

**M42 Junction 6 Improvement
Scheme Number TR010027
Volume 6
6.1 Environmental Statement
Chapter 6 – Air Quality**

Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed
Forms and Procedure) Regulations 2009

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6.1 Environmental Statement Chapter 6 Air Quality

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6 Air quality

6.1 Competent expert evidence

- 6.1.1 This chapter presents the results of an assessment of the likely significant effects of the Scheme on existing air pollutant concentrations, potential air quality impacts associated with the construction and operation of the Scheme.
- 6.1.2 The competent expert responsible for the assessment is a Technical Director who holds a BSc (Hons) in Combined Sciences and a PhD in Environmental Science. They are a full member of both the Institution of Environmental Sciences and the Institute of Air Quality Management.
- 6.1.3 They have 16 years of experience in undertaking and reporting air quality impact assessments as part of environmental impact assessments (EIA) for a wide range of development types. They have worked on numerous road schemes across the UK, from the options appraisal through to construction, and have fulfilled the role of Air Quality Expert for Highways England schemes since 2004.

6.2 Legislative and policy framework

- 6.2.1 The following legislation and planning policy is of direct relevance to the assessment of air quality. Compliance (or otherwise) with statute and policy relating to the protection of air quality is addressed (where applicable) within the Planning Statement [TR010027/APP/7.1].

The Environmental Protection Act (1990)

- 6.2.2 The Environmental Protection Act 1990 [REF 6-1] defines a number of issues relating to dust and air pollution effects on local amenity, that are recognised in the National Planning Policies and considered in this assessment.

Ambient Air Quality Directive (2008/50/EC)

- 6.2.3 Directive 2008/50/EC [REF 6-2] is transcribed into UK legislation by the Air Quality Standards Regulations 2010 which came into force on the 11 June 2010 [REF 6-3].
- 6.2.4 These regulations set limit values on a number of pollutants in ambient air. This assessment uses these limit values which are legally binding on the UK government and have been set with the aim of avoiding, preventing or reducing harmful effects of air quality on human health and on the environment as a whole.

National Air Quality Strategy

- 6.2.5 The UK National Air Quality Strategy [REF 6-4] was initially published in 2000, under the requirements of the Environment Act 1995 [REF 6-5]. The most recent revision of the Strategy [REF 6-6] sets objective values for key pollutants as a tool to help local authorities manage local air quality improvements in accordance with the EU Air Quality Framework Directive [REF 6-7]. Some of these objective values have been laid out within the Air Quality (England) Regulations 2000 [REF 6-8] and later amendment [REF 6-9].

- 6.2.6 The air quality objective values have been set down in regulation solely for the purposes of local air quality management. Under the local air quality management regime, local authorities have a duty to carry out regular assessments of air quality against the objective values and if it is unlikely that the objective values will be met in the given timescale, they must designate an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) with the aim of achieving the objective values. The boundary of an AQMA is set by the governing local authority to define the geographical area that is to be subject to the management measures to be set out in a subsequent action plan. Consequently, it is not unusual for the boundary of an AQMA to include within it, relevant locations where air pollutant concentrations are not at risk of exceeding an air quality objective value.
- 6.2.7 The UK's national air quality objective values for the pollutants of relevance to this assessment are displayed in **Table 6.1**.

Table 6.1: Air quality standards

Pollutant	Averaging period	Limit value/objective	Date for compliance
Nitrogen dioxide (NO ₂)	Annual average	40 µg/m ³	UK 11 June 2010
			EU 1 January 2010
	1-hour average	200 µg/m ³ (not to be exceeded more than 18 times a year)	UK 11 June 2010
			EU 1 January 2010
Particulate matter (PM ₁₀)	Annual average	40 µg/m ³	UK 11 June 2010
			EU 1 January 2005
	24-hour average	50 µg/m ³ (not to be exceeded more than 35 times a year)	UK 11 June 2010
			EU 1 January 2005
Particulate matter (PM _{2.5})	Annual average	25 µg/m ³	UK N/A
			EU N/A
Nitrogen oxides (NO _x)*	Annual average	30 µg/m ³	UK 31 December 2000
			EU 19 July 2001

* For the protection of ecosystems

DEFRA National Air Quality Action Plan

- 6.2.8 In July 2017, The Department for Environment, Food and Rural Affairs (DEFRA) released the 'UK plan for tackling roadside nitrogen dioxide concentrations' [REF 6-10]. The plan principally focuses on empowering local councils to make major changes to their road systems. The plan requires local authorities to set out initial plans by the end of March 2018, followed by final plans by the end of December 2018.

- 6.2.9 Alongside these plans a dataset of DEFRA's predicted pollutant concentrations along specific roads was published. This dataset is called the Pollution Climate Mapping (PCM) dataset and this is used to inform the assessment of compliance of the proposed Scheme with EU Limit Values.
- 6.2.10 In October 2018, DEFRA published a 'Supplement to the UK plan for tackling roadside nitrogen dioxide concentrations' [REF 6-11]. The supplement focuses on measures to bring forward compliance in 33 local authorities with NO₂ exceedances. Solihull Metropolitan Borough Council (SMBC), within which the Scheme is located, was identified as one of the local authorities included in the supplementary plan.

National Planning Statement for National Networks

- 6.2.11 National Planning Statement for National Networks (NPSNN) [REF 6-12] statements 5.3 - 5.15 relate to air quality and have been considered in this assessment. The information presented in statements 5.12 and 5.13 relate to situations where substantial weight should be given to air quality considerations in the decision making process and when refusal, after taking into account mitigation, should be determined.
- 6.2.12 The NPSNN also includes a separate reference in statement 5.18 in regard to any potential increases in carbon emissions as a result of the Scheme.

National Planning Policy Framework

- 6.2.13 The National Planning Policy Framework (NPPF) [REF 6-13] concisely sets out national policies and principles on land use planning. Paragraph 103 of the NPPF [REF 6-13] considers how the planning system should contribute towards sustainable development and support the achievement of national objectives.
- 6.2.14 Air quality is considered as an important element of the natural environment. On conserving and enhancing the natural environment, Paragraph 170 considers how planning policies and decisions should be made to enhance the natural and local environment.
- 6.2.15 Air quality in the UK has been managed through the local air quality management regime using national objectives. The effect of a proposed development on the achievement of such policies and plans are matters that may be a material consideration by planning authorities, when making decisions for individual planning applications. The effect of planning policy and decisions on local air quality management, and how they should be considered, are set out in Paragraph 181, while the roles of the planning authority and the pollution control authority are set out in Paragraph 183.
- 6.2.16 This assessment considers the degree to which the Scheme impacts upon local air quality, and the ability of the relevant authority to achieve its stated objectives.

National Planning Practice Guidance

- 6.2.17 The Planning Practice Guidance (PPG) was updated on 24 July 2018 [REF 6-14], with specific reference to air quality, originally published on 6 March 2014. The PPG states that the planning system should consider the potential effect of new developments on air quality where relevant limits have been exceeded or are near the limit. Concerns also arise where the development is likely to adversely affect the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife). In addition dust can also be a planning concern, for example, because of the effect on local amenity.
- 6.2.18 The PPG provides a number of factors to be considered when deciding whether air quality is relevant to a planning application, and provides guidance on how detailed any air quality assessment needs to be depending on the stated factors. It also considers the scope of mitigation should this be required.

Local Planning Policy

- 6.2.19 In addition to national planning policy frameworks, local authorities publish their own planning policies and guidance. These are presented below for the local authorities within the air quality study area.

Solihull Metropolitan Borough Council

- 6.2.20 SMBC adopted their Local Plan in December 2013 [REF 6-15], replacing the Unitary Development Plan. The plan contains one policy relating to air quality, which states:

“POLICY P14 Amenity: The Council will seek to protect and enhance the amenity of existing and potential occupiers of houses, businesses and other uses in considering proposals for new development, and will:

- i. permit development only if it respects the amenity of existing and proposed occupiers and would be a good neighbour;*
- ii. encourage better air quality in and around the Borough through the adoption of low emission zone initiatives such as those involving the use of electric vehicles for freight and public transport. Development that would contribute to air pollution, either directly or indirectly will be permitted only if it would not hinder or significantly harm the achievement of air quality objectives or any relevant Air Quality Management Plan, and it incorporates appropriate attenuation, mitigation or compensatory measures.”*

Birmingham City Council

- 6.2.21 Birmingham City Council adopted their Local Plan in January 2017 [REF 6-16]. There is no specific policy addressing local air quality and pollution; however, improving air quality and reducing air pollution and emissions do form key parts of the following policies:
- a. Policy TP37 – Health;
 - b. Policy TP38 – A sustainable transport network;
 - c. Policy TP43 – Low emission vehicles; and

d. Policy TP44 – Traffic and congestion management.

