16 Air Quality

This chapter considers the potential impacts of the proposed scheme on air quality during construction and operation. Air quality modelling was undertaken to determine the likely changes to ambient air quality concentrations and the overall emissions from road traffic. Potential local impacts during construction were also considered.

The following pollutants emitted from vehicles were assessed: oxides of nitrogen (NOx), nitrogen dioxide (NO2), Particulate Matter (PM) less than 10 and 2.5 microns in diameter respectively (PM10 and PM2.5) and carbon dioxide (CO2). The potential effect of construction on ambient PM concentrations was also considered.

To establish local baseline air quality conditions, a project specific air quality monitoring survey along with a review of available reports and data from Perth & Kinross Council was undertaken.

Air quality monitoring undertaken along the route of the proposed scheme shows that NO2 concentrations currently meet the prescribed air quality objectives (AQOs). Defra background mapping also shows that PM concentrations currently meet the prescribed air quality objectives (AQOs).

Impacts of the proposed scheme were assessed for the anticipated first full year of opening (2026) using the DMRB 'Simple Assessment' approach. The conclusion was that there are no significant local air quality impacts at either human exposure locations or ecosystems/designated sites. A regional emissions assessment was also undertaken for the first full year of opening (2026) and the design year, 15 years later (2041). The regional assessment predicted that emissions of NOx, NO2, PM and CO2 will increase with the proposed scheme but these are not considered to be significant.

An assessment of potential dust deposition and emissions from construction vehicles during construction of the proposed scheme predicted no significant residual impacts. A range of mitigation measures are proposed for the construction phase in relation to dust control.

16.1 Introduction

16.1.1 This chapter presents the DMRB Stage 3 assessment of the proposed scheme in relation to air quality. It considers local air quality impacts on sensitive receptors at human exposure locations and at ecosystems/designated nature conservation sites (hereafter referred to as designated sites) during construction and operation. An assessment of the wider regional emissions impacts of the proposed scheme once in operation is also provided. The chapter is supported by Appendix A16.1 (Air Quality Annexes).

16.1.2 Air quality is measured in relation to the concentrations of certain pollutants in the air, taking account of the effects of these pollutants on sensitive receptor locations. Emissions from vehicle exhausts are the major contributor to the concentrations of these pollutants in the UK. In rural areas, such as near the A9, vehicle emissions are often the main source of air pollutants. Changes to road alignments and junctions can affect air quality as they can change the quantity, location and speed of traffic in a local area. Nitrogen oxides (NO_x), nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) are pollutants arising from vehicle traffic emissions which have been considered in the local air quality assessment of the proposed scheme during operation. In addition to these pollutants, carbon dioxide (CO_2) was considered in the regional emissions assessment.

16.1.3 As well as the impact on local air quality at human exposure locations, air quality can affect natural environment. Concentrations of pollutants in the air and deposition of nitrogen (N) can damage certain vegetation directly or affect plant health. The pollutant of most concern for sensitive vegetation near roads is NO_x. Increases in concentrations of NO_x directly increase N deposition which has the potential to affect receptors sensitive to this, including designated sites.

16.1.4 The main air quality impacts associated with construction activities relate to dust deposition. Emissions of dust to air can occur during land preparation (e.g. demolition, site clearance), earthworks (including the handling and storage of materials) and during construction activity. These emissions can vary substantially depending on the level of activity, the specific operations being undertaken and the weather conditions. In general, construction dust rarely represents an adverse risk to health due to its temporary nature, and impacts are more typically associated with the soiling of surfaces and the nuisance of material depositing on property as well as the transfer of dust generating materials from site to the local road network. High levels of dust soiling can also affect designated sites, such as Sites of Special Scientific Interest (SSSIs).

16.1.5 During construction, there can also be a localised increase in concentrations of PM and NO_2 due to exhaust emissions from diesel powered vehicles and equipment used on-site (non-road mobile machinery) and vehicles accessing the site.

16.2 Approach and Methods

Overall Approach

16.2.1 This air quality assessment identified potential air quality impacts during operation by predicting the changes in concentrations of air pollution and comparing these with the baseline situation. The current/baseline conditions were established qualitatively by reviewing information relating to air quality that is readily available from relevant local authorities, including Review and Assessment Reports and historic monitoring data. These data were used to understand current/baseline pollutant concentrations at receptors within the study area and the risk that any changes in air quality may cause exceedance of air quality objectives (AQOs) at these locations. Future baseline air pollutant concentrations at sensitive receptor locations were then modelled and predicted, considering air pollutant contributions from local roads without the proposed scheme in place (Do-Minimum; DM).

16.2.2 A future situation with the proposed scheme in place (Do-Something; DS) was then modelled and compared with the DM air pollutant concentrations to determine the potential operational phase impacts of the proposed scheme. This approach follows DMRB Volume 11 guidance, Section, Part 1 HA207/07 Air Quality (hereafter referred to as HA207/07) (Highways Agency et al, 2007) and associated DMRB Interim Advice Notes (IANs) as listed below:

- IAN 170/12: 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 (Highways Agency et al, 2012);
- IAN 174/13: Updated advice for evaluating significant local air quality effects for DMRB Volume 11, Section 3, Part 1 Air Quality (Highways Agency et al, 2013a); and
- IAN 175/13: Updated air quality 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 (Highways Agency et al, 2013b).

16.2.3 The assessment was undertaken following the Department for Environment, Food and Rural Affairs' (Defra) Local Air Quality Management (LAQM) technical guidance (hereafter referred to as LAQM.TG(16)) (Defra, 2016).

16.2.4 Potential construction phase impacts were assessed following an approach consistent with the DMRB HA207/07 methodology, with an assessment made of potential impacts due to the generation and dispersion of dust, based on likely construction activities and distance to sensitive receptors.

Study Area

Local Air Quality - Construction

16.2.5 Sensitive receptors at risk of being affected by dust, including residential and other sensitive properties as well as designated sites were identified within 200m of the proposed scheme using Ordnance Survey (OS) Address Base Plus and Scottish Natural Heritage (SNH) datasets. These dust sensitive receptors are shown on Figure 16.1.

16.2.6 The extent of road links considered for the assessment of vehicle emissions from construction traffic was determined by the route of the mainline of the proposed scheme, and up to 500m either side of this.

