national highways

M60/M62/M66

Simister Island Interchange

Preliminary Environmental Information Report

Document Control

Project Manager:	Bernardo Begonha
Originator (Company):	Jacobs
Document Number:	HE548642-JAC-EGN-SII_MLT-RP-LE-0001
Rev Number:	P05
Date:	01/02/23
Document Status:	**S4** - SUITABLE FOR STAGED APPROVAL
Client Ref Number (PIN):	HE548642
PCF Stage:	3

Document history and status

Revision	Date	Description	By	Check	Review	Approved
P05	01/02/23	FINAL	MS	VB	VB	BB
P04	27/01/23	FINAL	MS	VB	VB	BB
P03	01/03/22	UPDATED FOR STATUTORY CONSULTATION	MS	VB	VB	BB
P02	15/12/21	FINAL VERSION	MS	VB	VB	HD
P01	14/12/21	FINAL VERSION	MS	VB	VB	HD

Preliminary Environmental Information Report

The Preliminary Environmental Information Report (PEIR) has been produced in PDF and digital formats. This document is the PDF format.

The digital PEIR presents the same project information in digital format. The digital PEIR can be accessed via the following link:

https://experience.arcgis.com/experience/5ab335c8f58948e78a9790093b375bcc

The digital PEIR can be viewed through internet web browsers on desktop computers, laptops, tablets and mobile phones. It is recommended that recent versions of the Google Chrome, Mozilla Firefox, Apple Safari or Microsoft Edge web browsers are used to view the digital PEIR.

Contents

Preliminary Environmental Information Report i
1. Introduction 1
1.1 Scheme overview 1
1.2 Purpose of this report 1
1.3 The applicant 1
1.4 Legislative and policy overview 2
1.5 Structure of this report 4
1.6 Next steps 5
2. The scheme 7
2.1 Need for the scheme 7
2.2 Scheme objectives 7
2.3 Scheme location 10
2.4 Scheme description 12
2.5 Construction 20
2.6 Operation and maintenance 30
2.7 Changes in traffic flows 31
2.8 Design uncertainty and limits of deviation 31
3. Assessment of alternatives 33
3.1 Introduction 33
3.2 Scheme history 33
3.3 Further scheme development 43
4. Consultation 47
4.1 Statutory consultation 47
4.2 Non-statutory engagement 47
5. Environmental assessment methodology 52
5.1 Environmental scoping 52
5.2 Surveys, predictive techniques and methods 56
5.3 General assessment assumptions and limitations 60
5.4 Mitigation and enhancement 60
5.5 Identifying potential effects 61
5.6 Significance criteria 61
5.7 Duplication of assessment 64
5.8 Residues and emissions 65
6. Air quality 66
6.1 Topic introduction 66
6.2 Stakeholder engagement 66

6.3 Legislative and policy framework 68
6.4 Assessment methodology 70
6.5 Assessment assumptions and limitations 73
6.6 Study area 74
6.7 Baseline conditions 75
6.8 Potential impacts 82
6.9 Design, mitigation and enhancement measures 83
6.10 Assessment of likely significant effects 84
7. Cultural heritage 88
7.1 Topic introduction 88
7.2 Stakeholder engagement 88
7.3 Legislative and policy framework 89
7.4 Assessment methodology 90
7.5 Assessment assumptions and limitations 91
7.6 Study area 92
7.7 Baseline conditions 93
7.8 Potential impacts 100
7.9 Design, mitigation and enhancement measures 102
7.10 Assessment of likely significant effects 105
8. Landscape and visual 113
8.1 Topic introduction 113
8.2 Stakeholder engagement 113
8.3 Legislative and policy framework 116
8.4 Assessment methodology 117
8.5 Assessment assumptions and limitations 122
8.6 Study area 124
8.7 Baseline conditions 124
8.8 Potential impacts 137
8.9 Design, mitigation and enhancement measures 138
8.10 Assessment of likely significant effects 140
9. Biodiversity 155
9.1 Topic introduction 155
9.2 Stakeholder engagement 155
9.3 Legislative and policy framework 157
9.4 Assessment methodology 158
9.5 Assessment assumptions and limitations 159
9.6 Study area 160

9.7 Baseline conditions 162
9.8 Potential impacts 180
9.9 Design, mitigation, and enhancement measures 182
9.10 Assessment of likely significant effects 187
10. Geology and soils 220
10.1 Topic introduction 220
10.2 Stakeholder engagement 220
10.3 Legislative and policy framework 223
10.4 Assessment methodology 224
10.5 Assessment assumptions and limitations 224
10.6 Study area 225
10.7 Baseline conditions 225
10.8 Potential impacts 234
10.9 Design, mitigation and enhancement measures 236
10.10 Assessment of likely significant effects 237
11. Material assets and waste 241
11.1 Topic introduction 241
11.2 Stakeholder engagement 241
11.3 Legislative and policy framework 243
11.4 Assessment methodology 243
11.5 Assessment assumptions and limitations 247
11.6 Study area 248
11.7 Baseline conditions 250
11.8 Potential impacts 264
11.9 Design, mitigation and enhancement measures 268
11.10 Assessment of likely significant effects 274
12. Noise and Vibration 277
12.1 Topic introduction 277
12.2 Stakeholder engagement 277
12.3 Legislative and policy framework 283
12.4 Assessment methodology 284
12.5 Assessment assumptions and limitations 285
12.6 Study area 286
12.7 Baseline conditions 287
12.8 Potential impacts 291
12.9 Design, mitigation and enhancement measures 292
12.10 Assessment of likely significant effects 294

13. Population and human health 303
13.1 Topic introduction 303
13.2 Stakeholder engagement 304
13.3 Legislative and policy framework 305
13.4 Assessment methodology 306
13.5 Assessment assumptions and limitations 309
13.6 Study area 310
13.7 Baseline conditions 311
13.8 Potential impacts 329
13.9 Design, mitigation and enhancement measures 332
13.10 Assessment of likely significant effects 334
14. Road drainage and the water environment 359
14.1 Topic introduction 359
14.2 Stakeholder engagement 360
14.3 Legislative and policy framework 364
14.4 Assessment methodology 365
14.5 Assessment assumptions and limitations 369
14.6 Study area 372
14.7 Baseline conditions 373
14.8 Potential impacts 410
14.9 Design, mitigation and enhancement measures 418
14.10 Assessment of likely significant effects 425
15. Climate 432
15.1 Topic introduction 432
15.2 Stakeholder engagement 433
15.3 Legislative and policy framework 434
15.4 Assessment methodology 437
15.5 Assessment assumptions and limitations 440
15.6 Study area 443
15.7 Baseline conditions 444
15.8 Potential impacts 453
15.9 Design, mitigation and enhancement measures 460
15.10 Assessment of likely significant effects 463
16. Assessment of cumulative effects 469
16.1 Topic introduction 469
16.2 Stakeholder engagement 470
16.3 Legislative and policy framework 472

16.4 Assessment methodology 473
16.5 Assessment assumptions and limitations 484
16.6 Assessment of likely significant effects 484
16.7 Mitigation 485
17. Summary 486
17.1 Summary of likely significant effects 486
17.2 Next steps of the EIA 488
Acronyms 490
Glossary 496
References 509
Appendix 1.1. Legislation and policy 532
1.1 Consenting regime 532
1.2 Legislation for environmental aspects 532
1.3 National policy context 534
1.4 Local planning policy 539
1.5 Other 553
Appendix 1.2. Figures 554
Appendix 5.1. Major accidents and disasters 651
1.1 Introduction 651
1.2 Methodology 651
1.3 Screening and scoping 653
Appendix 5.2. Assessment criteria 657
1.1 Sensitivity criteria 657
1.2 Magnitude criteria 673
Appendix 6.1. Air quality assessment methodology 686
1.1 Air quality dispersion modelling process 686
1.2 Air quality model verification and adjustment 691
1.3 Air quality monitoring annualisation and bias-adjustment 692
1.4 Air quality modelled receptors 710
Appendix 6.2. Air quality assessment results 713
1.1 Human health assessment results 713
1.2 Ecological assessment results 739
1.3 PCM compliance results 785
Appendix 12.1. Baseline Noise Survey Results 792
1.1 Introduction 792
1.2 Methodology 792
1.3 Measurement results 795

Annex A. Graphs **806**
Appendix 12.2. Construction Noise and Vibration **812**
1.1 Introduction 812
1.2 Construction baseline 812
1.3 Construction activities by location 813
1.4 Construction plant 815
Appendix 14.1. Water Framework Directive (WFD) Regulations Assessment **823**
1.1 Purpose of the Report 823
1.2 Background 823
1.3 The Proposed Scheme 823
1.4 Methodology 824
1.5 Water Body Existing Status 825
1.6 Screening of Proposed Scheme Components 830
1.7 Scoping of Water Body Elements 833
1.8 Impact Assessment 834
1.9 Conclusions 841
Appendix 14.2. Preliminary Water Quality Assessment Report **842**
Executive Summary **842**
1. Introduction **844**
1.1 Background and context 844
1.2 Purpose of assessment 844
2. Assessment methodology and approach **845**
2.1 Introduction 845
2.2 Routine runoff – simple level assessment 846
2.3 Routine runoff – detailed level assessment 848
2.4 Spillage risk 848
2.5 Assessing the need for mitigation 849
2.6 Approach to assessment 850
3. Assessment results **855**
3.1 Introduction 855
3.2 Existing situation assessment results 855
3.3 Proposed Scheme assessment results 857
3.4 Embedded mitigation 861
3.5 Routine runoff: ‘detailed’ level assessment – M-BAT results 865
4. Spillage risk **868**
4.1 Assessment results 868
5. Significance of effects **869**

5.1 Assessment criteria 869
5.2 Significance with embedded mitigation 870
5.3 Essential mitigation 872
6. Conclusions 873
Annex A. Methodology 874
Annex B. Data summary 880
Annex C. Site visit photographs 886
Annex D. PCF Stage 2 Water Quality Sampling Data 891
Annex E. HR Wallingford HydroSolutions Ltd Q_{95} Report (selected pages) 892
Appendix 14.3. Groundwater Dependent Terrestrial Ecosystems (GWDTE) Assessment 906
1.1 Introduction 906
1.2 Assessment Methodology 907
1.3 Site Specific GWDTE Assessments 911
1.4 Summary of Effects 933
Appendix 14.4. Preliminary Flood Risk Assessment 934
1.1 Introduction 934
1.2 Scheme and Location 935
1.3 Methodology 936
1.4 Flood Risk Policy and Guidance 938
1.5 Climate Change 943
1.6 Assessment of Flood Risk to the Proposed Scheme 944
1.7 Flood Risk from the Development 960
1.8 Residual Risks 962
1.9 Summary and Conclusion 962
Appendix 16.1. Long list of other developments 964
Appendix 16.2. Shortlist of other developments 983

1. Introduction

1.1 Scheme overview

1.1.1 The M60/M62/M66 Simister Island Interchange Scheme (the 'Proposed Scheme') comprises improvements to the M60 Junction (J)18 interchange (also known as Simister Island), and widening the M60 carriageway between J17 and J18 to five lanes and a discontinuous hard shoulder.

1.1.2 The proposed junction improvement works are located at M60 J18 (Simister Island), north of Manchester (National Grid Reference (NGR) SD 82825 05937) (Figure 1.1).

1.1.3 The main objectives of the Proposed Scheme are to:

- Improve the journey experience for users of this section of network by:
  - Reducing peak congestion and faster average speeds
  - Reducing journey times
  - Delivering more reliable journey times
- Provide a scheme which is safe for all road users
- Minimise the impact of our scheme on the surrounding environment including within Noise Important Areas (NIAs) and Air Quality Management Areas (AQMAs)
- Facilitate future economic growth across the Greater Manchester area and support delivery of proposed development sites close to the M60 and M66

1.2 Purpose of this report

1.2.1 This is the Preliminary Environmental Information Report (PEIR) for the Proposed Scheme, which has been produced to support the statutory consultation. The PEIR includes environmental information to enable consultees to understand the likely significant environmental effects of the Proposed Scheme based on the preliminary environmental information available at the time, and measures proposed to mitigate such effects, to help inform their consultation responses.

1.2.2 This PEIR forms part of the consultation material provided for the statutory consultation process under the Planning Act 2008. Further details on the statutory consultation process are provided in Chapter 4: Consultation.

1.2.3 This PEIR has been prepared in line with guidance provided in Advice Note Seven: Environmental Impact Assessment: Preliminary Environmental Information, Screening and Scoping (Planning Inspectorate, 2020).

1.3 The applicant

1.3.1 National Highways is the developer of the Proposed Scheme. National Highways is a Government-owned company which plans, designs, builds, operates and maintains England's motorways and major A-roads, known as the strategic road network (SRN).

1.4 Legislative and policy overview

Development Consent Order

1.4.1 The Proposed Scheme would involve improvement of a highway which is wholly in England and where National Highways is the highway authority. The improvement is likely to have a significant effect on the environment. The Proposed Scheme is therefore classed as a Nationally Significant Infrastructure Project (NSIP) under the Planning Act (2008), triggering the need to apply for a Development Consent Order (DCO).

1.4.2 The Proposed Scheme is currently in the pre-application stage of the DCO process. This involves developing the design and undertaking all necessary assessment and consultation before submitting the DCO application. See Section 1.6 for more information on the next steps of the DCO process.

Environmental Impact Assessment

1.4.3 The Proposed Scheme falls under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations'). It falls under Schedule 2, Section 10f, infrastructure projects, construction of roads unless included in Schedule 1. The selection criteria in Schedule 3 of the EIA Regulations have been used to screen the Proposed Scheme and have identified the potential for significant effects. The Proposed Scheme therefore requires a statutory Environmental Impact Assessment (EIA) to support the DCO application.

1.4.4 An Environmental Scoping Report was submitted to the Planning Inspectorate on 2 July 2021 (Highways England, 2021), who in turn provided a Scoping Opinion on 12 August 2021 (Planning Inspectorate, 2021) agreeing on the scope of the EIA (see Section 5.1 of Chapter 5: Environmental assessment methodology, for more information). Links to these documents are provided in Section 5.1 of this report.

1.4.5 The results of the EIA will be documented in an Environmental Statement, which will be submitted as part of the DCO application.

1.4.6 This PEIR has been produced in advance of the Environmental Statement, for the statutory consultation, to provide preliminary information on the likely significant effects and proposed mitigation for the Proposed Scheme.

National Policy Statement for National Networks

1.4.7 Section 104 of the Planning Act 2008 requires applications to be decided in accordance with the relevant National Policy Statement. The National Policy Statement for National Networks (NPS NN) (Department for Transport (DfT), 2014) sets out principles by which applications for road and rail schemes should be assessed. Paragraph 4.3 of the NPS NN states:

'In considering any proposed development and in particular when weighing its adverse impacts against its benefits, the Examining Authority and the Secretary of State should take into account:

- *Its potential benefits including the facilitation of economic development, including job creation, housing and environmental improvement, and any long-term or wider benefits;*
- *Its potential adverse impacts, including any longer-term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.'*

1.4.8 The Proposed Scheme will be assessed against the policies outlined in the NPS NN. Each environmental aspect chapter in the Environmental Statement will set out the key NPS NN policies relevant to the aspect and highlight the extent to which the Proposed Scheme meets these requirements.

National Planning Policy Framework

1.4.9 The National Planning Policy Framework (NPPF), originally published by the Ministry of Housing, Communities and Local Government (MHCLG) (now the Department for Levelling Up, Housing and Communities (DLUHC)) in 2012 and last revised in July 2021 (MHCLG, 2021), sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced.

1.4.10 Paragraph 5 of the NPPF states that the NPPF does not contain specific policies for nationally significant infrastructure projects. These are determined in accordance with the decision-making framework in the Planning Act 2008 (as amended) and relevant national policy statements for major infrastructure, as well as any other matters that are relevant (which may include the NPPF).

National Highways' Licence, Plans and Strategies

Licence 2015

1.4.11 National Highways is a Government company that operates under a licence granted by the Secretary of State in April 2015 to Highways England (now National Highways). The licence (Department for Transport (DfT), 2015) sets out the Secretary of State's statutory directions and guidance to National Highways and includes duties with regards to the environment and sustainable development and design.

Delivery Plan 2020-2025

1.4.12 The Delivery Plan 2020-2025 (Highways England, 2020) sets out in detail how National Highways will deliver its strategic outcomes and measure success. The Delivery Plan gives details of specific funding, activities and projects it will deliver over the five years of the plan. It includes a reduction of National Highways' carbon emissions, supporting the Government's ambition to achieve net zero carbon emissions by 2050, improving noise mitigation, and committing to no net loss of biodiversity across National Highways' activities by 2025 and a net gain in biodiversity by 2040.

Net Zero Highways: Our 2030 / 2040 / 2050 Plan

1.4.13 The Net Zero Highways: Our 2030 / 2040 / 2050 Plan (National Highways, 2021) (the 'Net Zero Highways Plan') sets out a road map to decarbonise highway emissions by

2050, including from corporate activities (net zero by 2030), construction and maintenance (net zero by 2040), and road users (net zero by 2050).

Biodiversity Plan 2015

1.4.14 The Biodiversity Plan (Highways England, 2015) aims to halt the decline in the vitality of habitats and plant and animal populations on and around the road network. The Biodiversity Plan contains five key outcomes, with a range of actions designed to achieve these outcomes.

Air Quality Strategy 2017

1.4.15 The Air Quality Strategy (Highways England, 2017a) outlines National Highways' strategy to improve air quality on the SRN to deliver a cleaner network and improve the health of its neighbours and customers. The strategy includes four areas of action to improve air quality: policy; planning; monitoring; and operational management.

Environment Strategy 2017

1.4.16 The Environment Strategy (Highways England, 2017b) outlines National Highways' approach to improving the environment particularly with respect to noise, air quality, biodiversity, landscape, water quality, flooding and cultural heritage.

Sustainable Development Strategy 2017

1.4.17 The Sustainable Development Strategy (Highways England, 2017c) is designed to communicate the National Highway's approach and priorities for sustainable development to its key stakeholders. National Highways is keen to ensure its action in the future will further reduce the impact of its activities, seeking a long-term and sustainable benefit to the environment and the communities it serves.

Local planning policy

1.4.18 Local planning authorities are key consultees throughout the DCO process. They will typically produce Local Impact Reports during the DCO examination giving details of the likely impact of the Proposed Scheme on the authority's area (or any part of that area), which must be taken into account by the Examining Authority and Secretary of State.

1.4.19 Details of the local planning policies relevant to the Proposed Scheme are included in Appendix 1.1.

1.4.20 Although local planning policy is considered, National Policy Statements (NPS) are the sole policy on which NSIPs are determined. If there is any conflict between a designated NPS and any local planning document, the policies in the NPS will prevail (Planning Inspectorate, 2015).

1.5 Structure of this report

1.5.1 The environmental aspects covered in this PEIR include those within the EIA Regulations and the Design Manual for Roads and Bridges (DMRB). The relationship

between DMRB and EIA is provided in Section 5.2 of Chapter 5: Environmental assessment methodology. The structure of this report is set out in Table 1.1.

1.5.2 A separate Non-Technical Summary (NTS) for the PEIR has been produced to support the statutory consultation. The NTS presents the information in the PEIR in non-technical language which can be understood by a wider audience.

1.5.3 This report has been issued in two formats, PDF and as a digital report. The text in the two reports is the same. Appendix 1.2 of the PDF format includes the drawings whereas the drawings automatically appear opposite the relevant text in the digital report and therefore there is no requirement for a separate appendix.

Table 1.1: Structure of the PEIR

Chapter	Contents
1. Introduction	Provides an overview of the Proposed Scheme and the purpose of this report.
2. The scheme	Provides a statement on the need for the Proposed Scheme, sets out the objectives for the Proposed Scheme, and provides a description of the Proposed Scheme location and design.
3. Assessment of alternatives	Provides a summary of the development of the Proposed Scheme and the various options considered during the design process. Also includes consideration of how the environmental assessment has influenced the option selection process and design development.
4. Consultation	Provides a summary of the consultation with stakeholders undertaken to date in relation to the options selection, public engagement events, and the EIA, and consultation strategy going forward.
5. Environmental assessment methodology	Provides an overview of the environmental assessment methodology, including significance criteria and surveys and predictive techniques.
6-15. Aspect chapters	There is a chapter for each environmental aspect. Each sets out the assessment methodology, study area used, and baseline environmental conditions. Each chapter also describes the potential impacts, likely significant effects, and proposed mitigation.
16. Assessment of cumulative effects	Provides a summary of how the cumulative effects assessment will be undertaken and presents a preliminary long list and shortlist of other developments and combined effects matrix that will be included in the assessment.
17. Summary	Summarises the likely significant effects and proposed mitigation from the PEIR assessment.
Acronyms, glossary, references	Description of acronyms, definitions of technical terms, and a reference list of document sources.
Appendices	Figures and supporting information are provided in the appendices.

1.6 Next steps

1.6.1 A public consultation will take place in early 2023. National Highways welcomes comments from stakeholders on the Proposed Scheme and the environmental information provided in this PEIR. Consultation documents, including response forms, can be found on the National Highways webpage: www.nationalhighways.co.uk/M60-Simister-Island.

1.6.2 Once the consultation has closed, all suggestions and comments received during the consultation will be reviewed. All feedback will be considered when making further refinements to the proposed design and developing planned mitigation measures. A summary of the responses and how the Proposed Scheme has been informed and influenced by them will be provided in a consultation report. This will form part of the DCO application and will also be available to the public following submission of the application.

1.6.3 The DCO application will be made to the Planning Inspectorate, who will examine the application. The examination process is likely to involve public hearings. Following the examination, the Planning Inspectorate will make a recommendation to the Secretary of State for Transport, who will decide whether development consent should be granted or refused for the Proposed Scheme. The DCO application is planned to be submitted in 2023 and, if approved, construction is anticipated to start in 2025 and run for three years. All dates will be confirmed in the Environmental Statement.

2. The scheme

2.1 Need for the scheme

2.1.1 The M60 J18 provides the interchange between the M60, M62 and M66 motorways to the north of Manchester, and was identified within the Route Based Strategy (RBS) Evidence Report (Highways Agency, 2014) as a key junction capacity issue on the SRN. Congestion, delays, high usage, and a high accident rate have been identified as issues with the junction and surrounding routes.

2.1.2 The M60, M62 and M66 motorways connect important economic areas within Greater Manchester and Lancashire, and also facilitate a connection to Leeds, another important economic area. The M60 J18 links the Greater Manchester orbital motorway with Rossendale and Burnley to the north, and Rochdale and Leeds to the east. There are several significant employment areas accessed from the M60 J18, including Manchester's city centre and central business district, Bury Town Centre, Heaton Park and the Pilsworth Road industrial estate.

2.1.3 In addition, significant developments are proposed in the vicinity of M62 Junction 19 (M62 J19) (part of the proposed Northern Gateway development), in South Heywood. These are likely to involve increases in both employment and residential opportunities. As M60 J18 is approximately 2km away from this proposed development, it will be important to consider the impact of traffic growth associated with these developments. Further to this, any further traffic growth on the SRN generated as a result of the M60/M62 Smart Motorways project is likely to increase traffic at this interchange. This future increase in traffic has been incorporated into the traffic model.

2.1.4 Significant road developments and improvements are also proposed as part of the Manchester North-West Quadrant (MNWQ) scheme, which covers Junctions 8-18 of the M60. If the capacity constraints on the northern section of the M60 / M62 are not addressed, its impact on the wider transport network in the north could hold back growth across the region. Some of the busiest stretches of road outside the M25 are located between Junctions 8-18 of the M60, and the combination of local and strategic traffic, coupled with the design of the road, further exacerbates congestion and environmental problems.

2.1.5 Within the Greater Manchester City Region, it has been predicted there will be over 55,000 additional homes and 50,000 additional jobs by 2031. It is anticipated that these will impact on both the M60 and M62, leading to extra pressure on the M60 J18.

