11 Air Quality

This chapter presents the assessment of the potential air quality impacts associated with the A985 Kincardine Bridge Refurbishment: Piled Viaduct Replacement scheme.

For construction phase traffic, the expected traffic management measures that are to be implemented are unlikely to result in exceedances of nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$ (i.e. particulate matter with an aerodynamic diameter of 10 microns or less and particulate matter with an aerodynamic diameter of 2.5 microns or less)) and the impact on air quality is considered not significant.

For construction dust, there is predicted to be a Low to Negligible risk from demolition, earthworks, construction and trackout activities for dust soiling effects at sensitive human receptors. This is due to the potential for infrequent, short-term episodes when baseline dust deposition rates could be increased by an amount that residents could perceive. For human health impacts, the proposed dust generating activities are predicted to be a Low to Negligible risk as there is limited potential for emissions of PM_{10} to increase baseline concentrations to a value that is above the air quality objectives set for the protection for human health.

For the Firth of Forth Ramsar, Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI) designations, there is considered to be a Medium risk from earthworks and a Low risk from demolition, construction and trackout activities associated with construction of the proposed scheme.

With the implementation of the good practice mitigation measures recommended as specified in Appendix A11.1 (Air Quality - Dust Risk Assessment) and summarised in Section 11.6 (Mitigation), the likely effect of dust emissions on human health, amenity and ecological receptors during construction is not considered to be significant.

11.1 Introduction

11.1.1 This chapter of the Environmental Impact Assessment (EIA) Report presents the air quality assessment for the A985 Kincardine Bridge Refurbishment: Piled Viaduct Replacement scheme (hereafter referred to as the proposed scheme). It considers local air quality impacts on sensitive receptors at human exposure locations and designated nature conservation sites (hereafter referred to as designated sites).

11.1.2 This assessment is supported by the following appendices and figures:

- Appendix A11.1: Air Quality – Dust Risk Assessment;
- Figure 11.1: Affected Roads and Human Receptors; and
- Figure 11.2: Construction Dust Assessment Study Areas and Human and Ecological Receptors.

11.1.3 The chapter describes the methods used to assess the potential impacts; the current baseline conditions; the mitigation measures required to prevent, reduce or offset any potential significant adverse effects; and the likely residual effects following the application of those measures.

11.1.4 The term 'air quality' refers to air pollution that could potentially affect health, such as emissions of air pollutants from vehicle exhausts or dust generated for construction activities. Air quality effects can be toxicological from inhaled and dermal exposure and may have an effect on well-being (e.g. stress and anxiety) through perceived nuisance (e.g. dust deposition). 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. Pollutants emitted from vehicle traffic emissions include nitrogen oxides (NO_x), NO_2, PM_{10} and $PM_{2.5}$.

11.1.5 The main air quality impacts associated with construction activities relate to dust. The term 'dust' refers to all particulate matter including all particles suspended in air or settled and deposited onto a surface after having been suspended during land preparation (e.g. demolition, site clearance), earthworks

(including the handling and storage of materials) and during construction activity. This includes the smaller-sized particulates associated with potential health effects (i.e. PM_{10} and $PM_{2.5}$), and larger particulates associated with causing annoyance through deposition onto a surface. 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).

11.1.6 The chapter considers the potential emission sources of air pollutants and dust associated with the proposed scheme.

11.2 Legislation, Policies and Guidance

11.2.1 National and local planning policy and strategy documents, relevant to the air quality assessment are set out in Table 11.1. An assessment of the proposed scheme's compliance with policy is provided in Appendix A4.1 (Assessment of Policy Compliance).

Table 11.1: Legislation, Policies and Guidance

Legislation, Policies and Guidance	Relevance to the Proposed Scheme
Air Quality Standards (Scotland) Regulations 2010	These Regulations have the objective to improve air quality by reducing the impact of air pollution on human health and ecosystems. These standards include limit values, target values and critical levels for pollutants relevant to this assessment including NOx, NO_2, PM_{10} and $PM_{2.5}$.
The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Defra 2007)	The Department for Environment, Food and Rural Affairs (Defra) air quality strategy provides an overview and outline of the UK Government's and devolved administrations' ambient (outdoor) air quality policy. This strategy sets out the Air Quality Objectives (AQOs) and the measures selected to achieve the desired improvements in air quality.
Scottish Planning Policy (SPP) – (Scottish Government 2014)	In Principal Policies, paragraph 29 states: *This means that policies and decisions should be guided by the following principles: avoiding over-development, protecting the amenity of new and existing development and considering the implications of development for water, air and soil quality*
Scotland's National Marine Plan (Scottish Government 2015)	GEN 14 states: *Air quality: Development and use of the marine environment should not result in the deterioration of air quality and should not breach any statutory air quality limits.*
Planning Advice Note (PAN 51), Revised 2006 (Scottish Executive Development Department)	The introduction states: *The central purpose of this Planning Advice Note (PAN) is to support the existing policy on the role of the planning system in relation to the environmental protection regimes. The regimes includes Local Air Quality Management.*
Design Manual for Roads and Bridges (DMRB). Volume 11: Environmental Assessment, Section 3 (Highways Agency 2007) (HA207/07)	This Advice Note gives guidance on the assessment of the impact that road projects may have on local regional air quality. It should be noted HA207/07 has now been superseded by DMRB LA 105 Air quality (Highways England, Transport Scotland, Welsh Government and Department for Infrastructure Northern Ireland 2019a). As discussed in Chapter 4 (Overview of Assessment Process) of this EIA Report, confirmation of the continued application of DMRB HA207/07 was sought from Transport Scotland.
Local Air Quality Management: Technical Guidance (TG16) (Defra 2016)	This is designed to guide local authorities through the LAQM process and includes detailed technical guidance on air quality screening, modelling and assessment.

