MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
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CHAPTER 7

Air Quality and Greenhouse Gases

7.1 Introduction

7.1.1 The Portishead Branch Line (MetroWest Phase 1) Development Consent Order Scheme ("the DCO Scheme") has the potential to affect local air quality and emissions of greenhouse gases (“GHG”).

7.1.2 The construction of the DCO Scheme has the potential to result in temporary air quality effects largely due to the emission of dust. Particles may be deposited on properties and cars causing soiling and discolouration, which may result in nuisance, amenity loss or perceived damage. Dust will include fine particulate matter, defined as particulates with a diameter less than 10 µm (“PM_{10}”), which can have adverse effects on human health.

7.1.3 The operational phase of the MetroWest Phase 1 programme will add new services of diesel-powered trains on the three local rail lines, namely: the Portishead Branch Line, the Severn Beach / Avonmouth line, and the Bristol to Bath Spa line, and provide for modal shift from road to rail.

7.1.4 This chapter assesses the impact of the DCO Scheme on air quality along its route and the cumulative effects of construction and increased services under MetroWest Phase 1. Emissions of nitrogen oxides (“NO_x”) and PM_{10} associated with Diesel Multiple Units (“DMU”) have been considered in this assessment, as these emissions may adversely impact human health. Combustion of diesel also generates carbon dioxide (“CO_2”), which is a significant GHG. However, rail transport is typically more energy efficient than road transport as a transport mode, by virtue of greater scale, lower rolling resistance, and lower wind resistance. As a consequence, it would be expected to give rise to less pollution per passenger kilometre than road transport.

7.1.5 The DCO Scheme may affect road traffic emissions on roads surrounding railway stations serving the DCO Scheme and also on the wider network as a result of modal shift, but these are not expected to be significant.

7.1.6 This chapter:

- describes the relevant legal and policy framework which informs the undertaking of the assessment;
- describes the methodology used for the identification and assessment of likely significant air quality effects;
- describes the air quality baseline based on existing information;
- describes the measures that have been adopted as part of the DCO Scheme;
- identifies and assesses the likely significant effects that could result from the DCO Scheme during the construction and operation phases;
- considers the mitigation of likely significant effects and assesses those residual effects that will result;

- considers the cumulative effects of other developments in combination with the DCO Scheme on air quality;
- identifies the limitations encountered in compiling the Environmental Statement ("ES"); and
- provides a summary of the residual effects for the mitigated DCO Scheme.

7.1.7 The approach to the proposed assessment of operational GHG (as CO_2) emissions is presented in this chapter while the approach to construction carbon emissions is presented in Chapter 12 Materials and Waste (DCO Document Reference 6.15) of the ES. Only the operational GHG assessment is presented in this Chapter. This Chapter should be read in conjunction with Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7) of the ES.

7.2 Legal and Policy Framework

EU and National Legislation

Air Quality

7.2.1 The European Union ("EU") has established common, health-based and ecosystem-based ambient concentration Limit Values for main pollutants in the European Directive on ambient air quality and cleaner air for Europe (2008/50/EC[1]) ("the Air Quality Directive"). The Air Quality Standards Regulations 2010 implement the Ambient Air Quality Directive and Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air. Limit Values are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved[2]. Target Values are set out in the same way as Limit Values, and are to be attained where possible, taking all necessary measures not entailing disproportionate costs.

7.2.2 Part IV of the Environment Act 1995 provides that the UK Government will produce a national air quality strategy ("AQS") which contains standards, objectives and measures for improving ambient air quality. The current AQS for England, Scotland, Wales and Northern Ireland (Department of Environment, Food and Rural Affairs ("Defra") 2007) provides the policy framework for air quality management and assessment in the UK. The Environment Act 1995 also requires local authorities to review the quality of air within their area and provide an assessment as to whether any

[1] The Air Quality Directive replaced Council Directive 96/62/EC on ambient air quality assessment and management, Council Directive 1999/30/EC relating to limits for sulphur dioxide, nitrogen dioxide, oxides of nitrogen, particulate matter and lead and ambient air, Council Directive 2000/69/EC relating to limit values for benzene and carbon monoxide and ambient air, and Council Directive 2002/3/EC relating to ozone and ambient air.

[2] http://uk-air.defra.gov.uk/air-pollution/uk-eu-limits

prescribed air quality standards or objectives are being achieved or are likely to be achieved within the period prescribed by regulations.

7.2.3 The UK government is responsible to the European Commission for ensuring that it complies with the provisions of the EU Directives. The AQS objectives are presented in Table 7.1, showing the objectives in units of micrograms per cubic metre (µg m^{-3}) with the number of permitted exceedances in each year, where applicable.

7.2.4 The ambient air quality standards and objectives set out in the AQS are prescribed in England through the Air Quality (England) Regulations 2000 and Air Quality (England) (Amendment) Regulations 2002. The most relevant AQS objectives resulting from transport emissions are those for nitrogen dioxide ("NO_2") and PM_{10}. The UK government published its statutory air quality plan (Defra and Department for Transport, July 2017) setting out its direction to meeting the statutory limits for NO_2 across different zones in the country.

7.2.5 Local authorities have no legal requirement to achieve compliance with AQS objectives. Local authorities are however required to demonstrate best efforts to work towards achieving the objectives in order to meet statutory EU Limit Values. Under Local Air Quality Management ("LAQM"), local authorities have a duty to make periodic reviews of local air quality against AQS objectives. Where a local authority's Review and Assessment of local air quality indicates that AQS objectives are not expected to be achieved, local authorities are required to designate Air Quality Management Areas ("AQMA"). An Air Quality Action Plan must then be formulated detailing how the local authority proposes to meet the AQS objectives.

Table 7.1: Air Quality Strategy objectives

Pollutant	EU Limit Value/ UK Objective (pollutant concentration in µg m^{-3})	Averaging period
Human Health		
Nitrogen Dioxide (NO_2)	200 µg m^{-3} not to be exceeded more than 18 times a year	1-hour mean
	40 µg m^{-3}	Annual mean
Particulate Matter (PM_{10})	50 µg m^{-3}, not to be exceeded more than 35 times a year	24-hour mean
	40 µg m^{-3}	Annual mean
Ecological Sites		
Nitrogen Oxides (NO_x)	30 µg m^{-3}	Annual mean

Greenhouse Gases

7.2.6 Human activities are 95% certain[3] to be causing climate change, by enhancing the warming of the greenhouse effect (i.e. retaining more of the sun's heat in the atmosphere), by the increased emissions of GHGs. The most significant GHG emitted is CO_2. CO_2 equivalent ("CO_2e") is a standard unit for measuring carbon footprint and refers to expressing the impacts of each GHG in terms of the amount of CO_2 that would create the same amount of warming.

7.2.7 The United Nations Framework Convention on Climate Change ("UNFCCC") sets protocols to reduce the emissions of GHGs. The Kyoto Protocol set limits on GHG emissions to 2012, with a second commitment period to end 2020 (which includes the EU, and thus the UK) to reduce emissions[4]. The Kyoto Protocol provides for the establishment of mechanisms such as the EU Emission Trading Scheme, which caps the emissions of certain industrial sectors (including power generation and cement and steel production). The Doha Amendment to the Kyoto Protocol provides for transition arrangements to 2020. At the Paris Treaty (December 2015), 195 nations agreed to the first ever global climate deal to limit global warming to 2° C. The deal is expected to come into force in 2020.

7.2.8 The Climate Change Act 2008 establishes a framework for the UK to achieve its long-term goals of reducing GHG emissions by at least 80% from 1990 levels by 2050 and to ensure that steps are taken towards adapting to the impact of climate change. An interim target of 34% reduction from 1990 levels by 2020 has also been agreed. The reductions are in the context of government policy to increase economic activity as measured by gross domestic product ("GDP") growth.

7.2.9 The Carbon Plan[5] sets out the Government's plans for achieving the GHG emissions reductions committed to in the Climate Change Act and the first four carbon budgets. Low carbon transport is an essential part of the Carbon Plan. The Plan states that rail travel will become substantially decarbonised through increasing electrification and the use of more efficient trains and lower carbon fuels.

7.2.10 In 2011 (the latest figures available), the UK's progress against its Climate Change Act targets was a reduction of 29.1% (i.e. 549 Megatonnes CO_2e abbreviated to $MtCO_2e$) from 1990 levels excluding the effects of emissions trading[4, 5]. In terms of overall UK emissions, transport accounted for 135 $MtCO_2e$ (25%) and rail for 4 $MtCO_2e$ (less than 1%).

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3 IPCC Working Group 1, (2013), *Summary for Policy Makers*; http://www.climatechange2013.org/images/uploads/WGIAR5-SPM_Approved

4 UNFCCC *Appendix I - Quantified economy-wide emissions targets for 2020*; http://unfccc.int/meetings/copenhagen_dec_2009/items/5264.php ;

5 HM Government, (2011), *The Carbon Plan: Delivering our Low Carbon Future*, https://www.gov.uk/government/publications/the-carbon-plan-reducing-greenhouse-gas-emissions--2;

7.2.11 Carbon budgets were introduced as part of the Climate Change Act 2008. The first four, five-year budgets have been set in law from 2008 to 2027. The budgets are split into traded and non-traded carbon. A limit on UK carbon emissions is imposed for each five-year period. The budgets are prepared by the Committee on Climate Change, which was set up under the Climate Change Act as an independent evidence-base advisory body to the UK Government and Parliament. The Third Carbon Budget (2010) was accepted by Parliament and covers the period 2018 to 2022. The key recommendations for the budget include:

- the need for the UK to be on a pathway to at least an 80% cut in GHG below 1990 levels by 2050, with maximum 2050 emissions of 160 $MtCO_2e$; and
- by 2025, annual UK emissions should be reduced to around 390 $MtCO_2e$ (a 50% reduction relative to baseline levels).

National Planning Policy

National Policy Statement for National Networks

7.2.12 The Planning Act 2008 Section 104(3) requires the Secretary of State ("SoS") to determine the application for the DCO Scheme in accordance with the National Policy Statement for National Networks ("NPSNN"), unless specified factors provide otherwise. The NPSNN advises on the approach to the assessment of air quality, carbon and dust in the case of national infrastructure networks including railways. Table 7.2 identifies those policies of direct relevance to this assessment and the location where they are considered in this ES.

Table 7.2: Summary of relevant NPSNN advice on air quality and carbon (as carbon dioxide)

Summary of NPS provision	Consideration within the ES
Paragraph 5.6 states that where the impacts of the project are likely to have significant air quality effects in relation to meeting environmental impact assessment ("EIA") requirements or affect the UK's ability to comply with the Air Quality Directive, an air quality assessment is required.	This chapter presents the findings of the air quality assessment.
Paragraph 5.7 outlines the information required for the air quality assessment, including (i) existing air quality levels; (ii) forecasts of air quality at the time of opening; and (iii) any significant air quality effects, their mitigation and any residual effects.	This chapter presents the findings of the air quality assessment, which includes the information required pursuant to paragraph 5.7 of NPSNN.
Paragraph 5.8 states that the air quality assessment should be consistent with Defra's projections for national air quality.	The air quality assessment follows Defra's TG(16) guidance and relevant tools throughout.
Paragraph 5.9 states that there must be a statement on the risk as to whether the	This chapter presents the findings of the air quality assessment including

Table 7.2: Summary of relevant NPSNN advice on air quality and carbon (as carbon dioxide)

Summary of NPS provision	Consideration within the ES
project would affect the UK's ability to comply with the Air Quality Directive.	potential risks to compliance against the Air Quality Directive.
Paragraph 5.13 states that the Secretary of State should refuse consent where, after taking into account mitigation, the air quality impacts of the scheme will: • result in a zone / agglomeration which is currently reported as being compliant with the Air Quality Directive becoming non-compliant; or • affect the ability of a non-complaint area to achieve compliance within the most recent timescales reported to the European Commission at the time of the decision.	This chapter presents the findings of the air quality assessment.
Paragraph 5.17 requires consideration of the carbon impacts in the business case prior to submission of an application for DCO. The EIA needs to consider any likely significant climate factors.	This is not presented in the ES, but was provided in the preliminary business case.
Paragraph 5.84 requires EIA development to include the likely significant effects on amenity from emissions of dust.	This chapter presents the findings of the Construction Dust Assessment and the details are presented in Appendix 7.1 of the Technical Appendices (DCO Document Reference 6.25).
Paragraph 5.85 describes the scope for an assessment on inter alia dust emissions.	This chapter presents the findings of the construction dust assessment, which includes the information required pursuant to paragraph 5.85 of NPSNN.
Paragraph 5.86 requires the Applicant to consult with the local planning authority and where appropriate the Environment Agency on the scope and methodology of the assessment.	Record of consultation on scope and approach of air quality assessment with relevant Local Authorities is included in this chapter.

National Planning Policy Framework

7.2.13 The National Planning Policy Framework ("NPPF") (February 2019) does not contain specific policies for Nationally Significant Infrastructure Projects ("NSIPs"). However, NPPF paragraph 5 notes that applications for NSIPs

are to be determined in accordance with the decision-making framework set out in the Planning Act 2008 and relevant National Policy Statements "*as well as any other matters that are relevant (which may include the National Planning Policy Framework)*".

7.2.14 The NPPF advises that planning policies should sustain compliance with and contribute towards relevant air quality limit values or national objectives for pollutants. Developers need to specifically identify opportunities to improve air quality or mitigate impacts, such as through traffic and travel management, green infrastructure provision and enhancement. Developers are advised that plans are to be consistent with local air quality Management Plans and the Government's UK Air Quality Plan (paragraph 181).

Regional Planning Policy Framework

West of England Joint Local Transport Plan 3 (2011-2026) (March 2011)

7.2.15 The West of England Joint Local Transport Plan 3 ("JLTP3"), published by the West of England Partnership, outlines the transport strategy for the sub-region going forward. One of the aims of the JLTP3 is to improve air quality in AQMAs and ensure that air quality in other areas remains better than UK and EU standards. The Bristol AQMA is included within the DCO Scheme area. The plan also focuses on raising the awareness of air quality and promoting more sustainable modes of transport.

West of England Draft Joint Local Transport Plan 4 (2019-2036)

7.2.16 The Draft West of England Joint Local Transport Plan 4 ("JLTP4") was published in January 2019 for consultation between 6 February 2019 and 20 March 2019. The draft plan supports the identification and implementation of measures that will improve air quality. The JLTP4 will continue to support the preparation of Air Quality Action Plans and delivery of specific measures identified to improve air quality. Key initiatives involve encouraging the uptake of low emission vehicles. Bristol City Council ("BCC") and Bath and North East Somerset Council ("B&NES") are both involved in the Government's UK Air Quality Plan to meet National and EU Air Quality Objectives for NO_2 in the shortest possible timeframe. JLTP4 will support ongoing work, as appropriate, in fulfilment of the Plan.

Local Planning Policy Framework

7.2.17 A summary of planning policies in North Somerset District Council ("NSDC") and BCC is provided in Chapter 6 Planning Framework (DCO Document Reference 6.9) of the ES. Table 7.3 below summarises the key local policies on air quality, GHG emissions and climate change.

Table 7.3: Summary of local policy on air quality and greenhouse gases

Policy No.	Title of Policy	Description
North Somerset Council Core Strategy, Adopted January 2017		
CS1	Addressing Climate Change and Carbon Reduction	An overarching policy to encourage implementation of measures to reduce CO_2, through design, use of walking, public transport and reuse of land. The policy seeks to address climate change, by *inter alia*, reducing unsustainable carbon emissions and encouraging sustainable transport patterns.
CS3	Environmental impacts and flood risk management	An overarching policy aimed at directing developments away from flood plains. The policy also states that any development that would result in air (or other) pollution will only be permitted if "*potential adverse effects would be mitigated to an acceptable level by other control regimes or by measures included in the proposals, by the imposition of planning conditions or through a planning obligation*".
CS10	Transportation and movement	This policy references the reopening of the Portishead to Bristol line for passenger services, which is a priority objective, and outlines the criteria which transport schemes have to fulfil. The policy states that transport schemes should "*reduce the adverse environmental impacts of transport and contribute towards carbon reduction*".
Bristol Development Framework Core Strategy, Adopted June 2011		
BCS10	Transport and access improvements	This policy confirms the support for transport infrastructure, including the reopening of the Portishead to Bristol Rail Line. The Council is committed to an 80% reduction of CO_2 emissions by 2050. This commitment has influenced spatial planning in the city, including the approach to transport in BCS10.
BCS13	Climate Change	This policy requires the impact from development on climate change to be taken into account and requires development to mitigate its impact on climate change and adapt to the effects of climate change, and contribute to meeting targets to reduce CO_2 emissions.
BCS15	Sustainable Design and Construction	This policy aims to ensure that new developments minimise their environmental impact and emissions of CO_2.
BCS23	Pollution	This policy requires development to be sited and designed so as to maintain environmental amenity with regards to noise, dust, vibration, and odour, and to prevent pollution and contamination of air, land and water. While BCC recognises that it is not appropriate

Table 7.3: Summary of local policy on air quality and greenhouse gases

Policy No.	Title of Policy	Description
		to resist all development in the AQMA, regard should be had to minimise the contribution of development to airborne pollution. Air quality in the gorge is to be monitored to assess the impact on the Avon Gorge Woodlands Special Area of Conservation ("SAC").
Bristol City Council Site Allocations and Development Management Policies, Local Plan, Adopted July 2014		
DM33	Pollution Control, Air Quality and Water Quality	This policy seeks to ensure that development will not unacceptably impact on environmental amenity, air quality or water quality as a consequence of pollution emanating from new developments. Major development within AQMAs will require mitigation while developments outside AQMAs should not cause new AQMAs to be designated.