2.2 Scheme objectives

2.2.1 The Strategic Outline Business Case (SOBC), produced at PCF Stage 0 (Strategy, Shaping and Prioritisation) by Highways England in January 2016, identified the following scheme objectives:

- Contribute to economic growth
- Improve the operation and efficiency of the existing transport network
- Support employment and residential development opportunities

- Deliver capacity enhancements to the SRN whilst supporting the use of sustainable modes of transport and reducing the existing impact of the junction on the wider environment
- Improve connectivity and community cohesion

2.2.2 The Road Investment Strategy 2 (RIS2) (Department for Transport (DfT), 2020) has an ambition to develop a greener network, specifically through:

- *'The majority of all vehicles using the SRN, including almost all cars and vans, are zero emission at the tailpipe, transforming the impact of the SRN on air quality and carbon emissions.*
- *The SRN makes extensive and effective use of environmentally and visually sensitive 'green infrastructure', modern materials and careful planting, including trees. Together, these minimise and mitigate the air, light, noise, visual, and water quality impacts of the SRN on those living or working near to it, and sustain habitats and enhance biodiversity.*
- *Enhancements to the network create roads that fit with their surroundings and which keep negative consequences to a minimum. In particular they employ high standards of design, responding to place-specific issues and in keeping with the natural, built and historic environment.'*

2.2.3 RIS2 also sets Key Performance Indicators, including an environmental component, which the Proposed Scheme will aim to contribute towards. These indicators are set out below:

- Improving safety for all
- Providing fast and reliable journeys
- A well maintained and resilient network
- Delivering better environmental outcomes
- Meeting the needs of all road users
- Achieving efficient delivery

2.2.4 The Proposed Scheme design will be in accordance with National Highways' 10 principles of good design published in The Road to Good Design (Highways England, 2018) to support their aspirations for a network that responds better to both people and places through improved design processes. These promote environmentally sustainable design that fits in context, while making roads safe, useful and understandable. The 10 principles state that good design:

- Makes roads safe and useful
- Is inclusive
- Makes roads understandable
- Fits in context
- Is restrained
- Is environmentally sustainable
- Is thorough

- Is innovative
- Is collaborative
- Is long-lasting

2.2.5 The Proposed Scheme also will be in accordance with the requirements of GG 103 Introduction and General Requirements for Sustainable Development and Design (Highways England, Revision 0, 2019). This document describes how sustainable development and good road design can be applied to the design of motorway and all-purpose trunk roads.

2.2.6 The Proposed Scheme will be in accordance with LD 117 Landscape Design (Highways England, Revision 0, 2020a) which considers the landscape in more detail in relation to good design of roads. The Proposed Scheme also will be in accordance with LA 104 Environmental Assessment and Monitoring (Highways England, Revision 1, 2020b), paragraph 3.23 which covers the mitigation hierarchy of avoid, reduce then remediate.

2.2.7 DMRB LD 117 Section 3, Design Objectives, describes the design strategy for good road design through demonstrating an approach to:

1. *'protection and enhancement of the local environment;*
2. *sensitivity to the local context - its numerous, and sometimes complex combinations of landscape elements of fields, heathland, hedges, lanes, settlements and woodland;*
3. *interest by creating a sequence of attractive views, extending views along the road or maintaining existing views;*
4. *integration of footpaths, bridleways, and side roads into the landscape to minimise severance;*
5. *integration of roadside barriers, fences and walls with their surroundings;*
6. *structure designs to be slender and unobtrusive, respecting the local landscape character;*
7. *assessment of tranquility and its importance to the local context and/or wildness;*
8. *sensitivity to and respectful of 'dark skies' areas, minimising adverse environmental impacts and intrusion caused by lighting;*
9. *reflection and integration of the surrounding pattern and species grouping in any new planting;*
10. *reflection and integration of enhancement opportunities to biodiversity;*
11. *safeguarding individual trees/woodland as well as ecological interests; and*
12. *protection and enhancement of the surrounding historic environment'.*

2.2.8 The scheme-specific design principles below have been identified in relation to the environmental design:

- Retain as much existing vegetation as feasible, including where it provides important visual screening or forms part of the landscape structure. Where

vegetation loss is unavoidable, and where practicable, replace and extend areas of proposed planting into the landscape to provide visual screening.

- Maximise biodiversity gain throughout the Proposed Scheme and improve wildlife connectivity by incorporating linear habitats such as hedgerows and lines of trees, linking with retained woodland and hedgerows where possible.
- Reinforce the landscape character and pattern, and biodiversity, by planting native tree and hedge species typically found within the surrounding local landscape.
- Aim to limit the overall area of the Proposed Scheme design as much as possible, including when considering the design and location of drainage ponds.
- Integrate drainage and earthworks sensitively into the surrounding landscape and plan appropriate planting around the features.
- Careful design of structures, signage and gantries to help integrate these into the wider landscape.
- Sensitive design of attenuation ponds, to integrate these features into the landscape and provide greater biodiversity enhancement.
- Improve the quality and capacity of existing walking, cycling and horse-riding (WCH) infrastructure, and provide visual interest for local residents, users of public rights of way (PRoW) and public open space.

2.3 Scheme location

2.3.1 The proposed junction improvement works are located at M60 J18 (Simister Island), north of Manchester (NGR SD 82825 05937) as shown in Figure 1.1. The Proposed Scheme extents fall within the administrative boundary of Bury Metropolitan Borough Council (BMBC) and is close to Rochdale Borough Council (RBC), Salford City Council (SCC) Manchester City Council (MCC) and Oldham Metropolitan Borough Council (OMBC). Local Planning Authority (LPA) boundaries are shown in Figure 1.1.

2.3.2 It should be noted that the junction is situated on more than one motorway and as a result has two junction numbers: M60 J18 and M66 J4. For the purpose of this project and therefore this report, the junction is referred to as M60 J18.

2.3.3 M60 J18 provides the interchange between the M60, M62 and M66 motorways. The Proposed Scheme encompasses the following motorways and slip roads:

- M60 between J17 – J18, in eastbound and westbound directions
- M60 between J18 – J19, southbound and northbound, partly
- M60 J17, including the eastbound and westbound entry and exit slip roads
- M60 J18, including all entry and exit slip roads to and from the M60, M62 and M66 motorways
- M66 motorway from the M60 J18 (M66 J4) to M66 J3, partly

2.3.4 The Proposed Scheme is situated between several urban areas and settlements including Whitefield, Prestwich, Simister and Middleton. The Proposed Scheme is situated in an urban fringe landscape, with urban settlements to the west, north and

south of the Proposed Scheme and predominantly low-lying Grade 3/4 agricultural land to the east. The majority of the Proposed Scheme location falls within the Green Belt boundary.

2.3.5 Key environmental constraints figures have been produced for each environment aspect assessed in the PEIR. These environmental constraints figures appear alongside the text in the respective aspect chapters of the digital version of the PEIR and are provided in Appendix 1.2 of the PDF version of the PEIR.

2.3.6 Key environmental designations and features close to the Proposed Scheme include Philips Park Local Nature Reserve (LNR) and Ancient Woodland Inventory (AWI) site, Hollins Vale LNR, Mere Clough LNR and AWI site, North Wood AWI site, Prestwich Country Park, and Heaton Park Registered Park and Garden. In addition, there are nine Sites of Biological Interest (SBI) located within 1km of the Proposed Scheme.

2.3.7 There are no Main Rivers crossed by the Proposed Scheme. However, there are numerous Main Rivers and surface watercourses within 1km of the Proposed Scheme. There are several ponds located adjacent to the provisional Order Limits at Egypt Farm and Pike Fold Golf Club.

2.3.8 Six drainage catchments and corresponding outfalls have been identified as potentially receiving runoff from the existing carriageways within the provisional Order Limits.

2.3.9 Haweswater Aqueduct underbridge is located 300m west of M60 J18. This aqueduct supplies most of Greater Manchester's population with their daily water supply.

2.3.10 The Proposed Scheme is located within an Air Quality Management Area (AQMA) and there are several Noise Important Areas (NIAs) covering M60 J17 and J18 and sections of the adjacent motorways.

2.3.11 There are 25 routes which intersect or are in very close proximity to the provisional Order Limits which are used by walkers, cyclist and in some instances, horse riders. There are also eight open greenspaces (including community facilities such as playing fields and golf courses) located within or immediately adjacent to the provisional Order Limits (see Chapter 13: Population and Human Health for further details).

2.3.12 There are several development proposals within or close to (up to 2km) the provisional Order Limits that have been considered during the project development. A full list of committed development has been produced for the cumulative effects assessment, as set out in Chapter 16: Assessment of cumulative effects.

2.3.13 Other committed developments included in the Proposed Scheme traffic model are shown in the Traffic Modelling Report for Consultation (National Highways, 2022).

2.3.14 There are several development land allocations identified in the Places for Everyone Plan (Greater Manchester Combined Authority (GMCA), 2021). Major housing allocations of between 1,200 to 1,550 homes at Heywood and Pilsworth and Simister and Bowlee fall partly within the provisional Order Limits. The plan is expected to be adopted by the end of 2023.

2.4 Scheme description

Highway alignment

2.4.1 Table 2.1 summarises the elements/sections of the Proposed Scheme (these elements are also shown on Figure 2.1).

Table 2.1: Proposed Scheme elements/sections

Element/section	Description	Alteration of existing alignment or new element
M60 Mainline J17-J18	Widening of the M60 carriageway between Junction 17 and 18 from four lanes to five lanes in both directions and installation of a discontinuous hard shoulder	Alteration of existing alignment
M66/M60 Mainline	Widening of the M66 southbound through M60 J18 from two lanes to four lanes	Alteration of existing alignment
Northern Loop (M60 eastbound to M60 southbound free flow link)	A new loop structure (the 'Northern Loop') to provide a new free-flow link from the M60 eastbound to the M60 southbound.	New element. This element would be mainly on an embankment
M66 southbound diverge	Realignment of the M66 southbound diverge slip road to M60 J18 to accommodate the Northern Loop structure, including a new overbridge where the slip road crosses the Northern Loop and realignment of the left turn lane to the M62 eastbound	Alteration of existing alignment. This element would be on an embankment
M60 eastbound to M66 northbound free flow link	The existing one lane free flow link would be retained. The alignment of the approach to the free flow link would change as the M60 eastbound off-slip to the J18 circulatory will be closed for use by the public. Access to the circulatory will be provided to authorised vehicles only.	Alteration of existing alignment
M60 northbound to M60 westbound free flow link	Widening from one lane to two lanes	Alteration of the existing alignment. This element would consist of cutting (M60 northbound) and embankment (M60 westbound)
M62 westbound to M60 southbound free flow link	Realignment of the existing free flow link	Alteration of existing alignment
M60 J18 circulatory carriageway (i.e. the M60 J18 roundabout)	The M60 eastbound off-slip to J18 and southbound on-slip to the M60 would both be closed for use by the public, with only authorised access provided; the lanes on the roundabout would change to a new alignment to reflect the closures.	Alteration of existing alignment

2.4.2 The Proposed Scheme alignment and provisional Order Limits are shown on Figure 2.1. The provisional Order Limits include permanent land take required for the Proposed Scheme (including environmental mitigation) and temporary land take required for construction, including construction compounds, temporary works, statutory undertaker diversions, local road mitigation, material storage and haul routes (see Figure 2.1 for provisional attenuation pond locations, Figure 2.2 for a preliminary environmental design (which shows an assessment at PEIR stage of areas within the

provisional Order Limits which could be used for environmental mitigation), and Figure 2.3 for the locations of construction compounds, temporary working areas, access and haul roads and material storage areas).

2.4.3 Initial assessment of the mass haul volumes for earthworks shows a net fill requirement of circa 180,000m^3 to construct the new highway embankments and widenings. The first priority of the earthworks strategy will be to meet this fill requirement by utilising the cut material from the excavation of drainage ponds and other areas of cut across the scheme. This will be subject to ground investigation and geotechnical assessment of the material properties to ensure the material is suitable for use as an engineering earthworks fill. There may be a need to import fill from other sources depending upon the suitability of site won fill; this will be confirmed during PCF Stages 4 (Statutory procedures and powers) and 5 (Construction preparation).

Structures

2.4.4 The Proposed Scheme would require two new major structures (see Figure 2.1):

- Simister Pike Fold Viaduct will be a 3-span bridge to carry the new M60 eastbound to M60 southbound link (the Northern Loop) over the M66 and slip roads (parapet approximately 14m above the level of the M66 carriageway), approximately 70m north of M60 J18. An access route would be provided to the internal area of the Northern Loop to allow for maintenance of vegetation during operation.
- Simister Pike Fold Bridge will be a standard height (parapet approximately 8.5-9.0m above the level of the slip road beneath), single-span fully integral bridge carrying the M66 southbound off-slip road over the Northern Loop, some 350m north of M60 J18.

2.4.5 Two existing overbridge piers in the M60 central reserve would receive pier collars to provide continuity with the adjacent new rigid concrete barrier (RCB) vehicle restraint system (VRS). Headroom and verge piers are assumed to be unaffected within the Proposed Scheme extent.

2.4.6 The latest design proposes that ten new gantries would be required (this will be confirmed at the Environmental Statement stage); these will be steel lattice type structures and the form of construction will be single-span portal (with a support in the verge and central reserve), super-span portal (spanning the entire motorway), Motorway Signal Mark (MS) MS3 cantilever, MS4 cantilever or long-span cantilever gantries (with a single support in the verge). Two of these new gantries require a gantry leg in the central reserve, which would include a plinth to provide continuity with the adjacent new RCB. Plate 2.1 shows a sign and signal long-span cantilever gantry on the M60.

Plate 2.1: A sign and signal long span cantilever gantry on the M60

2.4.7 Some of the existing gantries would be retained. Seven gantries would need to be demolished and three gantries would receive new direction signs and electronic message signs. The leg of two existing portal gantries in the central reserve would receive encapsulation to strengthen it against vehicular impact and provide continuity with the adjacent new RCB, while the legs in the verge should remain unchanged with VRS located in front of them.

Walkers, cyclists and horse riders

2.4.8 The Proposed Scheme would include improvements to facilities for walkers, cyclists and horse riders (WCH). The proposals for WCH will be developed further as the design progresses, but it is likely to include features such as improved crossing facilities and shared use facilities.

2.4.9 Replacement routes are being provided for the existing Public Footpaths affected by the Proposed Scheme, including any Public Footpaths where they are affected by new drainage ponds, wetlands or swales.

Watercourse crossings

2.4.10 There are two buried drainage pipes located to the west of M60 J18, which would not require modification. Once drainage surveys have been completed the drainage network will be confirmed.

2.4.11 Haweswater Aqueduct, which passes underground between M60 J17 and 18, would not require modification.

2.4.12 Chapter 14: Road Drainage and the Water Environment considers watercourses that may be affected by the Proposed Scheme.

Drainage

2.4.13 The existing drainage network serving M60 J18 comprises the following primary drainage elements:

- Carrier pipes and drains
- Filter drains
- Kerbs and gullies

2.4.14 The highway drainage network serving M60 J18 generally discharges into watercourses via ditches or drains.

2.4.15 The presence of all the existing surface water attenuation features, such as attenuation ponds, underground attenuation tanks and pollution control measures, have not been fully confirmed during the drainage CCTV survey. A number of assumptions have been implemented based on the best engineering judgement. Nevertheless, it is not foreseen to find major changes on site.

2.4.16 The drainage design has been developed in accordance with the DMRB CG 501 Design of Highway Drainage Systems (National Highways, 2022, Revision 2.1.0; hereafter referred to as DMRB CG 501) and following discussions with the Lead Local Flood Authority (Bury Metropolitan Borough Council) and the Environment Agency.

2.4.17 The drainage design includes an allowance for the effects of climate change over a 100-year period. An allowance of 20% is to be applied together with a sensitivity test which considers a 40% climate change uplift in peak rainfall intensity.

2.4.18 As the Proposed Scheme is, for the most part, modification of the existing highway alignment, the general strategy is that the drainage of highway run off will follow the existing arrangement and will only be adjusted to suit new pavement locations, before continuing to attenuate and ultimately discharge at the watercourses or public sewers. Attenuation storage is to be provided within pollution containment ponds, carrier drains and manholes or a combination of all three measures. The proposed drainage system will discharge into the existing system where feasible (this is subject to the outcome of drainage survey).

2.4.19 The Proposed Scheme would result in an additional paved area of approximately 5.3ha, which would require additional attenuation storage to reduce the risk of flooding. Runoff rates would be restricted to existing site condition runoff rates for online road widening, or greenfield runoff rates for new offline road sections. The use of sustainable drainage systems (SuDS), such as attenuation ponds, is required to mitigate for failures in water quality as well as for attenuation.

2.4.20 Table 2.2 lists indicative attenuation pond locations and their connections to outfalls (see Chapter 14: Road Drainage and the Water Environment for further details regarding catchments and existing and proposed outfalls). The location and size of attenuation ponds is still to be confirmed, however indicative attenuation pond locations are shown on Figure 2.1.

Table 2.2: Indicative attenuation pond locations and outfall connections

Pond name* and indicative pond location	Connects to outfall	New or existing outfall
Pond 1 – South of Pike Fold Golf Club (east of the M66)	1	Existing and new
Pond 2 – North of Pike Fold Golf Course (east of the M66)	2	Existing
Pond 4 – South of the M60 northbound to M60 westbound link (north-east of St Margaret's Church of England Primary School)	4	Existing
Pond 5 – Field immediately north of Bridle Road and Heaton Park between M60 J18 and J19	5	Existing
Pond 6 – South of Whitefield Golf Club (west of M60 J17)	6	Existing
Pond 7 – North of the M60 eastbound to M66 northbound link / M60 eastbound to M60 southbound link (land south of Mode Hill Lane to the north-west of M60 J18)	7	New

**Note that the names of the attenuation ponds correspond to the nearest outfall.*

2.4.21 Attenuation ponds will be designed to be permanently wet in order to function as retention basins and achieve the desired treatment efficiencies in accordance with DMRB CG 501.

2.4.22 In addition to attenuation ponds, runoff would be collected via surface water channels, kerbs and gullies, filter drains, and combined carrier and filter drains.

2.4.23 Outfall 1 would be a new outfall designed to accommodate the Northern Loop (see Figure 14.2 in Chapter 14: Road Drainage and the Water Environment for the locations of existing and proposed outfalls). To accommodate the runoff from additional impermeable areas due to the new Northern Loop, an attenuation pond (Pond 1) would be provided within the field just north-east of M60 J18. In addition to this, a swale would be constructed adjacent to the pond to provide additional treatment. The flow would outfall locally into the existing Castle Brook tributary situated just north of Egypt Lane. Flows would be restricted to greenfield runoff rates if feasible.

2.4.24 Pond 6 would be constructed in land south of Whitefield Golf Course and would provide water treatment and attenuation before discharging to the south of the M60 into Bradley Brook via a new proposed culvert under the highway. There is an existing culvert at this location under the M60; the new proposed culvert would be adjacent to, but separate from, the existing culvert.

Lighting

2.4.25 Desktop study confirmed that existing lighting is located as follows:

- M60 J17 to J18 in the central reserve and both verges (Light Emitting Diode (LED))
- M62 east of J18 (LED)
- All slip roads and segregated left turn lanes (LED)
- M60 J18 roundabout circulatory (High Pressure Sodium (SON)) (note: at the time of writing this could not be confirmed as as-built information had yet to be received, however a desk study indicated that the roundabout circulatory is lit with SON)

2.4.26 The lighting design is being carried out in accordance with the latest BS 5489 standard (British Standards Institution, 2020) and National Highways specifications, and also takes into consideration guidance notes from the Institution of Lighting Professionals, including Guidance Note 1 for the Reduction of Obtrusive Light (2020) and Guidance Note 8 Bats and Artificial Lighting (2018).

2.4.27 All of the existing Scheme location is lit with high intensity discharge lamps and would remain lit.

2.4.28 At this stage, a scheme-wide preliminary lighting assessment has been undertaken, with Annual Average Daily Traffic (AADT) data used to obtain a lighting classification. Adaptive road lighting, which is where lighting levels are varied during the night according to the level of road usage, the needs of road users and specific risks on the road, will be used. Adaptive road lighting varies between levels M1 to M6, where M1 is the highest level and M6 the lowest. The stretch of road between M60 J17 and J18 will be lit to adaptive lighting class M2 and the slip roads to lighting class M3.

2.4.29 A lighting appraisal following the process outlined in DMRB TA 501 Road Lighting Appraisal (Highways England, Revision 0, 2020c) has been undertaken. The outcome of the appraisal confirmed that the Northern Loop, mainline and J18 should be lit. LED luminaires will have a glare class of G4 or above and will be designed with a zero tilt to produce no upward glare and minimal back light. LED luminaire implementation within the Northern Loop is a result of modification to the road layout, as such new lighting will be required to accommodate for these changes and to upgrade the current high-pressure sodium lighting, in keeping with the improvements to adjacent networks. While the benefit cost ratio (BCR) value is low (indicating there is not a requirement for lighting), based on congestion and the number of accidents around J18, lighting could reduce further accidents.

2.4.30 The lighting design for the mainline between M60 J17 to J18 will be confirmed following a site visit. Other scheme lighting will be upgraded to DMRB TA 501 standards.

2.4.31 The Northern Loop link would have columns fitted with LED luminaires. The Proposed Scheme would introduce new lanes and widening of the existing slip roads, which would affect the existing lighting layout. Replacement lighting columns would be fitted with LED luminaires for better efficiency.

Technology

2.4.32 The technology being designed as part of the Proposed Scheme provisionally includes the following:

- Motorway Signal Mark 4 (MS4) variable message signs mounted on cantilever and long span cantilever gantries
- Above lane signals mounted on gantries
- Closed-circuit television (CCTV) cameras
- Above ground and inductive traffic detectors, Motorway Incident Detection and Automatic Signalling (MIDAS) loops
- Highways Agency Detection Enforcement Camera System (HADECS) and External Aspect Verification (EAV) technology

- Entry slip signals
- Electrical interface cabinets

2.4.33 These technologies would be used to provide the traffic officer within the National Highways North West Regional Operations Centre to monitor and manage the road network covered by the Proposed Scheme.

2.4.34 The Proposed Scheme would utilise many of the existing technologies and gantries but would increase the number of Advanced Motorway Indicators (AMIs) where necessary to align with the number of lanes between J17 and J18. . This is likely to include additional signage and gantries, particularly at the junctions where the design changes the junction layouts. This would assist in monitoring traffic flows and identifying incidents and queues.

2.4.35 Variable message signs, mounted on cantilever and long span cantilever gantries, would be used to display essential mandatory and advisory signalling to motorists, along with travel information and any potential or upcoming hazard warnings. These will be provided along the route, as specified in National Highways guidance, and upstream of junction diverges. Signals would also be placed on these gantries above each lane to outline mandatory speed limits.

2.4.36 CCTV cameras would be positioned on both masts and gantries to provide a minimum of 95% coverage of the mainline with complete coverage of any emergency areas. Standard mast height would be between 10-15m above ground level to allow operators to visually monitor the network.

2.4.37 Traffic detection would be undertaken by a combination of Motorway Incident Detection and Automatic Signalling (MIDAS) loops and radar units mounted on posts at approximately 500m intervals, and within a short distance of every gantry location to provide monitoring of traffic flows and Queue Protection

2.4.38 Highways Agency Detection Enforcement Camera System (HADECS) and External Aspect Verification (EAV) technology would be located at one gantry location per link, in order to enforce the variable mandatory speed limits set by the MS4s and AMIs to encourage motorist compliance.

2.4.39 Each of the above assets would require power and associated equipment cabinets to enable operation. These would be located in the verge near equipment clusters. Electrical interfaces would be provided at the highways boundary, approximately every 1-2km, ideally over or under bridges or adjacent to local roads to ensure safe and easy access for maintenance workers.

2.4.40 The technology to be included in the Proposed Scheme has not yet been finalised and is subject to further studies and design. The information provided above could therefore change prior to the DCO application. The Environmental Statement will provide an updated description of the proposed technology.

Utilities

2.4.41 The permanent works of the Proposed Scheme would not significantly affect any statutory undertakers (such as high voltage electricity, gas and mains water suppliers)

and would not require major diversion or protection of their services and apparatus. However, existing statutory undertaker information shows a buried BT telecommunications cable beneath the existing M60 J18 circulatory carriageway, the exit from the circulatory carriageway to M60 westbound and the M60 northbound to M60 westbound link. Similarly, there is a buried low voltage electrical supply to National Highways communications cabinets and street lighting feeder pillar in the verge of the existing M60 northbound to M60 westbound link. Due to works to re-align this part of the junction these supplies might require re-direction or amendment to ensure supply to new features is not affected.

2.4.42 There is a high voltage electricity cable (voltage unknown) mounted on pylons to the south of and running parallel with the M60 between J17 and J18 up to St Margaret's Church of England Primary School. East of this point the cable runs south-east for approximately 770m before crossing the M60 between J18 and J19. The overhead cables should not be affected but construction staff should be aware of their proximity in respect to lifting operations.

2.4.43 There is a buried medium pressure (MP) gas pipe, low voltage (LV) buried electricity cable, and 33kv buried electricity cable at the southern edge of land proposed for attenuation ponds.

2.4.44 Haweswater Aqueduct underbridge is located 300m west of M60 J18. This aqueduct supplies most of Greater Manchester's population with their daily water supply. This supply is provided in a culvert and abridged by the M60 between J17 and J18. No structural work would be needed on the underbridge to accommodate the scheme improvements, however there would be works to the pavement and other highway infrastructure elements on the underbridge.