Legislation, Policies and Guidance	Relevance to the Proposed Scheme
Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction. Version 1.1 (IAQM 2016)	This document contains guidance for undertaking a risk-based appraisal of dust from demolition and construction-related activities and assigning an appropriate level of dust control and mitigation. It includes recommended dust mitigation measures, monitoring and an approach for determining the significance of effects from dust emissions. It also includes advice on identifying the need to undertake an assessment of emissions to air from construction plant and machinery.
Environmental Protection UK (EPUK) (2017). Land-Use Planning and Development Control: Planning for Air Quality.	This document provides guidance for the consideration of air quality within the land-use planning and development control process.
FIFEplan – Fife Local Development Plan, Adopted Plan September 2017 (Fife Council 2017)	Policy 10 of the FIFEplan states: *'Development will only be supported if it does not have a significant detrimental impact on the amenity of existing or proposed land uses. Development proposals must demonstrate that they will not lead to a significant detrimental impact on amenity in relation to…Air quality, with particular emphasis on the impact of development on designated Air Quality Management Areas'.* *'Development proposals that lead to a breach of National Air Quality Standards or a significant increase in concentrations of air pollution within an existing Air Quality Management Area (AQMA) will not be supported. Statutory supplementary guidance will provide additional information, detail and guidance on air quality assessments, including an explanation of how proposals could demonstrate that they would not lead to an adverse impact on air quality*'.
Falkirk Local Development Plan 2, Adopted Plan August 2020 (Falkirk Council 2020)	Policy PE26 Air Quality states: *'Development should not exacerbate existing air quality issues or introduce new sources of pollution which impact on local air quality without appropriate mitigation. Impacts on air quality will be taken into account in assessing development proposals, particularly within Air Quality Management Areas (AQMA). An Air Quality Assessment may be required for developments that are within an AQMA or where the proposed development may cause or significantly contribute towards a breach of National Air Quality Standards. Development proposals that result in either a breach of National Air Quality Standards or a significant increase in concentrations within an existing AQMA will not be permitted unless there are overriding issues of national or local importance'.*
Fife Council, Memorandum August 2018 (Ref: PC180134.C1-JR-MP-AQIA) in response to the pre-application to prepare an Environmental Impact Assessment	AQC1 Submission of an Air Quality Impact Assessment states: *'Development shall not commence until evidence is provided to the local authority demonstrating that the National Air Quality Strategy objectives would not be exceeded. The methodology shall be agreed with the Council and other relevant regulatory bodies, and shall include an appropriate air quality impact assessment of the proposed development. Where the assessment predicts that objectives will be exceeded, the applicant shall provide a scheme for mitigating their impacts for approval by the Council and other relevant regulatory bodies, and thereafter implement it in accordance with said details'.*

11.3 Approach and Methods

Scope of the Assessment

11.3.1 The scope of this assessment is to consider the potential air quality effects resulting from the construction and operation of the proposed scheme. It considers the impact of exhaust emissions from site equipment and vehicles and the following dust impacts:

- annoyance due to dust soiling;
- local air quality impacts at human health receptor locations due to an increase of exposure to PM_{10}; and

- effects at designated sites.

11.3.2 As detailed in Appendix 5.1 (Summary of Consultation Responses), Fife Council and Falkirk Council were consulted and provided with the Scoping Report (Jacobs 2018). In response, Fife Council noted that the air quality impact assessment should consider the short-term construction impacts; longer-term (construction phase) transportation impacts and proximity and potential cumulative effects of all existing developments and industrial processes. No specific comments regarding air quality were raised by Falkirk Council.

11.3.3 The following data sources have been used in this assessment:

- Defra, Emissions Factor Toolkit (Version 9), (Defra 2019a);
- Defra UK Air Information Resource website (Defra 2020);
- Fife Council Air Quality Annual Progress Report (Fife Council 2019);
- Scottish Government, Air Quality in Scotland website (Scottish Government 2020a); and
- Traffic data provided by Systra (Systra 2019).

Construction Plant and Machinery

11.3.4 The potential effect of emissions of air pollutants (principally NO_2, PM_{10} and $PM_{2.5}$) of exhaust emissions from construction plant and machinery has been considered. Based on the duration of the proposed construction programme (a programme of between 18 to 24 months is estimated at this stage), and the likely low number and size of plant and machinery items anticipated to operate simultaneously on-site (based on the scale of anticipated activities), such emissions are unlikely to be significant and can be mitigated by standard best practice measures (including the use of equipment meeting recent emission control standards and operating well maintained equipment). Therefore, construction plant and machinery has been scoped out from requiring a detailed assessment as per the Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction (IAQM 2016) (hereafter referred to as 'IAQM guidance') and as described in the Scoping Report (Jacobs 2018). Further details on scoping is provided in Chapter 5 (Consultation and Scoping).

Construction Phase Traffic

11.3.5 This assessment considered the potential impacts of emissions of air pollutants (principally NO_2, PM_{10} and $PM_{2.5}$) from road traffic movements associated with the construction phase of the proposed scheme.

Construction Dust

11.3.6 Construction sites of the scale envisaged for the proposed scheme can give rise to increasing long-term and short-term PM_{10} concentrations at off-site locations and may also cause annoyance due to the soiling of surfaces by dust unless appropriate mitigation measures are implemented. The impacts of dust emissions have therefore been considered within this assessment. It should be noted annoyance refers to loss of amenity due to dust deposition or visible dust plumes, often related to people making complaints, but not necessarily sufficient to constitute a nuisance according to legal definition. The term nuisance dust is often used in a general sense when describing amenity dust. However, this term also has specific meanings in environmental law: (a) statutory nuisance, as defined in S79(1) of the Environmental Protection Act 1990 (as amended); (b) private nuisance, arising from substantial interference with a person's enjoyment and use of their land; and (c) public nuisance, arising from an act or omission that obstructs, damages or inconveniences the rights of the community. Each of these applies as far as the nuisance relates to the unacceptable effects of emissions. It is recognised that a significant loss of amenity (or annoyance) may occur at lower levels of emission than would constitute a statutory nuisance.