Local Air Quality - Operation

16.2.7 The local air quality study area for the operational phase was defined in accordance with DMRB HA207/07 guidance. It encompasses human exposure locations and designated sites that lie within 200m of affected road links, i.e. those that meet the following HA207/07 local air quality screening criteria in the assessment year (2026):

- horizontal alignment of the road will change by 5m or more; or
- daily traffic flows anticipated to change by 1,000 annual average daily traffic (AADT) or more; or
- heavy-duty vehicle (HDV) flows anticipated to change by 200 AADT or more; or
- daily average speed anticipated to change by 10km/h or more; or
- peak hour speed anticipated to change by 20km/h or more.

16.2.8 As with the construction phase impact assessment, the extent of road links considered was determined by the route of the mainline of the proposed scheme and up to 500m either side of this.

16.2.9 The human exposure locations identified were predominantly residential properties. The locations identified for assessment are shown on Figure 16.2.

16.2.10 For receptors sensitive to N deposition, designated sites such as Special Areas of Conservation (SACs) and SSSIs were considered. Designated sites contain features which may be sensitive to air pollutants, either directly (i.e. on the primary habitat designated) or indirectly (i.e. on the habitat associated with a non-habitat designation, e.g. birds), and which could be adversely affected by the effect of air pollution on vegetation. The designated sites identified for assessment are shown on Figure 16.2.

Regional Emissions - Operation Phase

16.2.11 The regional emissions study area was defined in accordance with guidance provided in HA207/07 and using Defra's Emissions Factors Toolkit (EFT) (EFT v7.0).

16.2.12 The study area encompasses road links that meet HA207/07 regional emissions screening criteria in either the first full year after opening (2026) or the design year (2041) within the area of the proposed scheme or up to 500m from the proposed scheme. The regional emissions screening criteria are as follows:

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

Baseline Conditions

16.2.13 To assess the significance of any impacts, it was necessary to identify and understand the baseline conditions in and around the study area. This provided a reference against which any potential changes in air quality were then assessed.

16.2.14 A desk-based review of the available air quality information was undertaken, utilising the following information sources:

- Scottish Government LAQM 1km x 1km grid background pollutant maps (Scottish Government, 2015).
- Department for the Environment Food and Rural Affairs (Defra) LAQM 1km x 1km grid background pollutant maps (Defra, 2015).
- Defra Interactive Monitoring Networks Map (Defra, accessed 2016).
- Scottish National Heritage Information Service (SNHi) Interactive Map (SNHi, accessed 2016).
- Perth & Kinross Council Progress Reports (PKC, 2016).
- PKC Updating and Screening Assessments (PKC, 2015).
- N sensitivity and critical loads for designated sites (Air Pollution Information System website (www.apis.ac.uk accessed November 2017).

- Air Quality Management Areas locations obtained from Air Quality in Scotland website (www.scottishairquality.co.uk accessed August 2015).

16.2.15 The 'background concentration' of pollutants is the average concentration in the air that is not being directly affected by a local pollution source. The Scottish Government and Defra provide empirically-derived national background pollution concentration maps, with background pollutant concentrations at a 1km x 1km grid square resolution. These concentrations relate the National Atmospheric Emissions Inventory (NAEI) to the national network of pollution measurements. Data for NO_x, NO_2 and PM_{10} were obtained from the Scottish Government (www.scottishairquality.co.uk), and as data maps of $PM_{2.5}$ are not available on the Scottish Government's website, these were estimated by applying a factor of 0.7 to annual mean PM_{10} concentrations, as advised by LAQM.TG(16).

16.2.16 The UK Government's web-accessible Air Pollution Information System (APIS) is an online support tool for the assessment of the potential impacts of air pollutants on habitats and species. Of relevance to this assessment, APIS provided information on habitat and species responses to different air pollutants, critical loads and levels and deposition and concentration data.

16.2.17 Under Part IV of the Environment Act 1995, which established the LAQM regime, all local authorities are required to undertake a regular review of air quality in their area of jurisdiction. The local authority must designate any areas Air Quality Management Areas (AQMA) where ambient concentrations of pollutants exceed or are predicted to exceed the relevant objective values. The relevant LAQM Reviews and Assessments within PKC Progress Reports and Updating and Screening Assessments were reviewed. These describe recent air quality conditions within the PKC administrative area.

Local Monitoring

16.2.18 Although PKC uses a variety of automatic and non-automatic air quality monitoring methods within their administrative area, none of the locations where monitoring is undertaken were considered representative of pollution concentrations near the proposed scheme. Therefore, a six-month passive diffusion tube monitoring survey of NO_2 was undertaken by Jacobs between February and August 2015 to augment available baseline data for use in this assessment. Three locations were chosen for monitoring in consultation with PKC; these comprised roadside and background locations representative of sensitive receptors or road emission sources where pollution concentrations are highest. Details of the monitoring locations are provided in Table 16.3 and Appendix A16.1 (Annex A: Project Specific Air Quality Monitoring Results) and their location is shown on Figure 16.3.

Table 16.3 Diffusion tube monitoring survey locations

ID*	Location Description	Coordinates		Height (cm)	Type
		X	Y		
4	Wooden telegraph pole across from bins	300056	749192	260	Background
5	Parking sign preceding lay-by 28	299718	749202	160	Roadside
6	Give way sign at junction with A9	299468	749766	230	Roadside

*Note: surveys were undertaken as part of a wider assessment covering several A9 dualling projects. The survey location IDs for this project (Tay Crossing to Ballinluig) therefore commence at ID4.

16.2.19 All monitoring results were used to estimate annual mean concentrations (a process called annualisation), in accordance with LAQM.TG(16) as detailed in Appendix A16.1 (Annex A: Project Specific Air Quality Monitoring Results).

16.2.20 These annual mean concentrations were then used as part of the model evaluation and verification process, following LAQM.TG(16) guidance as detailed in Appendix A16.1 (Annex B Model Verification Project Specific Air Quality Monitoring Results). Of the 3 locations monitored, none of the locations within the study area were identified with good data capture and at suitable locations/position to be used to inform this process. Monitoring locations are shown on Figure 16.3.