Environmental design

2.4.45 The Proposed Scheme design is an iterative process which considers the potential significant effects on environmental receptors. The first option in mitigating any impact is to seek design measures that would enable the impact to be avoided or, if this is not possible, reduced. This is referred to as embedded mitigation and includes measures such as changing the road's horizontal and vertical alignment, reducing the temporary and permanent footprint of the Proposed Scheme and altering construction methods.

2.4.46 The Costain Jacobs Partnership (CJP) Environment Team have (and continue to have) input to the design process to avoid and reduce the effects at source. Environmental considerations that have influenced the option development and selection process, and Proposed Scheme design, are set out in Chapter 3: Assessment of alternatives. The ongoing design development will continue to be influenced by the EIA process.

Land for mitigation

2.4.47 It is not always possible to design out environmental impacts. As such, it is necessary to develop additional mitigation measures to reduce or offset impacts, and to include land within the Proposed Scheme Order Limits to deliver these measures.

2.4.48 Examples of permanent environmental mitigation that have been developed for the Proposed Scheme include noise barriers to mitigate noise level increases from road

traffic, flood risk mitigation, landscape planting to screen visual effects, and biodiversity habitat creation.

2.4.49 More detail on specific mitigation for each environmental aspect is provided in Chapters 6 to 15 of this PEIR. Mitigation measures will continue to be developed throughout the design development, informed by the EIA.

2.4.50 A Preliminary Environmental Design has been produced for this PEIR which shows the Proposed Scheme design and areas within the provisional Order Limits initially identified for environmental mitigation (Figure 2.2).

2.4.51 The Preliminary Environmental Design will be updated following the statutory consultation, with a final version included in the Environmental Statement.

Demolition and land take

2.4.52 Land would be required both temporarily and permanently to construct, operate and maintain the Proposed Scheme. Permanent land-take requirements include the footprint of the proposed highway infrastructure and associated earthworks, drainage works and access roads, together with environmental mitigation areas such as landscape planting and biodiversity habitat creation. Temporary land would be land required for the construction of the Proposed Scheme.

2.4.53 The total permanent land take within the provisional Order Limits is estimated to be 39.71ha and total temporary land take 18.24ha. Total areas required for temporary and permanent land take are subject to change with the evolving design and will be confirmed as part of the DCO application. In line with the requirements of the DCO, land take will be kept to a minimum and justified in the Statement of Reasons to accompany the DCO application.

2.5 Construction

Construction programme and phasing

2.5.1 In outline, the program is currently planned to be as follows (note: the construction program is subject to change):

- Mobilisation to site – 2025
- Start of works – 2025
- M66 southbound traffic switch – 2027
- Northern Loop traffic switch – 2027
- Open for traffic – 2027
- Demobilisation from site – January 2028

2.5.2 Start of Works is currently planned for 2025, although a window between 2024 and 2025 is currently being considered. The Proposed Scheme would take over three years to construct, with an assumed opening year of 2027. However, this will be reviewed as the scheme design is refined and the construction programme is developed.

2.5.3 Prior to the Start of Works, the construction phase would commence with an initial period of four to six months reserved for setting up of temporary construction compounds, the diversion and protection of utility services, archaeological mitigation (if required) and the implementation of other required environmental mitigation (such as protected species mitigation (again, if required)) before the main construction works could commence. This is the mobilisation period which is currently due to start in 2025.

2.5.4 The extent and volume of earthworks is one of the determining factors for the duration of the programme. In order to maximise the efficiency of the earthworks operations, these bulk activities would typically be carried out between mid-March and the end of October each year. The programme will encompass two main earthworks seasons, comprising mainly the following activities:

- First bulk earthworks season:
  - Site establishment including construction of site compounds, haul roads and laydown areas
  - Excavation of attenuation ponds as well as the pre-earthworks drainage
  - Construction of temporary works for the structures, including the main piling platforms, crane pads and general working areas
  - Preparation of any areas requiring ground improvement
  - Construction of embankment areas outside of structures temporary works footprints
- Second bulk earthworks season:
  - Removal of structures temporary works
  - Backfill to structure abutments and wingwalls
  - Completion of earthworks plugs to structures
  - Preparation of any further areas of ground improvement (if required)

2.5.5 There may be minor earthworks activities remaining within the third season including some backfill activities to structures, tie-in works for the Northern Loop, and stockpile management.

2.5.6 There will be earthworks required for the M60 online widening construction for both retaining wall construction and earthworks embankment widenings, these will be completed with access from both the M60 highways and the offline works areas.

2.5.7 The Proposed Scheme comprises elements of ‘online’ works, which require working on and directly adjacent to the existing motorway carriageways, and ‘offline’ works, which are located remotely from the current road alignments.

2.5.8 Both online and offline works would likely be carried out concurrently. The online works would commence early in the programme to create additional room for temporary traffic management and allow access into the verges.

2.5.9 The online works would include:

- Works to convert the M60 J17 and J18 four lane to five lanes by converting the hard shoulders to running lanes and includes works to the central reserve, gantries, signs, drainage, safety barriers and fencing
- Works to construct a new discontinuous hard shoulder on the M60 between J17 and J18 by widening the existing highways alignment
- Works to tie the new Northern Loop link and re-aligned M66 southbound diverge into the existing M60 and M66, including creating extra lanes on the southbound M66 through M60 J18 by converting the hard shoulders to running lanes and realigning the central reservation
- Elements of the new bridge structure to carry the Northern Loop over the M66 and its slip roads (e.g. bridge supports that are next to the M66)
- The improved M60 northbound to M60 westbound free flow link
- New drainage, gantries, signs and lighting on the M66 and M60 approaches to Simister Island
- Reconfiguration of lanes, signs and signals within the M60 J18 roundabout

2.5.10 The online works phases would comprise works to widen verges to construct additional lanes and the new hard shoulders and works to harden the central reservation and construct new safety barriers. The works within these phases would be undertaken on days using narrow lanes, hard shoulder running and temporary vehicle restraint barriers. However, a large proportion of these works will require concurrent night working to be undertaken due to the working room constraints and nature of work taking place.

2.5.11 Works within the central reserve will comprise drainage upgrade and renewal works, gantry works, hardening works and installation of new concrete safety barriers.

2.5.12 Works within the verges will comprise drainage replacements, street lighting and technology replacements, gantry demolition and installation, earthworks widenings, barrier works, retaining wall construction, pavement works, and installation of new street furniture.

2.5.13 Works within M60 J18 roundabout and the improved M60 northbound to M60 westbound free flow link would likely be carried out as the final phase of online works.

2.5.14 The offline works would include:

- Construction of the majority of the new Northern Loop link from the M60 eastbound to the M60 southbound
- Parts of the re-aligned M66 southbound diverge slip road (including new single span bridge over the Northern Loop)
- Elements of the new drainage system, such as attenuation ponds

2.5.15 Construction of the two main structures on the scheme – the Northern Loop three-span viaduct and the Pike Fold single-span bridge on the new M66 southbound diverge – would typically commence in the second/third quarter of the first year of construction. This will follow on from site setup, early earthworks activities, and construction of the temporary works for the structures.

2.5.16 Work on the M66 Pike Fold single-span bridge would be anticipated to run through to the middle of year two of the construction programme. This would allow for the new southbound diverge to be completed earlier in the programme to switch diverging traffic onto new alignment, thus allowing construction of the new Northern Loop online tie-in.

2.5.17 Work on the three-span Northern Loop bridge would be anticipated to run into the third year of construction. This programme will be longer due to the increased span of the structure combined with the on-line works interface; a large proportion of the works will need to be undertaken on overnight or weekend closures.

2.5.18 There will be ground improvement required to the new offline earthworks as well as the areas of structural abutments. These may compromise removal of shallow soft soils, installation of vertical band drains, surcharging of embankments and settlement hold periods. There may also be an activity of peat excavation and replacement where there are shallower peat deposits present beneath proposed embankments. Where excavation of soft soils and peat materials is required, they will be replaced by a suitable engineering fill which may be sourced from site won fill or imported.

2.5.19 There will be some works required on the Local Road Network on the north and south sides of the M60 between J17 and J18. This will be to facilitate the highways widening design, new gantry construction and diversion of utilities. Traffic management closures will be required where works encroach into the local highways.

Compounds and haul roads

2.5.20 A scheme of this size requires a main temporary site compound plus some smaller satellite compounds at strategic work locations around the works area. The locations for the main site compound and satellite compounds have not yet been confirmed, however the main site compound is likely to be located to the north-west of M60 J18 in land south of Mode Hill Lane and Cowlgate Farm, with satellite compounds located north-east, north-west and south-west of M60 J18 and at Philips Park and south-east pond locations. Indicative locations of the main site and satellite compounds and haul roads are shown in Figure 2.3 and summarised in Table 2.3.

Table 2.3: Main site and satellite compounds (to be confirmed)

Type	Location	Description
Main site compound	North-west of M60 J18 in land south of Mode Hill Lane and Cowlgate Farm	Access road off Mode Hill Lane for initial enabling works only and haul road off the M60 eastbound to M66 northbound link. Main offices, site welfare, vehicle recovery, parking for all staff, materials storage area.
N Satellite compound	North of M60 J18 in land north of Pike Fold Golf Club	Access road off Griffe Lane to undertake main works. Compound area will comprise space for van parking, office/welfare units and materials storage area.
NW Satellite compound	North-west of M60 J18, to the west of the M60 eastbound to M66 northbound slip road	Access road off Mode Hill Lane for initial enabling works only and haul road off the M60 eastbound to M66 northbound link. Van parking, office welfare units and materials storage area.
NE Satellite compound	North-east of M60 J18 in land south of Pike Fold Golf Club	Access via Egypt Lane for initial enabling works only, then access road off M66 southbound. Van parking, office/welfare units and materials storage area.

Type	Location	Description
SW Satellite compound	South-west of M60 J18, adjacent to the M60 eastbound to M60 southbound link in land north of Simister Lane	Access road off Simister Lane for initial enabling works only and M60 northbound to M60 westbound link. Van parking, office/welfare units and materials storage area.
W Satellite compound	North-west of M60 J17 in land south of Whitefield Golf Club	Access road off Ross Avenue (for use during enabling works only). Access road will be installed along with small area for welfare, parking and laydown.
SE Satellite compound	Pond positioned south of M60 in field adjacent to the National Grid pylon	Access to area will likely be created off the M60 mainline using a 24/7 hard shoulder closure. Access road will be installed along with small area for welfare, parking and laydown.

2.5.21 The location of site compounds, material storage areas and haul roads will be included in the Environmental Statement.

Logistics and traffic management

2.5.22 The existing motorways would generally be kept open during construction of the Proposed Scheme to avoid significant disruption to the road user. However, where construction activities require greater safe working areas, short-term carriageway closures would be required.

2.5.23 Examples of activities which may require full carriageway closures include:

- Bridge beam installation
- Gantry erection, modification and demolition
- Bridge deck construction over live carriageways
- Installation of certain signs and signals (e.g. on overhead gantries)
- Cross carriageway drainage and ducting works
- Major surfacing and white lining operations
- Temporary traffic management operations

2.5.24 Closures would include combinations of single carriageways, both carriageways and slip roads. These closures would happen at night-time, and possibly over weekends, to minimise disruption. Suitable diversion routes would be put in place for motorway traffic and these will be considered in the Environmental Statement.

2.5.25 For the online works described above, long-term temporary traffic management measures would be required during construction. These may include narrower lanes, temporary hard shoulder running, hard shoulder and lane closures, contraflow and tidal flow systems. Typically, temporary safety barriers and reduced speed limits are implemented with such measures for the safety of the road user and the construction workforce.

2.5.26 Construction of the attenuation pond within the land south of Whitefield Golf Club (Pond 6) will require earthwork excavations and export of earthworks arisings. There are numerous constraints around this area regarding access for construction vehicles and material movements. It is envisaged that a temporary access will be constructed off the

M60 eastbound to allow HGVs to enter the Whitefield area. However, it is likely that HGVs will need to exit the area via the local road network – making use of either Philips Park Road or Ross Avenue, Oak Avenue and Chestnut Avenue. The earthworks and mass haul strategy will be developed with the aim to minimise the number of HGV movements taking place within the residential areas.

2.5.27 Some access from the local road network will be required to gain entry to the offline work areas during the early stages of the Proposed Scheme. This will include access off Mode Hill, Griffe Lane, Simister Lane and Egypt Lane. This may involve some limited disruption to these roads, however, access for residents will be maintained throughout.

2.5.28 Table 2.4 indicates the anticipated traffic management measures for construction elements.

Table 2.4: Anticipated traffic management measures for construction elements

Construction element	Anticipated traffic management measures
Enabling works / site setup	Traffic management will be installed initially to enable access and egress to be constructed off the existing motorways and motorway slip/link roads. This will involve installation of temporary vehicle restraint barriers (overnight closures required) and reduced speed limits. Some Traffic Management may be required on the Local Road Network to facilitate temporary access.
M60 J17-18 – central reservation works	Traffic management for central reservation works will likely be carried out on daytime working by introducing new temporary traffic management layouts to create sufficient working room within the central reservation. Traffic will be shifted towards the verge making use of hard shoulder running and narrow lanes where required. There will be temporary traffic management arrangements on the slip and link roads of M60 J17 and 18 to facilitate this.
M60 J17-18 – online widening, hard shoulder and verge works (eastbound and westbound)	Traffic management where online widening works/verge works will take place would predominantly take the form of narrow lanes and installation of temporary vehicle restraint barrier to provide a safe working area for daytime working. Speed restrictions will be in place to facilitate this. A large proportion of night-time working and overnight closures will be required due to the nature of the works, and where there is insufficient room or work area is too close to existing merges/diverges. Some traffic management may be required on Simister Lane to tie the proposed maintenance access track into the existing pavement. This would likely be in the form of short-term two-way traffic lights.
M60 Junction 18 eastbound off-slip/designated free flow	Overnight working will be required for tie-in works of the new Northern Loop alignment into the existing M60 eastbound carriageway. Additionally, overnight working will be required for the finishing roadworks to the off-slip and designated free flow link. This will require full closures of the off-slip and designated free flow link with a suitable diversion put in place.
M66 central reservation works	Traffic management for central reservation works will need to be carried out on daytime working by introducing new temporary traffic management layouts to create sufficient working room within the central reservation. Traffic will be shifted towards the verge making use of hard shoulder running and narrow lanes where required. There will be temporary traffic management arrangements on the slip and link roads of M60 J17 and 18 to facilitate this. Some full closures will likely be required due to the re-alignment of the central reservation. These may be done through up-and-over diversions over the junction to minimise disruption and diversion times. Following completion of the central reservation hardening the traffic will be switched back to the centre to allow verge works to commence.

Construction element	Anticipated traffic management measures
M66 online widening, hard shoulder and verge works (northbound and southbound)	Traffic management where online widening works/verge works will take place would predominantly take the form of narrow lanes and installation of temporary vehicle restraint barrier to provide a safe working area for daytime working. Speed restrictions will be in place to facilitate this. Some overnight closures will be required at pinch points where there is insufficient room or work area is too close to existing merges/diverge.
Existing M66 southbound carriageway J3 – 4	Where the new M66 J18 southbound diverge ties into the existing carriageway, overnight full closures may be required to tie the existing pavement into the new pavement and carry out temporary white lining. Where the new northern loop ties into the existing M66/M60 anti-clockwise; the M66 southbound traffic will be pushed into the two lanes closest to the central reservation, and the diverging traffic will use the newly constructed M66 southbound diverge alignment. This allows a permanent closure of lanes 1 and 2 of the M66 southbound to construct the online section of the new northern loop. Full closures will be required for finishing tie-in works.
M60 Northern Loop Structure	The construction of the structure abutments and piers will be predominantly undertaken on daytime shifts behind temporary vehicle restraint barrier. However, overnight partial and full closures will be required for certain activities that comprise the overall construction of the structure and the construction and maintenance of temporary works. The installation of bridge beams and works to construct the bridge deck will be done under full overnight or weekend closures. This may be concentrated on partial spans at a time to limit the disruption caused to the whole junction.
M60 J18 – J19	Widening and verge works to the M60 clockwise south of J18 will be done behind temporary vehicle restraint barrier with traffic moved into narrow lanes. Some partial overnight closures will be required for finishing works and installation/removal of traffic management.
M60/M66/M62 J18 Simister Roundabout	Works will take place on daytime working where possible, with a large proportion requiring nighttime working for traffic management to be installed.
Gantry works – M60 and M66	Where there are new gantries to be installed, modifications to existing gantries, or demolition of existing gantries; full overnight closures will be required.
Technology and drainage	Overnight closures will be required where there is limited space in some verge areas to install directionally drilled telecommunications duct crossings and new drainage crossings under the existing M60/M66/M62 carriageway.
Restrictions / operational constraints	Speed restrictions would be in place from when works commence until completion. Full closures and lane closures would take place overnight with the specific closure times to be determined in advance of works commencing and be subject to traffic counts. The aim will be to keep the motorway and junction running at full capacity during peak hours, however, there may be certain activities where this will not be possible and capacity may be temporarily reduced. All full closures will take place overnight or over weekends. All diversion routes for full closures would be pre-signed and advance warning signs would be installed prior to the closure dates.

Workforce management

2.5.29 Peak workforce travelling times are expected to fall in line with the usual peak commuting times of 07:00–09:00 hours and 16:00–18:00 hours. It is likely that a proportion of the construction team would travel by shuttle bus from the main compound area to work fronts, satellite compounds and laydown areas where feasible to reduce the volume of site traffic on the road at these times.

2.5.30 This arrangement will not be possible for all sub-contractors/trade types due to the necessity of transporting work equipment in their company vehicles. Other methods of travelling to the Proposed Scheme and accessing work areas will be investigated.

2.5.31 The size of the workforce during construction is yet to be confirmed, however based on the workforce employed for other projects of a similar size and duration it can be assumed that, during peak construction, the total number of office staff may be around 50 to 60 and the site workforce may be around 100.

Working methods

2.5.32 The majority of the works will take place either offline or online with appropriate traffic management in place. Normal daytime hours are considered to be between 07:30 and 18:00 between Monday and Friday, and 07:30 and 13:00 on Saturday. In addition, there may be an hour before or after these times for site set up and close down (this would include activities such as deliveries, movement to place of work and general preparation works, but would not involve operation of plant or machinery). During the summer months, the working hours could extend to 07:00 to 19:00.

2.5.33 A proportion of the works will need to be undertaken outside these hours. Any works occurring outside of these hours as well as on bank holidays, is considered off-peak working. Overnight or weekend working may be required for the following activities:

- Installation, maintenance and removal of traffic management layouts
- Demolition of existing structures, construction of new structures, and any potential movements of large transporters to deliver bridge superstructures and gantry steel sections to their permanent locations
- Removal, modification and installation of new signage/technology to existing gantries and traffic signs
- Central reservation works where daytime working is not suitable due to existing carriageway widths or proximity to existing slip merges/diverges
- Works on slip roads and designated free flow links where carriageway widths will not allow for daytime works
- Online works within the verges which cannot be safely completed under the daytime working room available behind the temporary vehicle restraint barrier
- Cross carriageway duct crossings
- Installation/removal of street lighting and traffic signals
- Resurfacing and white lining of the existing carriageway and surfacing works to tie-in the existing carriageway to the new carriageway
- Some compounds may be in 24-hour operation at certain stages of the construction programme to facilitate off-peak working

Plant and equipment

2.5.34 Construction activities would involve the use of heavy plant items, for example excavators, dumper trucks, dozers, piling rigs, cranes, and demolition and compaction equipment.

2.5.35 Table 2.5 lists typical plant and equipment required for construction activities.

Table 2.5: Typical plant and equipment required for construction activities

Construction activity	Typical plant and equipment required
Site clearance	Excavator with tree shears, woodchipper, strimmer, chainsaw, mechanical and hydraulic breakers
Earthworks	Roller, bulldozer, grader, excavator, material sorting plant, tractor with bowser, dumper truck, mechanical crusher, ground improvement plant (if required)
Drainage/ducting	Roller, excavator, dumper truck, tractor with trailer, thrust bore rig, concrete delivery truck, directional drilling plant
Pipe jacking / microtunneling	Microtunnelling machine, operation and distribution boards, jacking system, hydraulic power pack, slurry system, separation plant, lubrication system, excavator, mobile crane
Fencing	Excavator, auger, post knocker
Technology	Vibration plate, excavator, roader tipper and grab, directional dig rig, loader crane
Street lighting	Excavator, loader crane, auger, cherry picker
Pavement	Vibrating roller, floor saw, hammer drills, dumper truck, front loader excavator, asphalt paver, asphalt planer
Structures demolition	Dumper truck, loader crane, demolition excavator, concrete crusher, cherry picker
Structure construction	Vibration plate, roller, excavator, loader crane, self-propelled modular transporter, crane, cherry picker, piling rig, concrete pump, concrete delivery truck, sheet piling rig
Slipform	Slipform paver, concrete delivery truck, excavator and breaker
Archaeology excavation	Excavator, dump truck
Landscaping / Planting	Soil rotavator, auger, tractor and bowser, mechanical hydroseeder
Miscellaneous	Delivery HGVs, motorised saws, concrete drills, tower lights, water management/treatment plant, generators, tractors, fuel bowsers, road sweepers

Earthworks

2.5.36 Large amounts of imported fill material may be required for construction, particularly for the new Northern Loop link. This may be reduced by recycling material generated at site. There is expected to be a significant shortfall of material, estimated at approximately 180,000m^3. The primary aim will be to utilise arising cut material to construct the permanent earthworks. However, this is subject to the arising material being suitable for reuse as an earthworks engineering fill which will be confirmed following site investigations. Should the material be unsuitable, various other options will be explored to obtain this material from local sources, including other nearby construction projects which have a surplus of suitable fill, as well as local quarries.

Borrow pits

2.5.37 No borrow pits will be created for the Proposed Scheme.

Drainage and de-watering

2.5.38 Ground investigation will be undertaken to determine the ground and groundwater conditions within the provisional Order Limits. The information obtained will be used to inform the risk assessment of any identified contaminated land impacting on the groundwater and will be used to determine the requirements for protective measures if deemed necessary. An assessment of the requirement for dewatering activities as part of the construction works will also be undertaken following the ground investigation.

Utilities diversions

2.5.39 The options being considered for utility diversions are described in Section 2.4. Utility diversions would typically take place prior to the main construction works, after DCO consent has been granted. Some critical diversions may take place before the start-on-site date; it is assumed that in these cases diversions would be delivered under the statutory undertaker's permitted development rights. In any event, all advanced works would be included in the application for development consent and assessed in the EIA.

Environmental management

2.5.40 All construction works would be undertaken with appropriate environmental controls in place, in line with an Environmental Management Plan (EMP). A 1st Iteration of the EMP will be included with the DCO application (see Section 5.4 of Chapter 5: Environmental assessment methodology).

Public access

2.5.41 To allow construction of the Proposed Scheme, there would be direct and indirect impacts on up to 18 public footpaths. Some would be closed temporarily for the duration of construction, whilst others would be maintained throughout but will experience some disruption during certain construction phases (see Chapter 13: Population and Human Health for further details).

2.5.42 During construction there would be impacts on businesses bordering the Proposed Scheme such as golf courses, Prestwich Heys Football Club and local schools. Construction would be planned to minimise the impact upon these businesses and keep key stakeholders informed and involved in the planning and delivery of the Proposed Scheme. Community engagement managers would form part of the project team to manage these relationships before and during the construction phase.

Carbon management

2.5.43 In order to deliver National Highways' aspirations with respect to the minimisation of carbon emissions and the efficient use of resources, the carbon intensity of the Proposed Scheme will be established and monitored throughout the design and construction phases.

2.5.44 Processes to evaluate greenhouse gas emissions (GHG) associated with construction of the Proposed Scheme are being embedded into the design process, thereby informing and identifying opportunities for iterative reductions in such emissions. These processes will inform the design stages allowing GHG emissions to be considered in a timely manner, rather than at the end of the design process. The sharing of information

is being promoted, along with the identification of innovations and engagement with suppliers, across the project team to ensure that GHG emissions along the supply chain have been considered.

2.5.45 Section 15.9 of Chapter 15: Climate provides examples of options that will be considered when identifying potential opportunities to reduce GHG emissions.

Sustainable procurement

2.5.46 In addition to ensuring a carbon efficient design, a sustainable procurement strategy will be implemented to ensure that low carbon materials are, where practicable, specified and that the carbon intensity of materials and sub-contract packages is measured and monitored throughout. This will include the responsible sourcing of the key material elements (asphalt, concrete, aggregate, steel, aluminium, plastics, timber and wood derived products) to be used in the construction of the Proposed Scheme (see Chapter 11: Material assets and waste, for more details).

Materials and waste management

2.5.47 Material resource efficiency will be implemented throughout the detailed design and construction of the Proposed Scheme. This will include the implementation of resource efficient construction principles, adoption of responsible sourcing practices, preparation of a Site Waste Management Plan (SWMP) and compliance with relevant legislation, policies and statutory guidance for materials and waste. Site-won (including demolition and excavation) materials arising from the Proposed Scheme will be reused and recycled, and where practicable, construction materials will be responsibly sourced from local sources of supply with consideration for secondary and recycled content.