7.3 Methodology

Guidance and Best Practice

Air Quality

7.3.1 The assessment of the DCO Scheme's impact on air quality follows the Defra *Local Air Quality Management Technical Guidance* TG16 (Defra, 2018) in conjunction with the Highways Agency's[6] *Design Manual for Roads and Bridges* ("DMRB"), Volume 11, Section 3, Part 1 HA 207/07 guidance where appropriate. Significance criteria were reported following Environmental Protection UK ("EPUK") and Institute of Air Quality Management ("IAQM") *Guidance on the Development Control Planning for Air Quality* (EPUK and IAQM, 2017). Construction dust impacts were considered against *Guidance on the assessment of dust from demolition and Construction* (IAQM, 2014).

Greenhouse Gases

7.3.2 The Department for Transport's web-based Transport Analysis Guidance Environmental Impact Appraisal was followed to quantify the operational carbon impact of the DCO Scheme. This methodology compares the difference in GHG emissions due to the DCO Scheme over an appraisal period of 60 years.

7.3.3 Overall operational emissions reductions through shifts from more polluting transport modes such as cars to less polluting transport modes such as rail are a key aspect of the original business case for the DCO Scheme. The DCO Scheme will, where possible, identify cost-effective opportunities to

[6] On 1 April 2015, the Highways Agency became the Highway England Company Ltd, to be known as Highways England.

reduce the embodied carbon emissions associated with DCO Scheme activities. This may be achieved through leaner design, designing out waste, reusing materials, and selecting materials with lower embodied carbon over the DCO Scheme life-cycle. This is discussed further in Chapter 12 Materials and Waste (DCO Document Reference 6.15) of the ES.

Consultations

7.3.4 The Applicant NSDC has consulted with the officers responsible for air quality within North Somerset Council and BCC to agree the air quality assessment approach. A summary of consultations undertaken is presented in Table 7.4:.

7.3.5 Further information on the consultation process is presented in Chapter 5 of the ES Approach to the Environmental Statement (DCO Document Reference 6.8). Response to consultation exercises undertaken in 2015 and 2017 are available on the MetroWest project website at the following address https://travelwest.info/metrowest while the Consultation Report is provided in the DCO Document Reference 5.1.

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
Scoping Opinion Responses (August 2015)		
SoS	Paragraph 3.29 states that sufficient evidence was not provided in the Scoping Report to scope out local air quality impacts from emissions from diesel locomotives. Paragraph 3.29 also states that there is no evidence to support the case that the only receptor that meets the screening criteria for the assessment (within Defra guidance) will not be affected by the proposed development.	The local air quality screening criteria for assessing rail impacts from DMUs used in this assessment are described in Section 7.3. The screening criteria are: • Heavy traffic from diesel trains, see Table 5.1 in Defra TG(16) • Estimated background NO_2 concentration is greater than 25 µg m^{-3} – see Section 7.4 Baseline. • Potential for long-term exposure within 30 m of the edge of the railway line – See Figure 7.3. The proposed DCO Scheme is for the construction of a railway between Portishead and Pill and the passenger service between Portishead and Bristol Temple Meads and so does not affect the heavily trafficked line between Bristol Temple Meads and Bristol Parkway.

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
	Paragraph 3.32 states that the SoS considers that Air Quality and Carbon should be considered in the same chapter.	This chapter considers air quality and GHG emissions from the combustion of fuel. Embedded carbon in construction materials is considered in Chapter 12 Materials and Waste (DCO Document Reference 6.15). In this chapter, Carbon is only discussed in the context of GHG emissions (specifically CO_2).
	Paragraph 3.33 states that any potential change to air quality should be assessed in relation to compliance with European air quality limit values and AQMA objectives.	The assessment of potential changes and compliance with AQMA objectives is assessed in relation to compliance with European air quality limit values and AQMA objective in Section 7.6.
	Paragraph 3.34 states that the impact on sensitive sites including ecological sites should be assessed, including construction dust.	The approach to the assessment of the risk of construction dust is covered in paragraphs 7.3.31 to 7.3.33 and the interpretation of the effect on habitats, flora and fauna, is considered in Chapter 9 Ecology and Biodiversity (DCO Document Reference 6.12) of the ES. The assessment of construction dust is reported in Appendix 7.1 in the Technical Appendices to the ES (DCO Document Reference 6.25).
	Paragraph 3.35 states that the assessment should address potential impacts from increases in airborne pollution including fugitive dust during site preparation and construction and from construction and operational traffic as well as emissions from diesel trains. Potential for reduction in emissions if electrification was delivered in	The assessment of construction dust is reported in Appendix 7.1 in the Technical Appendices to the ES (DCO Document Reference 6.25). The assessment of emissions from diesel trains and from road traffic is reported in Section 7.6. There are no plans to electrify the railway, so no description or

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
	the future should also be described.	assessment has been provided in the ES.
	Paragraph 3.36 states that the impacts on and off site should be considered, and methods and parameters used in the modelling should be clearly explained and justified.	The assessment of impacts is reported in Section 7.6. The methodology is described in Section 7.3 and in detail in Appendix 7.2 in the Technical Appendices to the ES (DCO Document Reference 6.25).
	Paragraph 3.37 states if the characteristics of the trains and timetabling are not known, a range of scenarios should be modelled including the potential worst case.	The range of scenarios modelled is described in paragraphs 7.3.35 to 38.
	Paragraph 3.38 states that the assessment must follow a robust and up to date methodology.	The methodology is described in Section 7.3.
	Paragraph 3.39 states that the need for appropriate mitigation and monitoring measures should be considered and agreed with consultees.	Mitigation and monitoring proposals are addressed in Sections 7.5 and 7.8.
Bristol City Council	The assessment should follow the latest version of the Environmental Protection UK's Development Control: Planning for Air Quality dated 2015.	The EPUK and IAQM guidance on the assessment of construction dust was followed as explained in paragraph 7.3.32.
	When defining the study area, consideration should be given to Table 6.2 of the EPUK and IAQM Land Use Planning And Development Control: Planning for Air Quality May 2015 (since updated by Moorcroft and Barrowcliffe, 2017) Guidance Document in addition to DMRB.	

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
Highways England	Consider adverse change to air quality including in relation to compliance with the European air quality limit values and/or in local authority designated AQMAs.	Section 7.6 contains the assessment of air quality effects.
Natural England	The assessment should take account of the risks of air pollution and how this can be managed and reduced.	Paragraphs 7.6.26 to 7.6.35 consider air quality changes in sensitive ecological areas. Mitigation measures are discussed in Section 7.7.
	The effect of changes in air quality on the Avon Gorge Woodlands SAC needs to be considered as part of the Habitats Regulations Assessment ("HRA").	The effect of air quality changes in the Avon Gorge Woodlands SAC are considered in the HRA screening report in the ES Appendix 9.12 (DCO Document Reference 5.5).
Public Health England	The potential effects of the scheme on public health, including issues arising due to air quality, need to be brought together in a summation.	A Health Impact Assessment report is provided in the ES Appendix 14.2, Volume 4 Appendices (DCO Document Reference 6.25).
	Best practice guidance should be followed to mitigate potential impacts on health from emissions from construction to decommissioning. An effective Construction Environmental Management Plan ("CEMP") (and Decommissioning Environmental Management Plan) will help provide reassurance. Robust mechanisms should be in place to respond to any complaints to traffic-related pollution.	The Code of Construction Practice ("CoCP") (DCO Document Reference 8.15) and the Master CEMP (DCO Document Reference 8.14) demonstrate how the works will be managed. These measures have been taken into consideration in assessing the potential environmental impacts. Decommissioning has been scoped out of the assessment for the reasons presented in Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7).
	The baseline, assessment and future monitoring should: encompass all pollutants and all stages of the project, include assessment of worst-	The air quality assessment is presented in this Chapter. The Construction Dust Assessment is set out in Appendix 7.1 (DCO Document Reference 6.25) of

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
	case impacts, identify cumulative and incremental impacts, consider appropriate sources of monitoring data, compare predicted environmental concentrations to the applicable standards or guideline values, consider the impact on sensitive receptors including any new receptors from future development, consider existing areas of poor air quality eg AQMAs, describe control measures and consider measures to control any emitted pollutants for which there are no set emission limits, include modelling using appropriate meteorological data; and take account of the local topography.	the ES. Cumulative effects are assessed in Section 7.8, in Chapter 18 In-Combination and Cumulative Effects (DCO Document Reference 6.21) of the ES and Appendix 18.2 (DCO Document Reference 6.25) of the ES.
	Liaison with other stakeholders and comments on local air quality should be sought from the local authority.	A summary of consultation with local authorities is provided in the following lines.
Informal micro-consultation on DCO Scheme boundary (22 June to 3 August 2015)		
No comments regarding air quality specifically were received.		
Formal Stage 1 Consultation (22 June to 3 August 2015)		
Public	General concerns over environmental pollution; noise and air	This chapter assesses the impact of the DCO Scheme on air quality and finds that the predicted increases in NO_2 and PM_{10} are negligible and not significant.
Landowner	The overall cumulative impact assessment in Chapter 18 of the ES (DCO Document Reference 6.21) should specifically assess the impact on residential amenities taking into account planning, air	The environmental impact of the DCO Scheme has been assessed and is presented in this Environmental Statement and the Transport Assessment, covering the planning framework, air quality, cultural

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
	quality, cultural heritage, landscape and visual impacts, noise and vibration, socioeconomics and transport and access.	heritage, ground conditions, landscape and visual impact, materials and waste, noise and vibration, soils / agricultural land / land use / assets, transport and water resources. The development of the design of the DCO Scheme is presented in the Design and Access Statement (DCO Document Reference 8.1). The cumulative effect of the DCO Scheme on its own and in combination with other projects is discussed in Chapter 18 In-Combination and Cumulative Effects (DCO Document Reference 6.21) of the ES and Appendices 18.1 and 18.2 (DCO Document Reference 6.25) of the ES.
Informal Consultation		
North Somerset Council, 14 January 2016	A meeting was held with the Environmental Health Officers ("EHO") from NSDC to discuss the methodology for the air quality assessment. Following the meeting NSDC requested that the Preliminary Environmental Information Report ("PEI Report") present air quality benefits from the modal shift in Portishead and Pill roads.	Transport model outputs were considered and modal shift is accounted for in the modelling. The outcome is however offset by new cars introduced onto the road network due to suppressed demand. This masks any expected benefits from the air quality assessment in Portishead and Pill.
Bristol City Council, 14 January 2016	A meeting was held with the EHO from NSDC to discuss the methodology for the air quality assessment. Following the meeting, further consultation was made with the Air Quality Officer from BCC to agree the Applicant's air quality approach with an email response received on 1/2/16. Emphasis was made to include screening for both DMRB and the more stringent	The approach to the assessment is described in Section 7.3.

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
	EPUK and IAQM (2017) criteria. Agreement was reached only to consider the first full Opening Year (2021[7]) impacts in the regional air quality assessment.	
Formal Stage 2 Consultation (23 October to 4 December 2017)		
Public Health England	The assessments of impacts were undertaken using 'worst-case' scenarios for air quality impacts and these were selected using professional judgement. Whilst we understand the desire to minimise unnecessary monitoring or modelling, we recommend that the final report should identify all sensitive receptors which may experience poorer air quality as a result of the project and that the impacts be modelled on an individual property / receptor basis. If this is not possible detailed reasons for the exclusion or scoping out of unassessed receptors should be included.	The assessment shows that the predicted increases in NO_2 and PM_{10} are negligible and not significant. The study area for the project is extensive, covering the scheme itself and numerous highways in the greater Bristol areas (see Figure 7.3 in the ES Volume 3 Book of Figures, DCO Document Reference 6.24). Given the results obtained for the sampled receptor points and the extent of the study area, it is disproportionate to calculate changes in air quality at all the sensitive receptors within the study area.
	We note that the scheme impinges on the BCC AQMA and that the developer has been in discussions with BCC. We welcome this liaison with BCC, particularly as they are in the process of developing proposals to improve air quality.	No action required. Ongoing liaison with BCC and a summary of recent consultation feedback from BCC is provided below.
North Somerset District Council	The NSDC is satisfied with the methodology used and the information provided. In particular the information provided in Appendices 7.1 to 7.4 is welcomed. It is noted	The air quality assessment combines both the air emissions from the new train service and vehicle emissions on affected roads. The approach is explained in Section 7.3.

[7] See comment in Paragraph 7.3.20.

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
	that the impact on air quality from the project will be low. It is not clear from the report whether the combined impact of freight and passenger trains has been taken into account in the air quality assessment. The impact of trains standing at stations, particularly Portishead, needs to be considered in the report. The emissions figures for the proposed trains need to be included in the report.	The air quality model assumes that trains are idling at Portishead for 6 minutes. This is a conservative figure, as the rail timetables indicate only 3 minutes. The assumptions for the modelling, including idling times and emission figures from the diesel engines are presented in Appendix 7.2 (DCO Document Reference 6.25) of the ES.
Bristol City Council	As assessed and reported, there would be moderate impacts on air quality predicted at the residential receptor locations closest to the railway line within BCC. The ES should set out how and if the monitored roadside concentrations in the Parsons Street area have been combined with the diesel locomotive emissions at those receptors closest to the railway. At present, there is uncertainty with regards to how realistic the predicted air pollution concentrations are in the locations at which moderate air pollution impacts are predicted. It is advised that monitoring of nitrogen dioxide concentrations is carried out in order to establish a site specific pollutant baseline for use in the ES assessment.	The study has been revised, using updated background data and the latest available emissions factors and no longer shows a “moderate impact” at receptors in the Parson Street area.
Bristol City Council	Section 7.3.7 – 7.3.10 and Table 7.21 of the PEI Report - It is unclear how the baseline air pollution levels have been determined at residential	Baseline data have been obtained by adding modelled local source (road and rail) to the Defra background maps. It should be noted that the Base

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
	receptor locations, R50 and R51, between Parsons Street and Parsons Street Junction for the Base and Do-Minimum ("DM") scenarios. Pollution levels at R50 appear to be based on roadside monitoring concentrations in the area of Parsons Street despite being approximately 35 m from the roadside. A breakdown of the relative contribution from road vehicles and diesel locomotives would be useful in ES air quality assessment. Whilst dispersion model validation has been carried out for roadside pollutant concentrations this would not be suitable for validating that fraction of pollution attributable to diesel locomotives. Future predicted vehicle emission reductions are generally accepted to be overly optimistic and good practice in assessment of impacts in future years is to carry out sensitivity analysis to account for this uncertainty. This does not appear to have been carried out.	Year is 2013, when background concentrations were higher than present. The study has been successively revised, using updated background data and the latest available emissions factors and no longer shows a "moderate impact" at receptors R50 and R51. Following Highways England's Interim Advice Note 170/12v3 on Long Term Trends Gap Analysis, the future DM baseline (future background + future local sources), as well as the Do-Something ("DS") scenario, have been corrected to account for the gap between the vehicle emission standards and real-world emissions. The contribution of DMUs is small compared with the road one and therefore, the use of a single verification factor is considered to be sufficient. The approach adopted in the ES follows Defra guidance and best practice methods.
Bristol City Council	Section 7.8.10 of the PEI Report - BCC does not agree with the statement in 7.8.10 that: "Given the percentage change in NO_2 at R50 and R51 is only 1%, and no new exceedances were created, these changes in NO_2 at Parson Street Junction are unlikely to lead to any significant impacts on the local air quality, particularly given the baseline NO_2 levels are already so high in the area".	Agreed. The wording used is based on modelling undertaken in 2015 and does not account for changes since the publication of Defra's latest Air Quality Direction. The air quality modelling of the DCO Scheme has been updated for the ES and the text modified to highlight where the unmitigated impact of the DCO Scheme is expected to interfere with the BCC plans to achieve compliance with air quality objectives in the city at all

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
	BCC is required to achieve compliance with air quality objectives in the city at all locations in the shortest time possible. The fact that baseline air pollution is currently high is not justification for allowing a worsening of air pollution. Any significant worsening of pollution will make it more difficult to achieve compliance. As a result, it is important to determine an accurate baseline air quality level at those receptors predicted to experience a moderate worsening in air pollution.	locations in the shortest time possible.
Bristol City Council	Section 7.10.6 of the PEI Report - Whilst a worst-case scenario for locomotive type has been used in the model, air quality impacts of idling of passenger trains have not been assessed. In paragraph 7.10.6 of the air quality report it states that: "Any passenger train idling at Parson Street Junction adjacent to these properties is likely to worsen the annual mean NO_2 impacts. However, given an exceedance is not being created and the number of receptors within that distance of the Portishead Branch Line at Ashton Junction is low, it is not expected to lead to any significant impacts". If baseline pollution levels are as high as they have been modelled at the sensitive receptor locations closest to the railway line, BCC would consider any increased	Idling passenger trains were considered at Parson Street for two minutes per stop in our air quality model as a sensitivity test. The Railsys train modelling assumes a 30 second stop. The intent of the wording was to stress that the information available regarding the idling time and frequency is limited and idling should be avoided, where feasible. The wording at sections 7.8.11 to 7.8.14 has been revised in the ES to clarify this point.