Consultation

16.2.21 Following a consultation letter sent on 23 March 2015, PKC provided information on existing air quality monitoring locations. PKC was also consulted and agreed on the selection of suitable monitoring locations for the six-month monitoring programme.

Traffic Data

16.2.22 Baseline air quality is expected to vary slightly year by year, due to changing concentrations and sources of local and background pollution. To project future air quality, base traffic modelling data (2015) were extrapolated forward to the opening year of the proposed scheme (hereafter referred to as the opening year). For this assessment, 2015 was used as the baseline year as it was the latest year for which traffic data and monitoring data were available which allowed for model verification.

Impact Assessment

Construction – Dust Deposition

16.2.23 A construction dust assessment was carried out, using a qualitative risk-based approach based on the location of the proposed scheme in relation to sensitive locations, as set out in DMRB HA207/07. Construction dust emissions receptors were defined based on the nearest potentially sensitive receptor within 200m of the proposed scheme. These receptors had the potential to experience impacts of greater magnitude when compared with other more distant receptors. The identification of sensitive receptors considered residential properties, other potentially sensitive properties such as schools and hospitals and designated sites.

Construction - Air Quality Impacts from Construction Traffic

16.2.24 Construction of the proposed scheme will generate associated construction traffic, including light and heavy duty vehicles. This will result in additional emissions of NO_x, PM and other combustion related pollutants on the local road network in the vicinity of the proposed scheme.

16.2.25 At DMRB Stage 3, detailed information regarding construction traffic characteristics such as vehicle numbers and journey origin/destination is not available. Consequently, in accordance with HA207/07, the effect of additional construction vehicles was considered qualitatively, considering background pollution concentrations in the study area, anticipated construction haulage routes, duration of the construction works and the location of sensitive receptors.

Operation

16.2.26 For the assessment of impacts of highways schemes on air quality, HA207/07 sets out two levels of assessment; ‘Simple’ and ‘Detailed’. Simple assessment is considered appropriate if air quality is not expected to be a fundamental issue in the decision-making process, with Detailed Assessment intended to be applied where the potential exists for exceedances of local air quality objectives or for the proposed scheme to cause significant impacts.

16.2.27 It was considered that a DMRB Simple Assessment was appropriate for this assessment, having considered the nature of the proposed scheme (generally an online widening of an existing road through an area of good local air quality and relatively few receptors) and the results of the DMRB Stage 2 air quality assessment, which concluded that significant impacts were unlikely (Transport Scotland, 2016a and 2016b).

16.2.28 The DMRB Simple Assessment method comprises an empirical spreadsheet-based model that focuses on road traffic as a source of pollutant emissions, and is a recognised tool for carrying out air quality impact assessments.

16.2.29 In addition to the requirements of HA207/07, the assessment of annual mean $PM_{2.5}$ concentrations was also undertaken as this pollutant is also included within the LAQM regime in Scotland.

16.2.30 Pollutant emission modelling allowed predicted ambient pollution concentrations and annual emissions of NO_2, PM_{10} and $PM_{2.5}$ to be quantified at local air quality sensitive receptor locations for the following scenarios:

- Baseline Year (2015);
- Opening Year (2026) – without proposed scheme (DM); and
- Opening Year (2026) – with proposed scheme (DS).

16.2.31 For the local air quality assessment, selected sensitive receptors (within 200m of affected road links) were identified using professional judgement. Selected sensitive receptors were those either closest to the affected roads, or representative of the anticipated maximum impacts of the proposed scheme in that area. The selected sensitive receptors are shown on Figure 16.2.

16.2.32 In addition to this, future scenarios (15 years after the Opening Year) were also considered for the regional emissions assessment of NO_x, PM_{10}, $PM_{2.5}$, and CO_2, as follows:

- Design Year (2041) – DM; and
- Design Year (2041) – DS.

16.2.33 Traffic data for the modelling scenarios were provided from the Transport Model for Scotland (TMfS14) traffic model. Traffic data represents the average daily conditions and the following traffic data parameters were provided:

- AADT, in vehicles/day;
- percentage HDV; and
- daily average vehicle speed, in kph.

Sensitivity

16.2.34 Sensitive receptors are identified as locations relevant for the protection of human exposure, and designated sites that lie within 200m of affected road links, i.e. those that meet HA207/07 local air quality screening criteria as described in paragraph 16.2.7.

16.2.35 These receptor locations represent where the maximum potential impacts of the proposed scheme may occur and may also be representative of other receptors within the study area which are at similar distances from the mainline of the proposed scheme.

16.2.36 All sensitive receptors are of equal value in terms of the air quality assessment. Representative sensitive receptors are shown on Figure 16.2 and listed in Section 16.3 (Baseline Conditions).

Air Quality Objectives

16.2.37 The assessment of impacts on local air quality considered relevant air quality legislation and guidance provided in IAN 174/13, considering the Limit Values set out in the EU Directive on Ambient Air Quality and AQOs applicable to LAQM in Scotland as set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No.97) as amended. Exceedance of AQOs was a key consideration in the assessment of impact significance. Most of these AQOs are health-based standards that were set at a level to provide protection to human exposure.

16.2.38 Relevant planning policy in relation to air quality is also discussed in Chapter 19 (Policies and Plans), Appendix A19.1 and Appendix A19.2.

Impact Magnitude Local Air Quality – Human Exposure Receptors

16.2.39 Magnitude of change criteria based on HA207/07 were defined using percentage ranges of AQOs as shown in Table 16.4. These criteria were applied to the modelling results for human exposure receptors, based on the change (increase or decrease) in annual mean concentration between the DM and DS for the Opening Year (2026).

Table 16.4: Air quality objectives and magnitude of change criteria

Pollutant	AQO (Annual Mean Concentration, µg/m^3)	Change (Worsening or Improving)			
		Large (>10% of AQO)	Medium (>5%-10% of AQO)	Small (>1%-5% of AQO)	Imperceptible (≤1% of AQO)
NO_x	30	>3.0	>1.5 – 3.0	>0.3 – 1.5	≤0.3
NO_2	40	>4.0	>2.0 – 4.0	>0.4 – 2.0	≤0.4
PM_{10}	18	>1.8	>0.9 – 1.8	>0.18 – 0.9	≤0.18
$PM_{2.5}$	10	>1.0	>0.5 – 1.0	>0.1 – 0.5	≤ 0.1

Impact Significance Local Air Quality – Human Exposure Receptors

16.2.40 Determining impact significance included consideration of whether modelling outputs exceeded AQOs. Where the assessment predicted that modelled concentrations at all assessed sensitive receptors were less than the AQOs or where any changes above the AQOs had a magnitude of change of imperceptible, it was concluded that the impact of the proposed scheme was Not Significant.