2.6 Operation and maintenance

2.6.1 There are a number of high-level principles which the Proposed Scheme is actively pursuing for the maintenance of assets once operational. These include, but would not be limited to, the following:

- Exploring off network access for assets to reduce the number of lane or road closures required to facilitate maintenance.
- Combining maintenance programmes to allow for the most effective use of traffic management and reduce the amount of work requiring deployment of traffic management on the network.
- Subsoil / substrate and topsoil requirements for grassland and species rich would be specified to ensure successful establishment and meet safety requirements.
- All grassland and wildflower seed mixes for areas that are deemed safety critical such as sight lines, in front of signs and access areas would be selected which allow proper establishment while maintaining safety critical requirements.
- Species will be selected following National Highways' Major Project Instruction for Low nutrient grassland for soft estate safety requirements whilst creating greater biodiversity on the SRN.
- Seed mix selection would be cognisant of the short term to medium term challenges to successful establishment from climate change.

- Use of technology to facilitate maintenance, including use of wireless assets to reduce the need for ducting.
- Exploring the diversion of statutory utility corridors outside the highway boundary to reduce the operational impact to the highway when assets require maintenance.
- During detailed design, materials would be further considered which could reduce the amount of maintenance required for an asset.
- Complementing national policies to reduce the risk to road workers and researching the potential application of new and innovative solutions which could be of benefit to operations and maintenance.

2.7 Changes in traffic flows

2.7.1 The impact that the Proposed Scheme is predicted to have on traffic flows is discussed in detail in the Traffic Modelling Report for Consultation (National Highways, 2023). A summary of the predictions is provided below:

- Journey times through M60 J18 would continue to worsen in the future if the Proposed Scheme is not built.
- The proposed free flow link for traffic travelling between M60 J17 and M60 J19 removes a substantial traffic flow from the M60 J18 roundabout, reducing delays for other movements.
- There will be less delay caused by traffic joining and leaving the M60 between J17 and J18 as a result of the proposed fifth lane on the M60 between these junctions.
- The Proposed Scheme would offer journey time savings of up to 1 minute 30 seconds from M60 J17 to M60 J19 and up to 3 minutes during rush hour between M66 J3 and M60 J17, compared to a scenario where the Proposed Scheme is not built.
- Some local roads would experience decreases in traffic due to the Proposed Scheme because reductions in delay on the motorway network will make this more attractive than travelling on local roads.
- A small number of local roads would experience increases in traffic, especially those which would be used to access the M60 in the vicinity of J18.

2.8 Design uncertainty and limits of deviation

2.8.1 This PEIR is based on an early preliminary design of the Proposed Scheme. The location and provisional Order Limits of the Proposed Scheme are shown on Figure 1.1. In accordance with the guidance provided in Advice Note Nine: Rochdale Envelope (Planning Inspectorate, 2018), the provisional Order Limits have been drawn at this stage to allow some flexibility. The scheme design process is ongoing, and as such, it is not possible at this point in time to define exactly the footprint of the Proposed Scheme. Figure 2.1 is intended to show the realistic scenario, including temporary working areas that could be required for construction compounds, temporary works, material storage and haul roads, based on current knowledge.

2.8.2 The DCO application will include Works Plans with limits of deviation for the Proposed Scheme design. Limits of deviation provide an envelope of development, as opposed to specific dimensions, and are used to allow design flexibility. The ongoing EIA will help

to inform the limits of deviation. For example, where there are environmental sensitivities, the limits of deviation may be smaller, and the design more fixed, to avoid the design impacting on a particular environmental feature.

Temporary works

2.8.3 The construction methodology is still in development. The construction methodology in Section 2.5 provides approximate descriptions for temporary construction activities. These are provided to give an indication of the extent of these activities but could be refined in the period leading up to the DCO application.

2.8.4 The Environmental Statement will provide more detail on the construction methodology, including the limits of deviation envelopes to define the maximum extents of temporary construction activities.

Permanent works

2.8.5 The scheme design is ongoing; the scheme description provided in Section 2.4 is therefore subject to change between statutory consultation and submission of the DCO application, including changes to address stakeholder comments received during the consultation period. For certain aspects of the design, particularly drainage design, options are still under consideration to determine the optimum design solution.

2.8.6 The Environmental Statement will provide an assessment of the Proposed Scheme design based on the realistic worst-case scenario afforded by the limits of deviation to be sought within the DCO application. For the permanent elements of the Proposed Scheme, this will include the maximum vertical and horizontal extents of the highway carriageway and junctions; locations of technology, lighting and signs; size and location of drainage features and WCH provision; and utility diversion corridors. The worst-case assessment may vary depending on the environmental aspect under consideration; for example, the worst case for visual effects may be the maximum height of a structure afforded within the limits of deviation envelope, while the reverse may be true for potential noise effects.

3. Assessment of alternatives

3.1 Introduction

3.1.1 This chapter outlines the alternative design options that have been considered during the development of the Proposed Scheme. The options appraisal process is summarised below within the context of National Highways' project control framework (PCF):

- PCF Stage 0 – Strategy, shaping and prioritisation: At this stage initial analysis and appraisal are conducted to assess the viability of transport scheme solutions to the problem, including road network and non-road network solutions
- PCF Stage 1 – Options identification: At this stage traffic modelling and economic and environmental assessment is undertaken on a number of options. The key output is the Technical Appraisal Report (TAR) which documents the decisions made on which options to present during non-statutory public consultation
- PCF Stage 2 – Option selection: At this stage the public are consulted on the recommended options from PCF Stage 1. Refinements are then made to the option designs, traffic modelling and economic and environmental assessments following feedback from the consultation. At the end of the stage a Preferred Route Announcement (PRA) is made to announce the decision on which option to progress
- PCF Stage 3 – Preliminary design: This is the stage the Proposed Scheme is currently in and involves developing a single preferred option to the required level for undertaking an EIA and applying for a Development Consent Order. Alternative ways of delivering the preferred option will be explored throughout PCF Stage 3 (see Section 3.3)

3.2 Scheme history

PCF Stage 0 (Strategy, shaping and prioritisation) options appraisal

3.2.1 In PCF Stage 0 a number of potential improvement options were considered to address the congestion at M60 J18 in addition to a do-nothing option. This produced 148 improvement options, formed from different combinations of 30 highway elements.

3.2.2 A sifting process reduced the number of options to be considered at a Value Management Workshop in October 2015 to eleven. At that workshop it was recommended that four options be further considered in PCF Stage 1. A record of the Value Management process is contained in the Value Management Report (Hyder, 2015).

3.2.3 On 28 October 2015, the Project Board agreed in principle to the results of the workshop but decided that a fifth option considered at the workshop should also be taken forward.

3.2.4 A Package Order brief for the scheme was included in the Collaborative Delivery Framework Scheme Specific Scope for PCF Stages 1 and 2 design services. In addition to the five options referred to above, the brief also included changing the M60

between J17 and J18 from a 4-lane controlled motorway with hard shoulder to a 5-lane ALR motorway with no hard shoulder.

Summary of PCF Stage 0 options to be considered at Stage 1

3.2.5 By the end of PCF Stage 0, five options were initially chosen for further assessment at PCF Stage 1. The five initial options were:

- Option 103 (re-named Option A at Stage 1)
- Option 003 (re-named Option B at Stage 1)
- Option 122 (re-named Option C at Stage 1)
- Option 013 (re-named Option D at Stage 1)
- Option 113 (re-named Option E at Stage 1)

3.2.6 Table 3.1 describes the elements that made up the above options.

Table 3.1: PCF Stage 0 options and the elements they comprised

Option	Elements (NB – northbound; EB – eastbound; SB – southbound; WB – westbound)
103 A	Element B9: M60 EB to M60 SB 2 lane loop interchange link. Element G2: M60 NB to M60 WB 2 lane interchange link with improved diverge and merge.
003 B	Element A1: M60 EB to M66 NB 2 lane interchange link with improved diverge and merge. Element B4: new 3 lane signalised link inside roundabout circulatory for M60 EB to M60 SB. Element G2: M60 NB to M60 WB 2 lane interchange link with improved diverge and merge.
122 C	Element A1: M60 EB to M66 NB 2 lane interchange link with improved diverge and merge. Element D3: new 3 lane signalised link inside roundabout circulatory for M66 SB to M60 WB. Element G2: M60 NB to M60 WB 2 lane interchange link with improved diverge and merge.
013 D	Element A1: M60 EB to M66 NB 2 lane interchange link with improved diverge and merge. Element N1: widening of roundabout circulatory on north, east and west parts to 5 lanes.
113 E	Element G2: M60 NB to M60 WB 2 lane interchange link with improved diverge and merge.

3.2.7 After further consideration (see Table 3.2 for justification) two options were taken forward to PCF Stage 1.

Table 3.2: PCF Stage 0 options for consideration at PCF Stage 1

Option	Take Forward	Reasons
A	**Yes**	• Provides free flow for highest peak hour traffic flows (M60 EB to M60 SB) • Frees up roundabout capacity for other movements • Improves journey times and reliability at the junction • Moves significant traffic flow away from properties close to the roundabout

Option	Take Forward	Reasons
B	No	• Does not provide free flow for highest peak hour traffic flows (M60 EB to M60 SB) and has very low impact on junction capacity • New route for M60 EB to M60 SB has low radius and limited visibility • Requires 3-way signals which results in reduced green light time and roundabout capacity • Very little impact on journey times and reliability at the junction
C	**Yes**	• Separates M60 EB to M60 SB from M66 SB to M60 WB within the roundabout, provides 3 lanes for M66 SB to M60 WB • Frees up capacity for M60 EB to M60 SB within roundabout • Some positive impact on journey times and reliability at the junction • Value for money estimated to be relatively high
D	No	• Does not provide free flow for highest peak hour traffic flows (M60 EB to M60 SB) • 5 lanes at a signal stop line not recommended – safety issue • Widening of roundabout bridges – buildability issue • Widening of circulatory affects viaduct abutment – requires M62/M60 closure • Value for money estimated to be very low
E	No	• Does not provide free flow for highest peak hour traffic flows (M60 EB to M60 SB) • Provides an improvement for only one traffic movement • Very little impact on journey times and reliability at the junction

3.2.8 Following the decision to take Options A and C forward for further consideration, these options were further assessed and developed to remove or mitigate problems. These two options were referenced as A1 and C1. This process was repeated and two further variants were identified, referenced as A2 and C2. Drawings of the four variants are shown in Plates 3.1 to 3.4.

Plate 3.1: Proposed Option A1 (excluding ALR)

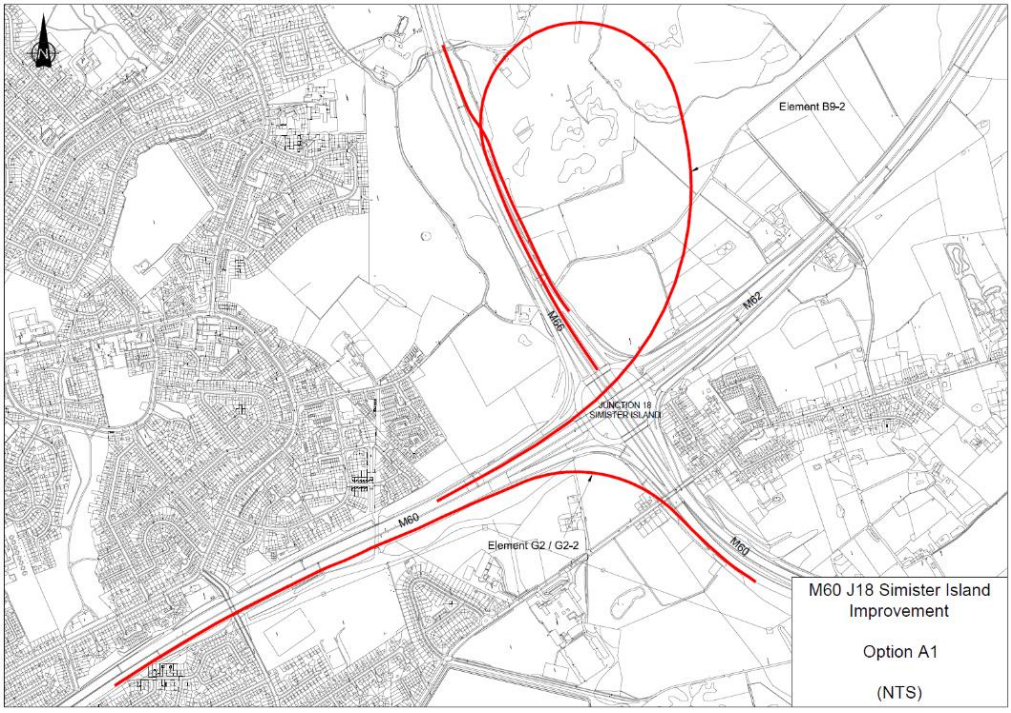


Plate 3.2: Proposed Option A2 (excluding ALR)

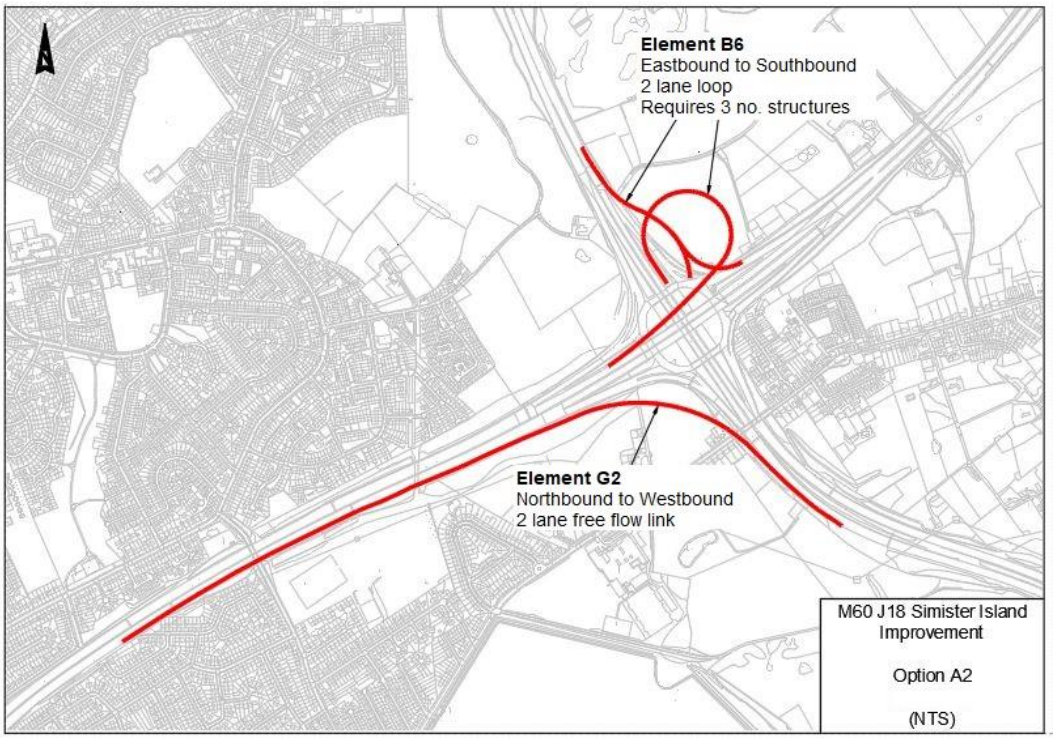


Plate 3.3: Proposed Option C1 (excluding ALR)

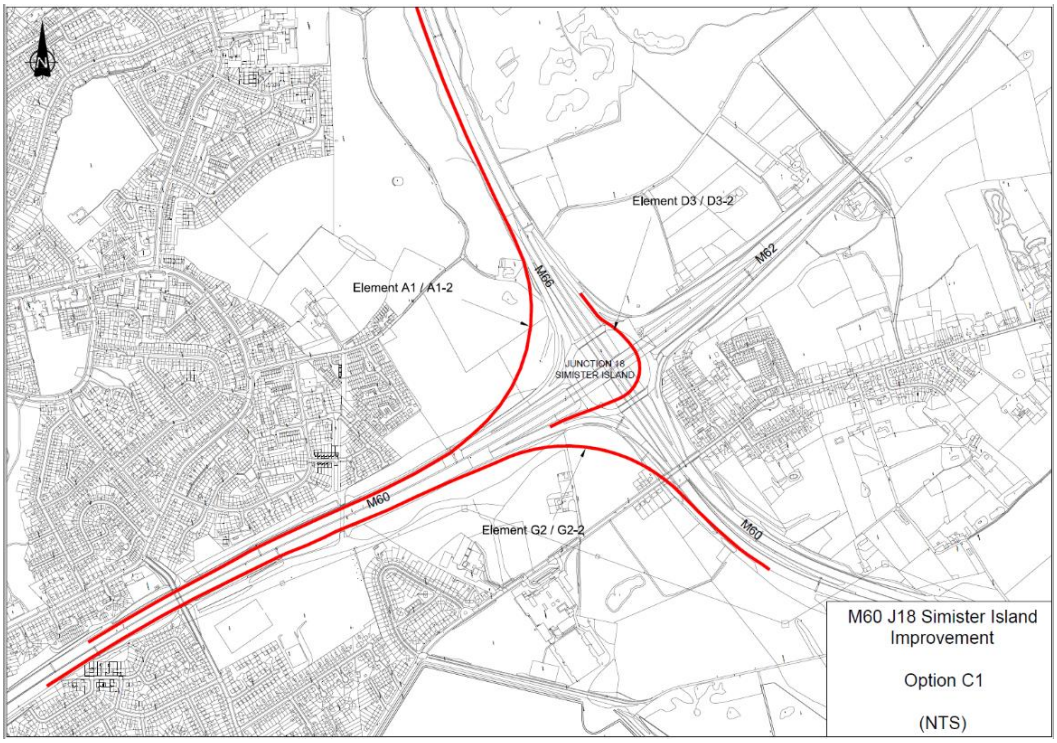
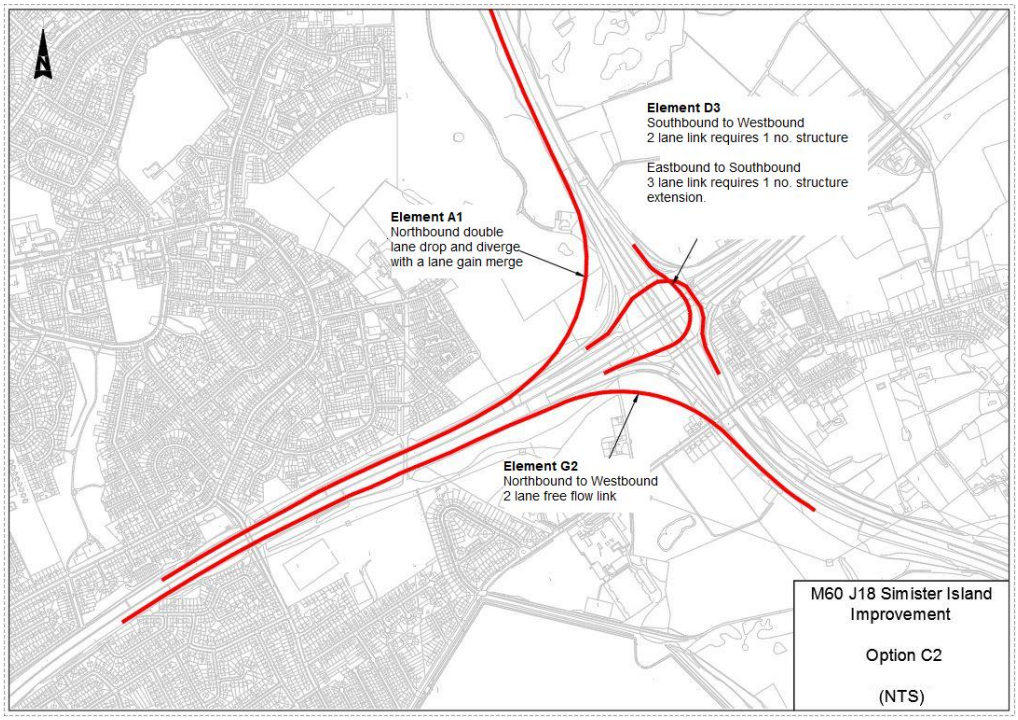


Plate 3.4: Proposed Option C2 (excluding ALR element)



PCF Stage 1 (Option identification) options

3.2.9 Options A and C were subject to a further design review particularly regarding highway layout and geometry, visibility and buildability. Design improvements were made to remove or mitigate problems identified with the Stage 0 proposals. Two variants of Options A and C were identified, and design proposals produced and assessed.

3.2.10 A sub-option of 5-lane ALR between M60 J17 and J18 was introduced for all the improvements (Options A1 and C1) and variants (Options A2 and C2) in-line with the Client Scheme Requirements.

3.2.11 The design of the improvements and variants was based on forecast 2023 opening year traffic flows. The traffic operation of the four options was assessed using a VISSIM micro-simulation traffic model. Impact on land and property, utility equipment, traffic signs and signals requirements, structures, earthworks requirements and environmental impact and effects on maintenance were also considered. The results of this review are in the PCF Stage 1 – Identification of Options Report (CH2M, 2017).

3.2.12 An Options Workshop was held in January 2018 to confirm the problems to be solved and objectives to be met by the scheme, share details of the development of options, assess options against objectives and make recommendations on which options to be considered further. It was confirmed at the Options Workshop held in January 2018 that Options A1, A2, C1 and C2 should be taken forward for further detailed appraisal within PCF Stage 1 (Table 3.3). All of these options included 5-lane ALR between M60 J17 and J18.

Table 3.3: PCF Stage 1 options

Option	Elements
A1	The improvements made to Option A during PCF Stage 1 were:

Option	Elements
	• Increasing the loop size to locate the M66 SB merge upstream of the J18 roundabout north overbridge • Improving the M60 EB diverge layout • Improving the M60 NB to M60 WB interchange link • Improving the M60 WB merge layouts • Closure of roundabout entry from M60 EB and exit to M60 SB except for emergency and maintenance vehicles
A2	This was a new option that was identified at the start of PCF Stage 1. It is similar to Option A1 but has the following differences: • A small loop (radius of 100m) for the M60 EB to M60 SB interchange link • The M66 SB merge is downstream of the J18 roundabout south overbridge • The M60 EB to M60 SB interchange link is separated from the M66 SB by the roundabout and viaduct bridge piers • An overall longer bridge span over the roundabout is required • The M66 SB exit slip road roundabout approach and the free flow left turn to the M62 EB require amendment
C1	The improvements made to Option C during Stage 1 were: • Improving the M60 EB diverge layout • Improving the M60 EB to M66 NB interchange link and merge with the M66 NB • Extending the new route within the roundabout to the entry of the M60 NB exit slip road and so increasing signals green time • Improving the M60 NB to M60 WB interchange link • Improving the M60 WB merge layouts
C2	This was a new option that was identified at the start of PCF Stage 1. It is the same as Option C1 except for the following differences: • Widening of the M60 EB exit slip road to three lanes • Widening of the roundabout north overbridge to provide two lanes for the M60 NB to M62 EB physically segregated from three lanes for the M60 EB to M60 SB • Eastern side of the roundabout marked for three lanes for the M60 EB to M60 SB • Roundabout exit to the M60 SB entry slip road initially marked as three lanes and then narrowed to two lanes

3.2.13 At the end of PCF Stage 1, Option A1 and Option C1 were discarded for a number of design, economic, and environmental reasons following their respective assessments. Option A2 and C2 were chosen to be taken forward for further assessment and consideration at PCF Stage 2, which was in part due to their lower environmental impact, particularly when compared to Option A1, which required larger amounts of land-take than the two chosen options.

PCF Stage 2 (Option selection) options

3.2.14 Early in PCF Stage 2, the two remaining options from PCF Stage 1 (Option A2 (renamed Option A2-1) and C2 (renamed Option C2-1)), were developed further and each split again into two new variants (Option A2-2 and C2-2) (Plates 3.5 and 3.6). Due to improvements in buildability, operational safety and estimated value for money of Options A2-2 and C2-2 over Options A2-1 and C2-1, it was decided that the Options A2-1 and C2-1 would be discarded, and A2-2 and C2-2 would be taken forward for the

rest of the stage. Therefore, Option A2-2 and C2-2 were the focus of the PCF Stage 2 Environmental Assessment Report (EAR) (CH2M, 2019).