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
	impacts from idling to be significant from an air quality perspective.	
Public	Portishead specific concerns: • Fumes from trains. • Concerns that train pollution is highest when pulling away from a station. • Trains should be electric. • Fumes from increased number of cars to the area. • Fumes from more congestion. • Cars not switching off whilst idling. • General decrease in air quality. • Concerns over the number of lorries affecting safety, traffic, pollution, noise etc. • Construction impacts increasing pollution levels	The air quality assessment covers construction dust and plant and vehicle emissions during construction and emissions from trains and traffic on affected roads during the first year of operation. The methodology is set out in Section 7.3 and the assessment in Section 7.6. The assumptions adopted in the air quality modelling are presented in Appendix 7.2 (DCO Document Reference 6.25) of the ES. The effect of construction traffic, including lorries, is assessed in Chapter 16 Transport, Access and Non-Motorised Users (DCO Document Reference 6.19) of the ES. Proposals to control the effects of construction traffic on people and communities are presented in the ES Appendix 16.1 Transport Assessment Appendix K Construction Traffic Management Plan (DCO Document Reference 8.13).
Public	Avon Gorge specific concerns: • Concerns of the impact of train noise and pollution to the Gorge.	The impact of the DCO Scheme on air quality and noise in the Avon Gorge is covered in this chapter Section 7.6 and Chapter 13 Noise and Vibration (DCO Document Reference 6.16) of the ES respectively. The implications for the predicted increase in noise and pollution on the biodiversity of the Avon Gorge is discussed in Chapter 9 Ecology and Biodiversity (DCO Document Reference 6.12) of the ES and the effect on the integrity of the Avon Gorge Woodlands SAC is discussed in the ES Appendix 9.12 HRA

Table 7.4: Summary of consultation responses

Organisation and date	Summary of response	Consideration within the ES
		Report (DCO Document Reference 5.5).
Local business owner / occupier	During Construction Phase: 1. Increased level of dust and rubble. 2. Increased level of noise from heavy construction vehicles and equipment. 3. Compromised security of our site as there will be large numbers of unknown personnel in close proximity. 4. Possible risk of impact on services.	The impact of the DCO Scheme on construction dust is assessed in Appendix 7.1 (DCO Document Reference 6.25) of the ES and summarised in this chapter in Section 7.6. Chapter 13 Noise and Vibration (DCO Document Reference 6.16) of the ES assesses construction and operation noise. The approach to the management of environmental issues during construction is explained in the ES Appendix 4.1 Code of Construction Practice (DCO Document Reference 8.15) and Appendix 4.2 Master Construction Environmental Management Plan (DCO Document Reference 8.14).

Definition of the Study Area

7.3.6 The emission source information underpinning the extent of the area affected by air quality impacts is derived from the Greater Bristol Area Transport Study (version) Four ("GBATS4"). The GBATS4 traffic model assessed the modal shift from road to rail, incorporating the rail portion of the DCO Scheme using Network Rail's Rail Demand Model.

7.3.7 The local and regional air quality study areas are defined separately for rail and road traffic following Defra TG(16) and EPUK/IAQM guidance (Moorcroft and Barrowcliffe, 2017). BCC requested that the affected road network for the local Air Quality assessment, which is different to the regional emissions assessment, should be defined using IAQM criteria.

7.3.8 As screening criteria differ for rail and road, these have been split into separate sections below. The assumed air quality study area consists of a combination of rail and road impacts that screen in based on relevant Defra (rail) and EPUK/IAQM (road) guidance criteria cited above, while the regional air quality screening is applicable to EPUK/IAQM criteria relevant to road traffic. Given the DCO Scheme is a rail project that has the potential to lead to changes in both road and rail emissions, both were assessed using a combined air quality dispersion model.

7.3.9 Figure 7.1 in the ES Volume 3 Book of Figures (DCO Document Reference 6.25) shows the study area for both the local and regional air quality

assessment together with the air quality constraints. This shows the DCO Scheme, the local highway network where the traffic modelling indicates significant changes in traffic flows, and the alignment of the Avonmouth/Severn Beach railway services.

Local Air Quality - Rail

7.3.10 The local air quality study area for assessing the rail impacts has been defined following Defra's TG(16) for air quality impacts on human health associated with the introduction of DMUs. Defra recommends that air quality impacts from non-road sources (including railway lines) only need to be considered where any sections of the railway line meet the following criteria:

- where there is heavy traffic from diesel trains (information on which lines are considered heavy traffic are shown in Table 5.1 in Defra TG(16));
- where estimated background NO_2 concentration is greater than 25 µg m^{-3} and
- where there is potential for long-term exposure within 30 m of the edge of the railway line.

7.3.11 The air quality impacts due to the new passenger service between Portishead and Ashton Junction would not require assessment based on the first two criteria above. However, there are areas of potential for long-term exposure within 30 m of the edge of the railway line in Portishead, Sheepway and Pill. So, the DCO Scheme has been scoped into the air quality assessment.

7.3.12 The only railway line which meets all of these criteria within the area to be served by the MetroWest programme is the Bristol Temple Meads to Bristol Parkway railway line. The section of the Bristol to Exeter mainline between Parsons Street and Bedminster stations, which lies within the area to be served by Portishead Branch Line, meets two of these criteria and required further consideration, covered in the cumulative impacts assessment. The DCO Scheme also passes through the BCC AQMA at Ashton Gate as does the section of the main line railway between Parsons Street Junction and Bristol Temple Meads. Therefore, based on these factors rail emission impacts on air quality have been scoped into the local and regional air quality assessment along these sections of the main line railway.

Local Air Quality - Road Traffic

7.3.13 The results of the traffic modelling are presented in the Transport Assessment in Appendix 16.1 (DCO Document Reference 6.25) of this ES and summarised in Chapter 16 Transport, Access and Non-Motorised Users (DCO Document Reference 6.19) of the ES. The 2013 baseline traffic data from the traffic modelling were modified in this revision of the ES Chapter 7 to provide 2015 baseline traffic data for the revised air quality assessment. This followed comments made by BCC in spring 2020 (and covered in the Statement of Common Ground) raising concerns over the time lapse between the original base year 2013 and the 2020 review year. It was agreed that a practical solution would be to revise the assessment using 2015 base traffic and hence be in general compliance with guidelines on the application of traffic model data. Changes in road traffic as a result of the DCO Scheme were screened based on EPUK and IAQM (2017) guidance

screening criteria. The indicative screening criteria relevant to the DCO Scheme are shown in Table 7.5. This approach was applied following consultation and agreement with BCC on 04 February 2016.

Table 7.5: EPUK and IAQM air quality indicative criteria for requiring an air quality assessment

The development will:	Indicative Criteria to Proceed to an Air Quality Assessment*
1. Cause a significant change in Light Duty Vehicle ("LDV") traffic flows on local roads with relevant receptors. (LDV = cars and small vans)	A change of LDV flows of: • more than 100 Annual Average Daily Traffic ("AADT") within or adjacent to an AQMA • more than 500 AADT elsewhere
2. Cause a significant change in Heavy Duty Vehicle ("HDV") flows on local roads with relevant receptors. (HDV = goods vehicles + buses >3.5 t gross vehicle weight)	A change of HDV flows of • more than 25 AADT within or adjacent to an AQMA • more than 100 AADT elsewhere
3. Realign roads, i.e. changing the proximity of receptors to traffic lanes.	Where the change is 5 m or more and the road is within an AQMA

Source: EPUK&IAQM, 2015

7.3.14 Some additional screening was undertaken to account for the uncertainty in the transport model. This screening removed roads with traffic changes predicted in the transport model that were considered unlikely to be attributed to the DCO Scheme and would not be relevant to the air quality assessment. The additional criteria screened out any roads where:

- the percentage changes at these links accounted for < 1% for traffic flows,
- Heavy Goods Vehicle ("HGV") impacts are not expected to be attributed to the DCO Scheme, and
- links are too far away from the DCO Scheme to be reliably assessed in the transport model.

7.3.15 The local air quality study area includes all roads that were screened in against EPUK and IAQM (2017) criteria (around Portishead and adjacent to Parson Street, Bedminster and Bristol Temple Meads stations). This distance band is a benchmark in DMRB assessments and has been considered suitable for ensuring all relevant road emissions sources close to the mainline are included in the model. For completeness, the modelling of these receptors also included the new passenger service between Portishead and Pill to account for all pollutant sources in the air quality modelling.

Regional Air Quality

7.3.16 The net impact of the DCO Scheme on regional NO_x, PM_{10} and GHG (i.e. CO_2) emissions was calculated as the sum of changes in regional road and rail based emissions. Different approaches have been applied to define the

regional study areas for emissions from these two modes of transport. The change in CO_2 emissions is included in the regional air quality assessment as an indicator for the assessment of climate change impacts associated with the DCO Scheme.

7.3.17 Regional emissions are primarily calculated for two “core” study areas (i.e. one each for road and rail). A refined appraisal of the regional emissions was also included, covering a different study area that intentionally focuses on the new portion of rail line associated with the DCO Scheme.

7.3.18 Regional air quality emissions from the road network, for the core assessment, have been estimated based on the full GBATS4 traffic model area. Though the DMRB provides guidance for defining the regional study area, the whole traffic reliability area is considered in this case in order to identify the net impact of small benefits across the wider road network that result from the DCO Scheme.

7.3.19 In local air quality assessments, IAQM criteria act to increase the size of the study area because they are more sensitive than the DMRB criteria. Though equivalent guidance to the DMRB is not issued by the IAQM for selecting the regional study area, the use of the full traffic model area is intentionally applied to capture the wider impacts of the scheme that may not be accounted for in a DMRB-defined regional road network.

7.3.20 The traffic data were modelled for 2021, which was expected to be the Opening Year of the DCO Scheme at the time of undertaking the assessment. The Opening Year is now estimated to be winter 2023/24 due to unforeseen programme delays. The air quality impact assessment was not repeated for the revised Opening Year over the core regional study area because the impacts on air quality with and without the scheme are expected to be similar in both years. However, given that ambient air quality is likely to improve between 2021 and 2023 due to various factors, such as improvements in modern vehicle emission controls and turnover of the UK fleet, a 2023 scenario was assessed for the study areas included in the options appraisal. Following consultation with the Air Quality Officer from BCC it was agreed that the Design Year (2036) scenario would be excluded given the uncertainties with forecasting vehicle emissions in 2036.

7.3.21 The core assessment of regional rail emissions considers emissions from the following lines: Severn Beach to Avonmouth, Avonmouth to Montpelier, Stapleton Road to Bristol Temple Meads and Portishead to Parson Street for passenger trains and Portbury to Bristol Temple Meads and St Andrews Road for freight trains.

7.3.22 In the refined regional emissions appraisal, the study area for rail emissions comprises only the proposed new line in the DCO scheme between Portishead and Bristol Temple Meads. The refined regional emission calculations consider reductions in vehicle kilometres travelled over the GBATS4 model area in response to assumed commuter preferences to switch from car to rail via Portishead and Pill stations.

Sensitive Receptors

7.3.23 Pollutant concentrations have been predicted at sensitive receptors, defined according to Defra's TG(16) guidance (Defra, 2009) as: *Locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the relevant air quality objective*.

7.3.24 These locations include sensitive receptors i.e. residential properties, schools, hospitals and care homes. The objectives do not apply to occupational uses such as shops and offices or uses such as hotels or medical centres where the public would not be expected to be present over a full year.

7.3.25 There are potentially a number of sensitive human receptors within 200 m of the DCO Scheme from Portishead into Pill and Bristol. The 87 worst-case receptors were selected using professional judgement as to where the highest pollutant concentrations would be likely to arise and where the greatest impacts would be expected to occur due to the DCO Scheme.

7.3.26 Ecological receptors consist of habitats and species within designated nature conservation sites that contain features sensitive to air pollution. Internationally designated sites include SAC, Special Protection Areas ("SPA"), and Ramsar sites. Nationally designated sites include Sites of Special Scientific Interest ("SSSI"). These sites have been considered where they are within 200 m of the new railway line or affected roads. Figure 7.1 (ES Volume 3 Book of Figures, DCO Document Reference 6.24) shows that four international nature conservation sites lie within 200 m of the DCO Scheme, comprising:

- The Severn Estuary SPA, SAC, and Ramsar sites.
- The Avon Gorge Woodlands SAC.

7.3.27 Figure 7.3 Sheets 1 to 6 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24) show the location of the relevant 'worst-case' human and ecological receptors along the DCO Scheme while Figure 7.3 Sheets 4 to 6 show the receptors considered for the cumulative assessment with the Parson Street Junction (including Liberty Lane Sidings), Parson Street Station, the Bedminster Down Relief Line and the Avonmouth / Severn Beach schemes.

Defining the Baseline

7.3.28 Baseline air quality conditions have been drawn together from consultation of the Local Air Quality Management reports from relevant local authorities within the DCO Scheme boundaries. Air quality monitoring data were obtained from the Progress reports and Update and Screening Assessments.

7.3.29 The Air Pollution Information System ("APIS") website was consulted to obtain the relevant critical levels of ecological designated sites within the DCO Scheme boundaries. Deposition flux at any given ecological receptor is a factor of the background NOx contribution combined with local road and rail source contributions. The total change in deposition flux owing to the DCO Scheme is calculated as the difference between the do minimum and

the DCO Scheme contribution minus the deposition from the background sources.

7.3.30 Baseline information related to carbon (as CO_2) has been obtained from Defra's National Atmospheric Emissions Inventory ("NAEI").

Assessment of Construction Impacts

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

7.3.32 The air quality impacts of construction dust and vehicle emissions were considered following IAQM Guidance on the assessment of dust from demolition and construction (IAQM, 2014) and the information contained within the railway Construction Strategy (DCO Document Reference 5.4).

7.3.33 IAQM construction dust guidance considers the potential for dust emission from the following activities: demolition, earthworks, construction and track-out. The aim of the assessment is to determine the risk of dust impacts from each construction activity in order to identify the level of required mitigation. The methodology takes into account the scale to which the above effects are likely to be generated (classed as small, medium or large). The distance of the closest receptors and background dust concentrations as measured by PM_{10} concentrations are also taken into account to determine the sensitivity of the surrounding area. These factors are then taken into consideration to derive an overall risk and identify suitable mitigation measures. The receptors can be both human and ecological and are chosen based on their sensitivity to dust soiling and PM_{10} exposure.

7.3.34 Emissions from construction vehicles were also considered as they are a potential source of both NO_2 and PM_{10}. According to the IAQM guidance (IAQM, 2014), where high numbers of vehicle movements, especially lorries, are expected to be generated over a long period of time (i.e. one year or more) in the same location, the impact of construction phase traffic should also be considered. The assessment was carried out following the same guidance used for the operational impacts assessment. According to the criteria, an increase in Heavy Duty Vehicles ("HDV") of less than 100 per day when averaged over a full year (25 per day within or adjacent to an AQMA) is not expected to result in significant air quality impacts and does not require further consideration.

Assessment of Operational Impacts

Air Quality Assessment

7.3.35 The local air quality assessment estimated the change in pollutant concentrations resulting from DMU and road traffic emissions during the operation of the DCO Scheme. Traffic flows have been modelled for the road network for three scenarios:

- 2015 - Base Year;
- 2021 - DM (without the DCO Scheme, no improvements along existing railway and no new rail service between Portishead and Bristol; including any committed development incorporated into the traffic model);

- 2021 - DS (with the DCO Scheme and including committed development represented in GBATS4).