16.2.41 IAN 174/13 sets out a framework to provide guidance on the number of receptors for each of the magnitude of change categories that might result in a significant effect. These are guideline values only, and are to be used to inform professional judgement on significant impacts of the proposed scheme. The guideline bands are intended to help provide consistency across all road schemes. The guideline property numbers are summarised in Table 16.5 against magnitude of change criteria.

Table 16.5: Guideline to number of receptors constituting a significant impact

Magnitude of Change in Annual Mean NO_2 or PM_{10} (µg/m^3)	Guideline bands showing total number of receptors with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large (>10% of AQO)	1 to 10	1 to 10
Medium (>5% of AQO)	10 to 30	10 to 30
Small (>1% of AQO)	30 to 60	30 to 60

16.2.42 Where the total number of receptors was between the lower and upper guideline bands for any of the magnitude criteria, then the potential impacts were potentially significant and professional judgement was applied, considering all assessment evidence. This included considering the results for all six magnitude categories of small, medium and large (worsening and improvement).

16.2.43 To inform the judgement of overall significance, reference was also made to EU Directive 2008/50/EC Compliance Risk Road Assessment, as set out in IAN 175/13. Where the proposed scheme was assessed as a low risk of non-compliance, it was considered likely to contribute to a judgement of Not Significant. Where the proposed scheme was assessed as having a high risk of non-compliance, it was considered likely to contribute to an assessment of Significant.

16.2.44 Consideration of whether the proposed scheme detracted from or supported measures set out in relevant local authority Air Quality Action Plans (AQAPs) and Key Criteria Questions set out in IAN 174/13 was also made when reaching a judgement of overall significance.

Impact Assessment - Local Air Quality – Designated Sites

16.2.45 An assessment of designated sites within 200m of affected roads that are sensitive to N was undertaken following the methodology set out in Annex F of HA207/07. The assessment compared the current baseline situation, Opening Year DM and the Opening Year DS for NO_x concentrations and N deposition where it was applicable.

16.2.46 The UK Government's web-accessible APIS was used, along with the professional judgement of both Air Quality and Ecology professionals, to consider whether designated sites relevant to annual mean AQOs for the protection of vegetation and ecosystems were sensitive to changes in N deposition.

16.2.47 For the consideration of impacts on sensitive receptors relevant to N deposition, a transect was measured using GIS software from the boundary of the designated site to the centreline of the affected road having the largest influence on local concentrations. Transect points were then placed at the boundary and at 10m increments into the designated site up to 200m from the affected road centreline. The NO_x contribution at each transect point within the designated site was then calculated using the DMRB Simple Assessment Methodology.

16.2.48 Where the assessment predicted annual mean NO_x concentrations at designated sites to be less than the annual mean NO_x AQO of 30µg/m^3 or where changes above the AQO were imperceptible, it was considered likely that the impact of the proposed scheme on these receptors overall was Not Significant. Where the resulting NO_x concentration was found to exceed this AQO, further data calculations into the impact on N deposition were undertaken which were then compared to relevant UN Economic Commission for Europe (ECE) critical loads as identified in Section 16.4 (Potential Impacts). Where appropriate, these results were used to inform Chapter 12 (Ecology and Nature Conservation).

16.2.49 Potential impacts on designated sites in relation to PM are not required to be assessed under DMRB guidance HA207/07. Consequently, their impact on designated sites was not considered in this assessment.

Regional Emissions

16.2.50 There is no government guidance published for assessing the significance of impacts of individual road schemes on regional emissions (which include greenhouse gases). Total Scottish emissions are managed and considered at a national (UK) level and not on a scheme by scheme basis.

16.2.51 The changes in regional emissions as a result of the proposed scheme were considered in the context of total UK emissions provided by the NAEI. The consideration of significance of the proposed scheme's impact on regional emissions was undertaken using professional judgement considering the change predicted and the sensitivity of the national (UK) total to change, with the outcome assessed as either Significant or Not Significant.

Limitations to Assessment

16.2.52 Identification of sensitive receptors was based on OS Address Base Plus data. There may in some cases be properties, such as those recently built, that were not present within this data source. Every reasonable endeavour was made to identify and consider all such properties within the study area during the DMRB Stage 3 assessment.

16.3 Baseline Conditions

Local Authority Reports

16.3.1 The proposed scheme is located in the administrative boundaries of PKC.

16.3.2 PKC declared an AQMA for an area which encompasses the main built-up areas of Perth and Crieff:

- Perth AQMA was declared in 2006 for exceedances of annual mean AQOs for NO_2 and PM_{10} and an AQAP was prepared in 2009.
- Crieff AQMA (Perth AQMA No. 2) was declared in 2014, also for exceedances of annual mean AQOs for NO_2 and PM_{10}. An AQAP for the Crieff AQMA has not yet been published.

16.3.3 The Perth and Crieff AQMAs lie approximately 23km and 26km respectively outside of the study area and are unlikely to be influenced by changes to traffic as a consequence of the proposed scheme. The proposed scheme would also have no implication on the implementation of the AQAP. The AQMA are therefore not considered further in this assessment.

Air Quality Monitoring

16.3.4 PKC operates a network of 66 passive diffusion tubes across the local authority area. The network of tubes is broken down into the following areas: Perth, Glencarse, Ballinluig, Glenfarg, Dunkeld, Blairgowrie, Kinross, Auchterarder and Crieff. The closest diffusion tube is in Main Road, Ballinluig approximately 1km from the proposed scheme. Given the distance of these diffusion tubes from the study area, no tube locations were considered representative of conditions local to the proposed scheme.

16.3.5 The results of the diffusion tube NO_2 monitoring survey undertaken for the proposed scheme as discussed in Section 16.2 are shown in Table 16.6, including the estimated annual mean NO_2 concentrations for the Baseline Year 2015.