Plate 3.5: Proposed Option A2-2 (excluding ALR)

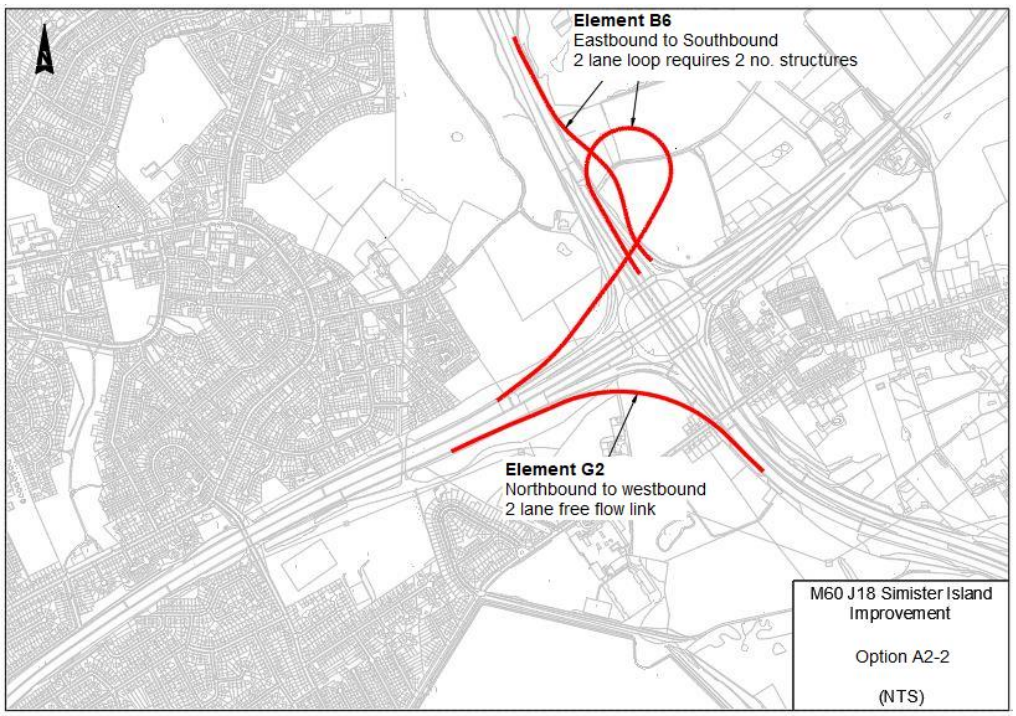
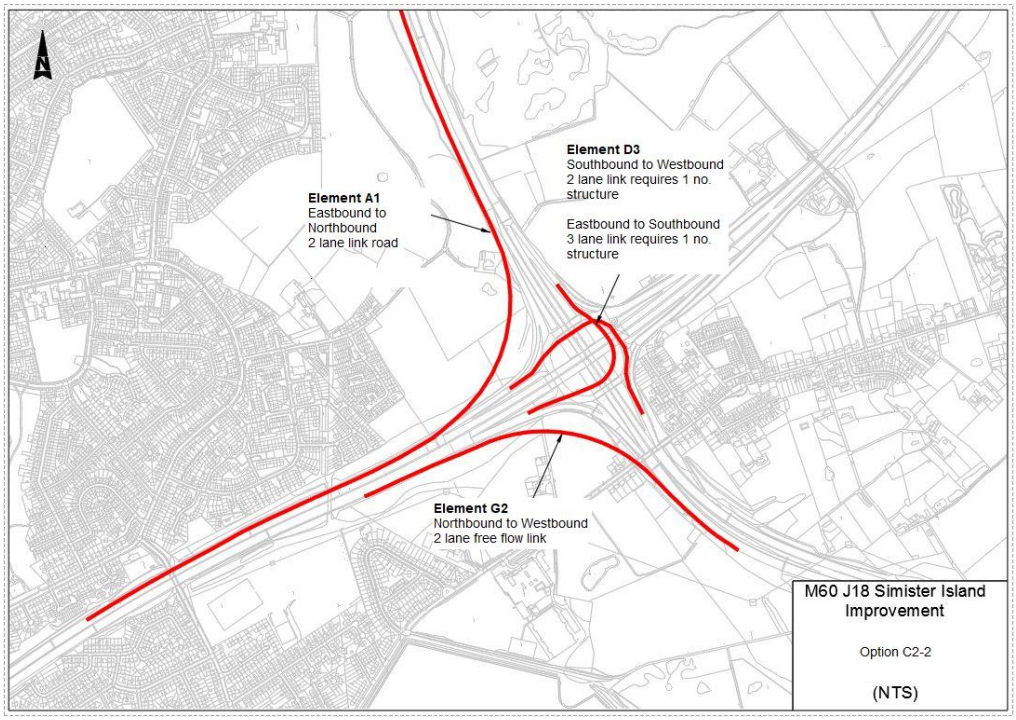


Plate 3.6: Proposed Option C2-2 (excluding ALR)



3.2.15 During PCF Stage 2 a comparison of the four options was undertaken to identify if there was any difference in Likely Significant Effect (LSE) between the options (taken from the PCF Stage 2 EAR (CH2M, 2019)) (see Table 3.4).

Table 3.4: Changes in LSE between Options A2-1 and A2-2 and C2-1 and C2-2

Subject	Option				Design changes which altered significance (where applicable)	Comment
	A2-1	A2-2	C2-1	C2-2		
Air Quality	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.
Cultural Heritage	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.
Landscape	**LSE**	**LSE**	**LSE**	**LSE**	N/A	All options would result in LSE on landscape and visual receptors. These effects would be significant on year of opening, generally reducing by year 15, to slight adverse for Option A2-2 and to negligible for C2-2.
Biodiversity	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.
Geology & Soils	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.
Material Assets & Waste	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.
Noise & Vibration	No LSE	No LSE	**LSE**	No LSE	Option C2-2 is proposed to reduce the radius of the M60 eastbound to M66 northbound interchange link from 360 m (as proposed in Option C2-1) to 255 m. Since this change will bring this link closer to the M60 J18 roundabout, hence further away from the sensitive receptors to the north-west of this junction, road traffic noise levels are expected to be lower at these receptors than those predicted for Option C2-1. Furthermore, since the options' designs were not yet fully developed in three dimension at PCF Stage 1, the noise model constructed for that stage assumed all road links and receptors to be located on level and flat ground, therefore not considering any noise	Impacts could potentially be improved with mitigation. Option C2-2 is the best option based on the number of dwellings in non-compliance with policies identified in the PCF Stage 2 assessment for daytime and night-time periods. With Option C2-1, significant environmental effects are expected at 16 dwellings where increases in road traffic noise levels above 3 dB(A) are predicted. No significant environmental effects are expected with Option C2-2 where the maximum increase in road traffic noise level is predicted to be 2.1 dB(A). However, since topography data associated with the

Subject	Option				Design changes which altered significance (where applicable)	Comment
	A2-1	A2-2	C2-1	C2-2		
					screening from terrain changes associated with the scheme options. However, since topography data associated with the Proposed Scheme was made available at PCF Stage 2, the noise levels predicted at this stage accounted for any screening provided by new embankments and other topographic changes between the proposed links and sensitive receptors. This may have been another contributing factor towards a difference in significance between the variants.	Proposed Scheme was made available at PCF Stage 2, noise screening from terrain changes associated with the proposed routes under study was not considered at PCF Stage 1.
Population & Human Health	No LSE	No LSE	**LSE**	No LSE	Reduction in significance of effect between C2-1 and C2-2 due to reduced land take on Cowl Gate Farm as a result of design changes to the M60 EB to M66 NB interchange link (Element A1). The radius was reduced from 360m to 255m to reduce land acquisition and the impact on Cowl Gate Farm.	No LSE for any of the remaining Stage 2 options (Option A2-2 and C2-2) after mitigation.
Road Drainage & the Water Environment	**LSE**	**LSE**	**LSE**	**LSE**	N/A	LSE before mitigation due to anticipated failures associated with the existing baseline situation, and potentially after mitigation, depending on the type and amount of mitigation required. More information on the extent of failures (and thus effects) will be known at PCF Stage 3 when a HEWRAT assessment is undertaken for routine runoff and its impacts upon water quality. Delivery of improvements to Priority Outfalls Categories A-C is a performance indicator (PI) identified in the Operational Metrics Manual (OMM). It forms a supporting measure as part of “Delivering better Environmental Outcomes” outlined in the RIS performance specification. Where identified and validated Priority outfalls are “coincidental with planned major projects”, then the Major Project should address these under scheme delivery as “business as

Subject	Option				Design changes which altered significance (where applicable)	Comment
	A2-1	A2-2	C2-1	C2-2		
						usual." Based upon this the whole project (and the whole drainage catchment to each outfall) needs to be included within the assessment in accordance with WebTAG, DMRB and in line with this PI.
Climate	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.

3.2.16 Prior to Public Consultation and to aid clarity, the options changed names in 2020 as follows:

- Option A2-2 became Northern Loop
- Option C2-2 became Inner Links

3.2.17 Public consultation was then carried out on these two options and this is covered further in Chapter 4.

Preferred Route Announcement (PRA)

3.2.18 Following public consultation in Summer 2020, the Northern Loop option was chosen as the emerging preferred option. When selecting the preferred route, Highways England considered several criteria, including the scheme objectives, safety, benefits, costs, environmental effects, construction and feedback from the public consultation. While both options would meet the scheme objectives, the Northern Loop would provide greater capacity improvements and journey time savings for road users when compared to the Inner Links. These benefits, therefore, will be felt for longer into the future, as predicted traffic levels continue to grow. The option selected was also widely supported during the public consultation, with over 67% of respondents preferring the Northern Loop.

3.2.19 The Preferred Route Announcement (PRA) was made for the Northern Loop Option on 27 January 2021.

3.3 Further scheme development

Non-All Lane Running alternatives

3.3.1 In January 2022 the Secretary of State for Transport responded to the Transport Select Committee's report on the roll out and safety of smart motorways. The key recommendation was pausing the construction of new All Lane Running (ALR) motorways until five years' safety data is available on the sections opened before 2020. As the Proposed Scheme included an element of ALR, the Department for Transport (DfT) instructed National Highways to consider alternatives to deliver the Proposed Scheme without the requirement for ALR. Consequently, National Highways instructed CJP to complete a Rapid Options Study (ROS) (CJP, 2022) to review and assess alternative options to progress the Proposed Scheme without an ALR element. The purpose of the study was to determine if any non-ALR alternative options were viable, with the aim of de-risking the Proposed Scheme delivery, allowing the Proposed Scheme to progress, while minimising the cost and time impacts of any delay.

3.3.2 The ROS evaluated three alternative options (Options 1-3), which focused specifically on the M60 between J17 and J18 to remove the ALR element, including the respective merges and diverges. For all options the M66 and junction improvements outside of those that interact with the M60 between J17 to J18 were the same (known as Option 0 – the Proposed Scheme including an ALR element). The three alternative options were as follows:

- Option 1 – provide a controlled motorway (motorway with variable speed limits) with five running lanes and a "full" hard shoulder (except at Sandgate Road Overbridge and Haweswater Aqueduct) on the M60 corridor between J17 and J18. There would

be some permanent land take and disruption to access for some residential properties in order to accommodate a “full” hard shoulder.

- Option 2 – provide a controlled motorway with five running lanes and an intermittent hard shoulder on the M60 corridor between J17 and J18 to minimise the impact to the surrounding properties and to remain within the existing highway boundary where possible.
- Option 3 – Controlled motorway regime: retain the existing four lanes on each side and existing hard shoulder arrangement, while providing the M60 J18 improvements as proposed in Option 0. There would be no highways works to the west of Sandgate Road Overbridge. The attenuation ponds south of Whitefield Golf Course would not be required for this option; instead, an attenuation pond would be constructed on land adjacent to Prestwich Heys Football Club (FC).

3.3.3 The ROS included a Preliminary Environmental Risk Assessment (PERA), which was produced to identify the initial environmental (including environmental policy) constraints, risks and opportunities for each option in order to establish if the project would encounter barriers to delivery in respect to scope, programme and budget. Red-Amber-Green (RAG) rating criteria, which were taken from the National Highways PCF product template for a PERA, was used to assess the potential environmental risks, opportunities and policy conflicts for each option. The RAG rating criteria were as follows:

- Red: Policy conflicts and environmental constraints that cannot be addressed using established and readily deliverable design solutions or mitigation, thereby posing a threat to project delivery
- Amber: Policy conflicts and environmental constraints that, whilst potentially significant, can likely be resolved / mitigated with potential implications for program and budget
- Green: Policy compliant environmental constraints that are likely be resolved / mitigated within program and budget

3.3.4 In summary, Amber ratings were assigned for all three alternative options, indicating that there are environmental constraints or policy conflicts which, while potentially significant, could likely be mitigated in most instances but with implications for the programme and/or budget. Summaries of the environmental risk assessment for each option are as follows:

- Option 1 would have the most notable environmental constraints or policy conflicts due to potentially significant effects arising through the permanent land take requirements affecting residential properties located close to the motorway, visual impacts affecting the same receptors (some impacts could not be mitigated to non-significant), noise impacts affecting the same receptors during construction works, particularly at night, and the cumulative impact on health/quality of life on those residents due to disruption to access and loss of amenity. Opportunities to reduce vegetation clearance were identified.
- Option 2 would still have notable environmental constraints or policy conflicts, but these were considered to be reduced compared to Option 1 as the option kept within the highway boundary where feasible, with reduced land take (no permanent land take affecting residential properties) and associated disruption to access and

vegetation clearance in comparison to Option 1. Opportunities to reduce vegetation clearance and impacts on residents were identified.

- Option 3 would avoid potentially significant effects associated with the construction of attenuation ponds south of Whitefield Golf Course as the ponds would not be required for this option. However, there were notable environmental constraints or policy conflicts, such as vegetation clearance and noise impacts associated with other aspects of the scheme. There was also the potential requirement to provide alternative open space of equivalent or better standard due to permanent acquisition of open space adjacent to Prestwich Heys FC grounds. Option 3 had a smaller footprint and reduced construction works compared with Options 1 and 2, however this option may not adequately address the key issues associated with the scheme, such as congestion, and could exacerbate existing environmental issues including air quality. Opportunities to reduce vegetation clearance were identified.

3.3.5 Taking into account the conclusions of the environmental risk assessment, alongside other factors such as scheme cost, viability (BCR), programme and deliverability, operational safety, engineering and construction challenges and risks, and legal and statutory process challenges and risks, it was recommended that Option 2 should be progressed at PCF Stage 3.

3.3.6 National Highways subsequently approved the recommendation to incorporate Option 2 into the Proposed Scheme design. This PEIR has therefore assessed the Proposed Scheme design including the Option 2 non-ALR elements.

3.3.7 Since the decision was taken to incorporate Option 2 into the Proposed Scheme design, the design of the Proposed Scheme was further refined. To accommodate a hard shoulder along the M60 J17 to J18 mainline, works would have taken place in close proximity to Prestfield Court (Kensington Street). The works may have been required to take place during the night, and there would have been significant clearance of trees that provided visual screening of the motorway. To remove the requirement for works outside Prestfield Court and avoid potential impacts on residents of Prestfield Court, it was confirmed that the hard shoulder provision would start further east of Prestfield Court and additional hard shoulder provision was accommodated into the design of the Proposed Scheme above Haweswater Aqueduct/Underpass.

Further scheme development

3.3.8 During PCF Stage 3, the design has been further refined. The main changes to the highway design from the PCF Stage 2 PRA design were as follows:

- **M60 J17 to J18 mainline hard shoulder provision added** (see ‘Non-All Lane Running alternatives’ section for further discussion).
- **Northern Loop (M60 eastbound to M60 southbound)** – vertical alignment changed so that the M66 southbound diverge link goes onto a bridge over the Northern Loop link (rather than under it). This results in a significant reduction of earthworks volumes compared to the PRA design and also removes a retaining wall adjacent to the M66 southbound merge.
- **M60 westbound merge and link from M60 northbound** – removed offline link that was shown in the PRA design to maintain use of existing M60 northbound to M60 westbound link. Westbound merge arrangement design has been modified so

that the merge occurs prior to Haweswater Aqueduct and weaving length to M60 J17 diverge is increased.

- **M66 / M60 northbound and southbound lane provisions and cross-sections modified** – hard shoulders added to design, accommodated by reducing the cross-sectional width of the central reserve to a minimum.
- **M60 J17 to J18 mainline lane provisions and cross-sections modified** – to optimise available verge (which is highly constrained) the central reserve has been designed to be as efficient as possible taking into account the requirement for a concrete barrier.

3.3.9 Further consideration of the location of attenuation ponds has been given during PCF Stage 3. The proposed locations are shown in Figure 2.1. Consideration of the environmental constraints was an integral part of the design development, as avoidance/minimising the impact on sensitive habitats is a requirement of the hierarchical mitigation system outlined in paragraph 3.23 of the DMRB LA 104 Environmental Assessment and Monitoring (Highways England, Revision 1, 2020). This was particularly pertinent in Philips Park LNR (which includes two areas of Ancient Woodland), which was considered for an attenuation pond but considered not to be suitable for environmental reasons.

3.3.10 There may be a requirement for a new culvert (alongside an existing one) from Whitefield Golf Course into Philips Park LNR. Detailed consideration was given to access within the LNR and, to minimise habitat loss, it was decided to access from the M60, rather than through the park.

3.3.11 Further embedded mitigation is described in the aspect chapters (Chapters 6-15).

3.3.12 The Environmental Statement will provide a full description of the alternatives considered as well as a justification for why the preferred option was selected.

3.3.13 The environmental assessment will consider alternative ways of delivering the Proposed Scheme. This will include consideration of:

- The location and type of technology to be included (e.g. traffic signals)
- The construction methodology and programme (including the phasing of construction works and number and location of compounds and haul roads)
- Optimising the cut-fill balance to reduce material requirements and waste
- The location and extent of carriageway widening
- The alignment of new offline carriageway
- The location and design of proposed WCH diversions
- The type, location and extent of environmental mitigation

3.3.14 The assessment will fully consider the environmental impact of delivering the Proposed Scheme, including incorporating any mitigation embedded into the scheme design to avoid or reduce environmental effects. This will be documented in the Environmental Statement.

4. Consultation

4.1 Statutory consultation

4.1.1 The Proposed Scheme is currently in a period of statutory consultation. National Highways are consulting with prescribed consultees as per the requirements of Section 42 of the Planning Act 2008. The consultees include, for example, Natural England, the Environment Agency and Historic England, relevant planning authorities and interested parties (e.g. landowners and tenants).

4.1.2 The local community and wider public are also being consulted on the Proposed Scheme via the statutory consultation programme in line with Section 47 of the Planning Act 2008.

4.1.3 A Statement of Community Consultation (SoCC) has been produced and published for the formal statutory consultation period. The SoCC outlines how National Highways will formally consult with the local community about the Proposed Scheme.

4.1.4 The purpose of this consultation is to seek comments from the local community and statutory consultees on the Proposed Scheme. This PEIR has been produced to support the consultation. This PEIR includes environmental information to enable consultees to understand the likely significant environmental effects of the Proposed Scheme, and measures proposed to mitigate such effects, to help inform their consultation responses.

4.1.5 The statutory consultation will include public events, webinars (these will be live online events where technical experts will talk through the design proposals and answer any questions), telephone consultation events and publication of brochures, reports and other information made available in local community facilities and online.

4.1.6 The planned consultation events are subject to the government's national and local COVID-19 guidelines. Any changes to these events will be updated on the webpage for the scheme at www.nationalhighways.co.uk/M60-Simister-Island, and on social media.

4.1.7 Once the statutory consultation has closed, a Consultation Report will be produced and submitted as part of the DCO application. This will summarise the feedback received during the consultation as well as how the project team have considered this feedback in the scheme design. The Consultation Report will demonstrate how National Highways has complied with the consultation requirements of the Planning Act 2008.

4.2 Non-statutory engagement

Consultation undertaken to date

4.2.1 A public consultation was held for Northern Loop and Inner Links options from 22 June to 17 August 2020. Due to the COVID-19 pandemic this was carried out remotely, which included posting of a consultation brochure and response form to almost 10,000 addresses, provision of on-line information, and providing telephone events to replace face to face engagement.

4.2.2 Highways England received 817 responses to the consultation, which included responses from the local authorities, impacted landowners and local communities.

Highways England received responses from a number of local authorities, including Bury Metropolitan Borough Council (BMBC), Transport for Greater Manchester (TfGM), Rochdale Borough Council (RBC), Salford City Council (SCC), Rochdale Development Authority and Lancashire County Council. Each of these stakeholders expressed the need for improvements at M60 J18, with the majority favouring the Northern Loop Option.

4.2.3 625 out of the 817 respondents agreed that there is a need to improve traffic flows through the junction and there was a clear preference for developing the Northern Loop Option over the Inner Links Option as a means of achieving this: 397 strongly supporting the Northern Loop Option compared to 65 strongly supporting the Inner Links Option.

4.2.4 Concerns raised by consultees included the following:

- The need to address congestion (162 responses)
- Air pollution (147 responses)
- Noise pollution (122 responses)
- Negative impacts on residents (115 responses)
- The carbon footprint (73 responses)
- Negative impact on the landscape (61 responses)
- Loss of land (25 responses)
- The impact on nature conservation (20 responses)

4.2.5 Other key concerns were:

- Safety (133 responses)
- Losing the hard shoulder (74 responses)
- Avoiding accidents (28 responses)
- Avoiding confusion for drivers (25 responses)

4.2.6 Another key concern was the construction phase impacts on the area and the duration of works.

4.2.7 Table 4.1 highlights key responses from statutory environmental bodies during the PCF Stage 2 consultation. Further information is available in the M60 Junction 18 Simister Island Interchange Report on Public Consultation (Accent, 2020).

Table 4.1: Statutory consultees – consultation responses

Stakeholder	Consultation response
Environment Agency	The Environment Agency's response focused on flood risk, water quality and environmental permitting. **Flood Risk**: The Environment Agency sees increased risk on watercourses from the works and the scheme may require a flood risk activity permit. There is potential to generate additional amounts of surface water, so Highways England will need to ensure that flood risk is not increased elsewhere. The Lead Local Flood Authority should be consulted on the proposals given their statutory role on surface water flood risk. **Water Quality**: The Water Framework Directive (and the associated statutory River Basin Management Plan) stipulates that there should be no deterioration of any waterbody. Measures to meet the overall objective of 'good' ecological status/potential should be addressed where possible. Surface water from the motorway network ultimately flows into the River Roch and River Irk watercourses which are monitored by the Environment Agency for compliance against the EU Water Framework Directive. Baseline evidence shows that they are currently failing to meet their required objectives with diffuse pollution pressures from 'Urban and Transport' noted as a contributing factor. The public consultation document notes that the two shortlisted options for the scheme are likely to have 'adverse impacts' on the water environment from a water quality perspective. It also states that 'these impacts to be mitigated and options for this will be identified and included in the design for the scheme as it progresses'. Any mitigation should consider opportunities to address current water quality impacts from the existing network to achieve a more sustainable solution to the final design of the scheme and/or avoid the need to retrospectively address current outfall problems in the future. These would ultimately cost more in the longer term. Therefore, as part of the further assessment work for the scheme (including any Environmental Statement) a Water Framework Directive Assessment should be undertaken to inform the scope around this. Opportunities to incorporate environmental best practice in the form of multifunctional and above ground sustainable urban drainage solutions (SUDs) should be adopted where feasible. This would not only address any water quality issues but also provide an opportunity for betterment with regards to biodiversity (net gains). **Environmental Permitting**: This development may require a permit under the Environmental Permitting (England and Wales) Regulations 2016 from the Environment Agency for any proposed works or structures, in, under, over or within eight metres of the bank of Castle Brook and Whitefield 4 Brook which, are designated 'main river'. Some activities are also now excluded or exempt. A permit is separate to and in addition to any planning permission granted.
Natural England	Natural England have no detailed comments to make about the proposal at this stage but want to be consulted in future.