Operational Phase Traffic

11.3.7 It is anticipated that the proposed scheme will not change the traffic flow, speed or composition of vehicles on the road network and therefore, changes in pollutant concentrations from vehicle emissions are considered unlikely. The proposed scheme is also unlikely to result in a change to the exposure of human receptors and designated sites to road traffic emissions. Therefore, as per Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1, HA 207/07 Air Quality (Highways Agency, Scottish Government, Welsh Assembly Government and the Department for Regional Development Northern Ireland 1993) (hereafter referred to as DMRB HA 207/07) guidance (see paragraph 11.3.14), it is considered that, in terms of its impact on air quality, the effect of the proposed scheme in its operational phase would be neutral and has been scoped out from requiring further assessment.

Methodology Overview

Construction Phase Traffic

11.3.8 DMRB HA 207/07 (Highways Agency et al 1993) sets out screening criteria for identifying where there is potential for a significant effect and identifying the need for an air quality assessment. These criteria are as follows:

- daily traffic flows will change by 1,000 average annual daily traffic (AADT) or more; or
- heavy duty vehicles (HDV) flows will change by 200 AADT or more; or
- daily average speed will change by 10 km/hr or more; or
- peak hour speed will change by 20 km/hr or more; or
- road alignment will change by 5 m or more.

11.3.9 Traffic data was obtained for temporary overnight road closures and also the implementation of traffic management measures (including the closure of the right turn from the A876 N approach road onto the A985 Kincardine Bridge) during the construction phase. When screening the traffic data for the Do Minimum (DM) and Do Something (DS) scenarios (see paragraph 11.3.12) of the proposed temporary overnight road closures and implementation of traffic management measures, the change in vehicle numbers between the DM and DS scenarios required an air quality assessment to be undertaken for the proposed traffic management measures only.

11.3.10 As per DMRB HA207/07 guidance (and also consistent with LA105), a scoping exercise was then undertaken to identify any potential effects on air quality from the proposed traffic management measures. It was concluded that based on the relatively low background air quality concentrations and the small temporary change in traffic flows during the construction period, a detailed air quality modelling assessment was not required to establish the significance of effects of the proposed scheme on air quality as exceedances of national air quality objective (AQO) thresholds was unlikely. Consequently, the scoping exercise concluded that a simple level assessment was required as defined by DMRB HA207/07 (and also consistent with LA105).

11.3.11 Diagram 11.1 outlines the stages within the simple level assessment.

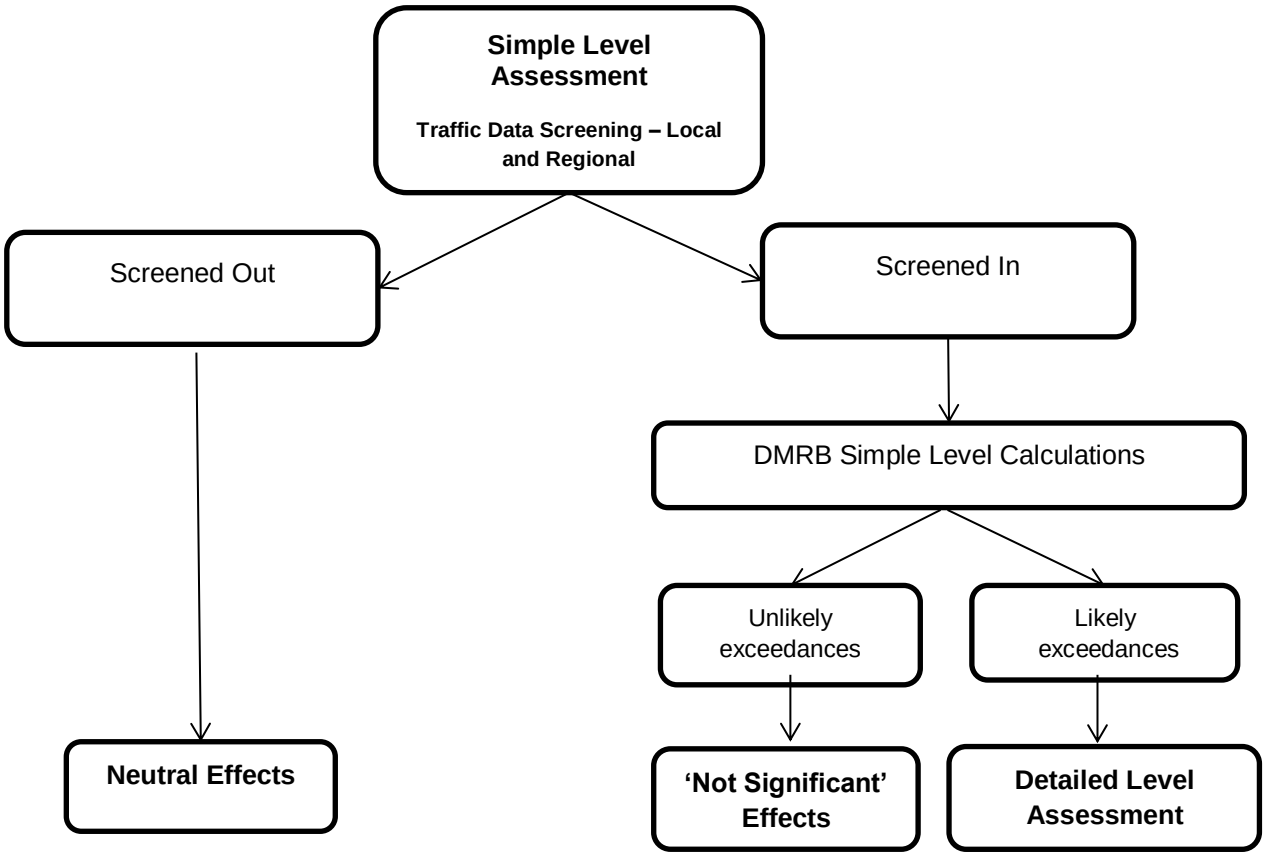

Diagram 11.1: DMRB HA207/07 Simple Level Assessment Process

11.3.12 The simple level assessment predicts concentrations of NO_2 and PM_{10} in the opening year (year of traffic management implementation (i.e. 2021)) for both DM and DS scenarios. The DM scenario represents the opening year without the proposed scheme and the DS scenario represents the opening year with the proposed scheme in place. Although the UK currently meets its legal requirement for the achievement of $PM_{2.5}$ air quality thresholds, for completeness, $PM_{2.5}$ has also been included in the assessment.