7.3.36 Operational air quality impacts associated with changes in road traffic and the proposed changes to road access to the railway stations at Portishead and Pill were assessed as defined in paragraph 7.3.13.

7.3.37 Total air pollutant concentrations comprise a background and local component. The background concentration is determined by regional, national and international emissions and often represents a significant proportion of the total pollutant concentration. The local component is determined by local pollutant sources such as roads and chimney stacks from domestic heating.

7.3.38 Background pollutant concentrations are spatially and temporally variable throughout the UK. Annual mean background concentrations of NO_x, NO_2, and PM_{10} were obtained from the LAQM Review and Assessment page on the Defra website. The Defra maps[8] provide yearly forecasts based on a grid at a resolution of 1 km^2 across the whole of the UK. Base year (2015) background concentrations were compared against background monitoring results and it was concluded that no adjustment was required (as outlined in Appendix 7.2 in the ES Volume 4 Appendices, DCO Document Reference 6.25). Sector removal was carried out as also outlined in Appendix 7.2 in the ES Volume 4 Appendices, DCO Document Reference 6.25.

7.3.39 The methodology used to assess the local air quality impacts at these receptors is detailed in Appendix 7.2 in the ES Volume 4 Appendices (DCO Document Reference 6.25) and summarised here for completeness. The dispersion model ADMS-Roads (v.4.1) was used to assess changes in NO_2 and PM_{10} concentrations at sensitive receptors within the study area.

7.3.40 Air quality dispersion modelling was undertaken for the Base Year (2015), and for the Opening Year (2021) with and without the DCO Scheme, although following delays to the submission of the DCO application the opening year is expected to be later than 2021. The Opening Year (2021) scenario was considered to provide a worst-case future year scenario for air quality. Emissions are expected to decline in future years as a result of more stringent emission controls on vehicles, and it follows that this approach provides a worst-case assessment of design year emissions.

7.3.41 The modelled road-traffic concentrations have been verified against monitoring data in order to determine the accuracy of the modelled predictions and to establish whether any adjustment of modelled values was required. The verification process undertaken for the local pollutant component is outlined in Appendix 7.3 in the ES Volume 4 Appendices (DCO Document Reference 6.25). In addition, long term trend gap analysis was applied to the background and modelled road NO_2 concentrations, following Highways England's Interim Advice Note 170/12v3.

7.3.42 Any changes to the DCO Scheme during its operating life, both in terms of frequency and train type, would be a decision for the Train Operating Company. Based on available information, three different classes of passenger trains could be in service: Class 150, Class 165 (2 coaches) and

8 (http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html)

Class 166 (3+ coaches). The modelling of local air quality impacts was carried out with the assumption that all passenger trains are Class 166 (3+ coaches). Emissions factors applied have been compared for each passenger train class from the Rail Emission Model Final Report (Hobson and Smith, 2001).

Ecological Assessment

7.3.43 The DCO Scheme passes through one internationally designated nature conservation site, the Avon Gorge Woodlands SAC (shown in Figure 7.1 in the ES Volume 3 Book of Figures, DCO Document Reference 6.24). The air quality effects of the DCO Scheme during operation on habitats within the site have been predicted along two transects (see Figure 7.3 Sheet 3) in the ES Volume 3 Book of Figures (DCO Document Reference 6.24). The first extends approximately 200 m into the site from the A369 to the west, and the second extends 200 m into the site from the railway line to the east.

7.3.44 Total NO_x concentrations and rates of nitrogen deposition for the site have been predicted at receptors along both transects for the Base Year 2015, DM 2021 and DS 2021 scenarios. NO_x concentrations have then been compared against the critical levels for habitats within the site (see paragraph 7.4.15 and paragraphs 7.6.26 to 7.6.35 below).

7.3.45 The effects of construction dust on the Portbury Wharf Nature Reserve near Portishead, the Severn Estuary SPA, SAC and Ramsar site in the vicinity of the Avon Road Bridge in Pill, and the Avon Gorge Woodlands SAC have been assessed and reported in Appendix 7.1 (DCO Document Reference 6.25).

Regional Air Quality and Greenhouse Gas Assessment

7.3.46 In addition to the assessment of local pollutant concentrations detailed above, opening year emissions of NO_x, PM_{10} and CO_2 from road and rail sources were estimated over a core regional study area in the opening year (considered to be 2021). The regional emissions from road sources were calculated over the defined study area using the annual link emission function of the Defra Emission Factor Toolkit (EFT v8.0.1). The emission calculations take account of changes in traffic data (daily flows, HDV and average speeds) between the DM and DS and road link length.

7.3.47 Rail emissions for the core regional assessment (see Regional Air Quality Study Area section) were estimated based on emission factors for various DMUs operating 40 services per day between Portishead and Parson Street Station and onward to Temple Meads. The rail emissions for each route section consider emission factors, the number of journeys and journey distance. Emissions were estimated for the rail component based on the assumption that the emission factors used in the models for passenger and freight trains do not change in future year scenarios. This is a pessimistic assumption as future train models will be required to meet stricter emission standards that would emit less NO_x, PM_{10} and CO_2. Furthermore, this approach means that any changes to the absolute rail NO_x and PM_{10} emissions are a direct result of the additional rail services due to the DCO Scheme.

7.3.48 Complementary to this core assessment, a further refinement of the regional emission calculations is included to 1) isolate potential benefits of the DCO

Scheme associated with the proposed new branch of rail line between Portishead and Bristol Temple Meads, including use of a vehicle kilometres approach for calculating road emissions, and 2) to investigate benefits of the DCO Scheme that could accompany conversion of the rail fleet from diesel to hybrid units under various running conditions. The options appraisal considers 6 additional scenarios for calculating NO_x, PM_{10} and CO_2 emissions, comprising six rail emission scenarios and 2 road emission scenarios. These are described in Appendix 7.2 Section 1.9 (DCO Document Reference 6.25) of the ES.

Assessment of Decommissioning Impacts

7.3.49 ES Chapter 4 Description of the Proposed Works (DCO Document Reference 6.7) explains that consideration has been given to likely significant effects arising during the decommissioning phase. However, owing to the nature and life span of the proposed development, the regulated process of any closure in the future, which would be overseen by the Office of Rail and Road, and there being no reasonably foreseeable decommissioning proposals such that likely impacts could be identified and assessed, these effects are not considered further in this chapter.

Assessment of Cumulative Effects

7.3.50 Cumulative effects of the DCO Scheme operation when in combination with other projects that may affect the study area are considered in the air quality modelling as forecast traffic data from the transport assessment includes traffic generated by committed developments between the base year and the DCO Scheme Opening Year. The other projects are detailed in the Transport Assessment in Appendix 16 (DCO Document Reference 6.25) of the ES.

7.3.51 A listing of other DCO projects within 10 km of the DCO Scheme and other projects on the NSDC and BCC planning portals within 0.5 km of the centreline of the DCO Scheme are provided in Appendix 18.1 and an assessment of the cumulative effects is provided in Appendix 18.2 (DCO Document Reference 6.25) of the ES.

7.3.52 The assessment of cumulative effects also considers other projects not incorporated into the traffic model GBATS4 (see Section 7.8). These may include developments for example that have come forward more recently than the latest revision of GBATS4 or projects that do not generate sufficient highways traffic to be included in GBATS4 but may still have a cumulative effect when taken into consideration with the DCO Scheme.

7.3.53 The assessment of cumulative effects also considers other projects being undertaken by Network Rail under their general permitted development rights. This includes other works required for MetroWest Phase 1 that have not yet been implemented, namely, the Parson Street Junction (including Liberty Lane Freight Depot), Parson Street Station, the Bedminster Down Relief Line, Severn Beach / Avonmouth Signalling works, and Bathampton Turnback, as well as other railway projects in the greater Bristol area. Additional services resulting from MetroWest Phase 1 along these routes have been included in the Opening Year DS rail forecast. Further environmental assessments of these works will be undertaken by Network Rail under their own project management procedures.

Use of Significance Criteria

Value of Resource

Air Quality Assessment

7.3.54 Sensitive receptors (including residential properties, hospitals and schools) were identified within 200 m of affected roads and rail links in the study area. A total of 87 sensitive receptors have been considered in the local air quality assessment and these are shown in Figure 7.3 Sheets 1 to 6 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24). These were selected using professional judgement as to where the highest pollutant concentrations are likely to arise and where the greatest impacts would be expected to occur due to the DCO Scheme. Annual mean air quality objectives do not apply to occupational uses such as shops and offices (Defra, 2016).

Ecological Assessment

7.3.55 Only the Avon Gorge Woodlands SAC has been considered in the ecological assessment for the operational phase owing to its proximity to the DCO Scheme, which passes through the designation and the European importance of the designation. DMRB HA207/07 Annex F (Highways Agency, 2007) has been used to inform the significance of airborne nitrogen effects due to the DCO Scheme on the designated site.

7.3.56 The annual mean objective for NO_x is the concentration above which direct adverse effects on vegetation may occur (APIS, 2016). The NO_x annual mean objective for vegetation susceptible to nitrogen effects is 30 µg m^{-3}.

7.3.57 The nitrogen deposition rates have been compared against critical load values for habitats reported in the APIS website[9].

Greenhouse Gas Assessment

7.3.58 The assessment of operational GHG emissions only included CO_2 as part of the DMRB regional air quality assessment. This is because only CO_2 is considered to be relevant to this DCO Scheme application.

Magnitude of Impact

Air Quality Assessment

7.3.59 Descriptors for magnitude of change and significance are recommended in guidance by EPUK and IAQM (2017) and have been adopted in this assessment for NO_2 and PM_{10}. The criteria are shown in Table 7.6.

9 http://www.apis.ac.uk/

Table 7.6: Air quality impact magnitude for changes to NO_2 and PM_{10}

Long term average Concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level ("AQAL")			
	<1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Source: EPUK and IAQM, 2015

Ecological Assessment

7.3.60 No specific magnitude of change descriptors are available for ecological receptors, therefore this has been judged through professional judgement by comparison against the AQS limits for NO_x (30 $\mu g\ m^{-3}$) and the relevant critical loads for the habitat. An assessment outcome that results in an exceedance is generally treated as more significant than if an exceedance is already present.

Greenhouse Gas Assessment

7.3.61 No specific magnitude of change descriptors are available for GHG emissions. A comparison of the assessment results against national inventories is provided.

Significance of Effect

Air Quality Assessment

7.3.62 EPUK and IAQM (2017) guidance has been used to inform the significance of the air quality effects attributed to the DCO Scheme.

7.3.63 AQALs, which refer to the annual mean air quality objectives described in Table 7.1 are used to define the concentration categories and reflect the degree of potential harm. At exposure levels of less than 75% of the AQAL, the degree of harm is likely to be small. This changes at AQAL approaches and exceedances, where the degree of harm to human health is greater.

7.3.64 The overall significance of impacts, whether adverse or beneficial, has been defined based on professional judgment. Significance is dependent upon the magnitude of change (or impact) in pollutant concentrations in relation to air quality objectives as well as the absolute pollutant concentrations in relation to air quality objectives and the sensitivity of the receptor.

7.3.65 The factors outlined below have also been considered when defining the overall significance (EPUK and IAQM, 2017):

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts; and

- the influence and validity of any assumptions adopted when undertaking the prediction of impacts.

7.3.66 The impacts on air quality, whether adverse or beneficial, will have an effect that can be judged as significant or not significant at receptors.

Ecological Assessment

7.3.67 The descriptors significant or not significant have been used to describe ecological impacts at receptors, dependent on whether the NO_x annual mean objective and nitrogen deposition critical loads (described in paragraph 7.4.15) are above or below the legal limit (Annual mean NO_x = 30 $\mu g\ m^{-3}$).

7.3.68 Developments likely to have a significant impact on a site of international importance such as an SPA, SAC or Ramsar site either alone or in combination with other projects, and which are not directly connected with or necessary to the management of the site, should be subject to an appropriate assessment in line with the requirements of the Habitats Directive (Council Directive 92/43/EEC). This is discussed in ES Chapter 9 Ecology and Biodiversity (DCO Document Reference 6.12) and Appendix 9.12 Report to Inform the HRA (DCO Document Reference 5.5) of the ES.

Greenhouse Gas Assessment

7.3.69 No specific significance descriptors have been used to describe GHG impacts. Only CO_2 emissions were considered relevant to this DCO Scheme. The estimated total annual mass emissions of CO_2 have been compared against the national levels based on information available from national GHG emissions inventories.

7.4 Baseline, Future Conditions and Value of Resource

Air Quality Baseline

Air Quality Management Areas

7.4.1 NSDC has not declared any AQMAs for NO_2 and PM_{10} in the vicinity of the DCO Scheme. BCC has declared a single AQMA that covers the city of Bristol and parts of the main radial roads including the M32, shown in Figure 7.1 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24). The DCO Scheme passes through the AQMA in the vicinity of Ashton Gate. The Bristol to Taunton mainline enters the AQMA at Parson Street Junction. This BCC AQMA has been declared for NO_2 (1-hour mean and annual mean objectives) and PM_{10} (24-hour mean objective).

Air Quality Monitoring

7.4.2 Both local authorities monitor NO_2 and PM_{10} from a network of continuous monitoring locations and diffusion tube sites. The air quality monitoring locations within both NSDC and BCC are shown on Figure 7.2 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24).

7.4.3 There are two principal methods for measuring air quality: passive sampling techniques such as diffusion tubes (also referred to as non-automatic

monitoring) and more sophisticated continuous monitoring equipment (also referred to as automatic monitoring).

7.4.4 A review of the air quality monitoring carried out by both NSDC and BCC is detailed below for sites within 500 m of the DCO Scheme and locations in the vicinity of the railway network that will be affected by the DCO Scheme.

North Somerset District Council's Air Quality Monitoring Programme

7.4.5 NSDC monitors NO_2 concentrations at 26 non-automatic monitoring sites and does not carry out any PM_{10} monitoring. Air quality monitoring sites located within 500 m of the DCO Scheme are shown in Table 7.7 and in Figure 7.2 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24). There are two air quality diffusion tube monitoring sites located within 500 m of the DCO Scheme, the closest being the Pill (Railway Line) monitoring site (No. 3) located 400 m north-west of Pill station and 50 m from the new railway line. The other monitoring site is located on Priory Road, in Portbury (No. 2).

7.4.6 Table 7.7 shows the NO_2 concentrations monitored within NSDC from 2011 to 2015. NSDC does not conduct any co-location studies with automatic monitoring. Therefore the 2015 results were bias adjusted using the Defra factor for the diffusion tube supplier (Gradko). The 2015 bias adjustment factor used was 0.91.

7.4.7 Although a discernible trend is not evident in the data, there were no exceedances of the annual mean objective for NO_2 at any monitoring site.

Table 7.7: NO_2 annual mean concentration from diffusion tubes within 500 m of the DCO Scheme in North Somerset from 2011 to 2015

ID	Location	X	Y	Site Type	Data Capture for 2015 (%)	Annual mean NO_2 concentration ($\mu g\ m^{-3}$)				
						2011	2012	2013	2014	2015
2	Portbury (Priory Road)	349766	175441	Roadside	100	24.7	28.8	24.9	22.8	23.0
3	Pill (Railway Line)	352084	176273	Back-ground	100	19.2	20.5	19.4	16.8	15.5

Annual mean AQS for NO_2 = 40 $\mu g\ m^{-3}$

Source: North Somerset Council, June 2016, Air Quality Annual Status Report

Bristol City Council's Air Quality Monitoring Programme

7.4.8 BCC operates five automatic monitoring stations, with the nearest station being located at Parson Street School 200 m south east of Parson Street Station and over 1 km from the end of the DCO Scheme at Ashton Junction (Table 7.8). The location of this monitoring station is shown on Figure 7.2 (No. 215) in the ES Volume 3 Book of Figures (DCO Document Reference 6.24).

7.4.9 The monitoring station is located within the BCC AQMA. The automatic monitoring results at Parson Street School show that there have been exceedances of the NO_2 annual mean objective every year over the period 2012-2016. Although overall NO_2 levels have decreased over this period, levels have increased between 2015 and 2016. Therefore, it is not possible to assume that concentrations will be lower in future years. The exceedances of the 1-hour mean concentration threshold are shown in brackets. There are, however, no exceedances of the 1-hour mean objective of 200 µg m^{-3} not to be exceeded more than 18 times a year.

7.4.10 No PM_{10} monitoring is carried out at this site; the nearest PM_{10} monitoring is carried out at the Bristol St Paul's Automatic Urban and Rural Network site.

