and therefore elevated concentrations in this location are anticipated.

Background Pollutant Concentrations

Modelled Background Concentrations

7.4.23 The Defra background air quality website (Defra, 2014c) includes estimated background air pollution concentrations for NO_x, NO_2 and PM_{10} for each 1 km by 1 km square covering the whole of Wales. Estimated pollutant concentrations are available for 2010 and include future predictions through to 2030.

7.4.24 The Defra background concentrations for the entire NCC area and the Monmouthshire County Council grid squares which the Scheme intersects are shown in Table 7.17. Maps showing the concentrations in each grid square are shown in Figure 7.9. Background pollutant concentrations in the area of the Scheme indicate that the annual mean standards for NO_x (30 µg/m^3), NO_2 and PM_{10} (40 µg/m^3) are met. As observed on Figure 7.9, pollutant concentrations are higher in urban areas and along the existing M4.

Table 7.17: Estimated Background Data (2014) for Annual Mean NO_x, NO_2 and PM_{10} Concentrations

Local Authority	Pollutant	Average Concentration (µg/m^3)	Max Concentration (µg/m^3)	Min Concentration (µg/m^3)
Newport City Council	NOx	17.0	25.9	11.9
	NO_2	12.7	18.6	9.1
	PM_{10}	13.2	15.1	12.3
Monmouthshire County Council	NO_x	18.6	26.9	13.7
	NO_2	13.7	19.1	10.4
	PM_{10}	14.7	18.3	12.8

Monitored Background Concentrations

7.4.25 Newport City Council does not undertake air quality monitoring at any background locations. However, the continuous monitor and co-located diffusion tubes at St. Julians School are representative of an urban background location. A number of background and urban background monitoring locations were included in the Scheme specific survey as this was required to determine the existing air quality conditions in the rural area surrounding the proposed new section of motorway. Monitored concentrations at background and urban

background locations are shown in Table 7.2.9 in Appendix 7.2. Monitored concentrations at background locations are all less than 50% of the annual mean NO_2 objective and at urban background locations monitored concentrations are less than 75% of the annual mean NO_2 standard.

7.4.26 As the majority of locations are based on Scheme specific monitoring, which has only been carried out for two years, no long term trend can be defined. However monitored NO_2 concentrations at St Julians School, undertaken by NCC, have been stable at 22 µg/m^3 – 23 µg/m^3 since 2010. Monitored PM_{10} concentrations at the same location are less than 50% of the annual mean PM_{10} standard. However, there is no clear trend in concentrations since 2010, as shown in Table 7.2.2 of Appendix 7.2

Background Concentrations Used for Modelling Purposes

7.4.27 A comparison of monitored concentrations has been undertaken with the modelled background concentrations available from Defra for the 1 km x 1 km grid square in which the monitoring location lies. Table 7.2.9 of Appendix 7.2 shows the comparison of monitored and modelled background concentrations.

7.4.28 The comparison of monitored and modelled data indicates that, at the majority of monitored locations, the Defra modelled background concentrations are greater than monitored concentrations. Notwithstanding this, Defra modelled background maps have been used, on a precautionary basis.

7.4.29 Road sources are included within the Defra modelled background pollutant maps. To avoid double counting of emissions from roads included within the model and within the background maps, the Defra tool (Defra, 2014d) for sector removal was used to calculate the final background concentrations by removing contributions from motorways and trunk roads within the grid square across all local authority areas and removing primary roads within the Newport City Council administrative area. Sector removed background concentrations have then been added to the modelled output to provide total pollutant concentrations.

Future Baseline Conditions

7.4.30 Air quality is predicted to improve over time due to the introduction of cleaner vehicle technologies in the UK vehicle fleet, therefore pollutant concentrations in the opening and future assessments years are predicted to be lower than baseline conditions.

7.4.31 The assessment of construction effects has considered a baseline of 2018, the likely start of the construction phase. For the assessment of construction traffic, emission factors and background pollutant data have been taken from estimates for 2018.

7.4.32 An assessment of pollutant concentrations at receptors included in the assessment of air quality effects has been undertaken for the opening and design year without the Scheme in place. This represents the future baseline air quality conditions to inform the assessment of the operational phase and confirms that pollutant concentrations would be lower than the existing scenario. The improvements to vehicle technologies outweigh potential traffic growth in the opening and future years.

7.4.33 As discussed above, the existing nitrogen deposition rates have been reduced by 2% per year to determine the likely deposition rates in the opening and future assessment years.

7.5 Mitigation Measures Forming Part of the Scheme Design

7.5.1 As set out in Chapter 4 of the ES, a key aim of the Scheme has been to reduce the air quality problems associated with the existing M4. The design of the route for the new section of motorway has taken into account the locations of existing populations and of the existing AQMAs.

7.5.2 In addition, the construction phase for the new section of motorway would include dust mitigation measures based on the recommendations of the IAQM, taking into account the findings of the assessment process. Details of these measures are provided in Section 7.9 below.

7.6 Assessment of Potential Land Take Effects

7.6.1 The land take associated with the Scheme would not have an effect on local air quality in itself. It is the activities for which the land take is required that have the potential to create either a temporary or permanent effect on air quality. These are discussed in the following sections of this chapter.

7.7 Assessment of Potential Construction Effects

Proposed New Section of Motorway

7.7.1 This section provides details of the assessment of dust emissions during construction of the proposed new section of motorway. Construction techniques would be widely varied and would be carried out over difficult terrain and therefore a range of mitigation measures are proposed (see Section 7.9).

7.7.2 The general sequence of works would typically be as follows.

- Enabling works, including pre–construction ecological mitigation, pre–construction archaeological investigation, provision of access points, temporary fencing and fencing to protect sensitive sites.
- Remediation of contaminated land or groundwater where required.
- Site clearance and water management works.
- Demolition works.
- Temporary highway diversions and traffic management.
- Diversion/protection of utilities.
- Earthworks.
- Construction of structures, pavement, road works and surfacing.
- Street furniture, including lighting columns, road signs and safety barrier.
- Accommodation works (for example, provision of new field access points where the existing entrances and fencing are affected).

- Landscaping.