11.3.13 Where exceedances of annual mean AQO thresholds are identified as being unlikely, it is reasonable to conclude that effects on air quality are likely to be 'not significant'. Where exceedances of annual mean AQO thresholds are identified as likely, there is a requirement for more advanced dispersion modelling (a detailed level assessment) to be undertaken.

11.3.14 The DMRB simple level assessment approach assumes that concentrations near to roads are made up of two components:

- local road traffic emission sources; and
- background sources (those arising from regional/national sources and/or ambient background).

11.3.15 A simple level assessment of the proposed scheme impacts from road traffic emission sources was undertaken at worst-case relevant sensitive receptor locations which included locations where pollutant concentrations were:

- likely to be the highest; and
- likely to receive the greatest change due to the scheme.

11.3.16 Local road traffic emission rates were estimated using Defra's Emissions Factor Toolkit (EFT) (v9) (Defra 2019a) and Highways England's drop-off equation set out in paragraph C3.2 of the DMRB guidance (HA

207/07). Due to the limited extent of the traffic data available, the unlikelihood of AQO thresholds being exceeded and the availability of only one monitoring location in the vicinity of the assessed road links (i.e. see paragraph 11.4.3), which if used would only identify site-specific error and not systematic error within the assessment process, verification has not been carried out.

11.3.17 Road component NOx, PM_{10} and $PM_{2.5}$ concentrations were then added to the Scottish Government and Defra's background mapping concentrations (see Section 11.4: Baseline Conditions) to derive total pollutant concentrations at the identified sensitive receptor locations. Road component NOx concentrations with relevant background concentrations were then converted to NO_2 using Defra's NOx to NO_2 calculator (Version 7.1) (Defra 2019b).

11.3.18 The results from the simple level assessment are provided in Section 11.5 (Potential Impacts).

Construction Dust

11.3.19 The assessment of dust during demolition and construction activities was carried out using a qualitative risk-based appraisal, which takes into account the location of nearby sensitive locations in relation to the works, the planned type and scale of the construction-related activities. The assessment follows the process described in the IAQM guidance (IAQM 2016). A full description of the methodology and the assessment is provided in Appendix A11.1 (Air Quality – Dust Risk Assessment).

11.3.20 The key potential construction dust emission sources which are considered in the assessment are set out below. These have been assigned into the four categories as specified in the IAQM guidance (IAQM 2016).

Demolition

11.3.21 Demolition of the existing piled viaduct and steel propping system.

Earthworks

11.3.22 Earthwork activities involved in establishing working areas and the formation of the temporary working platform.

Construction

11.3.23 Construction of a new structure to replace the existing piled viaduct and construction of the temporary bridge structure. The new five span piled viaduct structure would be of similar appearance to the adjacent existing 15m spans and would consist of a new deck formed using in-situ reinforced concrete beams with curved soffits.

Vehicle Movement and Trackout

11.3.24 Construction related vehicles moving on and around the proposed scheme study area emitting exhaust particulate matter and re-suspending loose material on the road. There would be the potential for spillage from transferring material around the site, and particulates being lifted from open container vehicles by the wind generated from the vehicle movement. Trackout refers to the transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the local road network.

11.3.25 The IAQM guidance (IAQM 2016) provides an assessment on three separate dust effects for the four activity types listed above, which are:

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

- harm to ecological receptors.

11.3.26 Although $PM_{2.5}$ is not specifically included as a parameter within the assessment, the risk levels associated with PM_{10} and any subsequent mitigation measures would also apply to $PM_{2.5}$.

Identification of Study Area

Construction Phase Traffic

11.3.27 As per the DMRB guidance, roads that meet the criteria (known as 'affected roads') and properties and designated sites within 200m of those affected roads are considered. Any relevant traffic data on road links that are within 200m of the identified receptors are also included in the assessment to provide an overall study area.

11.3.28 Nine sensitive human receptors were identified close to the 'affected' road links within the study area. No statutory ecological receptors were identified within 200m of the affected roads.

11.3.29 Traffic data for nine road links in the vicinity of the proposed scheme were provided by the Trunk Road Operating Company for the DM and DS scenarios and are presented in Figure 11.1. Of those nine road links, three were identified as being an affected road (i.e. meeting the DMRB criteria set out in paragraph 11.3.8). It should be noted the road link representing Kincardine Bridge (i.e. Link 2) did not meet the DMRB criteria. The human sensitive receptor locations selected for this assessment are presented in Table 11.2 and Figure 11.1.

Construction Dust

11.3.30 As per IAQM guidance (IAQM 2016), an assessment is required where there is a human receptor within 350m of the site boundary or within 50m of the route used by construction vehicles on the public highway, up to 200m from the site exit(s) (based on trackout dust emission magnitude being medium, see Appendix A11.1: Air Quality – Dust Risk Assessment).

11.3.31 Furthermore, an assessment is required where there is an ecological receptor (i.e. habitats that could be sensitive to dust soiling) within 50m of the site boundary or within 50m of the route used by construction vehicles on the public highway, up to 200m from the site exit(s) (based on trackout dust emission magnitude being medium, see Appendix A11.1: Air Quality – Dust Risk Assessment).