North Warwickshire Borough Council

6.2.22 North Warwickshire Borough Council submitted their Draft Local Plan for consultation in March 2018 [REF 6-17]. Policy LP31 states:

“LP31 Development Considerations: Development should meet the needs of residents and businesses without compromising the ability of future generations to enjoy the same quality of life that the present generation aspires to. Development should avoid and address unacceptable impacts upon neighbouring amenities through overlooking, overshadowing, noise, light, air quality or other pollution;”

6.2.23 Until the new plan is adopted, the policies set out in the Core Strategy [REF 6-18] are still in force. The Core Strategy did not present any air quality specific policies, but did retain policies set out in the Local Plan 2006 [REF 6-19]. The Local Plan 2006 did contain an air quality specific policy (policy ENV9 – Air Quality), which states:

“The air quality of the Borough will be safeguarded and enhanced by:

- i. not permitting new potentially polluting forms of development within and bordering the Borough’s Air Quality Management Areas (AQMA) to minimise potential risks to health. The existing AQMA is shown on the Proposals Map;*
- ii. not permitting development that would include hazardous substances likely to have an unacceptable risk to nearby areas and people;*
- iii. not permitting development in the vicinity of notifiable hazardous installations or premises if there is an unacceptable risk to occupiers;*
- iv. not permitting places of residence, employment or other noise-sensitive uses if the occupants would experience significant noise disturbance; and*
- v. not permitting development that would create significant noise disturbance to nearby housing, schools and other noise-sensitive uses.”*

6.3 Assessment methodology

Scope of the assessment

6.3.1 A scoping exercise was undertaken in late 2017 to identify the matters to be covered by the air quality assessment and agree the approach with relevant statutory bodies.

6.3.2 The outcomes of the scoping exercise were recorded in a scoping report [REF 6-27], which was consulted upon as part of a formal request to the Inspectorate for a scoping opinion. The scoping report [REF 6-27] included a summary of all assessment work undertaken as part of the design-development of the Scheme up to the point of its publication.

- 6.3.3 The Inspectorate's scoping opinion [REF 6-39] identified a number of additional overarching EIA and topic-specific matters that were subsequently brought into the overall scope of the assessment. These further considerations are detailed in Appendix 5.3 [TR010027/APP/6.3] and include a summary of how Highways England has responded to the points raised, and where the relevant information is presented within this chapter and elsewhere in the Environmental Statement.
- 6.3.4 In addition to the matters raised in the scoping opinion [REF 6-39], the final assessment scope has also been shaped by the following:
- a. the outcomes of consultation with statutory bodies; and
 - b. design changes made to the Scheme in respect of its form and extent and the associated modelled changes to traffic movements generated.
- 6.3.5 Consideration was given to the activities associated with the future maintenance and management of the Scheme, and whether these have the potential to result in significant effects on air quality. Following a review of the maintenance activities presented in Chapter 3 The project, the process concluded that there would be limited potential of such effects to occur, and that these activities are comparable with standard maintenance operations already being undertaken elsewhere on the strategic and local road networks. Accordingly, the effects associated with this phase of the Scheme were scoped out of the assessment and not considered further.

Assessment guidance

- 6.3.6 The following guidance has been used to inform the scope and content of the assessment, and to assist the identification and mitigation of likely significant effects. This builds upon the overarching EIA methodology and guidance presented in Chapter 5 EIA methodology and consultation.
- 6.3.7 The assessment approach is based on advice published by Highways England, current legislation, national, regional and local policies and some technical methods sourced from Local Air Quality Management Technical Guidance (LAQM TG(16)) [REF 6-20].
- 6.3.8 This report focuses on two main parts:
- a. fugitive dust emissions associated with construction related activities; and
 - b. emissions of nitrogen dioxide (chemical formulae NO₂) and particulate matter (size fraction PM₁₀) due to road traffic during the construction and operational phases of the Scheme.

Design Manual for Roads and Bridges (DMRB), Advice Note HA207/07

- 6.3.9 HA207/07 [REF 6-21] and subsequent interim advice notes (IANs), sets out a methodology to determining the impact that road projects may have on local and regional air quality for human health and ecological receptors. HA207/07 includes a calculation method to estimate local pollutant concentrations and regional emissions to air, including those for carbon.

- 6.3.10 The DMRB [REF 6-21] assessment methodology has been followed. The assessment has included the consideration of impacts on public exposure and impacts European and nationally designated habitat sites:
- emissions from construction works;
 - emissions from road traffic during the construction phase;
 - emissions from road traffic during the operational phase; and
 - compliance risk assessment.
- 6.3.11 The DMRB [REF 6-21] assessment makes reference to the results of the WebTAG assessment that has been carried out following the latest Transport Analysis Guidance (TAG) as provided by the Department for Transport (DfT) (Department for Transport, 2015). The WebTAG assessment allows for an assessment of the project viability based on a Cost-Benefit Analysis of the Scheme. The WebTAG assessment consists of a:
- DfT Web based Transport Analysis Guidance (WebTAG) plan level appraisal; and
 - Regional assessment of pollutant emissions.
- 6.3.12 In addition to DMRB guidance [REF 6-21], a number of air quality IANs have been issued, namely:
- IAN 170/12 v3: Updated air quality advice on the assessment of future NO_x and NO₂ projections for users of DMRB Volume 11, Section 3, Part 1 'Air Quality' [REF 6-22]. This document has been used to adjust future NO_x and NO₂ concentrations based on observed trends in improvements in air quality (see Section 6.3).
 - IAN 174/13: Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 Air Quality [REF 6-23]. This document has been used to assess the significance of local air quality effects as a result of changes in pollutant concentrations due to the Scheme (see Section 6.3).
 - IAN 175/13: Updated advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for users of DMRB Volume 11, Section 3, Part 1 Air Quality [REF 6-24]. This document is used to undertake the Compliance Risk Assessment section for this Scheme (see Section 6.3).
 - IAN 185/15: 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 A Air Quality [REF 6-25]. This document has been used to determine emissions rates for road links within the air dispersion models. See Appendix 6.1 [TR010027/APP/6.3].

- 6.3.13 The IANs listed above provide updates and additional methods to the DMRB [REF 6-21] in regards to road traffic emissions.
- 6.3.14 Advice note HA207/07 [REF 6-21] sets out an approach to considering practicable measures to mitigate construction dust effects and this assessment focuses on the application of good practice measures to minimise the magnitude and frequency of impacts at all receptors. The Outline Environmental Management Plan (OEMP) [TR010027/APP/6.11] (and subsequent Construction Environmental Management Plan) will specify a range of mitigation measures that can be implemented to reduce as far as practicable significant dust effects.
- 6.3.15 Where necessary, the modelling assessment and tools used refer to DEFRA's LAQM Technical Guidance LAQM.TG16 [REF 6-20]. The LAQM.TG16 guidance is accompanied by background pollutant maps and a NO_x to NO₂ calculation spreadsheet. The use of DEFRA background maps are detailed in Section 6.6.12. The NO_x to NO₂ calculation spreadsheet has been used to process model outputs (as NO_x) to nitrogen dioxide for comparison to the relevant national limit value.
- 6.3.16 HA207/07 [REF 6-21] sets the requirement to report the results of any WebTAG appraisal that has been completed for the scheme. WebTAG quantifies the emissions from the Scheme at local and regional levels.

Construction phase

- 6.3.17 The identification of the potential impacts due to construction dust emissions has been based on the approach advised in DMRB [REF 6-21] i.e. to consider sensitive receptors within 200m of construction site. The locations of any sensitive receptors such as housing, schools, hospitals or special ecological sites within 200m of a construction site have been identified so that mitigation measures to reduce dust emissions could be identified and applied.
- 6.3.18 Demolition and construction plant emissions have not been explicitly modelled, as these are considered to be a small emission source relative to ambient local conditions in the vicinity of the Scheme. As such, the assessment has been considered in a qualitative manner based on professional experience and judgement.
- 6.3.19 Assessment of construction traffic also follows DMRB guidance [REF 6-21] to consider the additional vehicle movements due to the construction of the Scheme. If construction is expected to last for more than six months, then construction traffic should be assessed, and follows the same criteria set out in Section 6.3, that is:
- annual average daily traffic (AADT) flows will change by 1,000; or
 - heavy duty vehicles (HDV) (vehicles greater than 3.5 tonnes, including buses and coaches) flows will change by 200 AADT or more.

- 6.3.20 Where the traffic data shows that there are unlikely to be more than a change of 1000 AADT or a change of 200 HDVs per day during the proposed construction phase, then it is considered that the change in vehicle movements are not sufficient to give rise to significant air quality effects.
- 6.3.21 The Scheme would require significant works to the existing M42 Junction 6, and A45 Coventry Road (A45) at Clock Interchange, which would necessitate the use of active construction phase traffic management for the duration of the works in order to minimise traffic re-routing. Where there is insufficient data to undertake a detailed assessment, a qualitative approach will be used to assess the risk of causing significant local air quality effects.
- 6.3.22 Defined mitigation measures have been presented in the OEMP [TR010027/APP/6.11]. These mitigation measures will be based on those presented by the Institute of Air Quality Management (IAQM) guidance on the assessment of dust from demolition and construction sites [REF 6-26], which provides a summary of good practice measures that have been used in the U.K. on similar schemes for many years.