7.7.3 The effects of these construction works are considered in the following section.

Need for Assessment

7.7.4 An assessment is required due to the presence of both human and ecological sensitive receptors within 350 metres of the proposed new section of motorway and within 50 metres of the trackout routes.

Sensitive Receptors

Ecological Receptors

7.7.5 The proposed new section of motorway would cross six areas with national or international ecological designations, as well as local level designations.

- River Usk/Afon Wysg Special Area of Conservation (SAC).
- Gwent Levels - Nash and Goldcliff Site of Specific Scientific Interest (SSSI).
- Gwent Levels - Redwick and Llandevenny SSSI.
- Gwent Levels - St. Brides SSSI.
- Gwent Levels – Whitson SSSI.
- River Usk/Afon Wysg SSSI.

7.7.6 SSSIs have a national designation status, while SACs have an international designation status. As the Scheme crosses the SAC and SSSIs, they are therefore at risk of being affected by dust soiling. The sensitivity of ecological receptors has therefore been classified as high according to the IAQM guidance (the maximum level available in the IAQM guidance). It is noted that internationally designated sites may be considered to be of very high sensitivity in ecology and nature conservation terms. This has been taken into account in the assessment.

7.7.7 The inclusion of ecological receptors in the construction dust assessment complies with Welsh Government's duties under Section 28G of the Wildlife and Countryside Act and Section 42 of the Natural Environment and Rural Communities Act and allows any impacts on designated sites to be mitigated where necessary.

Human Receptors

7.7.8 Human receptors are defined as those residential properties/schools/hospitals that are likely to experience a change in pollutant concentrations and/or dust nuisance due to the construction of the proposed new section of motorway. There are sensitive receptors located within 20 metres of the route (Figure 7.10). These are residential dwellings. Receptor sensitivity to dust soiling and PM_{10} exposure has been classified as high according to the IAQM guidance.

7.7.9 The sensitivity of the area to dust soiling and human health effects during the construction phase has been determined by identifying the number of receptors within 20 metres of the proposed new section of motorway and is shown in Table 7.18. There are between 10 and 100 receptors within 20 metres, mainly at the Castleton and Magor junctions with isolated properties at Pye Corner. The

sensitivity of the area to human health effects has also considered background PM_{10} concentrations. As outlined in Section 7.4, these are below the 24 µg/m^3 criterion presented in the IAQM guidance.

Table 7.18: Sensitivity of the Area

Activity	Sensitivity of the surrounding area			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	High	High	High	High
Human health	Low	Low	Low	Low
Ecological	High	High	High	High

7.7.10 It should be noted that throughout the assessment it has been assumed that there are receptors within 20 metres of the construction works along the entirety of the new section of motorway. In reality, there are long stretches of the route, for example across the Gwent levels, where no human health receptors are located in the vicinity of the construction works. The construction assessment is therefore considered to be worst case.

Dust Emission Magnitude

7.7.11 Following the methodology and criteria outlined in Section 7.3, each dust-generating activity has been assigned a dust emission magnitude as shown in Table 7.19. Further information on each construction activity is outlined below.

Demolition

7.7.12 The proposed construction work would require the demolition of both buildings and structures.

7.7.13 A number of existing highway structures would require demolition. These include the following existing structures.

- Park Farm Footbridge (SBR-0200, M4 29-30 31F).
- A48(M) Overbridge (Castleton 1C) (SBR-0250, M4 2929-10).
- Pound Hill Overbridge (SBR-0340, M4 28-29 75).
- Pound Hill Retaining Wall (SRW-0340).

7.7.14 The existing Wilcrick Maintenance Depot is proposed to be demolished. A new depot at Glan Llyn would be provided.

7.7.15 Details of the approach to demolition during the construction phase are provided in Chapter 3.

Earthworks

7.7.16 Geological maps show that a thick layer of clay overlying mudstone at Castleton can be expected, and a relatively thin layer of clay overlying limestone is present at Magor with pockets of mudstone in some areas. In between these areas are the low lying Gwent Levels that consist of clay and peat deposits.

7.7.17 The main earthwork activities for the new section of motorway would include the following.

- Pre-earthworks drainage.

- Soil stripping.
- Bulk earthworks.
- Breaking, ripping or blasting rock.
- Haulage of excavated materials.
- Remediation of contaminated material.
- Temporary storage of excavated materials.
- Placing and compacting of excavated material.

7.7.18 These operations may be supplemented with additional works at some locations depending on conditions encountered, for example reprocessing of excavated material and dealing with additional drainage installations.

Construction

7.7.19 The new section of motorway would be approximately 23 kilometres (km) in length and would provide three lanes in both directions, crossing the Gwent Levels and River Usk. In order to construct the new section of motorway, a haul road is required. Construction of the haul road using quarried material would generate approximately 3,200 wagon movements and a lengthy route for these movements to travel to avoid congested areas and areas where sensitive receptors are present. As such, an alternative is proposed whereby a cement/lime stabilised road is constructed, which would stabilise the top 300 mm-500 mm crust of the peat. This would reduce the number of wagon movements required but not necessarily the route taken by these vehicles. The stabilised haul route would be dressed with a layer of 150-200 mm of stone to protect the stabilised layer. The layer of stone would minimise the potential for dust emissions from use of the stabilised haul route.

7.7.20 A key element of the new section of motorway would be the River Usk Crossing, which would be a 2.1 km elevated structure with a 440 metre main span over the river.

7.7.21 In addition to the River Usk Crossing, there are a number of new major structures (overbridges and underbridges) and new minor structures (culverts and reen bridges) to be constructed. Two temporary crossings of the South Wales to London Mainline railway and two temporary crossings of existing highways are required to ensure continuity along the length of the new section of motorway for construction traffic, thus reducing the number of traffic movements on public roads. Further details of the new structures that would be constructed are set out in Chapter 2 of this ES, with details of temporary works during construction provided in Chapter 3.

7.7.22 There would be no sand blasting as part of the construction works, although soil stabilisation is likely to be required. This is generally undertaken within a self-contained item of plant.

7.7.23 As part of the construction phase, a number of borrow pits would be dug which would be up to 5 metres in depth. Controlled blasting would be needed to extract the rock from the area of cut and the borrow pits at Magor. Rock would be processed where it is blasted and then removed from the excavation and transported to where it is needed.