Identification of Key Air Quality Receptors

Construction Phase Traffic

11.3.32 The human sensitive receptors identified for this assessment are presented in Table 11.2 and Figure 11.1.

Table 11.2: Relevant Receptor Locations

Relevant Receptors	National Grid Reference	
	X (m)	Y (m)
R1	293294	687541
R2	293497	687455
R3	293950	687257
R4	294312	687071
R5	293615	686856
R6	293187	687156
R7	292970	687286
R8	293081	687378
R9	293193	687542

Construction Dust

Human Receptors

11.3.33 The IAQM guidance (IAQM 2016) defines human receptors as those locations where members of the public could be present over short or long periods, for example residential properties, schools, hospitals, doctor's surgeries, places of worship, busy streets, shops, playing fields or parks, public rights of way (PRoW) and footpaths.

11.3.34 For the assessment of emissions of dust from construction activities associated with the proposed scheme, a receptor count has been carried out to identify the highest level of area sensitivity (see Table 2 and 3 of the IAQM guidance (IAQM 2016)) within 350m of the respective proposed scheme boundary and within 50m of the route(s) used by construction vehicles on the public highway, up to 200m from the respective proposed scheme site exit(s).

11.3.35 There are two High sensitive human receptors (i.e. residential properties north of the Higgins Neuk roundabout) within 350m of the site boundary. These two receptors are also the only High sensitive human receptors (i.e. residential properties) within 50m of the potential route(s) used by construction vehicles up to 200m from the site exit(s) (see Appendix A11.1: Air Quality – Dust Risk Assessment and Figure 11.2).

Ecological Receptors

11.3.36 The nearest ecological receptors to the proposed scheme are the Firth of Forth Ramsar, Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI) sites which are located directly beneath and adjacent to Kincardine Bridge and have been included in the assessment. Technical discussions between air quality and ecology professionals were held to identify the sensitivity of the ecological receptor to dust impacts in accordance with the example of sensitivities set out in the IAQM guidance (IAQM 2016, Box 8 page 18). After consideration of the likely effect and value of the ecological assets, the Firth of Forth Ramsar, SPA and SSSI sites were classified as a medium sensitivity receptor.

Assessment Inputs

Construction Phase Traffic

The traffic data for the traffic management measures included in the DMRB simple level assessment is presented in Table 11.3 and Table 11.4.

Table 11.3: DM 2-Way Traffic Parameters

DM 2-Way Traffic Parameters				
Link	**AADT**	**No of HGVs**	**HGV %**	**Average Speed (kph)**
1	19,562	1,009	5.2%	86.8
2	12,711	530	4.2%	49.3
3	32,291	1,538	4.8%	98.4
4	23,083	1,130	4.9%	65.1
5	4,656	194	4.2%	60.9
6	3,741	127	3.4%	48.6
7	2,892	162	5.6%	66.7
8	11,173	543	4.9%	94.1
9	9,192	453	4.9%	100.7

Table 11.4 DS 2-Way Traffic Parameters

DS 2-Way Traffic Parameters				
Link	**AADT**	**No of HGVs**	**HGV %**	**Average Speed (kph)**
1	19,876	1,037	5.2%	86.8
2	12,396	499	4.0%	50.4
3	32,293	1,536	4.8%	98.3
4	23,078	1,127	4.9%	65.2
5	4,341	166	3.8%	60.9
6	2,649	94	3.6%	48.6
7	3,911	162	4.2%	66.7
8	11,173	543	4.9%	94.2
9	10,905	454	4.2%	100.5

Construction Dust

11.3.37 The assessment inputs for the construction dust assessment are provided in Appendix A11.1: Air Quality – Dust Risk Assessment.

Assessment Criteria

Construction Phase Traffic

11.3.38 Results of the simple level assessment calculations are compared respectively to the annual mean AQOs for NO_2 (40 µg/m^3), PM_{10} (18 µg/m^3) and $PM_{2.5}$ (10 µg/m^3) to establish the likelihood of exceedance.

11.3.39 Where potential exceedances are considered likely, in accordance with DMRB guidance, a detailed level assessment should then be undertaken to establish the significance of the effects of the proposed scheme on air quality.

Construction Dust

11.3.40 The IAQM guidance (IAQM 2016) uses a consistent approach to define the risks associated with the construction activities (demolition, earthworks, construction and trackout) in order to specify the level of mitigation required to reduce and manage those risks. Following Step 1 (Identify the need for a detailed assessment) of the IAQM guidance (IAQM 2016) (see Appendix A11.1: Air Quality – Dust Risk Assessment), the risk is defined from the dust emission magnitude and the sensitivity of the area in the

vicinity of the site, which are determined during Step 2 (Assess the risk of dust impacts) of the assessment.

11.3.41 The risk definitions for the four categories of potential dust effects (i.e. demolition, earthworks, construction and trackout) are shown in Table 11.5. A full description of the methodology including further explanation on how the dust emission magnitude and area sensitivity are defined is provided in Appendix A11.1 (Air Quality – Dust Risk Assessment).

Table 11.5: Risk Definition of Potential Dust Effects from Demolition, Earthworks, Construction and Trackout

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

Determining Significance

Construction Phase Traffic

11.3.42 As discussed previously, where potential exceedances are considered likely, a detailed level assessment should then be undertaken to establish the significance of the effects of the proposed scheme on air quality.

Construction Dust

11.3.43 Step 3 of the IAQM guidance (IAQM 2016) (Site-specific mitigation) identifies the appropriate site-specific mitigation that is required based on the dust risk categories determined for each of the four activity types. The relevant and appropriate measures to mitigate dust emissions are set out in Appendix A11.1 (Air Quality – Dust Risk Assessment).

11.3.44 The approach in step four of the IAQM guidance (IAQM 2016) has been adopted to determine the significance of effects with regard to dust emissions. The guidance states the following:

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

11.3.45 The IAQM guidance (IAQM 2016) also states that:

'Even with a rigorous DMP [Dust Management Plan] in place, it is not possible to guarantee that the dust mitigation measures will be effective all the time, and if, for example, dust emissions occur under adverse weather conditions, or there is an interruption to the water supply used for dust suppression, the local community may experience occasional, short-term dust annoyance. The likely scale of this would not normally be considered sufficient to change the conclusion that with mitigation the effects will be not significant'.