Operation phase

- 6.3.23 The local air quality impact assessment of the operational phase of the Scheme focuses on emissions of the key pollutants nitrogen dioxide and particulate matter (PM₁₀) as these are the principal pollutants of concern with regards to emissions from road traffic, as set out in the DMRB [REF 6-21] and confirmed within the scoping opinion [REF 6-27].
- 6.3.24 For this assessment of operational impacts on local air quality, the Scheme and all affected roads have been assessed at a detailed level of assessment due to the presence of measured elevated concentrations of nitrogen dioxide (see Section 6.6) and the size of predicted increases in traffic flows along sections of the Scheme.
- 6.3.25 This assessment uses dispersion modelling to estimate pollutant concentrations, taking into account additional variables (e.g. meteorological data and variations in flow across the day). The detailed assessment of local air quality reported within this chapter has used the Atmospheric Dispersion Modelling System (ADMS) roads dispersion model (version 4.1.1) software to predict road pollutant contributions at selected sensitive receptors.
- 6.3.26 Predictions have been made for the following scenarios:
- baseline year (2016);
 - opening year (2023) without the Scheme (Do Minimum); and
 - opening year (2023) with the Scheme (Do Something).

- 6.3.27 On the basis of these predictions, the changes in key pollutant concentrations (nitrogen dioxide and PM₁₀) associated with the Scheme have been modelled. Predictions have been verified by comparing the baseline modelling predictions and baseline air quality monitoring data, in line with the methodology published in LAQM TG (16) [REF 6-20] (refer to Appendix 6.1 [TR010027/APP/6.3]). This comparison indicates that there is a close statistical correlation between the two data sets, sufficient to have confidence in the model results (see Table 3 Verification Details, in Appendix 6.1 [TR010027/APP/6.3]).
- 6.3.28 The assessment of PM_{2.5} is considered to be unnecessary as part of the assessment of road traffic emissions, as background concentrations of PM_{2.5} are well below the objective criteria of 25 µg/m³. A conservative assumption is that all PM₁₀ emissions are in fact PM_{2.5}, then the predicted changes in concentrations are still well below the objective criteria. Highways England position is set out and detailed in their position statement on PM_{2.5} [REF 6-28], and includes monitoring data from across the UK. This conservative assumption does not materially change the conclusions of this assessment.
- 6.3.29 Detailed air quality modelling of the likely effects during the Scheme' operational phase have been undertaken in accordance with relevant guidance outlined in DMRB and associated IAN. DEFRA's LAQM Technical Guidance (LAQM.TG(16)) [REF 6-20] will also be taken into account.
- 6.3.30 LAQM guidance and tools, for example NO_x to NO₂ conversion approach and background maps, has also been used as required. Hourly sequential meteorological data for 2016 has been taken from a representative meteorological station (Birmingham Airport) and is used within the dispersion modelling. Birmingham Airport is located within the study area.
- 6.3.31 A key element of the local air quality impact assessment is the rate of improvement in air quality over time as cleaner vehicles enter the national vehicle fleet. The methodology outlined within IAN 170/12 v3 [REF 6-22] on the assessment of future NO_x and NO₂ projections has been used in this assessment. The method considers DEFRA's advice on long term trends related to roadside NO₂ concentrations, which suggests that there is a gap between current projected vehicle emission reductions and projections on the annual rate of improvements in ambient air quality as previously published in DEFRA's technical guidance and observed trends.
- 6.3.32 The methodology, known as 'Gap Analysis', involves the completion of air quality modelling and verification, to correct verified modelled total NO₂ concentrations. Following verification of the modelled results, they are then adjusted to represent the observed long term trend (LTTE6) profile described in IAN 170/12 v3 [REF 6-22]. These results are considered to present a realistic worst-case scenario, as only a portion of the full anticipated improvements in air quality by DEFRA guidance are assumed to occur in the Gap Analysis results by the future opening year. The adjusted results from this Gap Analysis are presented within this chapter.

- 6.3.33 For sensitive designated ecological sites, the effect of the Scheme on annual mean NO_x concentrations and total annual nitrogen deposition will be considered in accordance with DMRB methodology [REF 6-21]. Comparison of results has been made with the critical levels for NO_x and the critical loads for nitrogen deposition (the latter varies according to designation). The implications for designated sites have been considered separately to the air quality assessment as part of the Biodiversity assessment (see Chapter 9 Biodiversity).
- 6.3.34 Results are presented in tabular format showing concentrations at discrete representative sensitive receptors, together with interpretative text. Concentration values are reported to no more than one decimal place.

WebTAG

- 6.3.35 DMRB [REF 6-21] states that the assessment of air quality in relation to highways schemes should report the results of the local air quality WebTAG appraisal (plan level), as completed in line with the guidance set out by The Air Quality Sub Objective, TAG Unit 3.3.3 [REF 6-29]; [REF 6-30].
- 6.3.36 The plan level WebTAG appraisal provides an indication of the overall change in operational air quality as associated with the Scheme.
- 6.3.37 The local plan level methodology within the TAG guidance aims to quantify the change in exposure at receptors in the opening year as a result of schemes, through the quantification of exposure for all DMRB local affected roads. The methodology follows a number of steps comprising:
- a. identification of the Affected Road Network (ARN), which is determined by the criteria set out in DMRB [REF 6-21] (see Section 6.3);
 - b. quantification of the number of properties within 0m-50m, 50m-100m, 100m-150m and 150m-200m bands, from the affected roads;
 - c. the calculation of concentrations within each band at 20m, 70m, 115m and 175m from the road centreline using the DMRB spreadsheet model;
 - d. calculation of property-weighted NO₂ and PM₁₀ concentrations;
 - e. calculation of the total numbers of properties where air quality improves, worsens or stays the same for each pollutant; and
 - f. a calculation of an overall assessment score for NO₂ and PM₁₀.
- 6.3.38 An overall positive score indicates an overall worsening in air quality and an overall negative score indicates an overall improvement in air quality. The results of the WebTAG appraisal are presented in Section 6.9.

Compliance risk assessment

- 6.3.39 Air quality has been evaluated for compliance with Directive 2008/50/EC [REF 6-2] in accordance with IAN 175/13 [REF 6-24]. The assessment has used the results of the local air quality modelling overlaid on the DEFRA compliance network provided to establish whether specific compliance conditions are met as a result of the Scheme. The study area for this element of the assessment differs from the main impact assessment reported in this chapter, in that it only relates to receptors that are more than 25m from a junction. The conditions considered are:
- a. a compliant zone becoming non-compliant; and/or
 - b. delay DEFRA's date for achieving compliance for the zone i.e. the change on a road link would result in concentration higher than the existing maximum value in the zone; and/or
 - c. an increase in the length of roads in exceedance in the zone which would be greater than 1% when compared to the previous road length.
- 6.3.40 This assessment enables Scheme assessors to undertake and report on the risk of the Scheme being non-compliant with Directive 2008/50/EC [REF 6-2]. The evaluation of significance will also include information on compliance risks in relation to Directive 2008/50/EC [REF 6-2] (see Section 6.3).

Regional assessment

- 6.3.41 The regional assessment provides the change in pollutant emissions as a result of Scheme operation.
- 6.3.42 The regional assessment considers changes in annual road transport emissions of NO_x, PM₁₀ and CO₂ that may be brought about by the Scheme in the opening year (2023) and the design year (i.e. 15 years after opening, 2038) at a regional level. The latest Emission Factor Toolkit (EFT v8.0.1) [REF 6-29] spreadsheet has been used in the estimation of these emissions. As the DEFRA projections are only available up to 2030, the assessment of the design year emissions assumes no further improvement in emissions between 2030 and 2038.
- 6.3.43 HA207/07 [REF 6-21] regional scoping criteria in Section 6.3 have been applied to opening year traffic data and the design year traffic data to define the regional affected road network (which is different to that assessed for local air quality).
- 6.3.44 The scenarios modelled include:
- a. the existing base case (the traffic model base case, 2016); and
 - b. the future 'Do Minimum' and 'Do Something' scenarios in the opening year (2023) and design year (2038).
- 6.3.45 The regional assessment has been undertaken for the whole study area - the results of the assessment (annual emissions, change in emissions with the Scheme) are presented in tabular format, together with descriptive text in Section 6.9.
- 6.3.46 The output of this assessment for NO_x and PM₁₀ emissions does not contribute to the overall evaluation of significance for air quality.

Establishment of the baseline conditions

- 6.3.47 In this assessment, the baseline air quality conditions are quantified through dispersion modelling. Existing air quality data has been gathered from publically available data sources covering the local authorities in whose areas the Scheme would be situated and where there are anticipated to be significantly affected road links. In addition to measurement data available from the local authorities, nitrogen dioxide diffusion tube surveys have been conducted by Highways England in the vicinity of the Scheme, and the results of these surveys have been used to calibrate the models used to quantify baseline conditions at selected sensitive receptors. Where there is no suitable background monitoring data, this has been sourced from data published by DEFRA.
- 6.3.48 This data has been used in model verification in order to predict the baseline conditions at selected sensitive air quality receptors. The data used in the determination of the existing baseline conditions are set out in Section 6.5. The approach to predict the baseline conditions at sensitive receptors is set out in Appendix 6.1 [TR010027/APP/6.3] and the results are reported in Appendix 6.3 [TR010027/APP/6.3].