7.7.24 Topsoil stores would be generated very early in the construction programme and would be in place for the duration of the construction phase. Topsoil and subsoil stores would be up to 3 metres (topsoil) and 5 metres (subsoil) in height.

7.7.25 The unsuitable material stores would predominantly comprise peat and clay material generated during the initial works (e.g. piling arisings, culvert arisings). Other unsuitable material would be generated towards the end of the construction phase from the creation of the water treatment areas. The height of the unsuitable material stores would be up to 7 metres. The unsuitable material would be used to restore the borrow pits.

7.7.26 As part of the construction phase, the embankments within the Caldicot levels may be partially constructed from lime stabilised TATA lagoon sludge and slag, subject to material testing. The material would be cementitious, however, if laid in a wet form is unlikely to generate dust.

7.7.27 The construction of the new section of motorway would require the installation and operation of batching plants, two mobile plants on either side of the River Usk and a permanent batching plant within the Imperial Park compound. These would be located within the buffer areas shown in Figure 7.10

7.7.28 The borrow pits and topsoil/subsoil/unsuitable material stores have been taken into account within the assessment and are shown on Figure 7.10.

Trackout

7.7.29 As discussed above, it is assumed that there would be an unpaved road along the full length of the new section of motorway, including up to the boundary of Ifton Quarry. This would serve as a haul route.

7.7.30 As outlined in the Earthworks section above, a relatively thin layer of clay overlying limestone at Magor has been identified from geographical maps with pockets of mudstone in some areas.

7.7.31 The construction phase is likely to generate approximately 239 HGV movements per day.

7.7.32 The dust emission magnitude for each of the activities described above is provided in Table 7.19.

Table 7.19: Dust Emission Magnitude for Construction Activities

Activity	Dust emission magnitude	Reasoning
Demolition	Large	• Total building volume >50,000 m3 • Potentially dusty construction material (e.g. concrete) • On-site crushing and screening, demolition activities >20 m above ground level
Earthworks	Large	• Total site area >10,000 m2 • As noted, the soil type is potentially dusty (e.g. clay, which will be prone to suspension when dry due to small particle size) • >10 heavy earth moving vehicles active at any one time • Formation of bunds >8 m in height • Total material moved >100,000 tonnes

Activity	Dust emission magnitude	Reasoning
Construction	Large	• Total building volume >100,000m3 • Piling • On-site concrete batching • Blasting
Trackout	Large	• >50 HDV (>3.5t) trips in any one day • Potentially dusty surface material (e.g. high clay content) • Unpaved road length >100 m

Risk of Impacts

7.7.33 Taking into consideration the dust emission magnitude and the sensitivity of the area, the site has been classified in terms of risk for all activities (Table 7.20).

Table 7.20: Summary Dust Risk Table Prior to Mitigation

Activity	Dust Emission Magnitude	Dust soiling risk	Human health risk	Ecological risk
Demolition	Large	High risk	Medium risk	High risk
Earthworks	Large	High risk	Low risk	High risk
Construction	Large	High risk	Low risk	High risk
Trackout	Large	High risk	Low risk	High risk

7.7.34 Due to the large dust emission magnitude, there would be a high risk in relation to dust soiling and ecology, prior to the implementation of mitigation measures. Such effects are therefore potentially significant, prior to mitigation. Mitigation is described in Section 7.9.

Construction Traffic

7.7.35 The assessment of effects from additional HGV movements during the construction phase (2018) were assessed at both human health and ecological receptors. The results of this assessment at each of the assessed receptors are shown in Table 7.3.1 to 7.3.3 of Appendix 7.3. No exceedences of the air quality objectives relevant to human health are predicted in 2018, which is the likely start of the construction phase. Exceedences of the annual mean NO_x objective for the protection of vegetation are predicted at Langstone - Llanmartin Meadows SSSI in the without construction scenario in 2018. Exceedences of the annual mean NO_x objective are also predicted at Severn Estuary SPA, however this is a marine habitat and therefore the objective for the protection of vegetation does not apply.

7.7.36 At the majority of human health receptors assessed, the impact of additional HGV movements associated with the construction phase on annual mean NO_2 concentrations would be negligible based on the criteria outlined in Table 7.12.

7.7.37 The maximum increase in annual mean NO_2 concentrations (0.7µg/m^3), as shown in Table 7.3.1 of Appendix 7.3, would occur at receptors HH16 (Church Road), HH19 (Caerleon Road) and HH22 (Caerleon Road to the north of Junction 25). The impact of this increase on annual mean NO_2 concentrations would be minor adverse, based on the criteria outlined in Table 7.12. Given the location of these receptors, it is unlikely that construction traffic would use the roads immediately adjacent and this is representative of a worst case scenario.

7.7.38 At all human health receptors assessed, the impact of additional HGV movements associated with the construction phase on annual mean PM_{10} concentrations would be negligible, as the maximum change in annual mean PM_{10} concentrations is predicted to be 0.1 µg/m^3, as shown in Table 7.3.1 of Appendix 7.3.

7.7.39 At the majority of ecological receptors assessed, the impact of additional HGV movements associated with the construction phase on annual mean NO_x concentrations would be negligible based on the criteria outlined in Table 7.13, as the change in annual mean NO_x concentrations would be less than 0.3 µg/m^3, as shown in Table 7.3.2 of Appendix 7.3. This is the case at Langstone-Llanmartin Meadows SSSI where annual mean NO_x concentrations would be greater than 30 µg/m^3 in the without construction scenario. The maximum increase in annual mean NO_x concentrations (0.4 µg/m^3) would occur at Receptor Eco60 (Nedern Brook Wetlands SSSI) and Eco 75 (Severn Estuary SPA). The magnitude of impact on annual mean NO_x concentrations would be minor adverse, based on the criteria outlined in Table 7.13. Given the distance of these designated sites from the proposed new section of motorway, and the commitment to source materials locally sourced or delivered from locations within Wales where practicable, it is possible that the M48 and M4 second Severn crossing would not be used as routes during the construction phase.