11.3.46 Step 4 of the IAQM guidance (IAQM 2016) (Determine significant effects) recognises that the key to the above approach is that it assumes that the regulators would ensure that mitigation measures, and any appropriate monitoring, are implemented. The environmental management of the construction activities would be co-ordinated through the application of a Dust Management Plan or another appropriate management plan. These would include the necessary systems and procedures to facilitate ongoing checking by the regulators to ensure that dust mitigation is being delivered, and that it is effective at reducing any effect to not significant, and statutory dust nuisance issues would not be anticipated.

Assumptions and Limitations

11.3.47 For the construction phase traffic assessment, all available traffic flows for each road link within 200m of the assessed human receptors have been included in the assessment. In practice, this means vehicles may be double counted in the assessment to provide a conservative, worst-case approach. A verification process has not been undertaken (see paragraph 11.3.16).

11.3.48 For the assessment of dust from activities associated with the construction and demolition of the proposed scheme, it is assumed all construction activities are undertaken simultaneously. In practice, the works associated with the construction of the proposed scheme are likely to be split into several stages, which could potentially involve different periods of demolition, earthworks, construction and trackout activity. Furthermore, IAQM guidance recommends that the receptor distance is based on the distance from the source rather than the site boundary. This assessment was undertaken on the basis that all activities (i.e. demolition, earthworks, construction and trackout) take place at the construction boundary. This represents a conservative assumption, as in practice most activities would not take place at the site boundary, thus increasing the distance between the source and the receptor.

11.3.49 Where information required to facilitate the assessment of dust from demolition and construction activities is not available, a conservative assumption was made to provide a more robust approach to the assessment (e.g. for trackout activities, it was assumed unpaved road lengths were greater than 100m and a potentially dusty surface material was present (see Appendix A11.1: Air Quality – Dust Risk Assessment)).

11.3.50 The IAQM guidance (IAQM 2016) recommends that the proposed mitigation would ensure that any potential significant adverse effects would not occur, so the residual effects can be considered as not significant. However, the IAQM guidance (IAQM 2016) suggests that even with a rigorous air quality management plan (AQMP) in place (including construction standard best practice by the contractor), it is not possible to guarantee that the mitigation measures would be effective continuously, and if, for example, dust emissions occur under adverse weather conditions due to the failure of a dust-control measure, local receptors may experience infrequent, short-term dust annoyance.

11.4 Baseline Conditions

11.4.1 In order to assess the potential air quality effects of the activities associated with the construction of the proposed scheme, it is necessary to have an understanding of the existing air quality situation in the vicinity of the proposed scheme. A review was undertaken of the available data sources to inform the characterisation of the current air quality environment, and to determine the background air quality concentrations for use in the air quality assessment.

11.4.2 Information on background NOx, NO_2 and PM_{10} concentrations near the assessed human receptors was obtained from the Scottish Government air quality website (www.scottishairquality.scot) (Scottish Government 2020a). The Scottish Government provides empirically derived background maps, which provide estimates of background pollutant concentrations on a 1km by 1km grid square resolution across Scotland. The 2017-based background maps represent the average concentration across a 1 km by 1 km square (i.e. the background map concentrations do not provide the concentrations at a specific location, for example adjacent to a road source). For $PM_{2.5}$, background concentrations were obtained from Defra's 2017-based background map datasets (Defra 2020).

11.4.3 Consideration was also given to automatic and non-automatic (i.e. diffusion tube) monitoring undertaken in the vicinity of the proposed scheme. The closest automatic PM_{10} monitoring location is the Grangemouth monitoring site (site ref. UKA00420) (National Grid Reference E 293830, N 681021), which measured an annual mean PM_{10} concentration of 12.6 µg/m^3 in 2019 (Scottish Government 2020a). However, this monitoring location is an urban industrial location approximately 6.1km southeast of the proposed scheme and is not considered representative of the likely PM_{10} background concentration within the study area. The closest non-automatic monitoring location is a kerbside location type (site ref. North Approach A, B Kincardine (National Grid Reference E 293182, N 687527)) approximately 1.2km from the site. This site recorded an annual mean NO_2 concentration of 15 µg/m^3 in 2018 which is well within the respective annual mean national AQO (40µgm^3) (Fife Council 2019). It should be noted that whilst this data provides a useful indication of existing air quality concentrations within the scheme area, the data itself was not utilised in the assessment as verification and adjustment was not undertaken (see paragraph 11.3.16).

Construction Phase Traffic

11.4.4 The pollutant background map concentrations for the 1km by 1km grid squares representing the assessed receptors for the opening year (i.e. 2021) are provided in Table 11.6.

Table 11.6: Background Concentrations for Assessed Human Receptors

Receptor	2021 Annual Mean Concentration (µg/m^3)			
	NOx	NO_2 (AQO 40 µg/m^3)	PM_{10} (AQO 18 µg/m^3)	$PM_{2.5}$ (AQO 10 µg/m^3)
R1	8.2	6.3	10.2	5.8
R2	8.2	6.3	10.2	5.8
R3	8.2	6.3	10.2	5.8
R4	7.4	5.7	10.3	5.7
R5	7.9	6.1	9.9	5.6
R6	8.2	6.3	10.2	5.8
R7	7.4	5.8	9.5	5.6
R8	8.2	6.3	10.2	5.8
R9	8.2	6.3	10.2	5.8

11.4.5 All background map concentrations presented are well within the respective annual mean national AQOs.

Construction Dust

11.4.6 The 2021 (when construction would commence) PM_{10} background map concentration for the 1km by 1km grid square representing the maximum PM_{10} concentration in the vicinity of the proposed scheme is predicted to be 11.1 µg/m^3. The background map concentration is well within the annual mean AQO for PM_{10} of 40 µg/m^3.