Table 7.8: Automatic monitoring results from 2012 to 2016 for Bristol City Council diffusion tubes at station No. 215

ID	Location	X	Y	Site Type	Data Capture for 2016 (%)	Annual mean NO_2 concentration (µg m^{-3}) (Number of exceedances of the 1-hourly objective shown in brackets)				
						2012	2013	2014	2015	2016
215	Parson Street School	358042	170582	Road-side	99	**47.9** (0)	**50.8** (1)	**45.7** (2)	**44.2** (0)	**46.1** (0)

Annual mean AQS for NO_2 = 40 µg m^{-3}; 1 hour mean for NO_2 = 200 µg m^{-3} (not to be exceeded >18 times)

Source: Bristol City Council, September 2017, Air Quality Annual Status Report

7.4.11 BCC also monitors NO_2 from a network of 105 diffusion tube sites. A summary of the bias-adjusted annual mean NO_2 concentrations for sites used in this assessment are shown in Table 7.9 for 2012 to 2016. The air quality monitoring sites closest to the study area are also shown in Figure 7.2 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24). The nearest air quality monitoring stations to the Portishead Branch Line in BCC are the Greville Smyth Park monitoring station in Ashton Gate (No. 99) and several monitoring stations around Clifton, Parson Street and Bedminster.

7.4.12 There are several BCC monitoring sites which consistently show NO_2 concentrations well above the annual mean NO_2 objective from 2012 to 2016 as shown in bold on Table 7.9. The maximum annual mean NO_2 concentration (81.3 µg m^{-3}) was recorded in 2012 for Bedminster Down Road, located about 50 m northeast of the railway line. At some locations, there is a decreasing trend over the five years while at others the trend is less evident with NO_2 levels recorded in 2014 higher than those recorded in 2015. Most of the monitoring sites with exceedances are located within the existing AQMA (Figure 7.1 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24)).

Table 7.9: Monitoring results from 2012 to 2016 for Bristol City Council diffusion tubes

ID	Location	X	Y	Site Type	Data Capture for 2016 (%)	Annual mean NO_2 concentration (µg m^{-3})				
						2012	2013	2014	2015	2016
99	Greville Smyth Park	357099	171627	Urban Background	100	30.0	33.1	27.2	28.7	31.6
242	Parson Street Bedminster Down Road	357510	170401	Roadside	91	**73.9**	**75.1**	**56.2**	**61.7**	**68.4**
418	Bedminster Down Road	357737	170642	Roadside	100	**81.3**	**74.0**	**67.7**	**63.7**	**69.3**
419	Parson Street	357832	170686	Roadside	100	**54.1**	**53.6**	**56.6**	**53.6**	**55.8**
239	Parson Street A38 East	357880	170506	Roadside	100	**76.9**	**78.0**	**69.6**	**69.2**	**68.9**
439	Parson Street School	358042	170582	Roadside	100	**40.9**	**44.7**	**42.0**	**41.0**	**43.6**
474	Martial Arts West Street	357991	170979	Roadside	100	37.9	39.1	35.8	38.5	38.7
473	B&G Snax West Street	358105	171124	Roadside	100	**44.6**	**43.5**	**40.7**	**49.6**	**57.1**
472	Jamiesons Autos	358226	171284	Roadside	92	**46.5**	**48.2**	**45.2**	**40.0**	**45.3**
422	North St/Langton	358168	171525	Roadside	100	39.8	39.0	34.1	35.0	39.4
420	North St/Dean	358277	171562	Roadside	100	38.1	38.9	37.2	36.7	38.6
5	Bedminster Parade	358723	171704	Roadside	100	**54.6**	**58.7**	**47.6**	**50.9**	**51.3**
105	Victoria Park	359097	171368	Urban Background	100	20.4	21.2	17.2	18.2	20.8
125	York Road	359213	171916	Roadside	98	**63.0**	**59.6**	**53.3**	**52.9**	**52.9**
8	Higham Street	359836	171903	Urban Background	92	25.6	26.8	22.6	22.5	26.3
4	Three Lamps	359903	171850	Roadside	100	**58.4**	**60.6**	**55.8**	**53.3**	**55.2**
305	Lamppost Sarah Street Redfield	360661	173373	Roadside	100	36.0	37.1	34.2	33.3	35.0
436	Shriners Garage	361013	173352	Roadside	100	39.6	**40.1**	38.2	37.9	**47.7**

Table 7.9: Monitoring results from 2012 to 2016 for Bristol City Council diffusion tubes

ID	Location	X	Y	Site Type	Data Capture for 2016 (%)	Annual mean NO_2 concentration (µg m^{-3})				
						2012	2013	2014	2015	2016
6	Church Road	361237	173422	Roadside	100	33.6	33.5	30.5	31.3	33.7
405	Whitehall Rd/Easton Rd lamppost	361051	173743	Roadside	100	**53.1**	**55.0**	**51.1**	**53.1**	**42.6**
429	Façade Villiers Road/Stapleton Road Jnc	360484	174097	Roadside	89	**57.3**	**60.7**	**54.7**	**50.4**	**52.1**
487	Junction 3 Millpond	360243	174327	Kerbside	100	-	**47.4**	**47.4**	**46.2**	**45.7**
462	Millpond School play area	360385	174381	Roadside	100	31.7	32.9	29.2	30.4	30.8
461	Millpond School Fence	360381	174405	Roadside	100	35.5	37.2	34.1	33.2	37.0
263	Gatton Road	360343	174473	Roadside	100	35.7	35.0	33.9	33.6	33.6
407	Lamppost Sussex place	359829	174370	Roadside	100	**47.3**	**47.1**	**43.9**	**43.1**	**48.7**
312	Lamppost Ashley Hill St Paul's	359832	174616	Roadside	100	**43.7**	**44.5**	36.7	36.8	**41.8**
311	Give Way Sign Chesterfield Rd/Ashley Down Road	359677	175057	Roadside	100	**46.7**	**49.5**	**43.3**	**44.0**	**46.2**
159	Cromwell Road	358891	174608	Roadside	100	**49.7**	**49.0**	**44.5**	**44.1**	**44.8**
314	Lamppost on Whiteladies Road / Cotham Hill, Clifton	357751	174063	Roadside	91	**40.4**	**44.4**	**43.0**	**43.9**	**41.5**
17	Anglesea Place	357273	174582	Roadside	100	21.3	25.0	21.2	20.0	21.9
7	St. Andrew's Rd	351706	178250	Roadside	100	27.9	27.7	28.0	26.8	28.6
3	Blackboy Hill	357448	174650	Roadside	100	37.7	**41.2**	36.3	37.9	37.6

Annual mean AQS for NO_2 = 40 µg m^{-3}. Readings in bold indicate exceedances.

Source: Bristol City Council, September 2017, Air Quality Annual Status Report

Ecological Designated Sites

7.4.13 There are several internationally and nationally designated nature conservation sites within 1 km of the DCO Scheme:

- The Severn Estuary SPA, SAC, Ramsar site and SSSI located along the coast near Portishead and entering the lower Avon near Pill;
- Avon Gorge Woodlands SAC and Avon Gorge SSSI, which is traversed by the DCO Scheme; and
- Ashton Court SSSI near the DCO Scheme just north of Ashton Gate.

7.4.14 Table 7.10 provides data on the average nitrogen deposition within the designated nature conservation sites and an empirical estimate of the critical load ranges. Critical loads are a quantitative estimate of an exposure of one or more pollutants below which significant harmful effects on specified sensitive environmental receptors do not occur.

Table 7.10: Average nitrogen deposition (based on measured-interpolated data for 2016-2018) and critical loads for designated sites near the DCO Scheme

Designated Site	Local Authority	Habitat Type or Species	Critical Load (kg N ha^{-1} yr^{-1})	2016-2018[1] Average Baseline Nitrogen Deposition (kg N ha^{-1} yr^{-1})
Severn Estuary (SPA, SSSI)	North Somerset	Pioneers, low-mid, mid-upper saltmarshes	20 to 30	12.3
	Bristol City	Shifting coastal dunes	10 to 30	12.3
		Coastal stable dune grasslands – acid type	8 to 10	12.3
		Coastal stable dune grasslands – calcareous type	10 to 15	12.3
		Moist and wet oligotrophic grasslands	10 to 20	12.3
		Low and medium altitude hay meadows	20 to 30	12.3
Horseshoe Bend, Shirehampton (SSSI)	Bristol City	Vascular plant assemblage	No comparable habitat with established critical load estimate available	8

Table 7.10: Average nitrogen deposition (based on measured-interpolated data for 2016-2018) and critical loads for designated sites near the DCO Scheme

Designated Site	Local Authority	Habitat Type or Species	Critical Load (kg N ha^{-1} yr^{-1})	2016-2018[1] Average Baseline Nitrogen Deposition (kg N ha^{-1} yr^{-1})
Avon Gorge Woodlands (SAC)	North Somerset Bristol City	Meso- and eutrophic Quercus woodland	15 to 20	29.7
		Sub-Atlantic semi-dry calcareous grassland	15 to 25	17.2
Avon Gorge (SSSI)	North Somerset Bristol City	Meso- and eutrophic Quercus woodland	15 to 20	29.7
		Sub-Atlantic semi-dry calcareous grassland	15 to 25	17.2
Ashton Court (SSSI)	North Somerset Bristol City	Invertebrate assemblage	No comparable habitat with established critical load estimate available	10.5

[1] The deposition of nitrogen represents the Total Deposition based on Concentration Based Estimated Deposition ("CBED"). CBED is based on measured–interpolated data for a 3 year average (2016-2018). The data used here were current at time of assessment.

Source: APIS Website

7.4.15 Estimated average nitrogen deposition on the Severn Estuary SSSI is less than the critical load for meadows and saltmarshes along the shore. However, averages are estimated above or within the critical load for coastal stable dune and moist and wet oligotrophic grasslands. Average nitrogen deposition is at the lower end of the critical load range for grasslands in the Avon Gorge. However, estimated nitrogen deposition exceeds the critical load for broadleaf, deciduous and eutrophic Quercus woodlands, located within the Avon Gorge Woodlands SAC and Avon Gorge SSSI. Further discussion on the interpretation of these results on biodiversity and the integrity of these nature conservation sites are presented in the ES Chapter 9 Ecology and Biodiversity (DCO Document Reference 6.12) and Appendix 9.12 Report to Inform the HRA (DCO Document Reference 5.5).

Greenhouse Gases

7.4.16 An estimate of the mass of CO_2 emitted (in kilotonnes ("Kt") for 2015) in the administrative boundaries of NSDC, BCC, and B&NES is shown in Table 7.11.

Table 7.11: BCC, NSDC and B&NES CO_2 emissions for 2015 for different economic sectors

Economic Sector	CO_2 (Kt)		
	BCC	NSDC	B&NES
Industry & Commercial Electricity	396	135	128
Industry & Commercial Gas	145	39	61
Large Industrial Installations	1	5	0
Industrial & Commercial Other Fuels	37	67	31
Agricultural Combustion	1	14	13
Domestic Electricity	230	119	107
Domestic Gas	363	181	163
Domestic Other Fuels	14	18	21
Road Transport (A roads)	153	106	135
Road Transport (Motorways)	76	246	0
Road Transport (Minor roads)	298	178	110
Diesel Railways	6	7	6
Transport Other	4	14	1
LULUCF Net Emissions	5	19	8
Total for all sectors	1,729	1,149	783

Source: National Atmospheric Emissions Inventory (2015)

7.4.17 On average, the carbon (as CO_2) emissions for diesel railways for all three local authorities were estimated to be 0.5% of total CO_2 emissions, with road transport accounting for about 30% of total CO_2 emissions for BCC, about 46% for NSDC, and about 31% for B&NES.

7.5 Measures Adopted as Part of the DCO Scheme

7.5.1 A number of measures have been included as part of the DCO Scheme design in order to minimise certain environmental effects. These include:

- careful designing of the scheme to ensure key receptors are avoided where possible;
- construction adopting best practicable means ("BPM"), which are outlined in the CoCP (DCO Document Reference 8.15) and presented in more detail in the Master CEMP (DCO Document Reference 8.14); and
- compliance with regulatory and legislative regimes as required by law.

7.5.2 The contractor(s) will be required to produce a CEMP to comply with the CoCP (DCO Document Reference 8.15) and the Master CEMP (DCO document Reference 8.14). This will include an Air Quality and Dust Management Plan.

7.5.3 The contractor(s) will be required to implement BPM at all the construction sites including the Portishead Station site, the railway line between Portishead and Pill, the Pill car park and Station site and the operational railway from Pill to Ashton Junction in Bristol, as well as the construction compounds.

7.5.4 There are many measures that could reduce the impacts of demolition and construction dust on sensitive receptors. For example, IAQM 2014 lists measures to take based on the level of risk identified in the construction assessment. BPM to reduce dust emissions during construction include techniques such as those outlined in *The Control of Dust and Emissions from Construction and Demolition* (Greater London Authority, 2006) and *Control of Dust from Construction and Demolition Activities* (Building Research Establishment, 2003).

7.5.5 The Air Quality and Dust Management Plan will include measures as detailed in the Master CEMP in ES Appendix 4.2 (DCO Document Reference 8.14). The following are provided as examples of potential measures.

- General site management, such as planning the site layout to place dusty activities away from residential areas, erection of hoardings to restrict dust, and dust suppression techniques.
- Construction plant, vehicles and equipment: employ measures to reduce emissions such as using plant with lower emissions, operating and maintaining plant in accordance with manufacturer's instructions, switching off plant when not in use, and adopting lower speed limits on site.
- Transportation, storage and handling of materials: employ measures to avoid the entrainment of dust and spreading of mud on the roads such as sheeting lorries, location and protection of stockpiles, and use of wheel washers at egress points at construction sites.
- Excavation and earthworks: measures to reduce entrainment of dust such as careful top soil stripping, minimise drop heights, compaction of materials, and revegetation soon after the works are completed.
- Conveying, processing, crushing, cutting and grinding: measures to limit dust pollution from dusty activities, for example by use of temporary enclosures and damping of materials.

7.6 Assessment of Effects

Construction Phase

7.6.1 The assessment of construction dust was undertaken following the latest IAQM construction guidance (IAQM, 2014 based on information provided in the railway Construction Strategy (DCO Document Reference 5.4)). This approach addresses impacts during demolition, earthworks, construction and trackout without mitigation on dust soiling, human health, and ecological sites, as a means to identify the level of mitigation required in different locations and phases of the DCO Scheme. Further details on the construction dust assessment are provided in Appendix 7.1 (DCO Document Reference 6.25) of the ES. This assessment was used to identify the mitigation measures included in the Master CEMP (DCO Document Reference 8.14).

7.6.2 The risks of construction dust causing soiling, affecting human health and ecological sites will be greater where there is close proximity between high value receptors (people in residential areas and designated ecological sites) and largescale construction works (large-scale demolition works, extensive areas of excavation and earthworks, and handling large volumes of ballast). The weather conditions will affect dust generation, transport and deposition with greater impacts on windy days during a period of dry weather. The distance over which the dust may be transported will also be affected by measures set out in the Master CEMP DCO Document Reference 8.14) to control dust emissions and environmental features such as the presence of vegetation (hedgerows, trees and woodland), buildings, and topography. Consequently, the impact of dust on receptors is likely to be intermittent, affected by the predominant wind direction and limited in extent by measures employed in the CEMP and the nature of the surrounding area.

7.6.3 In Portishead, the scale of the construction works for the station, car parks, highway realignment and Trinity Primary School Bridge indicates that the magnitude of construction dust emissions is medium to high. The sensitivity of the surrounding area to dust soiling (deposition of dust on cars, laundry, vegetation, and other surfaces) is high within 20 m of the works, falling to medium within 50 m and low beyond, taking account of the number of receptors within those distance bands. The sensitivity of dust to human health is considered to be low, as the existing background dust levels are approximately 15 µg m^{-3} and according to Defra (2009), exceedances of the 24-hour objective for PM_{10} are unlikely at annual mean concentrations of less than 24 µg m^{-3} and also considering the low numbers of receptors in the distance bands. The overall risk of construction to dust emissions without mitigation is assessed to be medium to high for dust soiling, low for human health and not-applicable for ecological sites in this urban environment. With the application of dust control measures identified in the Master CEMP (DCO Document Reference 8.14), such as dampening down working surfaces and erecting hoardings around construction sites, the risk of dust soiling is assessed to be reduced to low. A **low risk** of temporary, intermittent dust emissions on dust soiling and human health is considered to be **not significant** in relation to the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (“the EIA Regulations 2017").