7.7.40 The additional HGV movements associated with the construction phase would not result in any change in total nitrogen deposition at the designated sites assessed, as shown in Table 7.3.3 in Appendix 7.3.

7.7.41 As the assessment has identified a minor adverse temporary impact on pollutant concentrations at worst and, given that no exceedences of the relevant human health objectives or changes to nitrogen deposition at ecological receptors are predicted, construction traffic effects would not be significant.

Evaluating Significance

7.7.42 As shown in Table 7.20, the construction of the Scheme has been determined as being at high risk of giving rise to dust soiling and ecological impacts and low to medium risk for human health impacts, without any mitigation in place. Therefore, the construction of the Scheme has the potential for significant effects, particularly for ecological receptors along the proposed new section of motorway. As set out above, mitigation measures are proposed in Section 7.9.

7.7.43 The assessment of effects from additional HGV movements during the construction phase has been assessed and effects would not be significant.

Complementary Measures

7.7.44 Construction activities associated with the Complementary Measures would be limited and would focus on changes to the slip roads of Junctions 25A and 25 of the existing M4. These works include the widening of the westbound diverge slip for Junction 25, including construction of a retaining wall and construction of new connecting slip roads between Junctions 25 and 25A and the existing M4. No demolition or earthworks are required as part of these works and therefore effects would be limited to dust soiling and elevated exposure to PM_{10} concentrations from construction activities only. It is unlikely that trackout would have an effect

as vehicle movements associated with these works would be minimal and vehicles would travel along the existing highway network.

7.7.45 Sensitive human health receptors are present within 50 metres of the construction activities required for the Complementary Measures. No designated ecological sites would be affected by these works. Taking into account the presence of human receptors, the sensitivity of the area has been determined to be high.

7.7.46 The dust emission magnitude for activities associated with the Complementary Measures is anticipated to be small due to the limited amount of construction required.

7.7.47 Taking into consideration the dust emission magnitude and the sensitivity of the area, the site has been classified as low risk to dust soiling and to human health and therefore appropriate mitigation measures should be applied.

7.8 Assessment of Potential Operational Effects

Proposed New Section of Motorway

Modelled Local Air Quality Concentrations

Human Health

7.8.1 This section describes the predicted changes at human receptor locations as a result of the Scheme in the opening year (2022) and future year (2037). The impact of the Scheme on AQMAs within the ARN is summarised below and in Table 7.21.

7.8.2 The modelled results for the opening year of the Scheme (2022) do not predict any exceedences of the air quality objectives for NO_2 and PM_{10}. Figure 7.11 provides an overview of the modelled results showing those areas where the air quality concentrations are predicted to improve or worsen. The figures show clearly that the main improvements would be located along the existing M4 corridor predominantly as a result of a large proportion of traffic moving to the proposed new section of motorway but also due to reduced congestion at key links along the existing M4 corridor, such as the entrance to the Brynglas Tunnels. It should be noted that these improvements are in the more populated parts of the study area and result in significantly reduced population exposure to air pollutants. The largest decrease in annual mean NO_2 and PM_{10} concentrations (-6.5 µg/m^3 and -0.9 µg/m^3 respectively) is predicted at Receptor HH32 (Buckland Cottage), which is located within the Royal Oak Hill AQMA.

7.8.3 An improvement in local air quality is predicted in all AQMAs within the study area. Although modelled pollutant concentrations are below the annual mean NO_2 objective in the do-minimum scenario, without the Scheme in place, the urban areas surrounding the existing M4 corridor would benefit from the Scheme, reducing pollutant concentrations and residential exposure further. The modelling predicts that AQMAs along the existing M4 corridor could be revoked.

7.8.4 NO_2 concentrations are predicted to increase at some locations, particularly around the proposed new section of motorway. The largest increase in pollutant concentrations at receptors within 200 metres of the proposed new section of

motorway would occur at Fair Orchard Farm off Lighthouse Road, where an increase of 1.4 µg/m^3 annual mean NO_2 is predicted. Due to the very low background pollutant concentrations in this area, annual mean NO_2 concentrations are predicted to remain well below the annual mean NO_2 objective.

7.8.5 PM_{10} concentrations follow a similar trend as NO_2 across the study area. There are no predicted exceedences of the annual mean or daily mean PM_{10} objective in either 2022 or 2037 anywhere in the study area.

7.8.6 Modelled results at receptors assessed are presented in Table 7.3.4 and Table 7.3.5 of Appendix 7.3. The magnitude of impact is also shown in Appendix 7.3, based on the criteria shown in Table 7.12.

7.8.7 Figure 7.12 shows modelled pollutant concentrations for the do minimum and do something scenarios as well as the change in pollutant concentrations as a result of the Scheme across the study area.

AQMA Results

7.8.8 The assessment identifies improvements in local air quality in all AQMAs across the study area. Modelled concentrations in all AQMAs are below the air quality objectives and limit values in both 2022 and 2037. It should be noted that in 2022, without the Scheme in place, annual mean NO_2 concentrations along the existing M4 corridor would remain elevated and as such are at risk of exceeding the annual mean NO_2 objective, given the uncertainty in modelling. With the Scheme in place, a significant improvement in pollutant concentrations along the existing M4 corridor is predicted due to the decrease in vehicle flow along the reclassified route. A slight improvement is also predicted in the AQMAs elsewhere in Newport, as a result of traffic using the M4 travelling into Newport city centre from the south rather than the north.

Table 7.21: Summary of AQMA Modelled Results

AQMA Name	Modelled Results
AQMA adjacent to Existing M4	
Glasllwch AQMA	Concentrations of NO_2 and PM_{10} are predicted to improve within this AQMA. A decrease in annual mean NO_2 concentrations of 5.2µg/m^3 and 3.3µg/m^3 are predicted at the closest properties to the east and west of the motorway corridor, respectively. Annual mean NO_2 and PM_{10} concentrations are predicted to be below the annual mean NO_2 and PM_{10} objectives in the opening and future year of the Scheme.
Shaftesbury/ Crindau AQMA	Concentrations of NO_2 and PM_{10} are predicted to improve within this AQMA. A decrease in annual mean NO_2 concentrations of 2.2µg/m^3 and 3.9µg/m^3 is predicted at the closest properties to the north and south of the motorway corridor, respectively. Annual mean NO_2 and PM_{10} concentrations are predicted to be below the annual mean NO_2 and PM_{10} objectives in the opening and future year of the Scheme.
St. Julians AQMA	Concentrations of NO_2 and PM_{10} are predicted to improve within this AQMA. A decrease in annual mean NO_2 concentrations of 2.5µg/m^3 is predicted at those properties closest to the motorway corridor. Annual mean NO_2 and PM_{10} concentrations are predicted to be below the annual mean NO_2 and PM_{10} objectives in the opening and future year of the Scheme.