11.5 Potential Impacts

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

Construction Phase Traffic

11.5.2 As per DMRB HA207/07 guidance, the scoping exercise identified 3 road links (links 6, 7 and 9) meeting one of the DMRB screening criteria (i.e. daily traffic flows will change by 1,000 AADT or more). An overall summary of the affected road network is shown in Table 11.7 and presented in Figure 11.1.

11.5.3 A road link can be positively or negatively affected depending on whether an increase or a decrease in the relevant screening criteria is predicted.

Table 11.7: Traffic Data Screening Summary

Road Link ID	Change DS - DM		
	AADT	No of HGVs	Average Speed (kph)
1	314	28	0.0
2	-315	-31	0.4
3	2	-2	0.0
4	-5	-3	0.0
5	-316	-28	0.0
6	**-1,092**	-33	0.0
7	**1,019**	1	0.0
8	0	1	0.0
9	**1,713**	1	-0.1

Bold *denotes trigger of DMRB assessment criteria.*

DMRB Simple Assessment Results

11.5.4 The DMRB simple level assessment calculations at the identified sensitive receptors was undertaken in accordance with HA207/07; the results for NO_2, PM_{10} and $PM_{2.5}$ are presented in Table 11.8.

Table 11.8: Annual Mean NO_2, PM_{10} and $PM_{2.5}$ Simple Level Assessment Calculations

Receptor I.D	X	Y	NO_2					PM_{10}					$PM_{2.5}$				
			DM2021	DS2021	DS-DM	Exceedance?	Magnitude of Change	DM2021	DS2021	DS-DM	Exceedance?	Magnitude of Change	DM2021	DS2021	DS-DM	Exceedance?	Magnitude of Change
R1	293294	687541	8.2	8.5	0.3	No	Imperceptible	10.6	10.7	0.1	No	Imperceptible	6	6.1	0.1	No	Imperceptible
R2	293497	687455	7.5	7.9	0.4	No	Imperceptible	10.5	10.6	0.1	No	Imperceptible	6	6	0	No	Imperceptible
R3	293950	687257	7.1	7.4	0.3	No	Imperceptible	10.4	10.5	0.1	No	Imperceptible	5.9	5.9	0	No	Imperceptible
R4	294312	687071	8.2	8.2	0.1	No	Imperceptible	10.8	10.9	0.1	No	Imperceptible	6	6	0	No	Imperceptible
R5	293615	686856	7.6	7.9	0.3	No	Imperceptible	10.2	10.3	0.1	No	Imperceptible	5.8	5.8	0	No	Imperceptible
R6	293187	687156	7.2	7.4	0.2	No	Imperceptible	10.4	10.4	0	No	Imperceptible	5.9	5.9	0	No	Imperceptible
R7	292970	687286	10.7	10.6	-0.1	No	Imperceptible	10.5	10.5	0	No	Imperceptible	6.2	6.2	0	No	Imperceptible
R8	293081	687378	8.1	7.7	-0.4	No	Imperceptible	10.6	10.5	-0.1	No	Imperceptible	6	6	0	No	Imperceptible
R9	293193	687542	9.3	9.0	-0.4	No	Imperceptible	10.9	10.8	-0.1	No	Imperceptible	6.2	6.1	-0.1	No	Imperceptible

11.5.5 The results indicate that predicted pollutant concentrations at the identified sensitive receptors are unlikely to result in exceedances of the annual mean NO_2, PM_{10} and $PM_{2.5}$ AQO thresholds during the construction works.

11.5.6 Table 11.8 shows that the indicative traffic management measures are predicted to result in imperceptible decreases and increases in concentrations for the assessed air quality pollutants between the DM and DS scenarios. The impact on air quality from the proposed traffic management measures is considered not significant. As a result of the DMRB simple level assessment, no additional air quality monitoring or mitigation measures are proposed.

Construction Dust Assessment

11.5.7 The assessment has identified that there are potentially sensitive human receptors located near to the proposed scheme. The sensitivity of the area, which takes into consideration the number and distance of human receptors from the proposed scheme and baseline conditions, is summarised as being low sensitivity with respect to changes in dust deposition rates and low sensitivity with respect to emissions of PM_{10} within the study area. For ecological receptors, the sensitivity of the Firth of Forth Ramsar, SPA and SSSI is considered a medium sensitivity receptor. A full description of how the sensitivities were determined is provided in Appendix A11.1 (Air Quality – Dust Risk Assessment).

11.5.8 The scale of the activities associated with construction of the proposed scheme has been used to assess the dust emission magnitude for the different types of potential dust generating activities (categorised into demolition, earthworks, construction and trackout). Prior to good practice mitigation measures being implemented, demolition and construction activities are considered a small dust emission magnitude and earthworks and trackout activities are considered a medium magnitude. A full description of how the magnitudes were determined is provided in Appendix A11.1 (Air Quality – Dust Risk Assessment).

11.5.9 When combining the sensitivity of the area and the dust emission magnitudes following the IAQM guidance (IAQM 2016), for potential dust soiling effects, there is predicted to be a Low to Negligible risk from demolition, earthworks, construction and trackout activities as there is the potential for infrequent, short term episodes when baseline dust deposition rates could be increased by an amount that residents could perceive. A full description of how the dust soiling risks were determined is provided in Appendix A11.1 (Air Quality – Dust Risk Assessment).

11.5.10 For human health effects, the proposed demolition, earthworks, construction and trackout activities associated with the construction of the scheme are predicted to be a Low to Negligible risk for as there is limited potential for emissions of PM_{10} to increase baseline concentrations to a value that is above the AQO set for the protection for human health. A full description of how the human health risks were determined is provided in Appendix A11.1 (Air Quality – Dust Risk Assessment).

11.5.11 For the Firth of Forth Ramsar, SPA and SSSI, there is considered to be a Medium risk from earthwork activities and a Low risk from demolition, construction and trackout activities associated with construction of the proposed scheme. A full description of how the ecological risks were determined is provided in Appendix A11.1 (Air Quality – Dust Risk Assessment).