Sensitivity of air quality receptors

- 6.3.49 Receptors have been selected at locations near to the route of the Scheme and at locations representative of conditions in the wider study area.
- 6.3.50 The construction of the Scheme is likely to change the rate of dust deposition and concentration of particulate matter (PM₁₀) at both human and ecological receptors in the vicinity of the Scheme. At residential properties, dust deposition has an effect on the amenity of the property, due to soiling of windows, cars and other property. At commercial receptors, the changed dust deposition can have different effects. Receptors such as car showrooms are sensitive due to soiling of cars outside, while food production, painting and spraying operations and glasshouses are sensitive as an increase in dust deposition would require a change in working practice such as additional cleaning requirements, or the installation of filters to control air flow to the process. At ecological sites, there is evidence that high dust deposition rates have an impact on vegetation, due to the soiling of leaves leading to a reduction in photosynthesis [REF 6-21]; [REF 6-31].
- 6.3.51 The construction phase can also lead to changes in the concentration of PM₁₀ at sensitive receptors due to fugitive dust generation and emissions from onsite plant and construction vehicles accessing the wider road network.
- 6.3.52 During the operational phase, the generation of traffic along the Scheme and changes in traffic flows on other links in the ARN would lead to changes in pollutant concentrations at sensitive receptors. The details of the receptors within the vicinity of the Scheme that are likely to be affected by construction and operational emissions are presented in Appendix 6.1 [TR010027/APP/6.3].

Magnitude of impact criteria

- 6.3.53 With regard to road traffic, the change in pollutant concentrations compared to 'Do Minimum' concentrations has been quantified at selected sensitive receptors. The absolute magnitudes of pollutant concentrations in the baseline and 'Do Minimum' scenarios have also been quantified and these have been used to consider the risk of the air quality limit values being exceeded in each scenario.
- 6.3.54 For a change of a given magnitude (increase or decrease) in pollutant concentrations, IAN 174/13 [REF 6-23] contains descriptors of the magnitude of change at individual sensitive receptors. For example, a change in predicted annual average concentrations of NO₂ or PM₁₀ of less than 0.4 µg/m³ is considered to be so small as to be imperceptible. A change (impact) that is imperceptible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant. The magnitude of change is divided into four classes as defined in **Table 6.2**.

Table 6.2: Magnitude of change in ambient pollutant concentrations (IAN 174/13)

Magnitude of change (µg/m ³)	Value of change in annual average NO ₂ and PM ₁₀
Large (>4)	Greater than full measure of uncertainty (MoU) value of 10% of the air quality objective (4 µg/m ³)
Medium (>2 to 4)	Greater than half of the MoU (2 µg/m ³), but less than the full MoU (4 µg/m ³) of 10% of the air quality objective
Small (>0.4 to 2)	More than 1% of objective (0.4 µg/m ³) and less than half of the MoU i.e. 5% (2 µg/m ³). The full MoU is 10% of the air quality objective (4 µg/m ³)
Imperceptible (≤0.4)	Less than or equal to 1% of the objective (0.4 µg/m ³)

- 6.3.55 The magnitude of the change in the predicted number of exceedances of the 24-hour objective is directly derived from the predicted annual average value using the relationship defined in LAQM.TG (16) [REF 6-20]. The magnitude descriptors for 24-hour average PM₁₀ are equal to the percentage changes set out above.
- 6.3.56 Research projects completed on behalf of DEFRA and the devolved administrations [REF 6-32]; [REF 6-33] have concluded that the hourly average NO₂ objective is unlikely to be exceeded if annual average concentrations are predicted to be less than 60 µg/m³. Therefore, this assessment evaluates the likelihood of exceeding the hourly average NO₂ objective by comparing predicted annual average NO₂ concentrations at all receptors to an annual average equivalent threshold of 60 µg/m³ NO₂. Where predicted concentrations are below this value, it has been concluded that the hourly average NO₂ objective (200 µg/m³ NO₂ not more than 18 times per year) is likely to be achieved.

Identification of likely significant effects

- 6.3.57 HA207/07 [REF 6-21] does not require impacts on dust sensitive receptors to be quantified or for defined effect descriptors to be applied at individual receptors. Instead the approach is to identify the location of receptors and to select measures that are both appropriate and practicable to mitigate potential effects at receptors. This chapter and the subsequent OEMP [TR010027/APP/6.11] will set out the measures that can be implemented with the aim of avoiding significant dust effects.
- 6.3.58 Evaluation of the significance of the local air quality assessment findings at sensitive receptors for health and designated ecological sites have been undertaken in accordance with Highways England guidance IAN 174/13 [REF 6-23]. This guidance evaluates the significance of air quality effects using the total estimated pollutant concentrations at sensitive receptors and the magnitude of change estimated to occur as a result of a scheme and recommends that the following key criteria for air quality are considered:
- Is there a risk that environmental standards will be breached?
 - Is there a high probability of the effect occurring?
 - 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 protected sites, areas or features will be affected?
 - Will it be difficult to avoid, or reduce or repair or compensate for the effect?
- 6.3.59 Following the collation of information to address these questions, an informed professional judgement on the significance of local air quality effects for public exposure and designated ecological sites has been established. Of the above questions, 'will many people be affected?' has been addressed in terms of the number of receptors predicted to have small, medium and large changes in air quality. The change focuses only on those receptors that exceed the air quality objective value and in cases where the numbers of affected properties are above the upper thresholds listed in **Table 6.3** (taken from IAN 174/13 [REF 6-23]) this may suggest likely significant air quality effects.

Table 6.3: Guideline for number of properties constituting a significant effect (in accordance with IAN 174/13)

Magnitude of change in NO ₂ or PM ₁₀ (µg/m ³)	Guideline for number of properties constituting a significant effect	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective or the removal of an existing exceedance
Large (>4)	1 to 10	1 to 10
Medium (>2 to 4)	10 to 30	10 to 30
Small (>0.4 to 2)	30 to 60	30 to 60

6.4 Assessment assumptions and limitations

Scheme design and limits of deviation

- 6.4.1 The assessment has been based on the Scheme description detailed within Chapter 3 The Project, and has taken into account the lateral and vertical limits of deviation defined on the Works Plans [TR010027/APP/2.3] in order to establish a realistic worst case assessment scenario.
- 6.4.2 This scenario has identified and reported the effect that any lateral and vertical deviation would realistically give rise to. This has for example, taken into account the potential for components of the Scheme to be positioned at a slightly higher elevation, or brought into closer proximity to receptors, and thereby potentially result in different levels of exposure to air quality emissions.
- 6.4.3 Taking the above into account, the limits of deviation associated with the Scheme are not considered to change the findings and conclusions of the assessment.

Warwickshire Gaelic Athletic Association

- 6.4.4 Using professional judgement, the illustrative reconfiguration design options for the Warwickshire Gaelic Athletic Association (WGAA) facility presented in **Figure 3.5a to 3.5e** [TR010027/APP/6.2] were appraised to take account of the variation in the physical extents, pitch layout, buildings, fencing and lighting provision across the options.
- 6.4.5 The objective of the appraisal was to identify whether one option would potentially give rise to different effects than another, in order to then identify the worst case for the purposes of the assessment presented within this chapter.
- 6.4.6 The appraisal concluded that the design variation between the options would not be of a level that would result in different types or significance of effect on air quality. Nor would any particular option introduce impacts to a reconfigured WGAA facility.

Baseline survey data

- 6.4.7 The assessment of potential air quality impacts is based on the data available at the time of writing.

- 6.4.8 Verification of the air quality model has been conducted based on six months of monitoring data (September 2017 to March 2018 inclusive).

Impact assessment and mitigation

- 6.4.9 Traffic data used in this assessment is based on April 2018 Design Fix. Since the development of the traffic model and subsequent traffic flow data, changes have been made to the Scheme design and are published as October 2018 Design Fix. The details of the changes between April 2018 and October 2018 Design Fixes are described in Chapter 4 Scheme history and alternatives. The consequential changes in layout on forecast traffic are reported in a Technical Note, contained in Transport Appraisal Report [TR010027/APP/7.2]. These changes in design fixes are not adjacent to any modelled receptors, and any changes to traffic flows are expected to be restricted to these changed road links and the roads.
- 6.4.10 Due to the low predicted air pollutant concentrations and the limited scale of changes in the concentrations, it is considered that the design changes between April 2018 and October 2018 would not cause a material change in predicted changes in pollutant concentrations, and that the conclusions of the assessment would remain valid.