Table 16.6: Estimated 2015 annual mean NO_2 concentrations

ID	6 Month Period Mean (µg/m^3)	Data Capture (100% = 6 months)	Annualisation/Seasonal Adjustment Ratio	Bias Adjustment Ratio	Estimated 2015 Annual Mean (µg/m^3)
4	4.5	100	1.19	0.87	4.6
5	26.2	83*	1.19	0.87	27.1
6	16.2	83*	1.19	0.87	16.8

*Note: data capture lower than 100% due to diffusion tube loss, interference, damage or failed laboratory testing.

16.3.6 These results show no exceedances of AQOs at any of the NO_2 monitoring survey locations, indicating that existing concentrations across the study area are within the NO_2 AQO.

Background Mapping

16.3.7 Average annual mean background pollution concentration estimates within the study area, obtained from Defra and the Scottish Government background mapping for the Baseline Year 2015, are presented in Table 16.7.

Table 16.7: Baseline year background mapping concentrations (rounded to one decimal place)

Pollutant	2015 (µg/m^3)	AQO (µg/m^3)
NO_x	3.7	30
NO_2	2.9	40
PM_{10}	8.5	18
$PM_{2.5}$	6.0	10

16.3.8 Table 16.7 shows average annual mean background pollutant concentrations for the Baseline Year to be well below (<75% of) AQOs.

Pollution Climate Mapping Model

16.3.9 The study area was reviewed against Defra's Pollution Climate Mapping Model (PCM). No PCM model links were identified within the study area. Consequently, the proposed scheme would not have an effect on Defra or the Scottish Government's achievement of EU Limit Values.

Selected Sensitive Receptors

16.3.10 The human exposure and designated sites selected sensitive receptors identified within the local air quality study area are identified in Table 16.8 and Table 16.9. The study area and location of selected sensitive receptors is shown on Figure 16.2.

Table 16.8: Selected sensitive receptor locations (relevant to annual mean AQOs for the protection of human exposure)

Receptor No.	Coordinates		Description
	X	Y	
1	300347	746895	St Colme's, Ballinluig, Pitlochry
2	300129	747975	1 Dowally Cottage, Dowally, Ballinluig
3	300032	748017	Self-catering Units - Dowally Farm, Dowally, Ballinluig, Pitlochry
4	299802	749143	Guay Farmhouse, Guay, Ballinluig, Pitlochry
5	299514	749725	Bracken Cottage, Kindallachan, Pitlochry
6	299343	750108	Rockview House, Kindallachan, Pitlochry
7	299082	750638	Haugh of Kilmorich, Ballinluig, Pitlochry
8	298810	751082	Haugh Cottage South, Westhaugh of Tulliemet, Pitlochry
9	298200	751776	Inch of Tulliemet, Ballinluig, Pitlochry
10	297975	751949	4 Station Cottages, Ballinluig, Pitlochry
11	297954	752221	Dalnabo Farm Cottage, Ballinluig, Pitlochry

16.3.11 Three statutorily designated sites were identified within 200m of affected road links to be considered in this assessment. These sites, together with their statutory designation are shown in Table 16.9 and their location and extent shown on Figure 16.2.

Table 16.9: Designated sites within 200m of the proposed scheme

Site Name	Site Designation
River Tay	SAC
Shingle Islands	SAC
Shingle Islands	SSSI

16.3.12 The Shingle Islands SSSI is not considered to be sensitive to NO_x as the features for which it is designated (flies, breeding birds and shingle) are not NO_x sensitive. APIS notes that the Shingle Islands SAC is also not sensitive to NO_x and is therefore not considered further in this assessment.

16.3.13 APIS also notes that the River Tay SAC may be N sensitive due to permanent oligotrophic waters. However, N inputs from catchment land-use, not N deposition from the atmosphere, are likely to be much more relevant contributors (Strong et al. 1997, Smith & Stewart 1989, Foy et al. 1982). APIS indicates that in 2012 the source contribution of N to the River Tay SAC from Scottish road transport (i.e. atmospheric N deposition from NO_x emissions) was 3.2% with the dominant contribution being livestock production (Scottish sources contributing seventeen times more than that from Scottish road transport). Consequently, APIS recommends that site specific advice should be sought on determining sensitivity to N, and decisions should be taken at a site-specific level, considering other sources of N, for example, discharges to water and diffuse agricultural pollution.

16.3.14 Technical discussions between air quality and ecology professionals were held and it was concluded that, given the total contribution to N deposition from Scottish road transport on the River Tay SAC is 0.9 kg N/ha/yr (APIS, 2017), changes in road transport NO_x concentrations due to the proposed scheme were unlikely to give rise to significant impacts given Scottish road transport's small overall influence (3.2%) on total N at the site. The River Tay SAC was therefore scoped out of further assessment with respect to N deposition.

Baseline Modelling Results

16.3.15 No exceedances of AQOs were estimated at any of the modelling receptor locations. Modelling results therefore indicate that existing concentrations across the study area are within each of the respective AQOs for each pollutant.

16.4 Potential Impacts

16.4.1 This section presents the findings of the assessment of potential impacts on air quality.

Construction

Dust Deposition Impacts

16.4.2 A qualitative assessment of the potential impacts of construction phase dust was carried out based on guidance that the maximum distance at which dust nuisance may be caused is 200m (DMRB HA207/07). There are approximately 78 receptors within 200m of the proposed scheme, comprising 60 residential properties, 15 other buildings and 3 designated sites (two SACs and one SSSI). The location of receptors is shown on Figure 16.1.

16.4.3 The potential impacts of dust generation during construction will be short term and temporary in nature and, as standard mitigation controls are required, are not considered to be significant. Nevertheless, details on the construction methodologies to be employed, including potential requirements for temporary traffic management and the locations of construction works compounds, will be defined by the appointed Contractor. In relation to this, mitigation measures will be applied for the control of dust generation and emissions near sensitive receptors, as discussed in Section 16.5.

Assessment of Potential Air Quality Impacts from Construction Traffic

16.4.4 The emissions from construction traffic on local air quality concentrations of NO_2 and PM_{10} are negligible when compared to the normal traffic on the existing road network in the study area. Taking account of the anticipated duration of construction phase of the proposed scheme, the impacts of emissions from these vehicles would be temporary in nature. Therefore, construction phase road traffic emissions are not considered to be significant.