AQMA Name	Modelled Results
Royal Oak Hill AQMA	Concentrations of NO_2 and PM_{10} are predicted to improve within this AQMA. A decrease in annual mean NO_2 concentrations of 6.5µg/m^3 are predicted at the property within the Royal Oak Hill AQMA. Annual mean NO_2 and PM_{10} concentrations are predicted to be below the annual mean NO_2 and PM_{10} objectives in the opening and future year of the Scheme. It should be noted that the verification process indicated that modelled concentrations were under predicting at this location by 12%. However, accounting for this, annual mean NO_2 concentrations would still remain within the annual mean NO_2 objective in the opening and future year of the Scheme.
AQMA elsewhere in Newport	
Malpas Road South AQMA	Concentrations of NO_2 are predicted to improve within this AQMA. A decrease in annual mean NO_2 concentrations of 2.3 µg/m^3 is predicted within this AQMA. There is a decrease of 0.2µg/m^3 in annual mean PM_{10} concentrations at this location as a result of the Scheme.
Caerleon Road AQMA	Concentrations of NO_2 are predicted to improve slightly within this AQMA. A small decrease in annual mean NO_2 concentrations of 1µg/m^3 is predicted within this AQMA. There is no change in annual mean PM_{10} concentrations at this location as a result of the Scheme.
Chepstow Road AQMA	Concentrations of NO_2 and PM_{10} are predicted to improve within this AQMA. A decrease in annual mean NO_2 concentrations of 1.6µg/m^3 is predicted at the northern end of the AQMA along Church Road. Smaller improvements of annual mean NO_2 (0.6µg/m^3) are predicted along Chepstow Road itself. Annual mean NO_2 and PM_{10} concentrations are predicted to be below the annual mean NO_2 and PM_{10} objectives in the opening and future year of the Scheme.

Designated Sites

7.8.9 This section describes the predicted changes at ecologically designated sites as a result of the Scheme in the opening year (2022) and future year (2037).

Annual Mean NO_x Concentrations

7.8.10 At the majority of designated sites across the study area, the annual mean NO_x limit value (30 µg/m^3) for the protection of vegetation would be met in the opening year (2022) and future year (2037) of the Scheme. It should be noted that the annual mean NO_x limit value has been applied to all designated sites on a precautionary basis only as all are within 20 km of a town with more than 250,000 inhabitants and therefore the limit value does not apply in these locations (see Section 7.2). Modelled concentrations within 20 metres of the road are greater than 30 µg/m^3 at two designated sites, Langstone - Llanmartin Meadows SSSI and Severn Estuary SAC/SSSI/SPA/Ramsar site in the opening year and future year without the Scheme in place.

7.8.11 The largest improvement in annual mean NO_x concentrations (10.3 µg/m^3) is predicted at Langstone-Llanmartin Meadows as a result of the Scheme due to the removal of a large proportion of traffic from the existing M4 corridor and modelled concentrations are predicted to improve to below 30 µg/m^3. The Scheme would result in an increase in annual mean NO_x concentrations (0.4 µg/m^3) at the Severn Estuary SSSI/SAC/SPA/Ramsar site where NO_x concentrations are

already greater than 30 µg/m^3 without the Scheme in place. However, it should be noted that this is a marine habitat and therefore does not have any vegetation sensitive to changes in gaseous concentrations of NO_x.

7.8.12 The largest increase in annual mean NO_x concentrations is predicted at the Gwent Levels - Redwick and Llandevenny SSSI with an increase of 10.5 µg/m^3 at the closest point to the proposed new section of motorway. Increases in annual mean NO_x concentrations are also predicted at Gwent Levels - Nash & Goldcliff SSSI, Gwent Levels - St Brides SSSI and Gwent Levels - Whitson SSSI as a result of the Scheme. In the do something scenario, annual mean NO_x concentrations at these locations are predicted to be below 30 µg/m^3, with the exception of the Gwent Levels St Brides SSSI, which is predicted to be 30 µg/m^3 at the closest point to the proposed new section of motorway.

7.8.13 Annual mean NO_x concentrations are predicted to be below 30µg/m^3 at all other designated sites in both the do minimum and do something scenario.Annual mean NO_x concentrations at each of designated sites are presented in Table 7.3.6 of Appendix 7.3.

Nitrogen Deposition

7.8.14 Table 7.3.7 and Table 7.3.8 of Appendix 7.3 show the predicted total nitrogen deposition rates and change in total deposition as a result of the Scheme at each of the designated sites for the opening year (2022) and future year (2037).

7.8.15 The Scheme would result in an increase in nitrogen deposition rates at all designated sites assessed, with the exception of Langstone - Llanmartin Meadows SSSI. However, the modelled results for both the opening year (2022) and the future year (2037) of the Scheme indicate that the critical loads applied to the designated sites would not be exceeded.

7.8.16 The largest increase in nitrogen deposition (0.5 kg N/ha/yr, 5% of the minimum critical load) is predicted at the Gwent Levels - St Brides SSSI, Nash & Goldcliff SSSI, Whitson SSSI and Redwick and Llandevenny SSSI at the closest point to the proposed new section of motorway. The largest decrease in nitrogen deposition (0.5 kg N/ha/yr, 5% of the minimum critical load) occurs at Langstone - Llanmartin Meadows SSSI. As discussed above this is as a result of a large proportion of traffic moving from the existing M4 to the proposed new section of motorway.