6.5 Study area

- 6.5.1 The study area for the construction phase dust assessment is the area within 200m of the sections of the M42 and A45 where works would be undertaken and the Scheme route as defined in HA207/07 [REF 6-21]. This is illustrated on **Figure 6.1** [TR100027/APP/6.2] and, in accordance with DMRB [REF 6-21], significant effects are not considered likely beyond this distance.
- 6.5.2 The assessment of construction phase traffic effects (construction vehicle movements assessment and traffic management assessment) and operational phase traffic effects (local operational assessment and plan level WebTAG) use a study area of 200m around road sections likely to be affected by the Scheme. This is due to the effect of pollutants from road traffic reducing with distance from the point of release, and beyond 200m these are likely to have reduced to a concentration equivalent to background concentrations.
- 6.5.3 Therefore, individual sensitive receptors (within or outside AQMAs) are studied in the local operational assessment at distances up to 200m. The regional assessment considers emissions rather than concentrations of pollutants. The air quality study area for the construction phase traffic and traffic management assessments and the local operational assessment consider the Scheme itself, and those routes where the Scheme is predicted to have an impact. Affected road links (individually modelled sections of road) have been identified by comparing traffic data with the Scheme (Do Something) and without the Scheme (Do Minimum) against the local air quality screening criteria presented in DMRB [REF 6-21] and set out below:
- road alignment will change by 5m or more; or
 - annual average daily traffic (AADT) flows will change by 1,000; or

- c. heavy duty vehicles (HDV) (vehicles greater than 3.5 tonnes, including buses and coaches) flows will change by 200 AADT or more; or
- d. daily average speeds will change by 10km/hr or more; or
- e. peak hour speed will change by 20km/hr or more.

6.5.4 These criteria are used to identify whether significant changes in air quality are likely. If a criterion is not met or exceeded, then a significant change in air quality is not anticipated. The ARN for the 2023 and 2038 Do Minimum scenarios are shown in **Figures 6.3** and **6.4** respectively [TR010027/APP/6.2].

6.5.5 A quantitative air quality assessment has been undertaken for the operational phase and so a study area for this phase has been established. A small number of road links which have been identified in the operational study area have not been subject to detailed air quality assessment. This is because these links are remote from the main Scheme route and are not considered to include locations which affect the overall significance of air quality effects due to the Scheme operation. However, these locations have been included in this chapter for completeness.

6.5.6 Construction phase vehicle movements have been compared against the relevant criteria set out above, and a qualitative assessment has been undertaken. Construction phase traffic management are discussed qualitatively, and traffic management measures will be included within the OEMP [TR010027/APP/6.11].

6.5.7 Additional links have been included in the local operational air quality modelling where the additional emissions from these areas or links are required to describe pollutant concentrations at sensitive receptor locations. This has been carried out with regard to sensitive receptors along affected routes and adjacent to the Scheme.

6.5.8 The plan level study area is the same as the local assessment study area.

6.5.9 The regional air quality study area is based on the regional screening criteria presented in DMRB [REF 6-21] given:

- a. a change of more than 10% AADT; or
- b. a change of more than 10% to the number of HDV AADT; or
- c. a change in daily average speed of more than 20km/hr.

6.6 Baseline conditions

Monitoring data

6.6.1 There is one AQMA in the vicinity of the Scheme, located approximately 2km to the west of the existing M42 corridor. This has been declared as a city wide AQMA by Birmingham City Council, covering the entirety of their administrative area due to the exceedance of the NO₂ annual mean limit value, and the exceedance of the 24-hour mean limit value [REF 6-34].

- 6.6.2 A review of the available modelled background concentrations along the Scheme has been carried out for annual mean background concentrations of NO₂ and PM₁₀ provided in 1km x 1km grid squares [REF 6-36]. Background concentrations for 2016 are well below the relevant objective values in this area for all pollutants. See Section 6.7 for details of the background data.
- 6.6.3 Both SMBC [REF 6-37] and North Warwickshire Borough Council [REF 6-35] have undertaken air quality monitoring at locations near to the study area. Birmingham City Council have undertaken monitoring across their administrative area (2017), however, none of their monitoring locations are within the study area.
- 6.6.4 Monitoring undertaken by SMBC was decommissioned in 2012 and so the most recent air quality monitoring data relate to 2011. Diffusion tube monitoring was restarted by SMBC in June 2017 at 24 locations across the borough in order to determine baseline conditions. The results are due to be reported in the next Annual Status Report by the Local Authority which has not been available for inclusion within this assessment.
- 6.6.5 In 2011, monitoring results near to main roads, such as along A45, indicate that concentrations of NO₂ were well below the national limit value for nitrogen dioxide of 40 µg/m³, with one monitoring location on Old Station Road near Junction 6 on the M42 had a reported NO₂ concentration of slightly below the national limit value. This monitoring location was located within 5m of the Junction 6 roundabout and indicates that receptors located close to the M6 are at risk of exceeding the NO₂ annual mean limit value.
- 6.6.6 Monitoring undertaken by North Warwickshire Borough Council in Coleshill record NO₂ concentrations at relevant receptors that were consistently well below the national limit value of 40 µg/m³ at locations near to the interchange between the M6, M6 Toll and M42.
- 6.6.7 Monitoring of NO₂ has been conducted by Highways England at eight locations using diffusion tubes in 2016. **Table 6.4** presents the results of the 2016 monitoring programme.

Table 6.4: Highways England NO₂ diffusion tube monitoring in proximity to the Scheme

Site ID	Site type	Grid reference		Annual mean NO ₂ concentration (µg/m ³)			
		X	Y	2013	2014	2015	2016
M42J3AJ5_007_0813 Warwick Road	Roadside ^a	416921	278428	28.0	26.2	- ^b	- ^b
M6J2J4_037_0513 Coventry Road	Roadside ^a	420012	287273	52.1	49.0	- ^b	- ^b
M6J2J4_040_0513 142 Cornfield Croft	Roadside ^a	418851	287187	32.8	34.1	- ^b	- ^b
BBP4_001_0116 Chester Road	Roadside ^a	420024	284970	- ^b	- ^b	- ^b	29.6
BBP4_002_0116 East Way	Roadside ^a	420281	283176	- ^b	- ^b	- ^b	26.5

Site ID	Site type	Grid reference		Annual mean NO ₂ concentration (µg/m ³)			
		X	Y	2013	2014	2015	2016
BBP4_003_0116 Church Lane	Roadside ^a	419283	282932	- ^b	- ^b	- ^b	24.7
BBP4_004_0116 Old Station Road	Roadside ^a	419854	282851	- ^b	- ^b	- ^b	32.2
BBP4_005_0116 St Peters Lane	Roadside ^a	418892	282217	- ^b	- ^b	- ^b	17.5
BBP4_006_0116 Shadowbrook Lane	Roadside ^a	419564	281289	- ^b	- ^b	- ^b	20.8
BBP4_007_0116 Warwick Road	Roadside ^a	416857	278508	- ^b	- ^b	- ^b	27.9
BBP4_008_0116 Warwick Road	Roadside ^a	416812	278547	- ^b	- ^b	- ^b	21.8
^a Classification for sites within 1 m and 5 m from the kerb, as defined in DEFRA Technical Guidance (TG16)							
^b No monitoring undertaken at this time							

6.6.8 SMBC and North Warwickshire Borough Council have undertaken monitoring within the vicinity of the Scheme and ARN. The latest monitoring results available are published by the councils [REF 6-35; REF 6-37], and detailed results at selected sites over the last five years in the nearby local authorities are provided in **Table 6.5**.

Table 6.5: Trends in NO₂ concentrations

				Annual mean NO ₂ concentrations (µg/m3)				
Site ID	Site name	Site type	Distance to Scheme (km)	2010	2011	2012	2013	2014
SMBC								
19	Partridge Close	Roadside	4.5	- ^a	28.6	- ^a	- ^a	- ^a
20	Blackfirs	Suburban	2.5	- ^a	22.5	- ^a	- ^a	- ^a
21	Old Station Road	Roadside	1	- ^a	39.7	- ^a	- ^a	- ^a
North Warwickshire Borough Council								
6	Coventry Road, Coleshill	Roadside	4.5	33	28	34	31	31
7	Coleshill School	Roadside	5	29	23	28	25	24
8	Packington Lane, Coleshill	Roadside	5	28	22	27	24	22

				Annual mean NO ₂ concentrations (µg/m ³)				
11	AQMA Farmhouse (Gate)	Roadside	4	39	33	38	38	35
^a No monitoring undertaken at this time								

- 6.6.9 Measured NO₂ concentrations have shown a range of variation over the last five years in and close to the study area, although concentrations vary from year to year depending on meteorological conditions. No monitoring location reported a concentration above the 40 µg/m³ national limit value for nitrogen dioxide.
- 6.6.10 AECOM have undertaken a nitrogen dioxide diffusion tube survey in order to reconfirm existing monitoring data. The monitoring locations are shown in **Table 6.6** and **Figure 6.2 (Sheet 1 to 8)** [TR010027/APP/6.2].
- 6.6.11 The monitoring data available at the time of this assessment covers a period of six months (September 2017 to March 2018), and has been annualised to 2016 in line with the methodology set out in LAQM.TG (16) [REF 6-20]. The monitoring results used in this assessment and details of the monitoring survey are set out in Appendix 6.2 [TR010027/APP/6.3].