11.5.12 The dust risks summarised above for each activity were used to identify the recommended level of good practice mitigation (refer to Appendix A11.1: Air Quality – Dust Risk Assessment). It should be noted no specific embedded mitigation measures have been included as part of the proposed scheme.

11.5.13 IAQM guidance (IAQM 2016) notes that, with the application of good practice mitigation measures of the type available for use on this project, the environmental effect will not be significant at any off-site receptor. IAQM guidance (IAQM 2016) also notes that, even with a rigorous package of good practice mitigation measures in place, such as is proposed in Appendix A11.1 (Air Quality – Dust Risk Assessment) and summarised in Section 11.6 (Mitigation), occasional impacts may occur.

11.5.14 In summary, with the good practice mitigation measures applied as specified in Appendix A11.1 (Air Quality – Dust Risk Assessment) and summarised in Section 11.6 (Mitigation), the likely effect of dust emissions on human health and amenity and ecological receptors during construction is not considered to be significant.

Operation

11.5.15 As described in Section 11.3 (Approach and Methods), there are no potentially significant air quality effects predicted during operation of the proposed scheme.

11.6 Mitigation

Construction

11.6.1 The Construction Environmental Management Plan (CEMP) (refer to **Mitigation Item SM1**) will adopt best practice measures to control dust emissions in compliance with IAQM guidance (IAQM 2016) on the assessment of dust from demolition and construction. The Contractor will enter into pre-works discussions with Falkirk Council to agree the method of works and appropriate dust mitigation measures outlined in a Dust Management Plan (DMP) (**Mitigation Item AQ1**).

11.6.2 Construction dust mitigation measures (for medium risk sites), based on those outlined by the IAQM, are detailed in Table 10 to Table 15 in Appendix A11.1 (Air Quality - Dust Risk Assessment). These mitigation measures will be used as a guide to inform the best practice measures within the DMP and will be reviewed as the Contractor confirms further details of the construction activities, location and programme.

11.6.3 It is considered that with an appropriate CEMP and DMP implemented, there would be no significant effects on air quality during the construction phase of the proposed scheme.

Schedule of Environmental Commitments

11.6.4 A summary of the essential mitigation measures, to be implemented in constructing and operating the proposed scheme relevant to air quality is provided in Table 11.9. Chapter 17 (Schedule of Environmental Commitments) contains the complete schedule of mitigation measures for the proposed scheme.

Table 11.9: Schedule of Environmental Commitments - Air Quality

Mitigation Item	Party Responsible for Implementation	Timing of Measure	Description	Mitigation Purpose/Objective	Specific Consultation or Approval Required	Monitoring / Compliance
AQ1	Contractor	Pre-construction Construction	The Construction Environmental Management Plan (CEMP) (refer to **Mitigation Item SM1**) will adopt best practice measures to control dust emissions in compliance with IAQM guidance (IAQM 2016) on the assessment of dust from demolition and construction. The Contractor will enter into pre-works discussions with Falkirk Council to agree the method of works and appropriate dust mitigation measures outlined in a Dust Management Plan (DMP) Guidance on appropriate mitigation measures for the proposed scheme (defined as a medium risk site) is provided in Table 10 to Table 15 in Appendix A11.1 (Air Quality - Dust Risk Assessment) of this EIA Report. These mitigation measures will be used as a guide to inform the best practice measures within the DMP and will be reviewed as the Contractor confirms further details of the construction activities, location and programme.	To minimise dust emissions as a result of construction of the proposed scheme.	Approval from Falkirk Council.	Monitoring report to be produced as per the IAQM (2016) guidance prepared by the Contractor quarterly.

11.7 Residual Effects

11.7.1 This section provides an assessment of the residual effects with the implementation of mitigation measures as discussed in Section 11.6 (Mitigation).

Construction Phase Traffic

11.7.2 Mitigation measures are not required, and no significant residual effects are predicted.

Construction Dust

11.7.3 Although a Low to Negligible risk for dust soiling effects and human health impacts and a Medium to Low risk of dust impacts for the Firth of Forth Ramsar, SPA and SSSI is predicted, with the implementation of appropriate dust management measures, there are not predicted to be any significant residual effects from construction activities.

Operation

11.7.4 Mitigation measures are not required, and no significant residual effects are predicted.

11.8 Assessment of Policy Compliance

11.8.1 DMRB LA 104 'Environmental assessment and monitoring' (Highways England, Transport Scotland, Welsh Government, and Department for Infrastructure Northern Ireland 2019b) states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

11.8.2 Appendix A4.1 (Assessment of Policy Compliance) provides a review of national and local policy documents which are of relevance to the assessment undertaken and reported in this chapter in accordance with DMRB guidance.

11.8.3 National policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in the National Planning Framework 3 (Scottish Government 2014a), Scottish Planning Policy (SPP) (Scottish Government 2014b), PAN 51 (Planning, Environmental Protection and Regulation) (Scottish Executive 2006), the Environment Strategy for Scotland: Vision and Outcomes (2020) (Scottish Government 2020b), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Defra 2011) and Scottish National Marine Plan (SNMP) Policy GEN 14 (Air Quality) (Scottish Government 2015). Additionally, Falkirk Local Development Plan Policy PE26 (Air Quality) and FIFEplan Policy 10 (Amenity) are of relevance (Falkirk Council 2020; Fife Council 2017).

Summary of Policy Compliance

11.8.4 Overall, the design and assessment of the proposed scheme has had regard to and is compliant with policy objectives to minimise impacts on air quality. A full policy compliance assessment can be found in Table 6 of Appendix A4.1 (Assessment of Policy Compliance).

11.9 Statement of Significance

11.9.1 The effects from the construction phase traffic and construction dust (considering mitigation measures as described in Section 11.6 (Mitigation)) assessment are predicted to be not significant. No significant residual effects are predicted during the operation of the proposed scheme.

11.10 References

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