Operation

16.4.5 This section presents the potential impacts of the proposed scheme on local air quality along affected roads in the study area during operation. The presentation of the modelled estimates at human exposure locations includes assessed receptors situated close to the mainline of the proposed scheme. This provides the results at receptors assessed to illustrate the changes (such as worsening or benefit), or new/removed exceedances of AQOs.

Local Air Quality - Background Concentrations

16.4.6 Average annual mean background pollution concentration estimates within the study area for the Opening Year (2026) are presented in Table 16.10. Table 16.10 shows average annual mean background pollutant concentrations for the Opening Year to be well below (<75% of) AQOs.

Table 16.10: Opening year (2026) background mapping concentrations (rounded to one decimal place)

Pollutant	2026 (µg/m^3)	AQO (µg/m^3)
NO_x	2.5	30
NO_2	2.0	40
PM_{10}	8.2	18
$PM_{2.5}$	5.7	10

Local Air Quality - Human Exposure Receptors

16.4.7 Estimated annual mean concentrations, based on IAN 170/12, for the assessed representative receptors and the changes (increases and decreases) in concentration between the DM 2026 and the DS 2026 scenarios are presented in Table 16.9, Table 16.10, and Table 16.11 for NO_2, PM_{10} and $PM_{2.5}$ respectively. IAN 170/12 Long Term Trend adjustment calculations are presented in Appendix A16.1 (Annex D IAN 170/12 Long Term Trend Adjustment Calculations) and Annual mean NO_2

assessment results following the TG(16) approach are presented in Appendix A16.1 (Annex D Detailed Assessment Results TG(16) Approach – Sensitive Receptors).

16.4.8 In areas close to where the proposed scheme would be constructed, nearby receptors are predicted to experience increases in annual mean concentrations between the DM and DS. However, there are no exceedances for the annual mean NO_2, PM_{10} or $PM_{2.5}$ AQO in either the DM or DS scenario. None of the impacts are considered significant, including the changes shown in Tables 16.11 to 16.13 and described in the following text.

Table 16.11: NO_2 concentrations at assessed representative receptors (Do-Minimum 2026 and Do-Something 2026)

Receptor	Baseline 2015 (µg/m³)	DM 2026 (µg/m³)	DS 2026 (µg/m³)	Change (µg/m³)	Magnitude Category
1	4.1	3.0	3.5	0.5	Adverse Small
2	16.3	13.0	18.2	5.2	Adverse Large
3	13.1	10.4	14.1	3.7	Adverse Medium
4	13.7	10.9	15.8	4.9	Adverse Large
5	11.4	8.9	17.4	8.5	Adverse Large
6	9.2	7.2	11.8	4.6	Adverse Large
7	14.0	11.1	13.3	2.2	Adverse Medium
8	16.7	13.3	16.1	2.8	Adverse Medium
9	11.2	8.8	11.7	2.9	Adverse Medium
10	6.3	4.8	5.5	0.7	Adverse Small
11	10.0	7.7	9.3	1.6	Adverse Small

*Change and magnitude categories are calculated from rounded DM and DS results and presented to one decimal place.

16.4.9 The greatest increase in annual mean NO_2 concentration between DM and DS is predicted at Receptor 5 (Bracken Cottage, Kindallachan, Pitlochry), with a concentration change of 8.5µg/m³, as a result of the A9 being brought closer to the property. This impact is of large (adverse) magnitude and predicted NO_2 concentrations at the receptor do not exceed the annual mean NO_2 AQO in the DM or DS scenario.

16.4.10 There are no decreases in annual mean NO_2 concentration between DM and DS. The smallest increase in annual mean NO_2 concentration between DM and DS is predicted at Receptor 1 (St Colme's Ballinluig, Pitlochry), with a concentration change of 0.5µg/m³. This impact is considered to be of small (adverse) magnitude and the predicted NO_2 concentrations at this receptor do not exceed the annual mean NO_2 AQO in the DM or DS scenario.

Table 16.12: PM_{10} concentrations at assessed representative receptors (Do-Minimum 2026 and Do-Something 2026)

Receptor	Baseline 2015 (µg/m³)	DM 2026 (µg/m³)	DS 2026 (µg/m³)	Change (µg/m³)	Magnitude Category
1	8.2	7.8	7.9	0.1	Adverse Imperceptible
2	9.5	9.0	9.3	0.3	Adverse Small
3	9.5	9.1	8.7	-0.5	Benefit Small
4	10.4	9.9	10.4	0.5	Adverse Small
5	10.7	10.3	10.4	0.1	Adverse Imperceptible
6	8.8	8.4	8.8	0.4	Adverse Small
7	9.3	8.9	8.9	0.0	Adverse Imperceptible
8	10.1	9.6	9.7	0.1	Adverse Imperceptible
9	9.8	9.4	9.3	-0.1	Benefit Imperceptible
10	8.9	8.5	8.6	0.1	Adverse Imperceptible
11	10.2	9.7	9.9	0.2	Adverse Imperceptible

* Change and magnitude categories are calculated from rounded DM and DS results and presented to one decimal place.

16.4.11 The greatest increase in annual mean PM_{10} concentration between DM and DS is predicted at Receptor 4 (Guay Farmhouse, Guay, Ballinluig, Pitlochry), with a concentration change of 0.47µg/m³,

as a result of the A9 being brought closer to the property. This impact is considered to be of small (adverse) magnitude and the predicted PM_{10} concentrations at the receptor do not exceed the annual mean PM_{10} AQO in DM or DS scenario.

16.4.12 The greatest decrease in annual mean PM_{10} concentration between DM and DS is predicted at Receptor 3 (Self Catering Units - Dowally Farm, Dowally Ballinluig, Pitlochry), with a concentration change of 0.5µg/m^3. This impact is considered to be of small (adverse) magnitude and the predicted PM_{10} concentrations at the receptor do not exceed the annual mean PM_{10} AQO in DM or DS scenario.