Table 6.6: September 2017 to March 2018 monitoring locations

Site ID	Description	Grid reference		September 2017 to March 2018 monitored NO ₂ concentration (µg/m ³)	Bias adjusted 2016 annual mean NO ₂ concentration (µg/m ³)
		X	Y		
M42_001	142 Cornfield Croft, Chelmsley Wood	418851	287187	35.6	31.2
M42_002	Coventry Road, Coleshill	420012	287273	62.4	54.7
M42_003	Old Station Road/M42 Junction 6 Roundabout	419849	282926	72.6	63.7
M42_004	Old Station Road	419854	282851	49.1	43.1
M42_005	1 Clock Lane, Bickenhill	418505	282884	34.0	30.1
M42_006	The Haven Caravan Park, B4438 Catherine-de-Barnes Lane, Bickenhill	418574	282476	37.1	32.6
M42_007	Glebe Farm, St Peters Lane, Bickenhill (Background)	418662	282416	26.2	23.9
M42_008	Bracey's Nursery and Garden Centre, B4438 Catherine-de-Barnes Lane, Bickenhill	418533	281791	36.7	32.2
M42_009	Four Winds, B4438 Catherine-de-Barnes Lane	418435	281234	27.3	24.0
M42_010	B4102 Hampton Lane, Catherine-de-Barnes	418082	280449	31.5	27.6
M42_011	B4102 Solihull Road	419251	280628	28.6	25.1

Site ID	Description	Grid reference		September 2017 to March 2018 monitored NO ₂ concentration (µg/m ³)	Bias adjusted 2016 annual mean NO ₂ concentration (µg/m ³)
		X	Y		
M42_012	3 High Street, Hampton in Arden	420320	280868	40.1	35.1
M42_013	Warwick Road, Solihull	416857	278508	32.5	28.5
M42_014	Warwick Road, Solihull	416921	278428	33.6	29.4

Background data

6.6.12 In addition to the available monitoring data, annual average background pollutant data for each 1km x 1km grid square within the vicinity of the Scheme have been sourced from the DEFRA 2015 Background Pollution Maps [REF 6-36]. Data for the baseline year 2016, construction year 2021 and opening year 2023 have been used. Contributions from motorways, trunk A roads and A roads have been manually removed from each grid square using DEFRA's 'NO₂ Adjustment for NO_x Sector Removal Tool', as these contributions have been explicitly modelled as part of applicable modelling for the air quality assessment. The mean, maximum and minimum concentrations of NO_x, NO₂ and PM₁₀ for the grid squares that encompass the Scheme are shown in **Table 6.7**.

Table 6.7: Background pollutant concentrations from DEFRA background maps

	Annual mean background pollutant concentration (µg/m ³)*								
	2016			2021			2023		
	NO _x	NO ₂	PM ₁₀	NO _x	NO ₂	PM ₁₀	NO _x	NO ₂	PM ₁₀
Mean	23.1	23.9	14.4	18.3	19.4	13.9	16.9	18.0	13.8
Maximum	32.4	23.9	16.7	26.0	20.0	16.3	24.6	18.9	16.3
Minimum	15.1	23.9	12.8	12.1	19.1	12.3	11.2	17.5	12.3
* Concentrations reported are after removal of contributions from Motorways, trunk A roads and A roads									

6.6.13 As shown in the table above, background pollutant concentrations within the vicinity of the Scheme are below the national limits values for the respective pollutants, with all maximum concentrations less than half of their respective limit values.

6.6.14 In addition to background concentrations from monitoring data and DEFRA, background concentrations of NO_x at ecological sites have been sourced from the Air Pollution Information System [REF 6-38]. The APIS online tool provides information on nitrogen deposition rates and NO_x concentrations at designated ecological sites, and can be searched by either site name (in the case of Sites of Special Scientific Interest (SSSIs)), or by grid square (in the case of Local Wildlife Sites (LWS) and Local Nature Reserves (LNR)). This provides site specific information for the assessment of air quality impacts at ecological receptors.

- 6.6.15 The complete background data used in this assessment, and specific values used at sensitive receptors, is shown in Appendix 6.1 [TR010027/APP/6.3].

6.7 Potential impacts

- 6.7.1 The introduction and/or modification of road infrastructure associated with the Scheme has the potential to result in changes to existing air quality emission levels within the study area on sensitive receptors, during both the construction and operational phases in the following ways:

Construction

- 6.7.2 Potential temporary impacts during construction may include:

- a. an increase in dust emissions and the associated impact at sensitive receptors during construction of the Scheme from dust generating activities on site;
- b. emissions associated with machinery undertaking construction works; and
- c. air quality could be affected by changes in traffic flows during construction, as a result of temporary traffic management measures and/or additional vehicles travelling to and from the construction site transporting materials, plant and labour.

Operation

- 6.7.3 The operation of the Scheme has the potential to impact local air quality at human health receptors (i.e. residential) and ecological receptors and regional air quality, due to:
- a. the inclusions and changes to the road layout and alignment associated with the Scheme has the potential to introduce new emissions sources in locations where emissions have not been present previously;
 - b. the Scheme having the potential to bring emission sources closer to existing receptors; and
 - c. the Scheme having the potential to change the flow, speed and composition of traffic on the road network, thus affecting local and regional air quality beyond the immediate extents of the Scheme.
- 6.7.4 On the basis of the available information, including existing monitored concentrations in the wider study area, no exceedances of the annual mean NO₂ UK AQS objective would occur.

6.8 Design, mitigation and enhancement measures

- 6.8.1 Environmental considerations have been taken into account during the development of the Scheme design, in order to reduce and/or avoid the potential air quality effects through design. This iterative approach has led to a range of mitigation measures capable of reducing the magnitude of impacts being embedded within the Scheme design or captured within the OEMP [TR010027/APP/6.11].

Construction

Embedded mitigation

- 6.8.2 The proposed locations of the main site compound and associated storage areas have been identified to reduce the potential for impacts to sensitive receptors.
- 6.8.3 Vehicle movements associated with construction phase have been considered as part of the construction phase of the Scheme. To reduce the generation of dust, temporary haul roads would form part of the construction works to reduce as far as practicable construction related traffic movements on the local road network.
- 6.8.4 The mainline link road route alignment has been designed to reduce its proximity to Bickenhill village and hence reduce the potential for changes to operational air quality emissions at identified sensitive receptors within the village.

Standard mitigation measures

- 6.8.5 The OEMP [TR010027/APP/6.11] details the measures that would be undertaken during construction of the Scheme to mitigate temporary effects as a result in changes in air quality emissions. These measures are based on industry best practice and those presented in the IAQM guidance [REF 6-26].
- 6.8.6 The types of activities with the potential to generate dust during the construction phase include:
 - a. movement of vehicles;
 - b. preliminary works (e.g. verge clearance);
 - c. earthworks;
 - d. demolitions (e.g. concrete bases and footings);
 - e. excavation and installation of drains and communication ducts;
 - f. construction of retaining walls etc.;
 - g. surfacing works;
 - h. central reserve works;
 - i. installation of verge furniture and planting vegetation; and
 - j. stock piling/storage.

Operation

- 6.8.7 No operational mitigation is required, as the results of the air quality assessment concluded that no significant air quality effects would be generated during operation of the Scheme.

6.9 Assessment of significant effects

Construction phase

Construction dust emissions

- 6.9.1 During the construction phase, there is the potential for adverse impacts from dust emissions from the construction site at sensitive receptors within the vicinity of the site and access roads.
- 6.9.2 Receptors located on St Peters Lane to the North West of Church Lane, and along the B4438 Catherine-de-Barnes Lane (Catherine-de-Barnes Lane) to the south of Bickenhill are located adjacent to the construction corridor, and are likely to experience a change in impacts due to activities associated with construction. However, with the implementation of standard mitigation measures, there is unlikely to be a significant air quality effect associated with for construction dust emissions.

Construction traffic emissions

- 6.9.3 During the construction phase, it is expected that there would be additional vehicle movements generated by staff, delivery light duty vehicles (LDVs) and HDVs accessing the site from the surrounding road network, and the potential for vehicles on haul roads within the site. These vehicles have the potential to increase concentrations of pollutants at receptors near to the ARN and haul roads, specifically nitrogen dioxide and PM₁₀. The routes these vehicles are likely to utilise will be included within the OEMP [TR010027/APP/6.11], and are likely to be restricted to the major roads in vicinity of the Scheme. This would further assist in the reduction of potential significant construction effects at identified receptors.
- 6.9.4 At the peak of construction (2021), there is predicted to be an additional 533 two way LDV movements and 493 daily two way HDV movements on the highway. These movements are spread across different Scheme areas, with the highest number of vehicle movements accessing the main project compound at Clock Interchange. A maximum of 533 LDV are expected to access the compound at peak construction. There would be a total of 1066 two-way movements at the construction compound. This traffic would be dispersed across the network, and no road is predicted to exceed the 1000 AADT criteria. The highest predicted number of two way vehicle movements is predicted to be on the A45 between Clock Interchange and Junction 6 of the M42, with a total of 958 two-way vehicle movements, of which 158 are HDVs. These additional movements are below the 1000 AADT criteria increase for all traffic, and the 200 AADT criteria for HDVs, set out in DMRB to determine affected links, and it is considered that this number of additional vehicle movements would not lead to a significant worsening of air quality in the vicinity of the Scheme.