Regional Air Quality Assessment

7.8.17 This section describes the effect of the Scheme on regional air quality across the regional ARN. It should be noted that the regional air quality assessment considers only those links from the traffic model that meet the criteria outlined in Section 7.3 of this chapter and shown in Figure 7.1. Total CO_2, NO_x and PM_{10} emissions for all assessed scenarios are presented in Table 7.22. The change in emissions as a result of the Scheme is presented in Table 7.23.

Table 7.22: Total Emissions for All Assessed Scenarios across the Regional ARN

Pollutant	Baseline 2014	Do Minimum 2022	Do Something 2022	Do Minimum 2037	Do Something 2037
	Units - tonnes/year				
CO_2	393,972	409,352	404,586	445,651	446,865
NOx	1,136	599	408	500	345
PM_{10}	79	66	47	77	56

Table 7.23: Change in Emissions as a Result of the Scheme

Pollutant	Changes in emissions (tonnes/year)	
	Opening Year (2022)	Future Year (2037)
CO_2	-4,767	1,215
NOx	-190	-155
PM_{10}	-19	-21

7.8.18 As shown in Table 7.23, the Scheme would result in a decrease in emissions, including greenhouse gas emissions represented by assessed CO_2 emissions, on a regional scale in the opening year. However, an increase in CO_2 is predicted in the future year likely due to the increase in capacity leading to more vehicles on the road in the future year.

7.8.19 The decrease in emissions in the opening year is likely to be a function of the proposed new section of motorway being 2.8 km shorter than the existing M4 and the emission rates used to determine the total emissions account for congestion and elevated vehicle emissions associated with this. The change in emissions has been compared with national emissions associated with the transport sector to determine the significance of the change. As shown in Table 7.24, the change in emission as a result of the Scheme is small compared with national emissions. Therefore the effect of the Scheme on regional emissions is not considered to be significant.

Table 7.24: Comparison of Change with National Emissions

Pollutant	National Emissions from the Transport Sector	Changes in emissions (tonnes/year)		Percentage Change of National Emissions	
		Opening Year (2022)	Future Year (2037)	Opening Year (2022)	Future Year (2037)
CO_2	5,700,000	-4,767	1,215	-0.08%	0.02%
NOx	22,300	-190	-155	-0.8%	-0.7%
PM_{10}	1,380	-19	-21	-1.4%	-1.5%

Evaluating Significance

7.8.20 IAN 174/13 (Highways Agency, 2013b) provides guidance on evaluating overall Scheme significance. The overall significance of the Scheme is based on all elements of the Scheme that have been assessed and the results discussed above.

7.8.21 The key criteria for evaluating significance are set out and results for each summarised.

Human Health

7.8.22 In 2022, the opening year, no exceedences of any of the air quality objectives for NO_2 or PM_{10} are predicted with or without the Scheme. As such it is not necessary to complete Table 2.1 from IAN 174/13 (Highways Agency, 2013b), as this is only concerned with receptor locations where the objectives are being exceeded.

7.8.23 The questions related to human health from IAN 174/13 (Highways Agency, 2013b) are addressed below.

"Is there a risk that environmental standards will be breached?"

7.8.24 The modelling results indicate that there is not a risk of environmental standards for NO_2 or PM_{10} being breached in the Scheme opening or future year. Although some locations across the study area result in an increase in pollutant concentrations, these are locations predicted to be below air quality objectives and have no risk of exceedance. There are also improvements predicted in urban areas along the existing M4 corridor.

"Will there be a large change in environmental conditions?"

7.8.25 This question relates specifically to areas where there are predicted to be exceedences of an air quality objective, which as already discussed, do not occur in the opening or future year of the Scheme. Also the change referred to is a large negative change. There are no large increases in pollutant concentrations (>4 µg/m^3) as a result of the Scheme. The maximum increase in annual mean NO_2 concentrations is 1.5 µg/m^3, which is classified as a minor adverse impact according to the criteria outlined in Table 7.22. Four of the receptor locations assessed experience an improvement in air quality of greater than 4 µg/m^3, which is classified as a major beneficial impact. It should be noted that these locations are representative of urban areas alongside the existing M4 corridor and therefore these populated areas would experience an improvement in air quality.

"Will the effect continue for a long time and will many people be affected?"

7.8.26 Each of these questions refers mainly to areas where there may be exceedences of the air quality objectives. As there are not any predicted exceedences for this Scheme, there is no length of time or number of receptors to consider here. There are considerably more areas of improvement expected as a result of the Scheme, as a result the number of people experiencing air quality levels close to the objectives would reduce. Due to the nature of the Scheme the effects of the Scheme would be permanent.

"Will it be difficult to avoid, or reduce or repair or compensate for the effect?"

7.8.27 The Scheme is not predicted to have any adverse effects during the operational phase of the magnitude which would need to be mitigated.

7.8.28 The findings from each of the key questions related to human health have provided evidence that the answers would result in a conclusion of the adverse effects of the Scheme being 'not significant'.

7.8.29 However, it should be noted that the Scheme would result in a number of beneficial effects not identified through the above IAN 174/13 process. A number of areas are predicted to experience a large improvement in air quality concentrations across the study area, most notably in urban areas adjacent to the existing M4 corridor. All AQMAs in the study area are predicted to experience improvements in concentrations as a result of the Scheme.

Designated Sites

7.8.30 The question related to ecological health from IAN 174/13 (Highways Agency, 2013b) is addressed below.

"Is there a risk that designated sites, areas, or features will be affected?"

7.8.31 Following DMRB HA207/07 (Highways Agency et al., 2007) guidance, the effect of the Scheme on annual mean NO_x concentrations at designated sites has been considered in the first instance, in establishing whether the Scheme results in significant effects. Using the Long Term Trends Euro 6 emissions trend for future projections of NO_x concentrations (which are likely to present the most pessimistic situation for the opening and future years of the Scheme), the precautionary annual mean NO_x objective (30 µg/m^3) is met in the do-something scenario at all designated sites, with the exception of Gwent Levels - St Brides SSSI where modelled annual mean NO_x concentrations are predicted to be 30 µg/m^3 and the Severn Estuary SSSI/SAC/SPA/Ramsar site. The Scheme would result in a large increase in annual mean NO_x concentrations (>3 µg/m^3) at the Gwent Levels St Brides SSSI, which applying the methodology in Table 7.13 is classified as a major adverse impact close to the road. Levels would drop quicly with increased distance from the carriageway. The greatest increase in concentrations at the Severn Estuary SSSI/SAC/SPA/Ramsar is predicted to be 0.4 µg/m^3 which applying the methodology in Table 7.13 would be a minor adverse impact.