Table 16.13: $PM_{2.5}$ concentrations at assessed representative receptors (Do-Minimum 2026 and Do-Something 2026)

Receptor	Baseline 2015 (µg/m^3)	DM 2026 (µg/m^3)	DS 2026 (µg/m^3)	Change (µg/m^3)	Magnitude Category
1	5.7	5.5	5.5	0.0	No Change
2	6.6	6.2	6.4	0.2	Adverse Small
3	6.5	6.1	6.0	-0.1	Benefit Imperceptible
4	7.3	6.9	7.1	0.2	Adverse Small
5	7.3	7	7.1	0.1	Adverse Imperceptible
6	6.2	5.8	6.1	0.3	Adverse Small
7	6.5	6.1	6.1	0.0	No Change
8	7	6.6	6.6	0.0	No Change
9	6.8	6.4	6.4	0.0	No Change
10	6.2	5.9	5.9	0.0	No Change
11	7.1	6.7	6.8	0.1	Adverse Imperceptible

*Change and magnitude categories are calculated from rounded DM and DS results and presented to one decimal place.

16.4.13 The greatest increase in annual mean $PM_{2.5}$ concentration between DM and DS is predicted at Receptor 6 (Rockview House, Kindallachan, Pitlochry), with a concentration change of 0.3µg/m^3, as a result of the A9 being brought closer to the property This impact considered to be of small (adverse) magnitude and predicted $PM_{2.5}$ concentrations at the receptor do not exceed the annual mean $PM_{2.5}$ AQO in DM or DS scenario.

16.4.14 The greatest decrease in annual mean $PM_{2.5}$ concentration between DM and DS is predicted at Receptor 3 (Self Catering Units - Dowally Farm, Dowally Ballinluig, Pitlochry), with a concentration change of 0.1µg/m^3. This impact is considered to be of imperceptible magnitude and the predicted $PM_{2.5}$ concentrations at the receptor do not exceed the annual mean $PM_{2.5}$ AQO in DM or DS scenario.

16.4.15 There is no change in annual mean $PM_{2.5}$ concentration between DM and DS predicted at Receptor 1 (St Colme's) and Receptors 7 to 10 (Haugh of Kilmorich, Haugh Cottage South, Inch of Tulliemet and 4 Station Cottages).

16.4.16 Overall, of the 11 receptors included in the assessment, all are predicted to experience an increase in annual mean NO_2 concentrations. Of the same 11 receptors included in the modelling, nine are predicted to experience an increase and two are predicted to experience a decrease in annual mean PM_{10}. Of the same 11 receptors, one is predicted to experience a decrease, five are predicted to experience an increase and five predicted to experience no change in $PM_{2.5}$ concentrations.

Impact Significance

16.4.17 The pollutant concentrations at all assessed receptors are well below (<75% of) AQOs and therefore, based on the IAN174/13 guidelines, no significant effects on local air quality at human exposure receptors were identified. There are also no affected links in the study area that are within the EU Compliance Risk Road Network; therefore, there is no potential non-compliance with this EU Directive.

16.4.18 In accordance with IAN 174/13 the following Key Criteria Questions were answered in Table 16.12 which indicates impacts are not significant.

Table 16.14: Overall evaluation of local air quality significance

No.	Key Criteria Question	Answer
1	Is there a risk that environmental standards will be breached?	No
2	Will there be a large change in environmental conditions?	No
3	Will the effect continue for a long time?	No
4	Will many people be affected?	No
5	Will it be difficult to avoid, reduce, repair or compensate for the effect?	No
6	On balance is the overall effect significant?	No

Local Air Quality – Designated Sites

16.4.19 As indicated in Table 16.7, three statutorily designated sites to be considered in this assessment were identified within 200m of affected road links. As noted in 16.3.13 and 16.3.14, the sites were therefore scoped out of further assessment.

Regional Emissions

16.4.20 The results for the regional assessment for the Opening Year (2026) are shown in Table 16.15 and for the Design Year (2041) in Table 16.16 along with the 2014 UK (Road Transport Sector and All Sectors) data showing total emissions. The 2015 data were used as these are the latest available from the 2015 National Atmospheric Emissions Inventory for comparison and the database does not currently project forward to future years.

Table 16.15: Regional emissions assessment (Opening Year 2026)

Pollutant	Baseline Year (2015) Total Emissions (tonne/year)	DM - Total Emissions (tonne/year)	DS - Total Emissions (tonne/year)	Change - Total Emissions (tonne/year)
NO_x	30.6	11.6	18.4	+6.8
PM_{10}	1.9	1.8	2.0	+0.2
$PM_{2.5}$	1.3	1.0	1.2	+0.2
CO_2 (as CO_2)	11931.2	13214.0	18367.0	+5152.1
CO_2 (as C)	3254.0	3603.8	50009.2	+1405.1
Pollutant	**2015 UK (Road Transport Sector) Total Emissions (tonne/year)**		**2015 UK (All Sectors) Total Emissions (tonne/year)**	
NO_x	311,367		2,523,742	
PM_{10}	20,554		237,980	
$PM_{2.5}$	13,880		187,688	
CO_2 (as C)	30,198,679		244,115,921	
Pollutant	**Percentage Change (%) due to Scheme compared to the 2015 UK (Road Transport Sector) Total Emissions**		**Percentage Change (%) due to Scheme compared to the 2015 UK (All Sectors) Total Emissions**	
NO_x	+0.0022%		+0.0003%	
PM_{10}	+0.0012%		+0.0001%	
$PM_{2.5}$	+0.0013%		+0.0001%	
CO_2 (as C)	+0.0048%		+0.0021%	

Table 16.16: Regional emissions assessment (Design Year 2041)

Pollutant	Baseline Year (2015) Total Emissions (tonne/year)	DM - Total Emissions (tonne/year)	DS - Total Emissions (tonne/year)	Change - Total Emissions (tonne/year)
NO_x	30.6	11.0	17.4	+6.4
PM_{10}	1.9	1.9	2.2	+0.3
$PM_{2.5}$	1.3	1.1	1.3	+0.2
CO_2 (as CO_2)	11931.2	14408.9	19866.6	+5456.7
CO_2 (as C)	3254.0	3229.7	5418.2	+1488.2
Pollutant	**2015 UK (Road Transport Sector) Total Emissions (tonne/year)**		**2015 UK (All Sectors) Total Emissions (tonne/year)**	
NO_x	311,367		2,523,742	
PM_{10}	20,554		237,980	
$PM_{2.5}$	13,880		187,688	
CO_2 (as C)	30,198,679		244,115,921	
Pollutant	**Percentage Change (%) due to Scheme compared to the 2015 UK (Road Transport Sector) Total Emissions**		**Percentage Change (%) due to Scheme compared to the 2015 UK (All Sectors) Total Emissions**	
NO_x	+0.0021%		+0.0003%	
PM_{10}	+0.0013%		+0.0001%	
$PM_{2.5}$	+0.0014%		+0.0001%	
CO_2 (as C)	+0.0049%		+0.0006%	

16.4.21 The results for the Opening Year DS scenario (2026) indicate an increase in NO_x, PM_{10}, $PM_{2.5}$ and CO_2 emissions, compared with the DM scenario, with a similar pattern in 2041.