Construction phase traffic management

- 6.9.5 The Scheme would involve a number of works on the M42, A45 and Junction 6 of the M42. During these works, there are likely to be changes in traffic flows due to speed restrictions, lane and slip road closures, and vehicle re-routing, requiring traffic management on the road network. The extent of the required traffic management will be included in the OEMP [TR010027/APP/6.11], and will consider potential air quality impacts as a result of changes to traffic flows. Traffic management should be designed to keep congestion to a minimum, and where re-routing of traffic is required, it should avoid areas of poor air quality, or creating such areas.

Summary of construction effects

- 6.9.6 These sensitive receptors are located along the route of the Scheme, primarily those along St Peters Lane in Bickenhill and along the Catherine-de-Barnes Lane and are adjacent to the site boundary, or near to construction activities. Standard mitigation measures will be incorporated into the Scheme where appropriate, in order to minimise construction related impacts on these receptors. With the implementation of mitigation measures defined within this chapter and presented in the OEMP [TR010027/APP/6.11], it is considered the Scheme would not give rise to significant air quality construction effects and no additional mitigation is required.

Operation phase

Local assessment

- 6.9.7 The Scheme would cause a change in pollutant concentrations at receptors across the study area due to a change in the flows of traffic around Junction 6, and the introduction of new road traffic to an area with currently low levels of traffic. The magnitude of these impacts are summarised in the following section, with the full results set out in Appendix 6.3 [TR010027/APP/6.3].

Sensitive human receptors

- 6.9.8 **Figure 6.2 (Sheet 1 and 2)** [TR010027/APP/6.2] present the areas to the north of the Scheme, covering Marston Green, Coleshill and Little Packington, and includes the receptors R1 – R13, R18, R50, R55 and R57 – R59. None of these receptors locations are predicted to experience a change in annual mean concentrations of nitrogen dioxide or PM₁₀ of greater than 0.1 µg/m³, which is considered negligible. Annual mean concentrations of nitrogen dioxide are predicted to be less than 30 µg/m³ at all receptor locations, and annual mean concentrations of PM₁₀ are less than half of the respective limit values.

- 6.9.9 **Figure 6.2 (Sheet 3) [TR010027/APP/6.2]** covers the northern extent of the Scheme (excluding Junction 6 of the M42), covering the areas of Bickenhill and Elmdon, and includes the receptors R15 – R17, R19, R36, R40, R43 – R46, R51, R52 and R60. Of these receptors, three are predicted to experience a change in annual mean nitrogen dioxide concentrations of greater than $0.4 \mu\text{g}/\text{m}^3$ – R16 ($-0.7 \mu\text{g}/\text{m}^3$), R40 ($+0.4 \mu\text{g}/\text{m}^3$) and R46 ($+0.6 \mu\text{g}/\text{m}^3$). At receptor R16, (Arden Hotel) located near to the A45 and between the Clock Interchange and Junction 6 of the M42, annual mean nitrogen dioxide concentrations are predicted to decrease from $31.3 \mu\text{g}/\text{m}^3$ to $30.6 \mu\text{g}/\text{m}^3$, a decrease of $0.7 \mu\text{g}/\text{m}^3$ which is considered to be a small change.
- 6.9.10 For PM_{10} , annual mean concentrations at R16 are predicted to decrease from $17.5 \mu\text{g}/\text{m}^3$ to $17.3 \mu\text{g}/\text{m}^3$ (a decrease of $0.2 \mu\text{g}/\text{m}^3$), and these changes are considered to be imperceptible.
- 6.9.11 Receptors R40 and R46 are predicted to experience an increase in annual mean nitrogen dioxide concentrations of greater than $0.4 \mu\text{g}/\text{m}^3$. Concentrations are predicted to increase from $20.2 \mu\text{g}/\text{m}^3$ to $20.8 \mu\text{g}/\text{m}^3$ (an increase of $0.6 \mu\text{g}/\text{m}^3$) at R46, and to increase from $20.1 \mu\text{g}/\text{m}^3$ to $20.5 \mu\text{g}/\text{m}^3$ (an increase of $0.4 \mu\text{g}/\text{m}^3$) at R40. These changes are considered to be small in magnitude. Both receptors are located near to the route of the Scheme, with R46 on St Peters Lane in Bickenhill, and R40 on Shadowbrook Lane to the south of Bickenhill.
- 6.9.12 For PM_{10} , concentrations at R46 are predicted to increase from $14.4 \mu\text{g}/\text{m}^3$ to $14.6 \mu\text{g}/\text{m}^3$ (an increase of $0.2 \mu\text{g}/\text{m}^3$). At R40, PM_{10} concentrations are predicted to increase from $13.0 \mu\text{g}/\text{m}^3$ to $13.1 \mu\text{g}/\text{m}^3$ ($0.1 \mu\text{g}/\text{m}^3$ increase). These changes are considered to be imperceptible.
- 6.9.13 **Figure 6.2 (Sheet 4) [TR010027/APP/6.2]** covers Junction 6 of the M42 and the area to the east of the Scheme, and includes the receptors R14 and R20 – R25. Of these receptors, R20 is predicted to experience a change in the annual mean nitrogen dioxide concentration of greater than $0.4 \mu\text{g}/\text{m}^3$. In the opening year (2023), annual mean nitrogen dioxide concentrations are predicted to be $46.9 \mu\text{g}/\text{m}^3$ in the Do Minimum scenario, and $44.7 \mu\text{g}/\text{m}^3$ in the Do Something scenario, a decrease of $2.2 \mu\text{g}/\text{m}^3$ between the two scenarios. This is predicted to be a medium change in annual mean nitrogen dioxide concentrations.
- 6.9.14 For PM_{10} , annual mean concentrations at R20 decrease from $19.5 \mu\text{g}/\text{m}^3$ to $19.1 \mu\text{g}/\text{m}^3$ (a decrease of $0.4 \mu\text{g}/\text{m}^3$). These changes are considered to be a small change in concentrations.
- 6.9.15 **Figure 6.2 (Sheet 5) [TR010027/APP/6.2]** covers the southern extent of the Scheme, covering the areas of Catherine-de-Barnes and Elmdon Heath, and includes the receptors R33 – R35, R37 – R39, R41, R42, R47 – R49, R53, R56, R61, and R62. With the exception of R42, none of these receptors locations are predicted to experience a change in annual mean concentrations of nitrogen dioxide or PM_{10} of greater than $0.1 \mu\text{g}/\text{m}^3$. R42 is predicted to experience a change of $-0.3 \mu\text{g}/\text{m}^3$, which is considered negligible. Annual mean concentrations of nitrogen dioxide are predicted to be less than $30 \mu\text{g}/\text{m}^3$ at all receptor locations, and annual mean concentrations of PM_{10} are less than half of the respective limit values.

6.9.16 **Figure 6.2 (Sheet 6, 7 and 8) [TR010027/APP/6.2]** cover the areas to the south and east of the Scheme and includes Hampton in Arden, Copt Heath and Barston, and the receptors R26 – R32, R54, R63 and R64. None of these receptors locations are predicted to experience a change in annual mean concentrations of nitrogen dioxide or PM₁₀ of greater than 0.1 µg/m³, which is considered negligible. Annual mean concentrations of nitrogen dioxide are predicted to be less than 30 µg/m³ at all receptor locations, and annual mean concentrations of PM₁₀ are less than half of the respective limit values.

6.9.17 Based on the results of the detailed modelling the predicted changes in nitrogen dioxide and particulate matter concentrations as a result of the Scheme are considered to be not significant.

Ecosystems assessment

6.9.18 The assessment shows that the annual mean NO_x UK AQS objective of 30 µg/m³ for the protection of vegetation would not be achieved at any modelled ecological receptor in the base year (2016). At Bickenhill Meadows SSSI (E1 and E2), the 30 µg/m³ objective is achieved in the opening year (2023) at all locations, with or without the Scheme. The change in NO_x concentration at E1 ranged from +0.3 µg/m³ at the closest point of the SSSI to the Scheme, to +0.2 µg/m³ at the end of the transect 150m back. The maximum predicted total NO_x concentration is 22.9 µg/m³ at the point closest to the Scheme.

6.9.19 At E2, the change in NO_x concentration ranged from +0.5 µg/m³ at the closest point to the Scheme to +0.2 µg/m³ at the end of the transect. The maximum predicted total NO_x concentration is 22.5 µg/m³ at the point closest to the Scheme.

6.9.20 Within the River Blythe SSSI, the NO_x UK AQS objective of 30 µg/m³ for the protection of vegetation would not be achieved at receptor locations E3 and E4 in the opening year (2023). These sites are adjacent to the M42. At both sites, the NO_x concentration change is +0.4 µg/m³.

6.9.21 Within the Coleshill and Bannerly Pools SSSI (E5), the NO_x UK AQS objective of 30 µg/m³ for the protection of vegetation would not be achieved in the opening year (2023). The predicted change in NO_x concentration is +0.2 µg/m³ at the point closest to the M42, and decreases to <0.1 µg/m³ at a location adjacent to the A446.