7.8.32 As noted above the Severn Estuary SSSI/SAC/SPA/Ramsar site is a marine habitat and therefore has no vegetation sensitive to changes in NO_x for the precautionary limit value to apply. To determine the potential significance of annual mean NO_x concentrations at Gwent Levels - St Brides SSSI, the total nitrogen deposition and change in nitrogen deposition as a result of the Scheme has been reviewed in relation to the habitats affected.

7.8.33 Predictions indicate that the total nitrogen deposition would be within the applied critical loads at all designated sites in the opening and future year of the Scheme. The largest increase (0.5 kgN/ha/yr) is predicted to occur at Gwent Levels - St Brides SSSI. Further details of the effects of changes in nitrogen deposition at assessed designated sites is provided in Chapter 10 of the ES.

7.8.34 The findings from the key question related to ecological health have provided evidence that there would be an increase in annual mean NO_x concentrations at some of the designated sites assessed. However, no exceedence of the critical loads for nitrogen deposition are predicted and increases in nitrogen deposition have been determined not to be large enough to affect the habitats for which the sites are designated. Therefore, the effect of the Scheme is considered not to be significant for designated sites.

Overall Significance

7.8.35 Table 7.25 summarises the overall significance, taking into account effects on human and ecological receptors and the potential impact for exceedences of EU limit values. The findings indicate that, overall, the Scheme would not have a significant adverse effect on air quality.

Table 7.25: Overall Significance Effects during the Operational Phase

Key Criteria Questions	Yes/No
Is there a risk that environmental standards will be breached?	No
Will there be a large change in environmental conditions?	No
Will the effect continue for a long time?	No
Will many people be affected?	No
Is there a risk that designated sites, areas, or features will be affected?	Yes
Will it be difficult to avoid, or reduce or repair or compensate for the effect?	No
On balance is the overall effect significant?	No

Complementary Measures

7.8.36 The proposed reclassification of the M4 has been included in the modelling discussed above. The main effect of these measures on local air quality is the change in speed limit between Junctions 25 and 26 from 70 mph to 60 mph and the removal of Lane 1 of the carriageway, the nearside lane, between Junctions 23A and 24 and westbound only between Junctions 24 and 25. The significant improvement along the existing M4 corridor is as a result of the movement of a significant proportion of traffic onto the proposed new section of motorway rather than from these measures. However, the further separation of vehicles and receptors generated by the removal of the Lane 1 of the carriageway would result in a negligible improvement in local air quality.

7.9 Additional Mitigation and Monitoring

7.9.1 The dust emitting activities assessed in Section 7.7 above can be greatly reduced or eliminated by applying site specific mitigation measures for high risk sites according to the IAQM guidance. The construction of the Scheme has been classified as high risk due to the presence of sensitive receptors in close proximity to the construction works. As such, the mitigation measures outlined below are considered suitable to mitigate the effects.

Construction Mitigation

7.9.2 The following measures are included in the Pre-Construction Environmental Management Plan (Pre-CEMP) provided at Appendix 3.2. It should be noted that the majority of measures are considered to be best practice.

Communication

- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.

- Display the head or regional office contact information.
- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
- Develop and implement a Dust Management Plan, which will include measures to control other emissions, approved by the local authority.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken.
- Make the complaints log available to the local authority when asked.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site and the action taken to resolve the situation in the log book.
- Hold regular liaison meetings with other high risk construction sites within 500 metres of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised.

Monitoring

- Carry out regular site inspections to monitor compliance with the Dust Management Plan, record inspection results and make an inspection log available to the local planning authority, when asked.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked.
- Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the local planning authority

Site Maintenance

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible.
- Erect solid screens or barriers around key construction compounds or around dusty activities within construction compounds that are at least as high as any stockpiles on site.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site runoff 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.
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas.
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Implement a Travel Plan than supports and encourages sustainable travel (public transport, cycling, walking and car-sharing).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques, such as water sprays or local extraction.
- 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 the fine water sprays on such equipment wherever appropriate.

Waste Management

- Avoid bonfires and burning of waste materials.

7.9.3 The above mitigation measures would be included as a minimum during the construction of the Scheme. Due to the categorisation of the site as 'high risk' and the nature of the construction works, further mitigation measures are proposed to reduce fugitive dust emissions and adverse air quality impact for specific construction works. These are outlined below.

Measures Specific to Demolition

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Bag and remove any biological debris or damp down such material before demolition.

Measures Specific to Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.

- Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
- Only remove the cover from areas where earthworks are programmed to occur within a reasonable timescale to minimise the potential for dust emissions.

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.
- 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 ensue bags are sealed after use and stored appropriately to prevent dust.

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 continuously in use.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving the site with dust generating materials are covered to prevent escape of materials during transport.
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Record all inspections of haul routes and any subsequent action in a site log book.
- Install hard surfaced haul routes, which are regularly dampened 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 the site size layout and layout permits.
- Access gates to be located at least 10 m from receptors where possible.

Operation

7.9.4 The assessment of potential operational effects as shown in Section 7.8 of this chapter indicated no significant adverse effects on local or regional air quality. Therefore, no mitigation measures are required or proposed.

7.10 Assessment of Land Take Effects

7.10.1 As discussed in Section 7.6, the land take associated with the Scheme would not have an effect on local air quality in itself. It is the activities for which the land take is required that have the potential to create either a temporary or permanent effect on air quality.

7.11 Assessment of Construction Effects

Proposed New Section of Motorway

7.11.1 The proposed mitigation measures set out in Section 7.9 above and included in the Pre-CEMP for the Scheme have been proven to be effective when implemented correctly. With these in place the effect of the Scheme during construction would be temporary and would not be significant.