Stakeholder	Consultation response
Public Health England (PHE) (now the UK Health Security Agency)	PHE commented on the following implications of the PCF Stage 2 options: • Human health and wellbeing • Environmental hazards • Air quality • Noise • Electric and magnetic fields. The health of an individual or a population is the result of a complex interaction of a wide range of different determinants of health, from an individual's genetic makeup, to lifestyles and behaviours, and the communities, local economy, built and natural environments to global ecosystem trends. All developments will have some effect on the determinants of health, which in turn will influence the health and wellbeing of the general population, vulnerable groups and individual people. Although assessing impacts on health beyond direct effects from, for example, emissions to air or road traffic incidents is complex, there is a need to ensure a proportionate assessment. This should focus on significant effects of the upgrade. From this standpoint PHE made the following observations: **Human Health and Wellbeing**: PHE wants to see the application for a scoping opinion once the public consultation is complete and the preferred option is announced. At that point, PHE recommends the applicants follow the methodology provided by DMRB LA 112, when assessing and reporting the effect of the development on population and human health. **Environmental Hazards**: PHE understands that Highways England will wish to avoid unnecessary duplication and that many issues including air quality, emissions to water, waste, contaminated land etc. will be covered elsewhere in their Environmental Statement (ES). The ES should summarise key information, risk assessments, proposed mitigation measures, conclusions and residual impacts, relating to human health. Compliance with the requirements of National Policy Statements and relevant guidance and standards should also be highlighted. **Air Quality**: PHE's position is that pollutants associated with combustion engine-based road traffic, particularly particulate matter and oxides of nitrogen are non-threshold. This means that an exposed population is likely to be subject to potential harm at any level and that reducing public exposures of non-threshold pollutants below air quality standards will have potential public health benefits. PHE supports minimizing or mitigating public exposure to non-threshold air pollutants, addressing inequalities in exposure and maximizing co-benefits (such as physical exercise). PHE encourages these to be considered during the development design, environmental and health impact assessment, and the development consent. **Electric and Magnetic Fields**: PHE notes that the current proposals do not appear to consider possible health impacts of Electric and Magnetic Fields (EMF). PHE requests that the ES clarifies this and if necessary, the proposer should confirm either that the proposed development does not impact any receptors from potential sources of EMF or ensure that an adequate assessment of the possible impacts is undertaken and included in the ES.
Bury Metropolitan Borough Council – Environment Team	**Overall view of scheme**: The Environment Team is neutral about the options for the scheme but is concerned about the potential impacts on air quality and how these can be mitigated. **Current junction problems**: The junction as it is now is likely to be contributing to high nitrogen dioxide levels on A 56 and at the side of M60 between J17 and J18. Monitoring of nitrogen dioxide emissions close to residential housing at the side of the M60 between Junction 17 and 18 indicate that objectives for nitrogen dioxide were not met in 2019. **Views on the proposals**: The Environment Team is neutral about both options for the junction. The prospect of having 10 lanes of running traffic closer to the above residential properties is of great concern, as would be the impact on air quality for residents of Simister. The Environment Team suggests that Highways England must ensure that any improvements at Junction 17 and 18 have a positive impact on air quality and reduce nitrogen dioxide at nearby properties. The Environment Team will need to see the detailed air quality modelling carried out for the schemes and associated reports. It will need assurances that the project will not undermine proposals in the Greater Manchester Clean Air Plan to meet nitrogen dioxide objectives in the shortest time possible.

Stakeholder	Consultation response
Rochdale Borough Council – Environment	The Council stated that, while there are issues to be assessed in due course through a statutory planning process, it welcomes the mitigation measures proposed to minimize additional impacts of both options in relation to nature conservation, noise and drainage and the water environment. The Council requests additional future proofing in the design of any proposals at Junction 18 to support a new northerly motorway access into the Northern Gateway site around Birch services together with necessary improvements to M66 Junction 3. However, it does not believe that Highways England has not engaged sufficiently to tackle air quality issues and support the Greater Manchester Clean Air Plan work. The Council stated that it will examine the air quality impacts of the selected improvement during the planning process when greater information is available. This, they stated will help them better understand how any scheme supports collective efforts to reduce nitrogen dioxide levels across Greater Manchester. The Council requests early engagement with Highways England on the design of the selected option to assess the timing of any planned work in terms of the Northern Gateway development as well as the impacts of any diversionary routes during the construction period. They stated that restrictions must be in place on several local roads within the Borough to minimize disturbance to residents. They stated that regular meeting with elected Members and communities will therefore be needed. The Council will also want to ensure we have ongoing dialogue with Highways England to ensure any master planning of the Northern Gateway employment site, and its early phases of its delivery, are integrated into the planning of whichever improvement option is taken forward.

Technical engagement

4.2.8 Stakeholders have been consulted during the assessment process, in particular:

- Local authority environmental health officers (BMBC)
- Local authority landscape planning officers (BMBC, RBC, Manchester City Council (MCC))
- Local authority geology and soils / water resources officers (BMBC)

4.2.9 Stakeholder feedback relevant to the proposed assessment scope and methodology is provided in the individual aspect chapters (Chapters 6-15), where appropriate.

4.2.10 Technical engagement will continue throughout PCF Stage 3 to discuss the scope, potential effects, and proposed mitigation with relevant stakeholders. This engagement will take the form of email exchanges, telephone calls, virtual meetings, and face to face meetings where required (subject to COVID-19 restrictions at the time the engagement takes place).

4.2.11 The project teams on both M60/M62/M66 Simister Island Interchange and Manchester North West Quadrant (MNWQ) schemes are working together to develop a common stakeholder database and to ensure that there is a consistent approach to consulting with stakeholders on potential improvements to the area around M60 J18.

5. Environmental assessment methodology

5.1 Environmental scoping

5.1.1 An Environmental Scoping Report was submitted to the Planning Inspectorate on 2nd July 2021 (Highways England, 2021) in PDF format and as a digital version. The digital version of the Environmental Scoping Report presents the same project information as is presented in the PDF format of the Scoping Report, submitted in accordance with Regulation 10 of the EIA Regulations 2017.

5.1.2 The PDF and digital versions of the Environmental Scoping Report can be viewed on the Planning Inspectorate's website under 'National Infrastructure Applications' (alternative contact is M60SimisterIsland@planninginspectorate.gov.uk, telephone: 0303 444 5000), or at the following links:

- PDF format:

  https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010064/TR010064-000013-TR010064%20-%20Scoping%20Report%20PDF%20VERSION.pdf

- Digital format:

  https://experience.arcgis.com/experience/4409d244b5f34f77a996047d4165fb38

5.1.3 The Environmental Scoping Report was produced to document the proposed scope of the environmental assessment, including a description of the aspects and matters to be included in the Environmental Statement.

5.1.4 The Planning Inspectorate reviewed and consulted on the Environmental Scoping Report and published a Scoping Opinion on 12 August 2021 (Planning Inspectorate, 2021). The Scoping Opinion can be viewed on the Planning Inspectorate's website under 'National Infrastructure Applications' or at the following link:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010064/TR010064-000030-TR010064%20-%20Scoping%20Opinion.pdf

5.1.5 The scope of the assessment could be refined, with agreement from stakeholders, as additional data and survey information become available. Where feedback from consultation has influenced the assessment methodology or scope, this has been stated in the individual aspect chapters within this PEIR.

Aspects and matters scoped out of the assessment

5.1.6 The construction and operation of the Proposed Scheme would not introduce any source of radiation and would only generate limited amounts of heat from technology. The assessment of heat and radiation is therefore not considered relevant to the Proposed Scheme and has been scoped out of further assessment. No further environmental aspects have been scoped out of the assessment in their entirety.

5.1.7 Certain matters of environmental aspects have been scoped out of the assessment, in line with the Scoping Opinion (Planning Inspectorate, 2021). These matters are summarised in Table 5.1.

Table 5.1: Summary of the matters scoped out of the assessment and Scoping Opinion response

Matter scoped out	Justification	Planning Inspectorate's comment
Effects on archaeological remains during the operational phase	Archaeological remains would be sensitive only to the potential for changes in the way in which sound and noise currently contribute to their heritage value. Their value is primarily derived from their physical remains and any intrusion on their setting during operation would have limited to no impact on our understanding and appreciation of these heritage assets. This would not be on a scale that would result in significant effects. Based on this, impacts on archaeological remains during operation are scoped out of further assessment.	ID 4.2.1 The Applicant concludes there is limited potential for significant physical impacts on historic buildings and archaeological remains during operation. Previously unknown archaeological assets that may be present within the footprint of the Proposed Development will be assessed as part of the construction phase assessment. Effects on setting of historic buildings will be assessed as part of the operational assessment. On this basis, the Inspectorate agrees that physical impacts on historic buildings and archaeological remains during operation can be scoped out.
European designated ecological sites	There are no Special Protection Area (SPA) or Ramsar sites within 2km of the Proposed Scheme or PCF Stage 2 Affected Road Network (ARN) and European sites designated for bats within 30km of the Proposed Scheme, therefore SPAs and Ramsar sites are scoped out of further assessment.	ID 4.4.1 There are no European sites or SSSI within 2km of the Proposed Development and no pathways of effect during the construction of the Proposed Development have been identified. As set out in item 4.1.1 of this Scoping Opinion, the Inspectorate does not agree that air quality effects of changes in road traffic during construction can be scoped out whilst the traffic screening exercise remains to be carried out. On this basis, the Inspectorate considers that there could be effects on the Rochdale Canal SAC and SSSI. For all other European sites and SSSI and other pathways of effect (with the exception of air quality), the Inspectorate agrees that these can be scoped out of the assessment of effects during construction.
National nature reserves (NNR)	There are no NNRs within 2km of the Proposed Scheme or PCF Stage 2 ARN, therefore NNRs are scoped out of further assessment.	ID 4.4.2 No NNR have been identified within the study area or within 2km of the site or ARN. The Inspectorate agrees that these matters can be scoped out of the assessment.
Invasive and non-native plant and animal species (INNS)	Given the negligible value assigned to INNS, invasive species are scoped out of further assessment during operation, however, they will be considered in relation to legislative compliance during construction.	ID 4.4.3 Paragraphs 9.4.8 and 9.4.24 explain that potential for INNS effects during construction will be considered. However, the Inspectorate agrees that significant effects during operation are not likely and that this matter can be scoped out of the assessment.

Matter scoped out	Justification	Planning Inspectorate's comment
Designated geological sites and sensitive / valuable non-designated geological features	There are no receptors located within the study area, therefore this matter of geology is scoped out of further assessment.	ID 4.5.1 Impacts to geology are proposed to be scoped out on the basis that no sensitive geological receptors are identified within the study area. Considering the baseline geological information presented, and the description of the Proposed Development, the Inspectorate is content that this matter can be scoped out.
Effects on soils during the operational phase	No additional impacts are predicted on soils during the operational phase. The permanent loss of agricultural land occurring during construction would persist during operation but is not considered as an additional effect. Temporary effects arising during construction on soil quality in relation to degradation during handling may extend into operation but should not be persistent assuming that best practice mitigation measures are applied. Operational effects on soils are therefore scoped out of further assessment.	ID 4.5.2 On the basis that impacts to soil will be assessed during construction (as permanent and temporary losses), the Inspectorate considers that effects on soils during operation can be scoped out.
Effects on the health of site users and the general public during the operational phase	Contamination within the Proposed Scheme extents would have been removed during construction, reducing the potential for contact with contaminated soil. Furthermore, implementing appropriate site-specific risk assessments and method statements would reduce exposure. This is likely to have a negligible magnitude of impact, resulting in a slight effect on human health. Therefore, human health for site users has been scoped out of the assessment.	The Planning Inspectorate did not make a specific comment in relation to this matter.
Effects on groundwater and surface water from contaminated land during the operational phase	During the operational stage, potential contaminated land linkages would have been broken due to the construction of the carriageway, therefore no additional impacts are predicted in relation to water receptors. Operational effects on surface water and groundwater from contaminated land are therefore scoped out of further assessment.	The Planning Inspectorate did not make a specific comment in relation to this matter.

Matter scoped out	Justification	Planning Inspectorate's comment
Effects from material assets and waste during the operational phase	DMRB LA 110 (Highways England, Revision 0, 2019) specifies that the assessment should only report on the first year of operational activities (opening year). Any construction phase effects overlapping within this period will be captured within the construction phase assessment. It is assumed that the assessment of any environmental impacts and effects associated with material assets and waste during any large scale future maintenance, renewal, or improvement works, would be undertaken by Highways England's North West Asset Delivery Contractor(s) (or equivalent) in accordance with the requirements of DMRB LA 110.	ID 4.6.3 These matters are proposed to be scoped out of the assessment on the basis that maintenance activities would be undertaken in accordance with the requirements of DMRB LA 110 and are not expected in the first year of operation (timescale defined by DMRB LA 110) or beyond. The Inspectorate is content to agree to scope this matter out on this basis.
Effects from traffic vibration during the operational phase	DMRB LA 111 (Highways England, Revision 2, 2020b) states that operational vibration should be scoped out of the assessment methodology as a maintained road surface will be free of irregularities so operational vibration will not have the potential to lead to significant adverse effects. It is considered that there is nothing within the initial design of the Proposed Scheme that would change this assumption.	ID 4.7.1 On the basis that the maintained road surface once complete will be free of irregularities under general maintenance provisions, the Inspectorate agrees that operational vibration can be scoped out of the Environmental Statement due to the low likelihood of long-term significant effects. The Inspectorate also notes the presence of the existing road network in terms of future baseline conditions.
Community severance during the construction phase	The Proposed Scheme has the potential to influence traffic flows on the wider road network, some of which may result in increases or alleviation of community severance. Further information is required to investigate the locations of changes to traffic flows and whether changes are of a scale that may affect existing levels of severance or cause new severance. It is proposed to assess this for operational traffic flows only. There is also potential to address existing severance through inclusion of new safe crossing points that would help re-connect community networks and support community cohesion. Since community severance and social cohesion are considered longer-term issues, it is proposed to assess this during the operational phase only. Potential disruption to community access from construction activities will be considered under 'accessibility for walking and cycling' and 'connections to employment, services, facilities and leisure'.	ID 4.8.2 Community severance is defined as a "longer-term issue" and therefore, as the construction phase is temporary in duration (3 years) and phased, construction impacts would not constitute a long-term change. Therefore, this matter is proposed to be scoped out of the assessment during construction but will be addressed in terms of operational effects. Accessibility is scoped in as a different impact. Based on the information provided, and in particular the statements at paragraphs 13.6.4 and 13.6.5 that severance during construction has the potential to be significant, the Inspectorate does not agree that this matter can be scoped out at this stage and should be considered alongside longer-term severance during operation.

Matter scoped out	Justification	Planning Inspectorate's comment
Effects on employment opportunities including training opportunities during the operational phase	As a highway project, the Proposed Scheme will not generate many direct employment opportunities in operation and so this is not a likely significant effect on human health. Operational effects on employment opportunities are therefore scoped out of the assessment.	ID 4.8.3 No clear explanation is provided as to why employment opportunities during operation are scoped out of the assessment, however, due to the nature of the Proposed Development, the Inspectorate is content to scope this matter out.

5.1.8 The following matters were proposed to be scoped out of the assessment but have been scoped back in following feedback from the Scoping Opinion:

- Air quality effects of changes in road traffic during construction
- Effects on archaeological remains due to new land take associated with the project
- Effects on Rochdale Canal Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) during construction
- Community severance during construction
- Impacts to ponds
- Impacts from construction compounds on groundwater
- Impacts on floodplains

5.1.9 These matters are discussed in the aspect chapters within this PEIR.

5.1.10 The full scoping opinion, as well as the Proposed Scheme's response and how and where these have been addressed in the Environmental Impact Assessment (EIA) and Draft Development Consent Order (DCO), will be included within the Environmental Statement.

5.2 Surveys, predictive techniques and methods

Design Manual for Roads and Bridges (DMRB)

5.2.1 The environmental assessment will comply with the general standards set out within DMRB LA 104: Environmental Assessment and Monitoring (Highways England, Revision 1, 2020a; hereafter referred to as DMRB LA 104), as well as the aspect specific DMRB standards (as contained within DMRB LA 105 to 115 and 120). DMRB is the established standard for assessing the environmental impacts of highway schemes and has been developed by National Highways (formerly Highways England) in collaboration with relevant stakeholders. DMRB has recently undergone an extensive update to capture the requirements of the EIA Regulations 2017.

5.2.2 Where relevant, the environmental assessment will draw on relevant topic guidance and best practice. More details on the methods to be used are provided in each of the aspect chapters (Chapters 6 to 15).

Study areas

5.2.3 Various study areas have been used to assess the impact on environmental receptors following DMRB standards and aspect specific guidance. Specific study areas are outlined in the individual aspect chapters.

Temporal scope

5.2.4 For the purpose of the preliminary EIA, the construction start of works is 2025, the opening year is 2027, and the design year is 2042 (15 years after opening to traffic).

Surveys and assessment

5.2.5 Environmental surveys have been carried out to inform the environmental assessment. The following environmental surveys have been undertaken or are due to be undertaken:

- UK Habitat Classification System survey
- Protected and notable species surveys:
  - Bat surveys (ground-based assessment of trees, emergence re-entry surveys of trees, tree-climbing inspection surveys, and bat activity surveys)
  - Badger surveys
  - Barn owl surveys
  - Great crested newt surveys (including Habitat Suitability Index (HSI) assessment, presence/absence surveys, population size class assessment, and eDNA surveys)
  - Wintering bird surveys
  - Breeding bird surveys
  - Otter and water vole surveys
  - Reptile surveys
  - Terrestrial invertebrate surveys
- River condition assessment of waterbodies
- Hydromorphology walkover survey
- Floating plantain survey
- Landscape winter survey
- Landscape summer survey
- Arboriculture surveys
- Air quality monitoring
- Cultural heritage site walkover survey
- Agricultural land classification (ALC) survey
- Soil resource survey
- Baseline noise surveys

- Ground investigation surveys
- Groundwater Dependent Terrestrial Ecosystems (GWDTE) survey

5.2.6 Most of the surveys listed in paragraph 5.2.5 were undertaken in 2021 and 2022. Additional barn owl, bat activity, terrestrial invertebrate, arboriculture, ground investigation and GWDTE surveys are due to be undertaken in 2023 to inform the aspect-specific environmental assessments in the Environmental Statement.

5.2.7 In addition to surveys, other predictive techniques have been used to inform the EIA, such as air quality, noise and flood risk modelling. Further information on the surveys and assessments undertaken is provided in the individual aspect chapters.

Traffic modelling

5.2.8 Predictions of future traffic levels both with and without the Proposed Scheme are produced using a traffic model. A traffic model was created to represent the transport system in this area of Greater Manchester on a typical weekday. It covers the whole of the UK to capture the actual start and end of every trip but is more detailed in Greater Manchester with a particular focus on the area around M60 J18.

5.2.9 The hours modelled in the traffic model are and average 07:00–09:00 in the morning (the morning peak) and average 16:00–18:00 in the evening (the evening peak) as these are the busiest times of day on the motorways in this area, confirmed by using 2018 traffic count data. A typical average hour in the middle of the day from 09:00 to 15:00 is also modelled (the inter-peak).

5.2.10 A traffic model known as the ‘base year model’ was developed to represent existing traffic conditions as they were in 2018. The information on where people are travelling to and from has been taken from an analysis of the movement of a vast number of mobile phones. This information is then scaled to match traffic counts and merged with other data sources to provide the travel patterns of cars, vans and heavy goods vehicles (HGVs) across the country.

5.2.11 The traffic model is then used to predict how traffic conditions will change in the future. Information on planned future housing and job developments are taken into account, as well as information on predicted growth in people, jobs and traffic provided by the Department for Transport (DfT).

5.2.12 Traffic models are created for two main future scenarios: the Do-Minimum (i.e. without the Proposed Scheme) and the Do-Something (i.e. with the Proposed Scheme). Traffic models are developed for 2027 (the expected year of scheme opening) and 2042 (15 years after opening). Traffic flows and speeds on each road in the study area have been provided to inform the preliminary environmental assessment.

5.2.13 Full details of how the traffic model was developed is provided in the Traffic Modelling Report for Consultation (National Highways, 2023). Section 2.7 of this PEIR summarises the key predictions outlined in the Traffic Modelling Report for Consultation.

Future baseline

5.2.14 The baseline conditions used for assessment purposes are the predicted future conditions that would exist in the absence of the Proposed Scheme either (a) at the time that construction is expected to start, for impacts arising from construction, (b) at the time that the Proposed Scheme is expected to open to traffic, for impacts arising from its operation, or (c) the design year, 15 years after opening. The future baseline is considered in each of the environmental aspect chapters, as relevant to the assessment in question.

Major accidents and disasters

5.2.15 The EIA Regulations require that risks due to accidents and disasters are considered within the EIA. At this stage, a two-stage qualitative assessment has been undertaken using technical judgement to identify whether the Proposed Scheme is at risk from major accidents and disasters. Firstly, a screening matrix was completed detailing a long list of major accidents and disasters that could occur (see Appendix 5.1). Accidents and disasters requiring further consideration were subject to a second more detailed risk assessment. The more detailed risk assessment considered the following:

- The vulnerability of the project to risks of major accidents and disasters
- Any consequential changes in the predicted effects of the project on environmental aspects from major accidents and disasters

5.2.16 The risk assessment concluded that there are two residual risks remaining that would need to be addressed through the design of the Proposed Scheme. These are inland floods and mass movements and ground hazards.

5.2.17 Inland floods are partly covered under Chapter 15: Climate on climate change adaptation, and partly through Chapter 14: Road Drainage and the Water Environment in terms of reducing future flood risk. Impacts and mitigation associated with these will be covered in the relevant aspect chapters of the Environmental Statement.

5.2.18 Mass movements and ground hazards, including risks of subsidence, are documented within the Preliminary Sources Study Report (PSSR) (CH2M, 2018a). This summarises the potential geohazards and risks associated with the ground conditions that need to be factored into the design process and assessed going forward. These risks are being further assessed through a programme of ground investigation surveys. The results and proposed mitigation will be presented within a Ground Investigation Report (GIR) and will be used to inform the design.

5.2.19 The PSSR (CH2M, 2018a) also contains an initial review of potential land contamination that may be present within the study area. Potential sources of contamination include made ground such as infilled sand and gravel pits and industrial areas. The Proposed Scheme could potentially open up pathways between contaminated sources and environmental receptors. These potential impacts are assessed within the relevant aspect chapters which are Chapter 10: Geology and Soils, Chapter 13: Population and Human Health and Chapter 14: Road Drainage and the Water Environment.

Transboundary effects

5.2.20 A transboundary effects screening matrix was provided in the Environmental Scoping Report. The Planning Inspectorate has undertaken a screening assessment to identify if the Proposed Scheme is likely to have significant effects on the environment in a European Economic Area state in accordance with Regulation 32 of the EIA Regulations. This concluded that the Proposed Scheme is unlikely to give rise to significant effects on any European Economic Area state. It is therefore assumed that transboundary effects are scoped out of the assessment. The screening matrix will be reviewed prior to the submission of the DCO application and included in the Environmental Statement.

5.3 General assessment assumptions and limitations

5.3.1 The Proposed Scheme is at an early stage in the scheme development. There are no detailed designs and the construction methodology is not fully defined at this stage. There could therefore be changes to the provisional Order Limits to accommodate changes in temporary working areas, or changes in permanent footprint associated with the design and/or environmental mitigation areas. The provisional Order Limits presented in Figure 2.1 are considered a 'worst-case' estimate of likely land use requirements, which may reduce as the Proposed Scheme is developed towards DCO submission.

5.3.2 Further design information will be obtained prior to carrying out the EIA for the Environmental Statement, including drainage design (e.g. the final layout and size of attenuation ponds) and construction information (e.g. the final layout of site compounds, haul routes and storage areas).

5.3.3 This PEIR reflects an ongoing EIA process and identified mitigation and likely significant effects will be refined as the design and EIA progress.

5.3.4 It is assumed that the information provided by third-party public sources is accurate at the time of preparing this report. Data sources will be verified and updated throughout the EIA process. References are included to provide details of relevant sources at this stage.

5.3.5 Aspect specific assumptions and limitations are included within each aspect chapter. This includes information on any data gaps at this stage in the assessment and how these gaps will be filled over the course of the EIA.

5.4 Mitigation and enhancement

5.4.1 Mitigation measures aim to avoid, reduce and, where possible, remedy significant adverse environmental effects. The purpose of any mitigation measure is to eliminate the effect or, if not possible, to reduce its significance. Mitigation measures for the Proposed Scheme will be developed in accordance with the mitigation hierarchy of avoidance and prevention, reduction and remediation, as described in DMRB LA 104, paragraph 3.23.

5.4.2 For the purposes of the environmental assessment, two types of mitigation are used, in accordance with DMRB LA 104 (paragraph 3.24):

- **Embedded mitigation:** project design principles adopted to avoid or prevent adverse environmental effects. This forms part of the project description in the PEIR (where known at this stage) or Environmental Statement.
- **Essential mitigation:** measures required to reduce and if possible offset likely significant adverse environmental effects, in support of the reported significance of effects in the environmental assessment.

5.4.3 The 1st Iteration of the Environmental Management Plan (EMP) will be produced in line with DMRB LA 120: Environmental Management Plans (Highways England, Revision 1, 2020c), which will contain all measures, including the Register of Environmental Actions and Commitments (REAC), to manage environmental effects in construction and operation. This 1st Iteration of the EMP will be submitted with the DCO application and will provide the framework for the future production of the more detailed 2nd Iteration of the EMP prior to construction and the 3rd Iteration of the EMP after construction for the handover stage.

5.4.4 If effects cannot be mitigated, remediation measures would be considered, for example, to provide replacement habitat.