7.6.4 The construction of the disused railway line between Portishead and Portbury Dock Junction will include construction activities likely to result in medium to high

magnitude dust emissions. These include earthworks to remove the old ballast and truck it to temporary holding points, tipping the old ballast into trucks or onto construction trains via conveyor, and laying the new ballast. The sensitivity of the area to dust spoiling is high within 50 m of the works falling to medium within 100 m due to large numbers of residences in the eastern part of Portishead, (although it would be low through the majority of the section through open countryside). The sensitivity of dust to human health is medium within 20 m and low beyond, given the low background concentrations of dust of about 16 µg m^{-3} and the numbers of receptors within 20 m of the works through Portishead. The sensitivity of dust to human health through the rural part of the disused line would be low due to low population density. The sensitivity of the Severn Estuary SSSI to construction dust is assessed to be medium, given its high value and distance within 50 m of the re-aligned cyclepath. However, this site is about 80 m from the nearest main construction works at Avon Road Bridge and embankments. The overall risk of construction dust without mitigation would be medium to high for dust soiling and low to medium for human health section through Portishead, but low along the rest of the disused line through the countryside. The risk of construction dust on designated ecological sites would be low to medium for the Severn Estuary SSSI.

7.6.5 The Master CEMP (DCO Document Reference 8.14) includes a range of measures that could be implemented by the contractor to reduce the risk of dust spoiling, impacts on human health and deposition on ecological sites. These include dampening down working areas during dry weather, erecting hoardings and other barriers to dust transport, arranging the layout of construction sites to remove dusty activities from sensitive receptors nearby, shielding dusty activities such as the use of conveyors to transport ballast onto construction trains. With these measures in place, the risk of construction dust on receptors would be reduced to **low**, which is considered to be **not significant** with regards to the EIA Regulations 2017.

7.6.6 Between Portbury Dock Junction and Ashton Junction, the construction activities are likely to result in medium to large magnitude dust emission, due to activities such as demolition of Avon Road Bridge and Station House, removal and replacement of ballast along the whole route, and extensive construction works at Pill station and car park. The sensitivity of the area to dust spoiling is high within 50 m of the works falling to medium with 100 m, and low beyond 100 m, due to large numbers of residences through Pill, in Bower Ashton and the outskirts of Bristol in those distance bands. The sensitivity of dust to human health is medium within 20 m falling to low beyond, reflecting the low ambient dust levels and numbers of receptors within distance bands. Through the rural areas the sensitivity to dust spoiling and human health would be low given the low numbers of receptors. The sensitivity of ecological sites to construction dust is assessed to be high for the Avon Gorge Woodlands SAC and low for the local wildlife sites within 20 m of the construction works, falling to medium for the Avon Gorge Woodlands SAC and low for other designated sites within 50 m of the works. The overall risk of construction dust emissions without mitigation is assessed to be medium to high for dust soiling, low to medium for human health, and medium to high for ecological sites.

7.6.7 With the application of dust control measures identified in the Master CEMP (DCO Document Reference 8.14), the risks of construction dust could be reduced to low. A **low risk** of temporary, intermittent dust emissions on dust soiling, human health and ecological sites is considered to be **not significant** in relation to the EIA Regulations 2017.

7.6.8 Emissions from plant and machinery and construction traffic have also been considered. According to IAQM guidance (IAQM, 2014), where high numbers of vehicle movements, especially lorries, are expected to be generated over a long period of time (i.e. one year or more) in the same location, the impact of construction phase traffic should be also considered and assessed using the same methodology described for operational impacts. The construction period is expected to be about 18 months, with construction at any one location expected to be shorter than a year for this DCO Scheme. While as much of the movement of materials and waste will be undertaken by train as possible thereby reducing the number of haulage vehicles on the highway network, we have considered a worst-case scenario for the use of HGVs for the disused section of the railway line. The haul roads are expected to be limited to specific areas (Portbury Hundred, Junction 19 of the M5 and Royal Portbury Dock Road).

7.6.9 Given that there are low pollution levels along much of the DCO Scheme and the intention to minimise road haulage where possible, it is assumed that construction plant and traffic is unlikely to affect compliance with air quality objectives.

7.6.10 With an Air Quality and Construction Dust Plan in place, any intermittent, short-term dust impacts and residual effects anticipated from the temporary construction works would be reduced. Following implementation of the proposed specific mitigation measures**, no significant effects** are anticipated during the construction phase.

Operation Phase

Air Quality Assessment

7.6.11 A total of 87 sensitive receptors were considered for the local air quality assessment. These were identified at realistic worst-case locations alongside the study area (as defined in Section 7.3). The location of the receptors considered in the assessment are shown in Figure 7.3 Sheets 1 to 6 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24).

7.6.12 Total NO_2 and PM_{10} concentrations were predicted for the Base Year (2015), DM (2021) and DS (2021) scenarios. The pollutant concentrations predicted in all scenarios are given in Appendix 7.2 in the ES Volume 4 Appendices (DCO Document Reference 6.25).

7.6.13 The receptors have been categorised based on the nearby emission sources that have been included in the ADMS model setup, as follows:

- “Rail”: For receptors near to the railway line where the DCO Scheme could result in a change in pollutant concentrations. At these receptors, the emission contribution from the railway line has been modelled but nearby road sources have not been included in the ADMS model.

- "Road": For roadside receptors that are near or over 200m from the railway line, where the railway line is not expected to contribute to pollution levels. Dominant nearby road sources have been modelled.
- "Road&Rail": For receptors where the pollutant contribution from dominant nearby road and rail sources have been modelled.

7.6.14 The receptors with the highest concentrations and greatest change in NO_2 and PM_{10} are presented and described in the following sections for the disused section between Portishead to Pill and the operating railway line between Pill and Ashton Junction.

Portishead to Pill

7.6.15 The screening of road traffic on the main highway links in Portishead and Pill did not identify any affected roads where the DCO Scheme resulted in a significant change in traffic flow. Therefore, the operational air quality assessment focussed on the receptors that were closest to the re-instated Portishead Branch Line (Figure 7.3 Sheets 1 and 2 in the ES Volume 3 Book of Figures DCO Document Reference 6.24)).

7.6.16 Modelling assumptions including train dwell times at the stations and frequencies and are detailed in Appendix 7.2 (DCO Document Reference 6.25) of the ES.

7.6.17 Table 7.12 and Table 7.13 show the annual mean NO_2 and PM_{10} concentrations at worst-case receptors in Portishead and Pill respectively for the DM (without DCO Scheme) and DS (with DCO Scheme).

Table 7.12: Modelled annual mean NO_2 and PM_{10} (µg m^{-3}) at worst case receptors in Portishead

Receptor ID	Type	NO_2					PM_{10}				
		2015 Base	2021 DM	2021 DS	Impact	Impact magnitude	2015 Base	2021 DM	2021 DS	Impact	Impact magnitude
R2	Road	18.6	15.0	15.0	0.0	Negligible	14.4	13.9	13.9	0.0	Negligible
R4	Road	20.6	16.6	16.6	0.0	Negligible	13.8	13.3	13.3	0.0	Negligible
R5	Road &Rail	18.2	14.7	14.8	0.1	Negligible	14.4	13.9	13.8	-0.1	Negligible
R6	Road &Rail	16.5	13.6	13.6	0.0	Negligible	14.1	13.6	13.6	0.0	Negligible
R7	Road	20.4	16.5	16.4	-0.1	Negligible	13.8	13.3	13.2	-0.1	Negligible
R8	Road	16.4	13.1	13.0	-0.1	Negligible	13.2	12.7	12.7	0.0	Negligible
R9	Rail	15.3	12.8	13.0	0.2	Negligible	14.0	13.5	13.5	0.0	Negligible
R10	Rail	15.1	12.7	12.9	0.2	Negligible	14.0	13.5	13.5	0.0	Negligible
R12	Rail	14.9	12.5	12.8	0.3	Negligible	13.9	13.4	13.4	0.0	Negligible

Table 7.13: Modelled annual mean NO_2 and PM_{10} (µg m^{-3}) at worst case receptors in Pill

Recept or ID	Type	NO_2					PM_{10}				
		2015 Base	2021 DM	2021 DS	Impact	Impact magnitude	2015 Base	2021 DM	2021 DS	Impact	Impact magnitude
R20	Rail	17.0	13.7	14.0	0.3	Negligible	13.5	13.0	13.0	0.0	Negligible
R21	Rail	17.0	13.7	13.9	0.2	Negligible	13.5	13.0	13.0	0.0	Negligible
R22	Rail	17.1	13.7	14.1	0.4	Negligible	13.5	13.0	13.0	0.0	Negligible
R23	Rail	17.1	13.7	13.9	0.2	Negligible	13.6	13.0	13.0	0.0	Negligible
R24	Rail	15.1	12.2	12.5	0.3	Negligible	12.9	12.4	12.4	0.0	Negligible
R25	Rail	15.3	12.4	12.9	0.5	Negligible	12.9	12.4	12.5	0.1	Negligible
R26	Rail	15.1	12.3	12.8	0.5	Negligible	12.8	12.3	12.3	0.0	Negligible
R27	Rail	15.1	12.3	12.7	0.4	Negligible	12.9	12.4	12.4	0.0	Negligible
R28	Rail	15.0	12.2	12.4	0.2	Negligible	12.9	12.4	12.4	0.0	Negligible
R29	Rail	14.8	12.0	12.2	0.2	Negligible	12.8	12.3	12.3	0.0	Negligible
R30	Rail	16.4	13.0	13.2	0.2	Negligible	13.1	12.5	12.5	0.0	Negligible

7.6.18 Table 7.12 and Table 7.13 show a small increase in the modelled NO_2 concentrations at most modelled worst-case receptors in Pill and Portishead. Modelled increases in NO_2 concentration due to the DCO Scheme are small, with the largest change recorded for R25 and R26, where a change of 0.5 µg m^{-3} is predicted. R25 and R26 are located on Chapel Row and Underbanks respectively, in close proximity (less than 10 m) to the Portishead Branch Line. The DCO Scheme results in a small benefit for NO_2 concentrations (change of 0.1 µg m^{-3}) at R7 and R8, which are located alongside the A369. All modelled receptors meet the annual mean objective for NO_2 and impact magnitudes are **negligible** based on EPUK and IAQM (2017) guidance.

7.6.19 The designation of "negligible" changes in NO_2 concentrations takes into account that there are low baseline NO_2 levels as well as a low predicted impact of the DMUs to the local air quality at this agglomeration of receptors. Absolute concentrations at "Rail" receptors may be slightly underpredicted as a result of nearby roads not being represented in the model. However, the disparity would not be sufficient enough to cause an exceedance or to change the EPUK and IAQM impact magnitudes. Annual mean NO_2 were below 75% or less of the air quality assessment level (40 µg m^{-3}) at all modelled receptors in the DM. This is considered to be the level at which the degree of harm to human health is likely to be small (EPUK and IAQM, 2015).

7.6.20 Hourly mean NO_2 concentrations were not modelled for the assessment. Concentrations are expected to meet the hourly objective at all receptors in Pill and Portishead, as annual mean concentrations are predicted to be less than 60 µg m^{-3} (Defra, 2016). Impacts are not expected to be significant.

7.6.21 Table 7.12 and Table 7.13 also show the annual mean PM_{10} concentrations. As can be seen, all values are below the annual mean PM_{10} objectives at all receptors in all scenarios. Based on the annual mean concentrations modelled, daily mean PM_{10} concentrations are also expected to be below the objective. Daily mean PM_{10} concentrations were only exceeded twice (maximum across all receptors), which is below the maximum permitted exceedances (18 times annually). Annual and daily mean PM_{10} concentration are therefore expected to be below the objective.

7.6.22 The overall effects of the DCO Scheme on the local air quality around Portishead and Pill are **not significant** in terms of the EIA Regulations 2017.

Pill to Ashton Junction

7.6.23 Table 7.14 shows the total annual mean NO_2 and PM_{10} concentrations predicted at worst case receptors between Pill and east of Ashton Junction near Ashton Drive (Figure 7.3 Sheet 4 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24)) in the Base Year (2015), and the DM (2021) and DS (2021) scenarios for the Opening Year based on Defra TG(16).

Table 7.14: Modelled annual mean NO_2 and PM_{10} (µg m^{-3}) at worst-case receptors between Pill and Ashton Junction

Recep-tor ID	Type	NO_2 (µg m^{-3})					PM_{10} (µg m^{-3})				
		2015 Base	2021 DM	2021 DS	Impact	Impact magnitude	2015 Base	2021 DM	2021 DS	Impact	Impact magnitude
R68	Road &Rail	29.8	23.9	24.0	0.1	Negligible	15.6	15.0	15.0	0.0	Negligible
R78	Road &Rail	25.6	20.8	21.0	0.2	Negligible	15.1	14.5	14.5	0.0	Negligible
R80	Road& Rail	22.2	17.1	17.5	0.4	Negligible	14.6	13.9	13.9	0.0	Negligible
R81	Road& Rail	19.9	15.4	15.8	0.4	Negligible	14.3	13.7	13.7	0.0	Negligible
R45	Road& Rail	21.0	17.0	17.3	0.3	Negligible	13.1	12.5	12.5	0.0	Negligible
R46	Road& Rail	19.3	15.4	15.7	0.3	Negligible	13.0	12.4	12.4	0.0	Negligible

7.6.24 Table 7.14 shows that the predicted impact of the DCO Scheme on the local air quality around Ashton Junction is limited. The assessment focused on worst-case receptors located in close proximity to the railway and therefore potentially exposed to the increase in emissions from DMUs. The largest change in NO_2 concentration of 0.4 µg m^{-3} is predicted for R80 and R81, which are located within 10 m of the railway line between the railway and the A369 Clanage Road. The next largest changes are predicted for R45 and R46 which are located less than 10 m from the railway near Ashton Drive, with increases in NO_2 concentrations of 0.3 µg m^{-3} respectively. The highest NO_2 annual average concentration in the DS scenario is 24.0 µg m^{-3} at R68 on Bower Ashton Terrace, which is below the limit by a good

margin. This receptor is influenced by emissions from the railway line and the nearby road junction of the A369 with Winterstoke Road. All modelled receptors meet the annual mean objective for NO_2 and impact magnitudes are **negligible** based on EPUK and IAQM (2017) guidance.

7.6.25 Local air quality effects due to the DCO Scheme near Ashton Junction cause negligible increases in NO_2 and PM_{10} for sites where the air quality is well within the air quality objective. The effects are therefore **not significant** in terms of the EIA Regulations 2017.

Ecological Assessment

7.6.26 Impacts to ecological receptors were assessed for the Avon Gorge Woodlands SAC and the Avon Gorge SSSI. The woodland is located between the A369 and the River Avon, with the DCO Scheme passing through the woodland fringe on the eastern side (Figure 7.3 Sheet 3 in the ES Volume 3 Book of Figures, DCO Document Reference 6.24). Habitats within the SAC are sensitive to both NO_x and nitrogen deposition, which can have direct and indirect effects on ecosystem health.

7.6.27 The annual mean objective/limit value for NO_x does not apply within 5 km of built up areas or motorways and therefore does not apply here, but concentrations have been compared against the objective as recommended by DMRB methodology. The nitrogen deposition flux has been calculated following the methodology outlined in paragraph 7.3.29 and compared against critical loads, as recommended by DMRB.

7.6.28 Total NO_x concentrations and nitrogen deposition rates have been calculated along two transects extending into the SSSI/SAC, one extending from the operational railway line and one on the other end of the SSSI/SAC extending from the A369. The locations of the transects are shown in Figure 7.3 Sheet 3 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24).

7.6.29 Total NO_x concentrations for each scenario were calculated by combining the road-traffic contributions with background concentrations. Background NO_x concentrations used in the assessment for the existing baseline year (2015) and the future DM and DS scenarios (2021) were obtained from Defra LAQM backgrounds and are presented in Table 7.15.

Table 7.15: Background NOx concentrations (µg m^{-3}) at ecological receptors in the base and opening years for Avon Gorge Woodlands SAC

Avon Gorge SAC Receptor	Type	Easting (m)	Northing (m)	Background NO_x	
				Base Year (2015)	Opening Year (2021)
R34-R38	Road&Rail	355500	173500	16.1	12.8
R39-R43	Road&Rail	356500	173500	22.6	17.4

7.6.30 The annual mean objective for NO_X (30 µg m^{-3}) is the concentration above which direct adverse effects on receptors may occur (APIS, 2016). This is the critical level for all vegetation susceptible to nitrogen effects, shown in Table 7.1. Scheme

impact magnitudes of NO_X follow the same criteria as those for NO_2 and PM_{10} impacts, as recommended by DMRB guidance. Table 7.16 shows total annual mean NO_X concentrations for the Base Year, DM and DS scenarios.