6.9.22 At receptors E6, E7 (Greens Ward Piece LWS), E8, E9, E14, E15 and E16 (Castle Hill Farm Meadows LWS), E17 and E18 (Greens Ward Piece), E29 (Marston Green Park LNR), E30 (Marsden Green Millennium Wood LNR), E31 (Elmdon Manor LNR), E32 (Elmdon Coppice LNR) and E33 (Malvern & Brueton Park LNR), the NO_x UK AQS objective of 30 µg/m³ for the protection of vegetation would be achieved in the opening year (2023). The maximum predicted change in NO_x concentration is predicted to be 3.2 µg/m³ at E17.

- 6.9.23 At receptors E10 (Hollywell Brook LWS), E11 (Hollywell Brook LWS), E12 (Disused Railway and Sidings LWS), E13 (Disused Railway and Sidings LWS), E19 (Aspbury's Copse LWS), E20 (Aspbury's Copse LWS), E21 (Trinity Park Grasslands LWS), E22 (Trinity Park Grasslands LWS), E23 (Aspbury's Copse LWS), E24 (Road Side Hedge LWS), E25 (Wayside Cottage Meadow LWS), E26 (Hollywell Brook LWS), E27 (Hollywell Brook LWS), and E28 (Aspbury's Copse LWS) the NO_x UK AQS objective of 30µg/m³ for the protection of vegetation would not be achieved in the opening year (2023) in either the Do-Minimum or the Do-Something scenarios. The maximum change in NO_x concentrations would be - 7.9 µg/m³ at E27, immediately adjacent to the southbound off slip from the M42 to Junction 6. The maximum increase in NO_x concentration is +4.1µg/m³ at E22. This site is immediately adjacent to the new southern junction.
- 6.9.24 There are no predicted new exceedances of the NO_x UK AQS objective of 30µg/m³ for the protection of vegetation at any modelled ecological receptor.
- 6.9.25 For nitrogen deposition, the maximum increase in deposition rate is 0.2 kg N/ha/yr at E22. At SSSIs (E1, E2, E3, E4 and E5), the change in nitrogen deposition is calculated at less than 0.1 kg N/ha/yr.
- 6.9.26 In summary, as the negligible change would only affect a minor part of the designated sites, the Scheme is not considered to have a significant effect on the SSSIs or other ecological receptors. The effects are discussed with Chapter 9 Biodiversity.

Compliance risk assessment

- 6.9.27 The results of the local air quality operational assessment have been used to determine compliance risks with the Air Quality Directive [REF 6-2], following guidance set out within the IAN 175/13 [REF 6-24].
- 6.9.28 A comparison between the results of the local air quality operational assessment and those links reported by DEFRA to the European Commission as non-compliant has found that there are no links anticipated to be non-compliant with the limit value within the air quality study area for the Scheme.
- 6.9.29 This indicates that the Scheme is at a no risk of non-compliance with the Air Quality Directive [REF 6-2] and thus an AQAP should not be required.

Plan level WebTAG appraisal

- 6.9.30 A plan level WebTAG appraisal has been completed in respect of PM₁₀ and NO₂ exposure. This assessment has been developed using the WebTAG methodology which considers individual links in isolation. The results of this assessment are provided as required by DMRB guidance, in Section 6.9.

6.9.31 The results of the plan level WebTAG appraisal (refer to Section 6.9) show that for PM₁₀ there is a net improvement with a negative score, although as the overall reduction is less than 1%, the overall reduction should be considered broadly neutral. A total of 65 properties are predicted to experience an improvement in PM₁₀ concentrations, whilst 0 (nil) properties are predicted to experience no change and 151 a deterioration.

Table 6.8: Plan level results for PM₁₀

Aggregated table	Distance from road link (m)				
	0 – 50	50 – 100	100 – 150	150 – 200	0 – 200
Total properties across all routes (Do Minimum)	40	57	54	58	209
Total properties across all routes (Do Something)	30	54	68	64	216
Do Minimum PM ₁₀ assessment across all routes	646.6	859.3	790.3	816.4	3112.6
Do Something PM ₁₀ assessment across all routes	450.1	810.8	947.5	884.6	3093.0
Net total assessment for PM ₁₀ , all routes (II-I)	-19.6				
Number of properties with an improvement	65				
Number of properties with no change	0				
Number of properties with a deterioration	151				

6.9.32 The results of the plan level WebTAG appraisal (refer to Section 6.9Error! Reference source not found.) show that for NO₂ there is a net improvement with a negative score, although as the overall reduction is approximately 2%, the overall reduction should be considered broadly neutral. A total of 38 properties are predicted to experience an improvement in NO₂ concentrations, whilst 0 (nil) properties are predicted to experience no change and 178 a deterioration.

Table 6.9: Plan level results for NO₂

Aggregated table	Distance from road link (m)				
	0 – 50	50 – 100	100 – 150	150 – 200	0 – 200
Total properties across all routes (Do Minimum)	40	57	54	58	209
Total properties across all routes (Do Something)	30	54	68	64	216

Aggregated table	Distance from road link (m)				
	0 – 50	50 – 100	100 – 150	150 – 200	0 – 200
Do Minimum NO ₂ assessment across all routes	1121.0	1218.1	1021.2	1049.3	4409.5
Do Something NO ₂ assessment across all routes	795.4	1156.7	1226.0	1139.7	4317.75
Net total assessment for NO ₂ , all routes (II-I)	-91.7				
Number of properties with an improvement	63				
Number of properties with no change	0				
Number of properties with a deterioration	153				

Regional assessment

- 6.9.33 This section presents the results of the regional air quality assessment for the Scheme opening year (2023) and design year (2038) for CO₂, HC, NO_x and PM₁₀.
- 6.9.34 The assessment results indicate that increased emissions of NO_x, PM₁₀ and CO₂ are anticipated between the present or baseline situation and the opening year (2023) without the Scheme (see **Table 6.10**) due to an increase in the number of vehicle kilometres travelled without the operation of the Scheme.
- 6.9.35 Increases in NO_x, PM₁₀ and CO₂ emissions are anticipated in the opening year with the Scheme (Do Something) compared to the without Scheme (Do Minimum) situation (refer to Section 6.9). This is primarily because of the increased traffic flows predicted with the operation of the Scheme.
- 6.9.36 In comparison to national CO₂ emissions targets, increases in CO₂ from the whole of the strategic road building scheme, as noted in the NPSNN [REF 6-12], anticipated over the next 10 - 15 years are considered to be small (less than 0.1% of annual carbon budget) and the increases associated with the Scheme are considered to be part of that small increase.

Table 6.10: Opening year regional assessment

Pollutant	Present (2016) (tonnes)	Without Scheme opening year (2023) (tonnes)	With Scheme opening year (2023) (tonnes)	With Scheme (2023) compared with	
				Present (2016) without Scheme (tonnes)	Future (2023) without Scheme (tonnes)
CO ₂	227,317	242,627	244,311	16,993	1,683
NO _x	32.7	64.6	66.4	33.8	1.8
PM ₁₀	2.6	7.9	8.4	5.8	0.5

6.9.37 In the Scheme design year (2038), increases in pollutant emissions are predicted between the baseline and future situation (see Section 6.9) for NO_x, CO₂ and PM₁₀. Between the future without the Scheme (Do Minimum) and with the Scheme (Do Something) scenarios, an increase in all emissions is predicted as a result of the increased traffic flows predicted with the Scheme.

Table 6.11: Design year regional assessment

Pollutant	Present (2016) (tonnes)	Without Scheme Design year (2038) (tonnes)	With Scheme Design year (2038) (tonnes)	With Scheme (2038) compared with	
				Present (2016) without Scheme (tonnes)	Future (2038) without Scheme (tonnes)
CO ₂	227,317	274,233	285,505	58,188	11,282
NO _x	32.7	43.5	46.9	14.3	3.5
PM ₁₀	2.6	9.0	10.1	7.6	1.1

Summary of operational effects

6.9.38 The receptors identified along St Peters Lane in Bickenhill and the Catherine-de-Barnes Lane would experience the greatest change in pollutant concentration during the operational phase of the Scheme, due to the introduction of new traffic along the route. However, as air quality is considered to be of a good quality in the vicinity of the Scheme, the introduction of new traffic along the route is not predicted to give rise to any changes considered significant in pollutant concentrations at these receptors.

6.9.39 A summary of the receptors which inform the Scheme significance is shown in **Table 6.12**.

Table 6.12: Local air quality receptors Informing Scheme significance

Magnitude of change in NO ₂ or PM ₁₀ (µg/m ³)	Total number of receptors with	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective or the removal of an existing exceedance
Large (>4)	0	0
Medium (>2 to 4)	0	1
Small (>0.4 to 2)	0	0

6.9.40 In summary, the Scheme is not considered to generate significant adverse construction or operational effects and no further mitigation is required.

6.10 Monitoring

6.10.1 As the Scheme would not generate significant adverse air quality effect during either the construction phase or operation phase, no monitoring is required.

6.11 References

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