Complementary Measures

7.11.2 The above mitigation measures would also be suitable for any demolition/construction activities associated with Complementary Measures. This would be implemented through a separate CEMP. With suitable measures in place, the effect of the Complementary Measures during construction would not be significant.

7.12 Assessment of Operational Effects

Proposed New Section of Motorway

7.12.1 The assessment of potential operational effects indicated that the Scheme would not result in any significant adverse air quality effects. As a result no mitigation is required or proposed. Therefore, operational effects remain as set out in Section 7.8 of this chapter.

Complementary Measures

7.12.2 The assessment of potential operational effects indicated that the Complementary Measures would not result in any significant air quality effects. As a result no mitigation is required or proposed. Therefore, operational effects remain as set out in Section 7.8 of this chapter.

7.13 Assessment of Cumulative Effects

7.13.1 An assessment of cumulative effects is included in Chapter 17 of the ES.

7.13.2 A number developments were identified within 350 metres of the proposed new section of motorway where there is the potential for cumulative effects during construction. It is possible that demolition/construction from other proposed developments in the local area would overlap with the construction phase of the Scheme. As discussed in Section 7.9, there are a significant number of mitigation measures that would be applied to the Scheme (M4CaN) to control dust and minimise any impacts off site.

7.13.3 The mitigation measures to be implemented are proven to be effective at minimising impacts from dust. Subject to the application of such measures, no significant cumulative effect is likely.

7.13.4 Traffic growth has been included within the modelling predictions discussed in Section 7.8 of this chapter for the opening and future years of the Scheme. The traffic data used within air quality modelling includes traffic associated with committed development included in Newport and Monmouthshire Local Plans. Therefore, no significant cumulative effects are predicted as a result of the operation of the Scheme.

7.14 Inter-relationships

7.14.1 Changes to local air quality as a result of the Scheme have the potential to generate inter-relationship effects for human health and designated sites. The effect of changes to local air quality as a result of the Scheme on human health is discussed above in relation to the air quality objectives and limit values which are based on evidence relating to the health impacts of these pollutants. In addition, the effect of the Scheme on human health are considered as part of the Health Impact Assessment produced for the Scheme (Appendix 5.4) in which local air quality is considered.

7.14.2 Changes in local air quality as a result of the Scheme have the potential to affect designated sites by changing and affecting vegetation, habitat and species. The effect of changes to local air quality as a result of the Scheme on designated sites is discussed above and in Chapter 10 (Ecology and Nature Conservation) of this ES. The assessment has shown that changes to local air quality do not have a significant effect on assessed designated sites and habitat specific critical loads are met at all designated sites.

7.14.3 Further details regarding inter-relationships between topics are provided in Chapter 17 of the ES.

7.15 Summary of Effects

7.15.1 The assessment has examined the potential effects of the Scheme on air quality during both its construction and operational phases.

7.15.2 A review of the current air quality legislation and planning policies relevant to the Scheme has been undertaken.

7.15.3 The baseline assessment demonstrates that there are existing air quality issues within the study area, with exceedences of the NO_2 annual mean objective being observed along the existing M4 corridor and in Newport City Centre. No exceedences of PM_{10} were recorded in the baseline assessment.

7.15.4 Assessment of the construction phase of the Scheme showed that mitigation is required to reduce potential nuisance dust issues at local residential properties and designated sites. This is a common finding from dust impact assessments and the mitigation measures applied are well tested and acknowledged as being effective. With these in place, the effect of the Scheme during the construction phase is not predicted to be significant. The assessment of effects associated with additional HGV movements during the construction phase has shown that no significant effects are predicted across the study area.

7.15.5 The regional assessment showed that the Scheme would result in a decrease in emissions on a regional scale in the opening year. The decrease in emissions in the opening year is likely to be a function of the proposed new section of motorway being 2.8 km shorter than the existing M4 and the emission rates used to determine the total emissions account for congestion and elevated vehicle emissions associated with this. In comparison with national emissions from the transport sector, the change in emissions as a result of the Scheme are small and are not considered to be significant.

7.15.6 Assessment of the opening and design years showed predicted concentrations of both NO_2 and PM_{10} would be below objective levels in all scenarios. As no exceedances of air quality objectives were observed across the study area at human or ecological receptors, no mitigation was required for the operational phase.

7.15.7 A number of areas were shown to experience a large improvement in air quality concentrations across the study area, most notably in urban areas adjacent to the existing M4 corridor. All AQMAs in the study area are predicted to experience improvements in concentrations as a result of the Scheme. Increases in pollutant concentrations have been predicted at locations within 200 metres of the proposed new section of motorway. However, given the existing low level of pollutant concentrations in this area, pollutant concentrations remain well within the relevant air quality objectives.

7.15.8 The Scheme would result in an increase in annual mean NO_x concentrations and nitrogen deposition at a number of designated sites. However, habitat specific critical loads would be met at all designated sites. As the critical loads are met, it is considered that the increase in nitrogen deposition would not be significant.

7.15.9 Based upon the professional judgement of suitably qualified and experienced specialists, it has been shown that overall the Scheme would provide greater benefits to the region with respect to air quality pollutant concentrations, than the do minimum scenario. With the proposed mitigation implemented during the construction phase, the Scheme would result in no significant adverse effects on air quality. A summary of the likely environmental effects of the Scheme on air quality is shown in Table 7.26.

Table 7.26: Summary of Likely Environmental Effects on Air Quality

Activity	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)
Construction phase	High/Very High	Dust nuisance and soiling, impacts on ecological receptors and exposure to elevated concentrations of PM_{10} for human health.	Short - Medium term	High risk site	Significant	Negligible (with dust control in place)	Not significant
Construction phase	High/Very High	Impacts on human health and designated sites associated with emissions generated by additional HGV movements during the construction phase.	Short - Medium term	Minor Adverse	Not Significant	N/A	Not Significant
Operational phase	High / Very High	Impacts on human health and designated sites associated with emissions generated by operational phase vehicles	Long term	Major Adverse (increase at locations within designated sites immediately adjacent to the proposed new section of motorway)/ Major Beneficial (improvement in human health receptors along the existing M4 corridor)	Not significant (based on IAN 174/13 evaluation. Note that this considers adverse effects only for human health receptors.	N/A	Not significant