Table 7.16: Annual mean NOx concentrations predicted along ecological transects in the Avon Gorge Woodlands SAC for the Base, Do-Minimum and Do-Something Scenarios

Avon Gorge SAC/SSSI Receptor	Type	Distance from the source* (m)	NO_X Concentration (µg m^{-3})				Magnitude of Change
			2015 Base	2021 DM	2021 DS	Change (DS - DM)	
R34	Road&Rail	25	32.2	24.3	24.2	-0.1	Negligible
R35	Road&Rail	59	24.6	18.1	18.1	0.0	Negligible
R36	Road&Rail	110	20.9	15.8	15.8	0.0	Negligible
R37	Road&Rail	158	19.8	15.0	15.0	0.0	Negligible
R38	Road&Rail	210	19.2	14.7	14.7	0.0	Negligible
R39	Road&Rail	193	25.8	19.3	19.4	0.1	Negligible
R40	Road&Rail	150	26.2	19.5	19.6	0.1	Negligible
R41	Road&Rail	100	26.4	19.7	19.8	0.1	Negligible
R42	Road&Rail	49	27.0	20.0	20.2	0.2	Negligible
R43	Road&Rail	19	27.6	20.5	20.8	0.3	Negligible

Annual mean NOx objective = 30 µg m^{-3}

*Distance measured from A369 for R34 to R38 and from the railway corridor for R39 to R43.

7.6.31 The results show that NO_X concentrations slightly increase with the DCO Scheme as a result of the additional train services on the Portbury Freight line. All changes in annual mean NO_X concentrations are expected to be negligible and the impact for annual mean NO_x concentrations drops off after 100 m.

7.6.32 The transect off the A369 (comprising receptors R34 to R38) was included to demonstrate that changes in road traffic emissions are imperceptible adjacent to the Avon Gorge SSSI/Avon Gorge Woodlands SAC. R34 to R38 show an imperceptible change in NO_X concentrations as they are situated far enough from the railway line to not be influenced by the DCO Scheme. The NO_x concentration at R34, furthest from the railway line, shows a small decrease in NO_x concentration with the DCO Scheme in place. In comparison, the influence of rail emissions on the transect along R39 to R43 leads to larger increases in NO_X concentrations but still below 0.3 µg m^{-3}. No exceedances of the 30 µg m^{-3} limit are predicted.

7.6.33 Table 7.17 shows the nitrogen deposition rates predicted for each scenario at the receptors along both transects extending into the Avon Gorge SSSI/Avon Gorge Woodlands SAC. Nitrogen deposition rates have been compared against critical loads, which are 15 to 20 N kg ha^{-1} yr^{-1} for the habitats within the Avon Gorge Woodlands SAC. The results indicate that nitrogen deposition rates exceed the critical load range at all receptors in all scenarios.

Table 7.17: Nitrogen deposition rates predicted at ecological receptors along transects into the Avon Gorge Woodlands SAC for the Base, Do-Minimum and Do-Something Scenarios

Avon Gorge SAC/SSSI Receptor	Type	Distance from the source* (m)	Nitrogen Deposition (N kg ha^{-1} yr^{-1})				Impact (%)
			Base (i.e. Baseline NO_2 Deposition Rate)	DM	DS	Impact Magnitude (DS-DM)	
R34	Road&Rail	25	29.7	28.6	28.6	0.0	0.0
R35	Road&Rail	59	29.7	28.8	28.8	0.0	0.0
R36	Road&Rail	110	29.7	28.8	28.8	0.0	0.0
R37	Road&Rail	158	29.7	28.9	28.9	0.0	0.0
R38	Road&Rail	210	29.7	28.9	28.9	0.0	0.0
R39	Road&Rail	193	29.7	28.6	28.6	0.0	0.0
R40	Road&Rail	150	29.7	28.6	28.6	0.0	0.0
R41	Road&Rail	100	29.7	28.6	28.6	0.0	0.0
R42	Road&Rail	49	29.7	28.6	28.6	0.0	0.0
R43	Road&Rail	19	29.7	28.6	28.7	0.1	0.0

Critical load for N deposition = 15 to 20 kg N ha^{-1} yr^{-1}

*Distance measured from the A369 for R34 to R38 and from the railway corridor for R39 to R43.

7.6.34 Predicted nitrogen deposition rates for all scenarios exceed the critical load range (15 to 20 N kg ha^{-1} yr^{-1}) for all habitats within the SAC in both Base and Opening Year. The impact of the DCO Scheme on Nitrogen deposition is small for all receptors with increases in deposition rates of up to 0.1 kg N kg ha^{-1} yr^{-1}. The largest change is predicted at the receptor (R43) closest to the railway line, consistent with the results reported for NO_X concentrations, and similarly as expected, drop off with distance.

7.6.35 The increase in nitrogen deposition as a result of the DCO Scheme is small. Further discussion on the implications of air quality on designated habitats is provided in the ES Chapter 9 Ecology and Biodiversity (DCO Document Reference 6.12) and in Appendix 9.12 HRA Report (DCO Document Reference 5.5) of the ES.

Regional Air Quality Assessment

7.6.36 The regional air quality assessment considers the change in Opening Year emissions resulting from the DCO Scheme, in recognition that emissions not only affect local air quality, but also have an impact at the regional, national and international scale. The Regional Air Quality Assessment considers NO_x, PM_{10} and CO_2 emissions from both road and rail transportation. The net impact is defined as

the sum of the changes in annual regional road and rail emissions resulting from the DCO Scheme.

Table 7.18: Changes in road and rail annual air quality and greenhouse gas emissions resulting from the DCO Scheme over the core regional study areas.

Regional Pollutant	Changes in Opening Year (2021) emissions
Road NO_x (kg/year)	**-465.9**
Rail NO_x (kg/year)	12,287
Net total NO_x (kg/year)	**+11,821**
Road PM_{10} (kg/year)	-59.1
Rail PM_{10} (kg/year)	406
Net total PM_{10} (kg/year)	**+340**
Road CO_2 (ton/year)	-266.1
Rail CO_2 (ton/year)	1,208
Net total CO_2 (ton/year)	**+942**

7.6.37 Table 7.18 shows the absolute changes in annual road, rail and net total NO_x and PM_{10} emissions over the core regional study area. The regional assessment predicts a decrease in NO_x and PM_{10} road emissions of -466 kg/year and -59 kg/year, respectively. However, any benefits are offset by increases in emissions from DMU trains. Overall, the DCO Scheme results in a net total increase in NO_x and PM_{10} emissions over the core regional study areas of 11,821 kg/year and 340 kg/year, respectively.

Greenhouse Gas Assessment

7.6.38 The overall absolute changes in opening year CO_2 emissions from road and rail sources, over the defined core regional study areas, are also compared in Table 7.18. This GHG assessment applies the same methodology for calculating road and rail emissions of CO_2 as the regional air quality assessment for PM_{10} and NO_x. Estimates of rail CO_2 are therefore also expected to be conservative based on the assumption of fixed future year emission factors.

7.6.39 As shown in Table 7.18, CO_2 emissions in the opening year of the DCO Scheme are predicted to increase overall by 942 tonnes/year compared with the DM. This is despite the scheme resulting in reductions in regional road CO_2 emissions of 267 tonnes/year. However, the magnitude of change is negligible on the national scale as it is only 0.003% of the total CO_2 emitted nationally from the transport sector, which is over 30,000 kilotonnes/year (NAEI, 2014).

Refinement of Regional Emission Impacts

7.6.40 A further refinement of regional emission estimates has been undertaken to examine whether the benefits of the DCO Scheme could have been under-valued

in the core assessment. Table 7.18 shows the absolute changes in NO_x, PM_{10} and CO_2 for a series of 6 refined emission calculations.

7.6.41 The net change in emissions (in Table 7.19) are calculated as the difference between increases in rail emission from just the new Portishead to Temple Meads train service and decreases in road emissions that result from shifts in transport mode onto this proposed branch of the train line. The reduction in road emissions is calculated using a vehicle kilometres approach (see Appendix 7.2 of the ES, DCO Document Reference 6.25). Note that the recalculation includes years 2021 and 2023 the revised opening year.

Table 7.19: Net change in refined regional emissions.

	NO_x: Road emissions (kg/year)	
NO_x: Rail emissions (kg/year)	***2021***	***2023***
Diesel (average conditions)	6699.7	6803.2
Hybrid (average conditions)	825.7	929.3
Hybrid w/ 20% reduction	452.2	555.8
	PM_{10}: Road emissions (kg/year)	
Rail PM_{10} emissions (kg/year)	***2021***	***2023***
Diesel (average conditions)	133.4	126.6
Hybrid (average conditions)	-108.1	-114.8
Hybrid w/ 20% reduction	-110.9	-117.6
	CO_2 Road emissions (tonnes/year)	
Rail CO_2 emissions (tonnes/year)	***2021***	***2023***
Diesel (average conditions)	268.9	247.0
Hybrid (average conditions)	116.6	94.7
Hybrid w/ 20% reduction	-5.2	-27.1

7.6.42 Using this approach and assuming existing diesel engines will be operated on the rail line in average running conditions, the net changes in NO_x, PM_{10} and CO_2 emissions are +6,699 kg/year, +133 kg/year and +269 tonnes/year, respectively for the year 2021. This approach therefore yields a smaller net increase (i.e. smaller disbenefit) in emissions than the core approach. The net increase in emissions is slightly larger for NO_x (larger disbenefit) and slightly smaller for PM_{10} and CO_2 (smaller disbenefit) when vehicle kilometres, speeds and emission factors representative of the year 2023 are applied. The rail emissions are assumed to be constant between the 2021 and 2023 scenarios. Note that road emissions were derived using the same version of the Emission Factor Toolkit applied in the core assessment. Whilst providing a consistent approach the results for road emissions are slightly pessimistic compared to results were the latest version to be applied.

7.6.43 Rail emissions increase as a result of the DCO Scheme. However, the implementation of modern technologies can reduce the magnitude of emission

increases. If diesel engines for example were to be replaced with hybrid technologies in average running conditions, the proposed Portishead to Temple Meads rail branch results in greatly reduced net increases in NO_x and CO_2 emissions of 826 kg/year and 117 tonnes/year, respectively, for the year 2021. There is a net decrease in PM_{10} emissions of 108 kg/year associated with the new rail line in 2021 when hybrid engines are used. Low levels of PM_{10} from hybrid engines are offset by relatively high levels of PM_{10} generated from road vehicles kilometres lost on the network.

7.6.44 The nature of the proposed line, with relatively low speed operation and frequent stops, could allow re-charging time and additional recovery of braking energy if hybrid engines are deployed. This would decrease reliance on the combustion engine and reduce rail emissions still further. The results in Table 7.19 show that a reduction in rail emissions of 20% from average hybrid running conditions, combined with year 2021 conditions for road emissions, would be required to achieve a net (road + rail) decrease in CO_2 emissions of 5.2 tonnes/year. However at 2023, the net benefit from the new proposed line is increased owing to a larger reduction in road based emissions. If such an efficiency increase is plausible, a 20% reduction would also reduce the net increase in NO_x emissions to 556 kg/year and would act to further increase the magnitude of the net decrease in PM_{10} emissions to -118 kg/year in 2023.

7.7 Mitigation and Residual Effects

7.7.1 In the absence of any predicted likely significant adverse effects, no further mitigation is proposed and the residual effects are as described above in Section 7.6.

7.8 Cumulative Effects

7.8.1 The methodology for assessing cumulative effects with other projects is set out in ES Chapter 18 In-combination and Cumulative Effects (DCO Document Reference 6.21). For the purposes of this chapter, the value, magnitude and sensitivities are as described in Section 7.3.

Other Schemes Incorporated into the Traffic Model

7.8.2 The air quality assessment for the operations phase takes account of the cumulative effect of air quality emissions from traffic generated from future committed development across Greater Bristol within the GBATS4 traffic model.

Other Schemes along the Portishead Branch Line

7.8.3 A list of other schemes in the vicinity of the Portishead Branch Line is provided in Appendix 18.1 and an assessment of the cumulative effects is presented in Appendix 18.2 (DCO Document Reference 6.25) of the ES. The location of these other schemes is shown in Figure 18.1 in the ES, Volume 3 Book of Figures (DCO Document Reference 6.24). The following paragraphs summarise the cumulative assessment of the DCO Scheme with those projects most likely to impact on air quality.

7.8.4 The National Grid Hinkley Point C Connection DCO project crosses the Portishead Branch Line DCO Scheme in the vicinity of Sheepway on the east side of Portishead. In the event that both schemes are constructed at the same time, there

is potential for cumulative effects in relation to the generation of construction dust. The application of dust control practices in the CEMP for both projects would help to mitigate dust generation and entrainment. The cumulative effect of both projects is assessed to be **neutral**.

7.8.5 There are a number of planning applications within both NSDC and BCC for new developments such as for new housing and mixed development, for example the application to NSDC reference 18/P/3591/OUT in respect of land off Old Mill Road in Portishead near Quays Avenue and BCC application reference 17/06559/FB for new housing on the Alderman Moores Allotments in Bristol. If these are constructed at the same time as the DCO Scheme there is potential for cumulative effects due to construction dust. Assuming that dust control practices are employed during construction; the cumulative effects are assessed to be **neutral**.

7.8.6 Two DCO applications have been posted on the Planning Inspectorate's website for power stations in Avonmouth, about 6 km north of Pill across the River Avon. These are the Avon Power Station and Seabank 3 Combined Cycle Gas Turbine. The programme for both projects has been delayed. As little is known about the power station projects and the programme is uncertain, an assessment of cumulative effects with these projects has not been undertaken.

Other Works for MetroWest Phase 1

Construction Phase

7.8.7 Other works for MetroWest Phase 1, namely the modifications to Parson Street Junction including Liberty Lane Sidings, Parson Street Station, Bedminster Down Relief Line and Bathampton Turnback comprise small scale works, confined within the existing railway land. These works will also be undertaken by Network Rail under their general permitted development rights and do not form part of the DCO Scheme. The works to facilitate an increased service on the Severn Beach / Avonmouth line have been undertaken by Network Rail under their permitted development rights as part of the Filton Four Track project although the new timetable has not been implemented.

7.8.8 The management and control process used by Network Rail for delivering projects that enhance or renew the operational railway is called Governance for Railway Investment Projects ("GRIP"). The GRIP process provides assurance that a project can successfully progress to the next stage and requires the preparation of reports for each GRIP stage. Environmental studies are undertaken as part of the GRIP process to identify potential issues and capture the need for mitigation during design and construction. The environmental reports are carried forward from options and feasibility design (GRIP 3 and 4), into the detailed design phase (GRIP 5) and construction (GRIP 6). In this way, environmental issues and mitigation measures are identified at an early stage and addressed through the design and construction phases. Consequently, while permitted development works do not require statutory environmental impact assessment, the GRIP process provides an internal, non-statutory environmental impact assessment process.

7.8.9 Given the small scale nature of these works and the distances between these projects and the Portishead Branch Line, it is considered that there are no significant cumulative effects during the construction of these projects on the air quality and dust.

Operation Phase

7.8.10 The DCO Scheme will result in increased services along the main line into Bristol Temple Meads with stops at Parson Street Station and Bedminster Station. The same approach used in the local air quality assessment for the DCO Scheme was used to assess the cumulative effects at worst-case receptors for Parson Street and Bedminster.

7.8.11 Table 7.20 shows worst case receptors in the vicinity of Parson Street and the locations are shown on Figure 7.3 Sheet 4 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24). Exceedances of the annual mean NO_2 are predicted only for the Base Year near Parson Street Junction, which is consistent with the BCC baseline NO_2 monitoring data for 2015 around Parson Street. This highlights the high baseline NO_2 around Parson Street Junction, in contrast with the assessment for Portishead and Pill.