5.4.5 Enhancement measures have also been considered. An enhancement is defined as a measure that is over and above what is required to mitigate the adverse effects of the Proposed Scheme. Unlike mitigation and compensation measures, enhancements are not factored into the determination of significance; however, the potential benefits of these measures are presented within the relevant aspect chapters, in accordance with the NPS NN.

5.4.6 Mitigation and enhancement measures have been outlined in the aspect chapters of this PEIR (chapters 6-15). Measures will be developed further throughout the EIA process and will be detailed in the Environmental Statement. Mitigation and enhancement proposals will be developed in consultation with statutory consultees, where appropriate.

5.5 Identifying potential effects

5.5.1 The aspect chapters identify potential impacts that might occur due to the construction and operation of the Proposed Scheme. These impacts in turn can lead to environmental effects (defined as the consequence of an impact). Effects can affect the environment in a variety of ways; Effects may be adverse or beneficial, direct, indirect, secondary or cumulative, temporary or permanent, short, medium or long term.

5.5.2 For an effect to occur, there needs to be an impact source, pathway and receptor.

5.5.3 In EIA, effects are assessed in terms of their significance to give decision makers a measure of the importance, or gravity, of the environmental effect.

5.6 Significance criteria

5.6.1 Tables 5.2 and 5.3 replicate the value (sensitivity) of receptors/resources and magnitude of impact (amount of change) criteria from DMRB LA 104. Appendix 5.2 summarises topic-specific interpretations of the DMRB value (sensitivity) and magnitude of impact criteria. These criteria have been used to identify the potential impacts that might occur due to the construction and operation of the Proposed

Scheme. Impacts may be adverse or beneficial, direct, indirect, secondary or cumulative, temporary or permanent, short, medium or long term. Impacts can affect the environment in a variety of ways.

5.6.2 Significance of effect is derived through a combination of the sensitivity of a receptor affected (value or importance) and the magnitude of the impact (amount of change). A typical matrix for these two variables is provided in DMRB LA 104 and replicated in Table 5.4.

5.6.3 Certain disciplines do not use a matrix-based approach, because they use calculations to assess effects in numerical terms. This includes noise, air quality and flood risk.

5.6.4 In all cases, professional judgement is applied to the assessment to underpin the outcomes identified through the matrix or calculation assessments. Where professional judgement is used, this is accompanied by text to explain the reasons and justification.

Table 5.2: Environmental value (sensitivity) and descriptions (taken from DMRB LA 104)

Value (sensitivity) of receptor / resource	Typical description
Very high	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Table 5.3: Magnitude of impact and typical descriptions (taken from DMRB LA 104)

Magnitude of impact (change)		Typical description
Major	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.
Moderate	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.

Magnitude of impact (change)	Typical description
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Table 5.4: Significance matrix (taken from DMRB LA 104)

		Magnitude of impact (degree of change)				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Environmental value (sensitivity)	**Very high**	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

5.6.5 Significance categories are described in Table 5.5 (taken from DMRB LA 104). This describes effects with a very large or a large significance as being 'material' and 'likely to be material' in the decision-making process respectively. Therefore, large and very large effects are considered 'significant' for the purposes of the EIA Regulations. Moderate effects are described as potentially being material in the decision-making process. Moderate residual effects are therefore also typically considered as 'significant'.

5.6.6 The significance of effect is only assessed after embedded and essential mitigation have been factored in, in line with DMRB LA 104. This is known as the residual effect. To arrive at a conclusion of significance, the effectiveness of design and mitigation measures must be assessed and described. This can be achieved by, for example, explaining the intended outcomes of the mitigation, and assessing how mitigation affects the magnitude of impacts (including impact probability, duration, scale, frequency and reversibility).

Table 5.5: Significance categories and typical descriptions (taken from DMRB LA 104)

Significance category	Typical description
Very large	Effects at this level are material in the decision-making process.
Large	Effects at this level are likely to be material in the decision-making process.
Moderate	Effects at this level can be considered to be material decision-making factors.
Slight	Effects at this level are not material in the decision-making process.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

5.7 Duplication of assessment

Habitats Regulations Assessment

5.7.1 Effects on European designated sites for nature conservation has been considered in Chapter 9: Biodiversity of the PEIR.

5.7.2 A Habitats Regulations Assessment (HRA) stage 1 screening exercise was undertaken at PCF Stage 2 (CH2M, 2018b). The HRA identified no possible source-receptor pathways to designated sites. It concluded that no likely significant effects on any European sites are anticipated, when considered alone or in combination with other plans and projects.

5.7.3 At the start of PCF Stage 3, the impacts of air quality on designated sites was reconsidered in light of the revised Affected Road Network (ARN). At this point the Rochdale Canal Special Area of Conservation (SAC) was scoped into assessment for air quality effects.

5.7.4 The HRA stage 1 has been reviewed and updated during PCF Stage 3 and Natural England will be consulted on the conclusions of the screening exercise to confirm if an Appropriate Assessment is required.

Water Framework Directive

5.7.5 The impact of the Proposed Scheme on the Water Framework Directive (WFD) has been assessed under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. The impacts to the WFD objectives were assessed in line with Advice Note Eighteen: The Water Framework Directive (Planning Inspectorate, 2017). A WFD compliance assessment has been prepared as an appendix to this PEIR (Appendix 14.1) and will be finalised for the Environmental Statement and the conclusions summarised in the Road Drainage and the Water Environment chapter of the Environmental Statement.

Flood Risk Assessment

5.7.6 A preliminary Flood Risk Assessment (FRA) has been undertaken and reported within a standalone report which forms an appendix to this PEIR (Appendix 14.4) and to the Environmental Statement. To avoid duplication, the Road Drainage and the Water Environment chapter of the PEIR and Environmental Statement will cross refer to the FRA Report and summarise where appropriate.

5.7.7 Consultation with the Environment Agency and BMBC (as Local Lead Flood Authority) on the preliminary FRA Report will be carried out prior to the Environmental Statement.

Health Impact Assessment

5.7.8 The impact of the Proposed Scheme on health have been considered in the Population and Human Health chapter of the PEIR and will be further assessed in the Environmental Statement. This in turn will be supported by technical appendices as required. A standalone Health Impact Assessment (separate from the EIA) will not be undertaken.

5.8 Residues and emissions

5.8.1 The EIA Regulations require an estimate, by type and quantity, of expected residues and emissions. This information is provided in the relevant aspect chapters. Table 5.6 sets out the residues and emissions that must be reported on to satisfy the EIA Regulations, as well as the aspect chapters which cover them.

Table 5.6: Residues and emissions

Residue or emission	Aspect chapter
Water pollution	Chapter 14: Road drainage and the water environment
Air pollution	Chapter 6: Air quality
Soil and subsoil pollution	Chapter 10: Geology and soils
Loss of soil resource	Chapter 10: Geology and soils
Noise	Chapter 12: Noise and vibration
Vibration	Chapter 12: Noise and vibration
Light	Chapter 8: Landscape and visual
Heat	N/A – scoped out of assessment
Radiation	N/A – scoped out of assessment
Types and quantities of waste	Chapter 11: Material assets and waste

6. Air quality

6.1 Topic introduction

6.1.1 Air pollution is associated with adverse human health impacts and is recognised as a contributing factor in the onset of conditions, such as heart disease and cancer. Furthermore, in certain circumstances, air pollution may adversely affect ecosystems either directly (e.g. through exposure to the pollutant itself) or by contributing to elevated rates of nitrogen deposition.

6.1.2 This chapter of the Preliminary Environmental Information Report (PEIR) describes the findings of an initial assessment of the likely effects of the Proposed Scheme on air quality.

6.1.3 This chapter is supported by the following figures and appendices:

- Figure 6.1: Air quality study area
- Figure 6.2: Air quality baseline conditions
- Figure 6.3: Modelled human health receptors
- Figure 6.4: Modelled ecological receptors
- Figure 6.5: Modelled compliance risk assessment receptors
- Figure 6.6: Human health assessment results
- Figure 6.7: Ecological assessment results
- Figure 6.8: Compliance risk assessment results
- Appendix 6.1: Air quality assessment methodology
- Appendix 6.2: Air quality assessment results

6.2 Stakeholder engagement

6.2.1 Stakeholder engagement has been undertaken verbally and via email with Bury Metropolitan Borough Council (BMBC) Environmental Health department. This engagement was undertaken in April 2021 and focussed on:

- Outlining the air quality assessment methodology
- Co-location of Scheme specific monitoring sites
- If the Proposed Scheme was likely to interfere with the aims of the Greater Manchester charging Clean Air Zone (CAZ), which was concluded as unlikely due to the Opening Year of the Proposed Scheme being beyond the likely scope of the CAZ
- Potential residential developments that may occur next to the Proposed Scheme

6.2.2 There were no fundamental changes to the assessment methodology of the PEIR because of comments received/discussed.

6.2.3 A summary of the relevant stakeholder feedback received during the scoping consultation and key requirements from the Planning Inspectorate, as identified within

the Scoping Opinion (Planning Inspectorate, 2021), are outlined in Table 6.1, along with the resulting response.

Table 6.1: Key stakeholder feedback for air quality

Stakeholder	Comment	Response
Planning Inspectorate	ID 4.1.1 Paragraph 6.2.1 states "it is assumed that road traffic assessment of changes in road traffic during construction is scoped out". Paragraph 6.4.2 appears to be contradictory, stating that "construction traffic screening will be undertaken for the worst-case construction year as per DMRB LA 105…it is unlikely that any road will meet the screening criteria and therefore further assessment is likely to be scoped out". The same paragraph also states that "a construction traffic assessment should be completed if the construction duration is longer than 2 years". For the avoidance of doubt (and as the construction traffic screening exercise remains to be carried out), the inspectorate does not agree that this matter can be scoped out of the assessment at this stage.	A screening assessment of preliminary estimates of changes in traffic flows during the construction phase (see paragraph 6.4.16 of this PEIR) suggests that construction traffic is unlikely to exceed relevant traffic scoping criteria. On this basis, construction phase traffic is considered unlikely to have a significant effect on local air quality. When updated traffic data for the construction phase are available they will be screened with reference to the traffic scoping criteria in paragraph 2.1 of DMRB LA 105. If any of the traffic scoping criteria are exceeded during the construction phase, then further assessment will be undertaken for the Environmental Statement.
Planning Inspectorate	ID 4.1.2 The Inspectorate agrees that the assessment of construction dust effects on human and ecological receptors is, by definition, limited to the construction phase and that this matter can be scoped out.	No response needed.
Planning Inspectorate	ID 4.1.3 The Applicant states that as per Design Manual for Roads and Bridges (DMRB) LA 105 paragraph 2.21.4, it is not proposed to model particulate matter less than 2.5µm in diameter ($PM_{2.5}$) concentrations. The DMRB paragraph in question states that "modelling of PM_{10} can be used to demonstrate the project does not impact on the $PM_{2.5}$ air quality threshold".	For this PEIR, the highest modelled concentration for particulate matter less than 10µm in diameter (PM_{10}) in the Opening Year was 16.6µg/m^3 (refer to the results for receptors R43, R51, R52, R54, R112, R113 and R367 in Appendix 6.2). As $PM_{2.5}$ is a subset of PM_{10}, $PM_{2.5}$ concentrations would therefore be lower than 16.6µg/m^3 at all modelled receptors. Therefore, the $PM_{2.5}$ air quality objective or Limit Value of 20µg/m^3 is very unlikely to be exceeded. No further detailed assessment of $PM_{2.5}$ has therefore been undertaken. In the Environmental Statement, $PM_{2.5}$ will be similarly assessed using PM_{10}.

Stakeholder	Comment	Response
Planning Inspectorate	ID 4.1.4 Figure 6.1 appears to show the alignment of the "Stage 2 Affected Road Network" nodes being somewhat distant from the actual alignments of the road as shown on the base map. This then potentially affects the inclusion / identification of receptors within the 200m buffer zone. The ES should present how the modelled nodes are more accurately representative of the road network and sensitive / representative human health and ecological receptors depicted on the same plan.	Figure 6.1 of the Environmental Scoping Report showed the Stage 2 Affected Road Network (ARN) over a simplified road network for illustrative purposes only. The ARN has been redefined for this PEIR based on more recent traffic modelling and will be redefined for the Environmental Statement too (based on a further set of traffic data). The geographical representation of the ARN is more accurate within this PEIR and is shown in relation to sensitive receptors in Figures 6.3, 6.4 and 6.5.
Planning Inspectorate	ID 4.1.5 The ES should clearly present and define the extents of both the Traffic Reliability Area (TRA) (extent of the traffic model) and the ARN, particularly where the ARN extends beyond the TRA. The additional traffic data used to screen in additional links into the assessment of air quality effects (i.e. the ARN) should be referenced and justified as being fit for purpose in effectively necessitating and supporting an extension to the TRA. These additional ARN links should be considered in terms of sensitive human health and ecological receptors.	The ARN does not extend outside the TRA – work was undertaken during the PEIR, in conjunction with the project's traffic modellers, to extend the TRA to ensure this issue did not occur. The extents of both the TRA and ARN are shown in Figure 6.1.
Planning Inspectorate	ID 4.1.6 Figure 6.3 shows an "AQMA study area" which is not defined in the text. It appears to show the extent of the ARN within the Air Quality Management Area (AQMA) but does not show the AQMA in its entirety. The "AQMA study area" should be separately defined in the Environmental Statement (ES) and the extents of the Greater Manchester AQMA shown in the context of the ARN and the DCO application site boundary as part of the assessment of significance of effects on the AQMA.	The extents of the ARN, air quality study area and DCO application boundary in relation to the Greater Manchester AQMA are shown in Figure 6.2.
Natural England	6. Air Quality The list of baseline air quality condition sources in chapter 6.3.1 would benefit from the inclusion of Air Pollution Information System (APIS) to access the site relevant critical loads.	Site relevant critical loads and background rates of nitrogen deposition obtained from the APIS website are included in Appendix 6.2 and will also be included in the Environmental Statement.

6.3 Legislative and policy framework

6.3.1 The National Policy Statement for National Networks (NPS NN) (Department for Transport (DfT), 2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NPS NN as the primary basis for making decisions on DCO applications.

6.3.2 Key policies from the NPS NN relevant to this aspect are set out below:

- Paragraphs 5.3-5.5 of the NPS NN outline the potential impacts of construction or operation of national network projects (i.e. changes in pollutant emissions) on human health as well as on protected species and habitats, as well as the potential geographical extent and distribution of these impacts. These paragraphs also outline UK legislation such as local air quality objectives (AQO) as well as EU legislation, such as Limit Values (LVs) for the main pollutants in the Ambient Air Quality Directive (2008/50/EU), which Member States are required to meet by various dates.
- National AQOs are defined in the Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002. The EU Ambient Air Quality Directive (2008/50/EU) forms the basis for UK air quality legislation. EU LVs were transposed into UK law by the Air Quality Standards (England) Regulations 2010. In addition, the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 included an amended LV for PM2.5 of 20$\mu g/m^3$.
- The AQOs and LVs for nitrogen oxides (NO_x), nitrogen dioxide (NO_2) and particulate matter with an aerodynamic diameter less than 10µm (PM_{10}) and 2.5µm ($PM_{2.5}$), respectively, are shown in Table 6.2.

Table 6.2: AQOs and LVs for NO_x, NO_2, PM_{10} and $PM_{2.5}$

Pollutant	Concentration (µg/m^3)	Averaging period
NO_x	30 (for the protection of vegetation)	Annual mean
NO_2	200, not to be exceeded more than 18 times a year	1-hour mean
	40	Annual mean
PM_{10}	50, not to be exceeded more than 35 times a year	24-hour mean
	40	Annual mean
$PM_{2.5}$	20	Annual mean

- Paragraphs 5.6-5.9 of the NPS NN state that where the impacts of any project may have a significant effect on air quality, then an assessment must be undertaken as part of the Environmental Statement. These paragraphs then go on to describe that the Environmental Statement must include existing air quality levels, forecasts of air quality at the time of project opening and significant effects on air quality, using the Department for Environment, Food and Rural Affairs' (Defra) future national projections of air quality during the modelling process. A judgement on the risks as to whether the project would affect the UK's ability to comply with the Air Quality Directive (i.e. with LVs) must also be included.
- Paragraphs 5.10-5.12 of the NPS NN state that the Secretary of State (SoS) must give air quality considerations substantial weight where, after taking into account mitigation, a project would lead to a significant air quality impact in relation to EIA and/or where they lead to a deterioration in air quality in a zone/agglomeration.
- Paragraph 5.13 of the NPS NN states that the SoS should refuse consent where, after taking into account mitigation, the air quality impacts of the scheme will result in a zone/agglomeration currently reported as being compliant with the Air Quality Directive (i.e. with LVs) becoming non-compliant; or delay the ability of a non-compliant area to achieve compliance.

- Paragraphs 5.14-5.15 of the NPS NN state that mitigation measures should be included in order to ensure LV compliance of a zone is not delayed. The SoS should then consider whether the mitigation measures put forward by the applicant are sufficient.

6.3.3 In addition to the national policy set out in the NPS NN, the Proposed Scheme must also have regard to relevant legislation and local plans and policy. Details of legislation and local planning policy relevant to air quality is detailed in Appendix 1.1.

6.4 Assessment methodology

6.4.1 A detailed preliminary assessment of air quality has been undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) LA 105 Air Quality (Highways England, Revision 0, 2019); hereafter referred to as DMRB LA 105) standard. By following DMRB LA 105, it is considered that the Proposed Scheme can be measured against the NPS NN policy requirements. In line with DMRB LA 105, a detailed assessment is normally undertaken where there is potential for exceedances of AQOs or LVs in the scheme Opening Year.

Local air quality - operational traffic

6.4.2 The main steps that were taken to assess the impact of changes in traffic conditions as a result of the operation of the Proposed Scheme are discussed below. Additional information on the air quality modelling methodology adopted can be found in Appendix 6.1.

Emissions calculations for peak, interpeak and off peak periods

6.4.3 Emission rates for NO_x and PM_{10} were calculated from speed-banded traffic data inputs using the speed banded Highways England emission calculation tool (v4.2, based on v11.0 of Defra's Emission Factors Toolkit) (Highways England, 2020a). As speed banded emission factors are not available for $PM_{2.5}$, modelling results for PM_{10} (of which $PM_{2.5}$ is a component) have been used to demonstrate that there is no risk of exceeding AQOs or LVs for $PM_{2.5}$.

Dispersion modelling

6.4.4 Annual mean concentrations of NO_x and PM_{10} were modelled at selected receptors using the latest version of ADMS-Roads 5 (Cambridge Environmental Research Consultants (CERC), 2020). Meteorological inputs were included based on 2018 data from a meteorological site in Manchester (Manchester Ringway).

Verification

6.4.5 Base Year 2018 modelled road NO_x concentrations were compared to monitored road NO_x to account for any systematic bias in the air quality dispersion modelling approach, following the methodology described in Local Air Quality Management Technical Guidance (LAQM TG(16); Defra, 2021). The verification process resulted in the application of three model adjustment factors: 0.52, 0.87 and 1.09, which were applied to raw modelled road NO_x concentrations within distinct zones within the air quality study area, as shown on Figure 6.3, 6.4 and 6.5 (see Appendix 6.1 for further details).

Post-processing/adjustment

6.4.6 The NO_x to NO_2 conversion tool v8.1 (Defra, 2020a) was then used, along with adjusted and sector-removed mapped background NO_2 concentrations (Defra, 2020b), to calculate annual mean NO_2 concentrations at sensitive human health, compliance risk and ecological receptors. Long term trend (LTT_{E6}) adjustment factors were applied to annual mean concentrations at human health and ecological receptors in accordance with the gap analysis methodology described in paragraphs 2.47 to 2.53 of DMRB LA 105.

6.4.7 Modelled road PM_{10} concentrations were added to adjusted and sector-removed mapped background PM_{10} concentrations (Defra, 2020b); no further adjustments were made.

Compliance risk assessment

6.4.8 Total NO_2 concentrations at Pollution Climate Mapping (PCM) compliance risk assessment receptors were processed as described in the paragraph 6.4.6 above. However, as per paragraph 5.54 of DMRB LA 105, LTT_{E6} adjustment factors are not applicable to PCM compliance risk receptors and were therefore not applied to modelled NO_2 concentrations at the PCM receptors considered in this assessment. As per Figure 2.79 of DMRB LA 105, total NO_2 concentrations were compared to the Opening Year Defra-modelled concentrations at PCM Census IDs and any risks to the EU LV identified.

Nitrogen deposition

6.4.9 Following identification of ecological sites with the potential to be affected by the Proposed Scheme, the project ecologist was consulted to confirm the presence of nitrogen-sensitive habitats within these sites and the locations of appropriate transects for modelling purposes. Baseline nitrogen deposition rates and critical loads were obtained from the Air Pollution Information System website (APIS; UK Centre for Ecology and Hydrology, 2021). Modelled DM and DS road NO_2 concentrations (verification and LTT_{E6} adjusted) were converted to dry nutrient nitrogen deposition rates (kg N/ha/yr) using the following conversion rates as set out in paragraph 2.44.1 of DMRB LA 105:

- Grassland and similar habitats: $1\mu g/m^3$ of NO_2 = 0.14kg N/ha/yr
- Forests and similar habitats: $1\mu g/m^3$ of NO_2 = 0.29kg N/ha/yr

6.4.10 The total nitrogen deposition rate at each receptor was then calculated by adding the estimated road-based nitrogen deposition rate to the relevant baseline nitrogen deposition rate.

Assessment of significance

6.4.11 The significance of the air quality effects for the individual matters considered (i.e. ecological/human health/compliance risk) were determined following DMRB LA 105 criteria described below.

6.4.12 For the local air quality assessment at human health receptors, the criteria shown in Table 6.3*:* (taken from Table 2.92N of DMRB LA 105) have been used to describe the magnitude of change in modelled annual mean NO_2 and PM_{10} concentrations at

modelled receptors, from 'negligible' to 'large', as a percentage change of the relevant AQO. As per paragraph 2.89 of DMRB LA 105, these criteria have only been applied for those sensitive receptors where there are modelled exceedances of the relevant AQO, either with or without the Proposed Scheme, in the scheme opening year.

Table 6.3: Air quality magnitude of change criteria

Magnitude of change	DM to DS change in annual mean NO_2 or PM_{10} (µg/m^3)
Imperceptible (< 1 % +/- of AQO)	< 0.4µg/m^3
Small (1-5 % +/- of AQO)	0.4 – 2µg/m^3
Medium (5-10 % +/- of AQO)	2 – 4µg/m^3
Large (>10 % +/- of AQO)	> 4µg/m^3

6.4.13 The number of receptors modelled to experience a small, medium or large magnitude of change were counted where modelled concentrations in either the Opening Year DM or DS scenario were above (i.e. exceeded) the relevant AQO. Table 2.92N of DMRB LA 105 provides guidance on the number of receptors in each magnitude of change category that could constitute a significant effect, as reproduced in Table 6.4:. These are guideline values, based on the considered opinion of National Highways, and are intended to help provide consistency across highways scheme assessments. The number of receptors in each guideline band have been used to inform professional judgement of the likely significance of the effects of the Proposed Scheme on human health.

Table 6.4: Guideline to the number of receptors constituting a significant effect

Magnitude of change in pollutant concentration	Number of receptors with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large	1 to 10	1 to 10
Medium	10 to 30	10 to 30
Small	30 to 60	30 to 60

6.4.14 Figure 2.98 of DMRB LA 105 indicates changes in air quality have the potential to have a significant effect on ecological receptors and should be considered further by the competent expert for biodiversity, if:

- The total modelled nitrogen deposition rate is larger than the minimum critical load for the relevant habitat;
- The modelled increase in nitrogen deposition rate with the Proposed Scheme is equivalent to more than 1% of the minimum critical load; and
- The modelled increase in nitrogen deposition rate is more than 0.4kg N/ha/yr.

6.4.15 For PCM compliance risk, a significant effect is concluded if the Proposed Scheme is assessed to create a risk of delaying the UK's reported ability to comply with the LV (40µg/m^3 for NO_2 at qualifying features) in the shortest possible time or result in a zone

becoming non-compliant. Should this occur, a Project Air Quality Action Plan should be produced outlining mitigation with the aim of reducing this risk. Significance is then reassessed as per the criteria outlined in Figure 2.79 of DMRB LA 105.

Construction traffic

6.4.16 Paragraph 2.60 of DMRB LA 105 states that a construction traffic assessment should be completed where construction activities are programmed to last more than two years. The construction phase of the Proposed Scheme is currently planned for 2025 to 2027, so would meet this criterion. An initial estimate of construction traffic movements has been provided at this stage, therefore, construction traffic screening was undertaken for the worst-case construction year (2027) with reference to the traffic scoping criteria in paragraph 2.1 of DMRB LA 105.