Impact Significance

16.4.22 There is no government guidance published for assessing the significance of impacts of individual road schemes on regional or greenhouse gas emissions. Regional scale emissions are managed at a national (UK) level, and are not considered for individual schemes in isolation.

16.4.23 The increase in emissions was compared with the 2015 NAEI (Defra, 2015) emissions for the pollutants. As shown in Table 16.13 and Table 16.14, the increases from the proposed scheme are very low in comparison to 2015 UK (All Sector) emissions, up to 0.0049% between the Opening and Design Year. As such, the potential impact on regional emissions is Not Significant.

16.5 Mitigation

16.5.1 This chapter makes reference to overarching standard measures applicable across A9 dualling projects ('SMC' mitigation item references), and also to any project-specific measures ('P03' mitigation item references). Those that specifically relate to air quality are assigned an 'AQ' reference.

Standard Mitigation

Construction

Dust Deposition

16.5.2 The application of control measures for dust arising during construction can be very effective. These are based on reducing dust generation at source. To reduce the potential for dust emissions, a range of standard mitigation commitments will be adopted covering the following (**Mitigation Items SMC-AQ1, SMC-AQ2** and **SMC-AQ3**).

16.5.3 In relation to minimising fugitive dust emission from earthworks, materials storage and concrete batching the following mitigation items will be implemented (**Mitigation Item SMC-AQ1**):

- stockpiles and mounds will be at a suitable angle of repose to prevent material slippage, will be enclosed or securely sheeted, and/or kept damped as necessary during dry weather;
- the surfaces of any long-term stockpiles which give rise to a risk of dust or air pollution will be covered with appropriate sheeting or will be treated to stabilise the surfaces;
- mixing of large quantities of concrete will be carried out only in enclosed or shielded areas;
- all handling areas will be maintained in a dust free state as far as is practicable with sprinklers and hoses used to prevent dust escaping from the site boundaries; and
- procedures will be established so that the site is regularly inspected for spillage of dusty or potentially dusty materials and any such spillage will be dealt with promptly where necessary to prevent dust nuisance.

16.5.4 In relation to minimising dust from vehicle movements within the site the following mitigations items will be implemented (**Mitigation Item SMC-AQ2**):

- the Contractor will employ appropriate measures, such as covering materials deliveries or loads entering and leaving the construction site by a fixed cover or sheeting appropriately fixed and suitable for the purposes of preventing materials and dust spillage;
- where unsurfaced routes are identified as creating dust emissions during periods of dry weather, surfaces will be regularly dampened down using water bowsers; and
- appropriate speed limits will be established and enforced over all unmade surfaces.

16.5.5 In relation to appropriate cleaning of public roads the following mitigation items will be implemented minimising (**Mitigation Item SMC-AQ3**):

- wheel washing facilities will be installed and heavy vehicles will be required to use the facilities prior to leaving the site;
- subject to approval from the Roads Authority, public roads immediately outside the site entrance will be cleaned using vacuum sweeper brushes and other specialised road cleaning equipment as necessary to maintain an appropriate state of cleanliness; and
- roads and footpaths adjacent to the proposed scheme will be cleaned, with damping if necessary.

Assessment of Potential Air Quality Impacts from Construction Traffic

16.5.6 There is not predicted to be a significant impact on local air quality concentrations as a result of construction traffic. No mitigation measures beyond standard mitigation commitments are therefore proposed.

Operation

Local Air Quality - Human Exposure Receptors/Designated Sites

16.5.7 There is no significant impact on local air quality concentrations at human exposure receptors or designated sites as a result of the proposed scheme. Therefore, no mitigation is required.

Regional Emissions

16.5.8 Regional emissions increase as a result of the proposed scheme are very low in comparison to the total UK emissions and are not considered significant. No mitigation is therefore required.

Specific Mitigation

16.5.9 No specific mitigation measures are proposed.

16.6 Residual Impacts

16.6.1 This section provides an assessment of the residual impacts with the implementation of mitigation measures as discussed in Section 16.5 (Mitigation).

Construction

Dust Deposition Impacts

16.6.2 With the implementation of appropriate dust management measures, there are not predicted to be any significant residual impacts from construction activities.

Construction Traffic Impacts

16.6.3 Traffic emissions from construction vehicles during the construction phase are not predicted to have a significant residual impact on air quality.

Operation

Local Air Quality - Human Exposure Receptors

16.6.4 The proposed scheme is predicted to lead to some increases and decreases in annual mean NO_2, PM_{10} or $PM_{2.5}$ pollutant concentrations at human exposure receptor locations within the study area. None of these increases exceed the annual mean AQOs for these pollutants in either the DM or DS scenarios.

16.6.5 Mitigation measures are not required and no significant residual impacts are predicted.

Local Air Quality – Designated Sites

16.6.6 The assessment of Designated Sites was scoped out of the assessment (as detailed in paragraphs 16.3.12 -16.3.14). Therefore, mitigation measures are not required, and no residual impacts are predicted.

Regional Emissions

16.6.7 Increases in regional emissions as a result of the proposed scheme are very low in comparison to total UK emissions and there is no significant residual impact.

16.7 Statement of Significance

16.7.1 With the proposed scheme in place, and considering mitigation measures as described in Section 16.5 (Mitigation), all impacts on air quality are predicted to be Not Significant.

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