Table 7.20: Modelled annual mean NO_2 and PM_{10} (µg m^{-3}) at worst case receptors between Parson Street Junction and Parson Street Station

Receptor ID	Type	NO_2 (µg m^{-3})					PM_{10} (µg m^{-3})				
		2015 Base	2021 DM	2021 DS	Impact	Impact magnitude	2015 Base	2021 DM	2021 DS	Impact	Impact magnitude
R48	Road &Rail	21.2	16.4	16.7	0.3	Negligible	14.3	13.6	13.6	0.0	Negligible
R49	Road &Rail	30.3	22.8	23.0	0.2	Negligible	15.4	14.5	14.5	0.0	Negligible
R50	Road &Rail	**40.9**	33.9	34.1	0.2	Negligible	15.8	15.0	15.0	0.0	Negligible
R51	Road &Rail	**41.1**	33.6	33.8	0.2	Negligible	15.7	14.8	14.8	0.0	Negligible
R52	Road &Rail	31.0	23.6	23.8	0.2	Negligible	15.2	14.3	14.3	0.0	Negligible
R53	Road &Rail	36.8	27.3	27.5	0.2	Negligible	15.8	14.7	14.7	0.0	Negligible
R54	Road &Rail	25.8	19.8	20.1	0.3	Negligible	14.6	13.8	13.8	0.0	Negligible
R55	Road &Rail	25.5	19.5	19.7	0.2	Negligible	14.6	13.8	13.8	0.0	Negligible
R62	Road &Rail	**48.4**	36.5	36.4	-0.1	Negligible	18.2	16.8	16.8	0.0	Negligible
R63	Road &Rail	**44.5**	34.4	34.3	-0.1	Negligible	17.7	16.5	16.5	0.0	Negligible
R65	Road &Rail	**40.6**	31.7	31.5	-0.2	Negligible	17.1	16.1	16.1	0.0	Negligible

Table 7.20: Modelled annual mean NO_2 and PM_{10} (µg m^{-3}) at worst case receptors between Parson Street Junction and Parson Street Station

Receptor ID	Type	NO_2 (µg m^{-3})					PM_{10} (µg m^{-3})				
		2015 Base	2021 DM	2021 DS	Impact	Impact magnitude	2015 Base	2021 DM	2021 DS	Impact	Impact magnitude
BCC_418	Road &Rail	**49.6**	35.2	35.3	0.1	Negligible	16.7	15.3	15.3	0.0	Negligible
BCC_419	Road &Rail	**53.1**	38.4	38.5	0.1	Negligible	17.9	16.3	16.3	0.0	Negligible

Type in bold indicates exceedances of the air quality standards

7.8.12 Passenger trains stopping at Parson Street Junction adjacent to receptors are likely to worsen the annual mean NO_2 owing to their proximity to this emission source. According to available scheme information, every train should stop at the station for 30 seconds. Both on this basis and extending this to 2 minutes (allowing for additional idling time), all NO_2 impacts at modelled receptor sites were predicted to be **negligible**, with concentrations in the DS scenario below the 40 µg m^{-3} limit.

7.8.13 Receptors R50 and R51 closest to the branch line have been considered in the modelling based on worst-case assumptions detailed in Appendix 7.2 (DCO Document Reference 6.25) of the ES. Opening Year DS NO_2 concentrations of 34.1 and 33.8 µg m^{-3} are predicted at receptors R50 and R51, respectively, which are located approximately 12 m from the railway. Concentrations at these receptors are the result of emissions from DMUs (including emissions during the trains approach to the station), together with background NO_2. The DCO Scheme was predicted to cause an increase in NO_2 concentration of 0.2 µg m^{-3} at these receptors. Other receptors R49 to R55, located within 30 m of the railway line, also undergo increases of 0.2 µg m^{-3}. The NO_2 impacts in these areas are predicted to be negligible.

7.8.14 The highest annual mean DS NO_2 concentration near Parson Street Station is predicted at R62 (36.4 µg m^{-3}), which is located at the junction of West Street and Palmyra Road. Concentrations on West Street are predominantly influenced by road traffic sources and are enhanced by street canyon effects. However, it is predicted that Opening Year concentrations will decrease on West Street by between 0.1 and 0.2 µg m^{-3} between the DM and DS scenario as a result of small reductions in predicted traffic. The NO_2 impacts on West Street are predicted to be negligible.

7.8.15 Opening Year NO_2 concentrations were modelled at monitoring sites 418 and 419 in order to assess the influence of the DCO Scheme at roadside locations. These sites were predicted to have DS concentrations of 35.3 µg m^{-3} and 38.5 µg m^{-3}, respectively, following an increase in annual mean NO_2 concentrations by 0.1 µg m^{-3} with the DCO Scheme. Therefore, the NO_2 impacts are also deemed to be **negligible** at these roadside monitoring locations.

7.8.16 Given that new exceedances are not being created and that the number of receptors within that distance of the Portishead Branch Line at Ashton Junction is low, it is not expected to lead to any significant impacts.

7.8.17 Modelled annual mean PM_{10} concentrations are below the annual mean objective at receptors in all scenarios. There is no change in PM_{10} concentrations predicted as a result of the DCO Scheme and the predicted impact on annual mean PM_{10} concentrations is therefore considered to be **negligible**. Daily mean PM_{10} concentrations were only exceeded twice (maximum across all receptors). Annual and daily mean PM_{10} concentration are therefore expected to be below the AQS objective.

7.8.18 Overall, the cumulative effects of the DCO Scheme at Parsons Street are considered to be **not significant.**

7.8.19 Table 7.21 shows the predicted total annual mean NO_2 and PM_{10} around Bedminster station and the proposed Bedminster Down Relief Line. The locations are shown on Figure 7.3 Sheet 4 in the ES Volume 3 Book of Figures (DCO Document Reference 6.24). The model included the new passenger service stopping at Bedminster Station, but did not include the idling of freight trains on the Bedminster Down Relief Line, which is expected to have a negligible impact on air quality, considering the low frequency of trains.

7.8.20 The nearest relevant receptors are at least 40 m away from the Bedminster Down Relief Line and modelled pollutant concentrations were low around Bedminster Station, a consequence of the lack of major pollutant sources in the vicinity. It was therefore considered that any short periods of freight train idling would not lead to any exceedances of the air quality objectives, and was therefore not considered further.

Table 7.21: Modelled mean NO_2 and PM_{10} (µg m^{-3}) at worst case receptors near Bedminster Station

Receptor ID	Type	NO_2 (µg m^{-3})					PM_{10} (µg m^{-3})				
		2015 Base	2021 DM	2021 DS	Impact	Impact magnitude	2015 Base	2021 DM	2021 DS	Impact	Impact magnitude
R57	Rail	22.6	17.7	17.8	0.1	Negligible	14.7	14.0	14.0	0.0	Negligible
R58	Rail	22.5	17.7	17.9	0.2	Negligible	14.7	14.0	14.1	0.1	Negligible
R59	Rail	22.2	17.6	18.0	0.4	Negligible	14.3	13.7	13.7	0.0	Negligible
R60	Road& Rail	25.1	19.9	20.1	0.2	Negligible	14.8	14.1	14.1	0.0	Negligible
R61	Road& Rail	22.7	17.9	18.0	0.1	Negligible	14.4	13.7	13.7	0.0	Negligible

7.8.21 The baseline concentrations of NO_2 and PM_{10} at most receptors are lower than at Parson Street Station and Junction; this agrees with baseline BCC air quality monitoring (see Section 7.4) and is mainly attributed to the lack of major road sources near to Bedminster Station, in contrast with Parson Street which is close to the A38.

7.8.22 There are no predicted exceedances of the annual mean objectives and impacts on annual mean NO_2 and PM_{10} are all **negligible**. Given annual mean concentrations are below the objective, concentrations are expected to meet the short term AQS objectives for both NO_2 and PM_{10} at Bedminster.

7.8.23 The DCO Scheme was not predicted to have any cumulative effects on receptor concentrations alongside the rail line between Bristol Temple Meads and Severn Beach stations.

7.8.24 Cumulative effects from the DCO Scheme on Bathampton Turnback are not expected owing to their geographical locations. Air quality impacts at Bath have therefore not been considered further in this assessment.

7.9 Limitations Encountered in Compiling the ES

7.9.1 There is a degree of uncertainty in the dispersion modelling predictions due to factors such as model error, uncertainties in model inputs including emissions data used, background concentrations and meteorological data. These uncertainties have been minimised by using the most relevant published data at the time of the assessment on emission factors and using the nearest and most representative meteorological station for the air quality modelling. There is a degree of uncertainty associated with the model algorithms used to represent physical and chemical atmospheric processes.

7.9.2 The delay to the Opening Year from 2021 to 2023 has the effect of making the assessment slightly more pessimistic in terms of absolute concentrations.

7.9.3 The findings from this assessment reflect outline forecasts obtained from the transport assessment. Adjustments and assumptions are made by the transport planners to allow for any difference in the years modelled in GBATS4 and the assessment years for the DCO Scheme, which contribute to uncertainty in future projections of traffic flows.

7.9.4 Detailed design and planning matters are still under development and likely to be integrated, including timetabling and choice of trains to be used. The assessment has assumed that all trains will be Class 166 with three carriages. These are the worst-case type of train in terms of available reported emission factors. Rail data are based on initial plans, are dependent on the design and future plans, and may be subject to change. However, a worst-case modelled scenario has been included in this assessment.

7.9.5 The construction dust assessment has been undertaken based on the railway Construction Strategy (DCO Document Reference 5.4), which is subject to change during detailed design and appointment of the construction contractor. The construction strategy is considered to be sufficiently broad, including reasonable worse case options, to facilitate assessment of the construction-related impacts.

7.10 Summary

7.10.1 The DCO Scheme has potential to cause air quality impacts during construction, operation and decommissioning. The impact assessment has considered impacts on local and regional air quality, and emissions of GHGs. Established guidance and professional judgement has been used to determine the significance of effects on sensitive receptors, including human receptors, designated ecological sites and global climate.

7.10.2 Some construction activities are likely to generate dust which has the potential to cause soiling at nearby properties and affect human health if uncontrolled. These effects will be mitigated through the implementation of BPM, secured through the

CoCP (DCO Document Reference 8.15) and Master CEMP (DCO Document Reference 8.14).

7.10.3 One of the DCO Scheme's supporting objectives is to contribute to managing traffic growth on the Portishead, Bath and Avonmouth, and Severn Beach arterial corridors. The new railway services are expected to reduce emissions per passenger kilometre travelled compared with equivalent road transport through modal shift from car to rail.

7.10.4 The overall operational impacts from rail and road traffic emissions were assessed. Annual mean NO_2 and PM_{10} were both predicted to be below 75% of the AQAL (40 µg m^{-3}) at all modelled receptors in Portishead and Pill in the DM scenario. The degree of harm to human health is likely to be small at exposures below the air quality objective. The largest predicted change in NO_2 concentration was a change of 1.2% of the AQAL for a residential property in Pill (R25) within 10 m of the existing railway line, where the DCO Scheme will result in additional rail services.

7.10.5 Annual mean NO_2 was predicted to be higher around Parson Street Junction and Bedminster, which are within the BCC AQMA but no exceedances are predicted in the Opening Year 2021 and the impact at all selected 'worse-case' receptors is classified as negligible. The impact results from the additional frequency of passenger trains. These moderate changes are approximately 1% of the AQAL for annual mean NO_2.

7.10.6 The modelled impacts on the Avon Gorge Woodlands SAC resulted in a small increase of less than 1 µg m^{-3} NO_x at the closest point to the DCO Scheme. Results show that NO_X concentration decreases with distance and is imperceptible at 100 m from the railway line. Similar impacts were observed for nitrogen deposition rates. These changes are regarded as not significant.

7.10.7 According to the core analysis, there would be an adverse impact on regional CO_2, NO_X and PM_{10} emissions from the DCO Scheme in the opening year. Further refinement of the regional emission calculations showed that adverse impacts on emissions are lessened when focussed on changes in rail and road emissions from just the new Portishead to Temple Meads rail line, where the greatest benefit from the DCO Scheme is expected to be focussed. Modernisation of the rail fleet would result in further lessening of adverse impacts on NO_x and CO_2 emissions and a net benefit in terms of PM_{10} emissions. Overall, the effects of the DCO Scheme on the local air quality are not significant in terms of the EIA Regulations 2017.

7.10.8 A summary of the effects of the DCO Scheme on air quality and GHGs is presented in Table 7.22.

Table 7.22: Summary of the assessment of the DCO Scheme on air quality and greenhouse gases

Aspect and control measures embedded in the DCO Scheme	Receptors	Impact	Environmental Mitigation	Residual Effects
Construction activities				
Raising dust during various activities: earthworks, storage of aggregate, tracking along dirt access road, etc. Emissions from construction plant and vehicles. Contractor to implement measures to suppress dust, minimise emissions from plant, and traffic management plans to reduce construction traffic to comply with the CoCP DCO Document Reference 8.15) and Master CEMP (DCO Document Reference 8.14).	Properties within 200 m of construction activities, including the railway, haul roads, construction compounds, and stations and car parks. Designated ecological sites within 50 m of the construction works. **Value: High**	Temporary increase in particulate matter in the air during construction phase, potentially causing soiling, affect human health and deposition on flora. NO_x and carbon contribute to global warming and climate change. **Magnitude of Risk: Low**	N/A	**Magnitude: Low adverse** **Significance for EIA legislation: Not significant**
Operation activities				
New service from Portishead to Pill.	Receptors such as residential properties and ecological sites within 200 m of the railway line.	New pollution source from DMUs leading to an increase in air pollutants alongside the railway line	N/A	**Magnitude: Negligible** **Significance for EIA legislation: Not significant**

Table 7.22: Summary of the assessment of the DCO Scheme on air quality and greenhouse gases

Aspect and control measures embedded in the DCO Scheme	Receptors	Impact	Environmental Mitigation	Residual Effects
No effective mitigation to reduce emissions from engines in the short term.	**Value: High**	and an increase in emissions of carbon. **Magnitude: Negligible**		
Cumulative Effects				
Construction dust, plant and vehicle emissions during construction works at Parson Street Junction, along the Bedminster Down Relief Line and Bathampton Turnback (see Table 5.1). Contractor to implement a CEMP to include measures to suppress dust, minimise emissions from plant, and traffic management plans to reduce construction traffic.	Sensitive receptors within 200 m of construction activities and along haul routes. Value: **High**	Dust nuisance likely to occur from time to time. Impacts are temporary. Emissions from plant and machinery are typically too low to affect compliance with air quality objectives and are very low in comparison to heavily trafficked roads such as the M5. The schemes are too far apart to cause a cumulative effect. NOx and carbon contribute to global warming and climate change. **Magnitude: Negligible**	N/A	**Magnitude: Negligible** **Significance for EIA legislation: Not significant**
Increased services along the Portbury Freight Line, Bedminster Down Relief	Residential properties and ecological sites	Increased carbon emissions and air pollution alongside the railway line where	N/A	**Magnitude: Negligible**

Table 7.22: Summary of the assessment of the DCO Scheme on air quality and greenhouse gases

Aspect and control measures embedded in the DCO Scheme	Receptors	Impact	Environmental Mitigation	Residual Effects
Line and Bristol to Bath Spa. No effective mitigation to reduce emissions from engines in the short term.	within 200 m of the railway line. Value: **High**	additional DMUs are introduced. **Magnitude: Negligible**		**Significance for EIA legislation: Not significant**
Modal shift from road to rail.	Receptors such as residential properties within 200 m of affected roads. **Value: High** Global effect for carbon. (No value placed on this.)	Change in road traffic pollutants and carbon emissions. Likely decrease in carbon. See ES Chapter 16 Transport, Access and Non-Motorised Users (DCO Document Reference 6.19) and the Transport Assessment in ES Appendix 16.1 (DCO Document Reference 6.25) on the results of the traffic modelling. **Magnitude: Negligible**		**Magnitude: Negligible** **Significance for EIA legislation: Not significant**

7.11 References

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7.12 Abbreviations

AADT	Annual Average Daily Traffic
APIS	Air Pollution Information System
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Areas
AQS	Air Quality Strategy
B&NES	Bath and North East Somerset Council
BCC	Bristol City Council
BPM	Best Practicable Means
CBED	Concentration Based Estimated Deposition
CEMP	Construction Environmental Management Plan
CO_2	Carbon dioxide
CO_{2e}	Carbon dioxide equivalent
CoCP	Code of Construction Practice
DCO	Development Consent Order
Defra	Department of Environment Food and Rural Affairs
DM	Do-Minimum
DMRB	Design Manual for Roads and Bridges
DMU	Diesel Multiple Unit
DS	Do-Something
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
EPUK	Environment Protection United Kingdom
ES	Environmental Statement
EU	European Union
GBATS4	Greater Bristol Area Transport Study (version) Four
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GRIP	Governance for Railway Investment Projects
HDV	Heavy duty vehicle
HGV	Heavy Goods Vehicle
HRA	Habitats Regulations Assessment
IAQM	Institute for Air Quality Management
IPCC	Intergovernmental Panel on Climate Change
JLTP3	Joint Local Transport Plan Three
JLTP4	Joint Local Transport Plan Four

LAQM	Local Air Quality Management
LDV	Light duty vehicle
PEI Report	Preliminary Environmental Information Report
PM10	Particulate Matter with a diameter <10 µm
NAEI	National Atmospheric Emissions Inventory
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NPPF	National Planning Policy Framework
NPSNN	National Policy Statement for National Networks
NSDC	North Somerset Council
NSIP	Nationally Significant Infrastructure Project
SAC	Special Area of Conservation
SoS	Secretary of State
SPA	Special Protection Area
SSSI	Sites of Special Scientific Interest
UNFCCC	United Nations Framework Convention on Climate Change