6.4.17 The outputs of the screening assessment indicated that all affected roads (i.e. all roads where the traffic scoping criteria paragraph 2.1 of DMRB LA 105 are exceeded) are associated with reductions in traffic flows, resulting from traffic diversions during construction of the Proposed Scheme. Due to these reductions in traffic flows (which are likely to have a positive effect), it is unlikely that a significant increase in air pollutant concentrations would occur at any modelled receptor locations. As a result, no further assessment has been undertaken of construction traffic impacts at this stage.

6.4.18 This issue will be considered further within the Environmental Statement based on more recent estimates of likely construction traffic volumes.

Construction dust

6.4.19 A construction dust assessment has been undertaken in accordance with paragraphs 2.56 to 2.59 of DMRB LA 105, which identified all sensitive receptors (human health and designated ecological sites) within 50m, 50–100m and 100–200m of all construction activity bounded by the provisional Order Limits.

6.4.20 The proximity of nearby receptors was considered in combination with the likely magnitude of construction activities to inform a qualitative assessment of the dust risk potential of the Proposed Scheme to the receiving environment, as per Table 2.58b of DMRB LA 105. The resulting risk potential was then used to inform the proposed mitigation measures included in this chapter.

6.5 Assessment assumptions and limitations

6.5.1 All reported monitoring data has either over 75% data capture (i.e. has nine or more months' worth of data for the represented year) or, where this is not stated in the source (i.e. some of the older local authority data), data capture is assumed to be greater than 75%. The local authorities have been contacted to obtain data capture information where this is not publicly available.

6.5.2 It should be noted that air quality modelling, like all modelling, is inherently uncertain, but it is the most reliable, reasonable and robust tool available to assess whether the Proposed Scheme has the potential to have a significant effect on air quality. In order to help manage uncertainty in air quality modelling, verification was carried out following the methodology described in LAQM TG(16) by comparing monitoring results to modelling results. As discussed in Section 6.4, the verification results produced three

verification factors: 0.52, 0.87 and 1.09, which were applied to raw modelled road NO_x concentrations within distinct zones within the air quality study area.

6.5.3 Sensitive receptors have been identified using an Ordnance Survey Address Base Plus dataset and additional information provided by BMBC on a potential housing development. There may in some cases be properties, such as those recently built, which are not yet present within these datasets.

6.5.4 It should be noted that an updated traffic modelled dataset will be used within the Environmental Statement assessment, to account for more recent changes to the design of the Proposed Scheme and updates to traffic modelling tools and procedures. This traffic data will be screened following the DMRB LA 105 methodology highlighted in paragraph 6.6.1, to determine a new ARN. Sensitive receptors will then be identified and included in the assessment and impacts on these receptors assessed.

6.5.5 Within this assessment, the potential additional contribution made to rates of nitrogen deposition by ammonia (NH_3) emissions from road traffic has not been accounted for. National Highways have, however, recently developed a tool to estimate the potential contribution made by NH_3 emissions to rates of nitrogen deposition, which will be used during the production of the Environmental Statement. It should be noted that the use of this tool is likely to result in higher rates of, and changes in, nitrogen deposition within designated habitats in the Environmental Statement than presented herein.

6.6 Study area

6.6.1 The study area for the operational local air quality assessment has been defined following the traffic screening process outlined within DMRB LA 105, which identifies the ARN based on predicted changes in traffic between the Opening Year DM (2027) and DS (2027) scenarios. Roads are included in the ARN where any of the following criteria are met between the Opening Year DM and DS:

- Annual Average Daily Traffic (AADT) flows change by more than or equal to 1,000; or
- Heavy duty vehicle (HDV) AADT flows change by more than or equal to 200; or
- Daily average or peak hour speed bands change; or
- Horizontal road alignment changes by 5m or more

6.6.2 The traffic screening process has only been applied to those road links within the Traffic Reliability Area (TRA), which is the area covered by the traffic model that the competent expert for traffic has identified as reliable for inclusion in an environmental assessment. The TRA was extended in discussion with the traffic modellers to ensure all roads that triggered the screening process were included within the TRA.

6.6.3 Figure 6.1 shows the extent of the ARN. The ARN is situated within the jurisdiction of the Greater Manchester Combined Authority (GMCA), and more specifically within five local authorities: BMBC, Rochdale Borough Council (RBC), Manchester City Council (MCC), Salford City Council (SCC) and Trafford City Council (TCC). The roads considered likely to be ‘affected’ by the Proposed Scheme are predominantly located along the M60, between J15 and J22, as well as between M66 J3 and J4 and M62 J18 and J20. In addition, many major (as well as some minor) roads near to these junctions are included in the ARN.

6.6.4 The air quality study area was then defined based on a distance of 200m from the ARN (i.e. the distance over which perceptible impacts on air quality have the potential to occur). The extents of the TRA, ARN and air quality study area are shown in Figure 6.1.

6.7 Baseline conditions

Baseline sources

6.7.1 A review of baseline air quality conditions in the air quality study area has been undertaken based on information from the following sources:

- GMCA 2019 Air Quality Annual Status Report (ASR; GMCA, 2020)
- GMCA 2021 Air Quality Annual Status Report (ASR; GMCA, 2021)
- SCC monitoring data (SCC, 2021)
- TfGM monitoring data (TfGM, 2021)
- Highways England monitoring data (Highways England, 2020b)
- National Highways monitoring for the Proposed Scheme (Jacobs, 2021)
- Defra background maps (Defra, 2020b)
- Defra PCM Census ID projections (Defra, 2020c)
- Ordnance Survey AddressBase+ (AB+) data
- Ordnance Survey Topography maps of the surrounding area
- Ecological site open data (Natural England, 2021)
- Ecological site baseline data and critical loads (UK Centre for Ecology and Hydrology, 2021)

6.7.2 All data used in the baseline assessment are publicly available, with the exception of the Ordnance Survey AB+ and Topography data, and the Highways England and National Highways monitoring data, which have been obtained for use within the assessment.

Baseline monitoring

Local authority monitoring

6.7.3 Local authorities have a legal duty to regularly review, assess and report on air quality within their areas; a process known as Local Air Quality Management (LAQM). The GMCA undertakes air quality monitoring as part of its LAQM duties across the entirety of Greater Manchester. This monitoring is carried out using a combination of both continuous monitoring stations and passive (diffusion tube) analysers. The annual mean NO_2 data collected between 2015 and 2019 at the monitoring locations within the air quality study area is shown in Appendix 6.1. Monitoring data for 2020 have not been considered within this assessment, as pollutant concentrations in this year are considered likely to have been substantially reduced due to the impact of COVID-19 travel restrictions resulting in reduced road traffic flows (as demonstrated in Table 1.8 of Appendix 6.1). Furthermore, until such time as 2022 monitoring data are available, it is currently unclear how representative 2021 data are of current air quality conditions. As such, local authority monitoring data for 2021 have also not been considered.

6.7.4 In order to understand baseline conditions in the modelled Base Year, 2018, and for the purposes of model verification, for those monitoring sites within the modelled study area with data capture less than 75% and/or with data available for 2019 only, the available data were bias-adjusted (where required) and annualised to the 2018 Base Year. This was done in accordance with the guidance provided in LAQM TG(16), with further details provided in Appendix 6.1. Specifically, the 2019 data for sites BU15, BU16, BU17, BU19 and MAN98, were annualised to the 2018 Base year.

6.7.5 The results of the 2018 bias-adjusted and annualised monitoring (shown in Figure 6.2) show three exceedances of the level of the NO_2 AQO of 40µg/m^3 in Bury (BU15 (44.7µg/m^3), BU16 (44.9µg/m^3) and BU19 (40.4µg/m^3)) and a single exceedance in Rochdale (RO6A (41.9µg/m^3)). However, none of these monitoring locations are positioned at locations of relevant exposure where the AQO is applicable (e.g. at the facades of residential properties. To estimate NO_2 concentrations at the nearest location of relevant exposure, the monitoring results at these locations were adjusted based on distance to the edge of the nearest modelled road using the NO_2 Fall Off With Distance Calculator tool (Defra, 2016). Following these calculations, annual mean NO_2 concentrations were estimated to be within the AQO at the nearest sensitive receptors to all of these local authority monitoring locations.

6.7.6 The five-years of NO_2 monitoring data between 2015 and 2019 measured at locations within the air quality study area suggest a slight downward trend in annual mean NO_2 concentrations has occurred over time.

6.7.7 There is no PM_{10} monitoring within the air quality study area. The nearest continuous monitoring stations that monitor PM_{10} are sites BUR2 (Bury Prestwich) and BU15 (Bury Whitefield), which are 1.6km and 2km from the air quality study area, respectively. Both annual mean and daily mean PM_{10} concentrations were within the respective AQOs between 2015 and 2019 at these monitoring locations.

6.7.8 There is no $PM_{2.5}$ monitoring within the air quality study area. The nearest continuous monitoring station that monitors $PM_{2.5}$ is SALM60 (Salford M60), positioned 3km from the air quality study area. The annual mean $PM_{2.5}$ concentrations at this site were well within the AQO between 2015 and 2019 at this and all other monitoring locations across the GMCA.

Highways England Transport for Greater Manchester (TfGM) monitoring

6.7.9 In addition to local authority monitoring, diffusion tube monitoring was undertaken within the air quality study area by Highways England and TfGM in 2018 and 2019. The 2019 Highways England and TfGM monitoring survey data were annualised and bias-adjusted to the 2018 Base Year in accordance with the guidance provided in LAQM TG(16). Similarly, data from the Highways England survey carried out in 2018 were annualised and bias-adjusted using the same approach (due to data capture being less than 75% at all monitoring sites). The annualised and bias-adjusted annual mean NO_2 data for 2018 (and where relevant measured values for 2019) at the monitoring locations within the study area are shown in Appendix 6.1.

6.7.10 Annual mean NO_2 concentrations for the bias-adjusted and annualised data were above the level of the NO_2 AQO in 2018 at monitoring locations BUR-B1 (58.4µg/m^3), BUR-A4 (57.8µg/m^3), BUR-A2 (54.2µg/m^3), BUR-A5 (52.0µg/m^3), BUR-A1 (46.6µg/m^3), BUR-A3 (45.6µg/m^3) and BUR-B2 (41.1µg/m^3). In addition, the monitoring results

suggest that there were several other locations that were close to exceeding the level of the NO_2 AQO in 2018. The monitoring results at these locations were adjusted based on distance to the edge of the nearest modelled road using the NO_2 Fall Off With Distance Calculator tool. Exceedances of the AQO were estimated at the nearest sensitive receptors to BUR-A2 (40.9µg/m^3), BUR-A5 (46.5µg/m^3) and BUR-A4 (47.0µg/m^3).

National Highways monitoring for the Proposed Scheme

6.7.11 Spatially, there are gaps in the pre-existing monitoring where it was established that additional monitoring would result in a more comprehensive baseline dataset. Therefore, an additional six-month monitoring survey was undertaken by members of the Project team between 28 April 2021 and 13 October 2021. Monitoring was undertaken in the vicinity of the Proposed Scheme and along the M60, M62 and M66 motorway corridors to support the necessary verification of the PCF Stage 3 modelling results and stakeholder engagement. See Figure 6.2 for the locations of the additional monitoring that was undertaken.

6.7.12 The 2021 scheme-specific monitoring data was also bias-adjusted and annualised to the 2018 Base year in accordance with the guidance provided in LAQM TG(16). This annualisation between different years inherently takes into account the reduction in traffic volumes seen during 2021, due to COVID-19 travel restrictions, as well as differences in meteorological conditions. A comparison of co-located sites annualised from 2021 to local authority monitored data in past years was also undertaken to confirm that this approach provided appropriate values for 2018. The full set of monitoring and annualised data is shown in Appendix 6.1.

6.7.13 The results of the 2018 bias-adjusted and annualised monitoring survey show exceedances of the level of the NO_2 AQO of 40µg/m^3 at a number of locations within the air quality study area (J_007 (109.1µg/m^3), J_002 (64.1µg/m^3), J_004 (45.9µg/m^3), J_014 (45.1µg/m^3), J_005 (40.7µg/m^3) and J_001 (40.5µg/m^3)). There are also a number of sites close to exceeding the level of the AQO. Again, to estimate NO_2 concentrations at the nearest sensitive receptors for comparison to the AQO, the monitoring results at these locations were adjusted based on distance to the edge of the nearest modelled road using the NO_2 Fall Off With Distance Calculator tool. No potential exceedances of the AQO were predicted at the nearest sensitive receptors to any of these National Highways monitoring locations.

Air quality management areas (AQMAs)

6.7.14 Local authorities review current and future air quality to assess whether or not AQOs are being achieved or are likely to be achieved. Where it is anticipated that an AQO will not be met, it is a requirement that an AQMA is declared. Where an AQMA is declared, the local authority is obliged to produce an Action Plan in pursuit of the achievement of the AQOs. The Proposed Scheme is located almost entirely in the Greater Manchester AQMA (as seen in Figure 6.2), the current extent of which was declared for exceedances of the NO_2 AQO in 2016.

Background concentrations

6.7.15 Defra provides background maps for a range of pollutants for all years from 2018 to 2030, which show predicted background pollutant concentrations for 1km x 1km grid squares across the UK (Defra, 2020b).

6.7.16 The range of Base Year (2018) and Opening Year (2027) background concentrations for the grid squares that cover the air quality study area (see *Table* 6.5) are all within the AQOs for annual mean NO_2, NO_x and PM_{10} in the Opening Year, although there are exceedances of the NO_x AQO in the Base Year.

Table 6.5: Background concentration data around ARN

Pollutant	AQO (µg/m^3)	Predicted background concentration (µg/m^3)	
		2018	2027
NO_x	30	21.2 – 49.4	14.2 – 27.7
NO_2	40	15.5 – 31.8	10.7 – 19.5
PM_{10}	40	11.2 – 14.9	10.3 – 13.8

Pollution Climate Mapping (PCM) model

6.7.17 The Pollution Climate Mapping (PCM) model is a collection of models developed to report on national compliance with air quality LVs. PCM model projections (Defra, 2020c) have been reviewed to identify whether any PCM links correspond with the ARN and if the identified links are likely to comply with the annual mean NO_2 LV. Figure 6.5 identifies the corresponding PCM links located between J17 and J18 and J20 and J21 of the M60 that have been considered in this assessment. Data on these links is detailed in Table 6.6.

Table 6.6: Projected roadside annual mean NO2 concentrations at PCM links corresponding to the ARN

PCM census ID	Road link	Projected roadside annual mean NO_2 concentration (µg/m^3)	
		2018	2027
802006053	M60 (J17 to J18)	31.3	18.8
802017924	A56 (at M60 J17)	**40.1**	24.1
802046572	A56 (at M60 J17)	32.5	20.0
802074590	M60 (J20 to J21)	**43.8**	25.7
802099614	M60 (J20 to J21)	**45.5**	27.2
Note: values in bold type denote exceedances of annual mean NO_2 Limit Value (40 µg/m^3)			

6.7.18 The 2018 Base Year projected roadside annual mean NO_2 concentrations adjacent to these PCM links are predicted to be between 31.3µg/m^3 and 45.5µg/m^3, meaning that that the annual mean LV (40 µg/m^3) is projected to be exceeded in the Base Year. Based on Defra's PCM projections, however, concentrations are predicted to be between 18.8µg/m^3 and 27.2µg/m^3 in the 2027 Opening Year, and therefore compliant with the LV.

Greater Manchester Clean Air Plan

6.7.19 In Greater Manchester, the 10 local authorities, GMCA and TfGM are working together to develop a Clean Air Plan to tackle exceedances of the annual mean NO_2 LV in the shortest possible time, herein referred to as the Greater Manchester Clean Air Plan (GM CAP). Modelling undertaken to inform the development of the GM CAP (GMCA, 2022) indicates that the annual mean NO_2 LV is currently exceeded within the air quality study area adjacent to the A56 (PCM link 802017924) immediately to the north of M60 J17 and that compliance is unlikely to be achieved at this location until 2025 (in the absence of any other action).

6.7.20 The original GM CAP included a Greater Manchester-wide category C charging CAZ, which was designed to comply with a legal direction from Government issued before the COVID-19 pandemic. Since then, there have been significant vehicle supply chain issues, particularly for vans, and the cost of living has increased. This means that the original GM CAP was considered unworkable as it would not have met the obligations in the direction to achieve compliance with the NO_2 LV by 2024 and could have caused significant financial hardship for people affected.

6.7.21 In February 2022 Government agreed to lift the legal direction that GM should achieve compliance with the NO_2 LV in the shortest possible time and by 2024 at the latest. It has since issued a new direction for compliance in the shortest possible time and by 2026 at the latest. As a result, the first phase of the planned Greater Manchester CAZ did not go ahead on 30 May 2022. GM local authorities have submitted the case for a new GM CAP, with no charging CAZ, to Government, and are currently awaiting a response.

National Highways PCM modelling

6.7.22 Monitoring and modelling have been undertaken by National Highways for those road links which form part of the Strategic Road Network (SRN) adjacent to which the PCM model suggests the annual mean NO_2 LV has the potential to be exceeded. The purpose of which is to determine if additional management solutions are needed to achieve compliance with the LV in the shortest possible time. Of those SRN links that coincide with the ARN, modelling was undertaken by National Highways for PCM links 802074590 and 802099614 (National Highways, 2022), which, as shown in Table 6.7, indicated that whilst the annual mean NO_2 LV was potentially exceeded in 2018 adjacent to PCM link 802099614, by 2026 (the latest modelled year), roadside annual mean NO_2 concentrations are modelled to be well within the LV adjacent to both links.

Table 6.7: National Highways modelled roadside annual mean NO_2 concentrations at PCM links corresponding to the ARN

PCM census ID	Road link	Modelled roadside annual mean NO_2 concentration (µg/m^3)	
		2018	2026 [a]
802074590	M60 (J20 to J21)	36	23
802099614	M60 (J20 to J21)	**41**	27
Note: Values in bold type denote exceedances of annual mean NO_2 Limit Value (40 µg/m^3) **[a] The latest year for which modelling was undertaken**			

Human health receptors

6.7.23 Locations that are sensitive to air quality include residential properties and buildings used by the young, elderly and other susceptible populations, such as schools and hospitals (as defined in DMRB LA 105). There are numerous receptors (residential properties and schools) in areas such as Simister, Whitefield and Prestwich located within the air quality study area.

6.7.24 As per paragraph 2.20 of DMRB LA 105, sensitive receptors have been included in the local air quality assessment to represent those receptors likely to be exposed to the highest pollutant concentrations (e.g. closest to the road, junctions etc.) and/or are anticipated to experience the highest level of change (i.e. next to roads within the ARN modelled to experience the greatest changes in traffic conditions).

6.7.25 A total of 519 worst-case human health receptor locations were modelled in this assessment, which included a transect directly north-west of M60 J18 to represent the possible locations of potential housing. The placement of human health receptors was focussed on areas near the ARN, where traffic modelling indicated that emissions were likely to increase and/or where the highest concentrations were expected to occur i.e. on the nearest façade of the building to the road. Locations of these receptors are shown in Figure 6.3.

Ecological receptors

6.7.26 Nitrogen deposition can damage vegetation directly affecting plant health and productivity. DMRB LA 105 states that designated habitats are '*internationally, nationally and locally designated sites of ecological conservation importance for protected species and for habitats and other species identified as being of principal importance for the conservation of biodiversity*'. Designated habitats, as defined within DMRB LA 105, include Ramsar sites, Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSIs), Local Nature Reserves (LNRs), Local Wildlife Sites (LWSs), Nature Improvement Areas (NIAs), Ancient Woodlands (AWs) and veteran trees.

6.7.27 Figure 6.4 shows the locations of the designated habitats within the air quality study area deemed to contain nitrogen sensitive habitats, which included AWs, LNRs, LWSs, SACs and SSSIs. Transects were modelled within all nitrogen sensitive habitats within 200m of the ARN, regardless of whether traffic modelling indicated increases or decreases in traffic flows in their vicinity. A total of 336 ecological receptors across 27 ecological transects have been modelled, covering 21 designated sites.

6.7.28 Details of each of the designated habitats included in this assessment are divided between two tables in Appendix 6.2: Table 1.2 and Table 1.3, the first featuring the priority habitats at each receptor location identified by the project ecologists with the lowest site relevant critical load, and the second, other sensitive habitats identified at each receptor location. Baseline nitrogen deposition rates and critical loads were obtained from the APIS website (UK Centre for Ecology and Hydrology, 2021). Additional habitats beyond the worst-case priority habitats were assessed on advice from the project ecologists.

6.7.29 As stated in paragraph 2.26.1 of DMRB LA 105, water course habitats are not typically evaluated in air quality assessments as typically they are not considered sensitive to

nitrogen deposition. However, for the purpose of this assessment, and following advice from Natural England and the project ecologists, a worst-case critical load of 3kg N/ha/yr was assigned to the Rochdale Canal SAC and SSSI receptor points, representing the *Luronium natans* – Floating water-plantain (S1831) habitat.

Future baseline

6.7.30 The Opening Year (2027) baseline conditions were modelled by following the methodology outlined in Section 6.4 based on a Do-Minimum (DM) traffic scenario. The DM traffic scenario is representative of the predicted growth in traffic, accounting for local and regional development. Opening Year vehicle emission estimates used fleet projections for 2027 as per the latest Highways England speed banded emission calculation tool (which was provided by Highways England).

6.7.31 The modelled Opening Year DM results are displayed in Appendix 6.2 with those receptors in exceedance of the NO_2 AQO (40µg/m^3) shown in Table 6.8.

Table 6.8: Modelled 2027 DM NO_2 concentrations in exceedance of the NO_2 AQO

Receptor ID	Location (m)		Modelled NO_2 2027 Opening Year DM (µg/m^3)
	X	Y	
R3	381504	405238	41.7
R42	380855	404768	41.3
R43	380900	404844	43.9
R44	380924	404874	45.2
R47	380897	404860	40.5
R49	380896	404863	40.1
R50	380899	404847	42.9
R51	380928	404855	45.9
R52	380927	404860	45.8
R54	380925	404870	45.4
R81	381558	405276	40.4
R356	380914	404928	42.9
R357	380919	404900	44.2
R360	380911	404943	42.4
R361	380922	404885	44.8
R364	380916	404914	43.6
R365	380843	404758	40.7
R441	381500	405235	41.8
R447	381531	405257	41.1
R599	381500	405236	41.4
R600	381527	405254	40.9
R601	381554	405273	40.3

6.7.32 As shown in Table 6.8, the NO_2 AQO is predicted to be exceeded at 22 worst-case receptor locations within the air quality study area, in the Opening Year without the Proposed Scheme in place. Most of these modelled receptors are located to the north of J17 of the M60, either side of Bury New Road/A56, stretching up to the intersection with Clyde Avenue. The remaining receptors are located along Kensington Street, immediately to the north of the M60 between J17 and J18, parallel to and within 15m of the running lane of the M60.

Value / sensitivity of receptors

6.7.33 The baseline conditions described above have been used to define the receiving environment sensitivity with reference to the criteria in Table 2.11a and Table 2.11b of DMRB LA 105. The sensitivity of the receiving environment is considered to be high, for the following reasons:

- Monitored exceedances of the AQO for NO_2 within the air quality study area (in 2018 (Base Year) and 2019)
- The Proposed Scheme being situated almost entirely within the Greater Manchester AQMA
- Modelled concentrations at sensitive receptors in the Opening Year (2027), without the Proposed Scheme, predicted to be in exceedance of the AQO for NO_2
- National and local projected exceedances of the EU Limit Value in the Base Year, albeit that compliance is expected to be achieved by the Opening Year
- The exceedance of lower critical loads for nitrogen deposition in the baseline at designated ecological sites identified within 200m of the ARN

6.7.34 All receptors are considered to be of equally high value.

6.8 Potential impacts

Construction

6.8.1 Construction activities can give rise to emissions of dust, which could cause damage to vegetation or annoyance associated with the soiling of surfaces. Construction dust emissions can also elevate airborne particulate matter concentrations at off-site locations, which may affect human health if appropriate mitigation measures are not implemented.

6.8.2 The level and distribution of construction dust emissions would depend on where within the Order Limits the dust raising activity takes place, the nature of the activity and associated controls, and weather conditions.

6.8.3 The number of receptors with the potential to be affected by construction dust emissions within the distance bands outlined in Table 2.58b of DMRB LA 105 are presented in Table 6.9.

Table 6.9: Distance-banded receptor counts within 200m of construction activities

Type of receptor	Distance from construction activities (m)		
	0 – 50	50 – 100	100 – 200
Human health	721	714	1,309
Designated habitat: Ancient Woodland	2	0	0
Designated habitat: Local Nature Reserve	2	1	0
Designated habitat: Local Wildlife Sites	4	1	0
Total:	**729**	**716**	**1309**

6.8.4 Based on the number of receptors within the distance bands and the large potential for dust emissions to occur during the construction activities associated with the Proposed Scheme (determined with reference to Table 2.58a of DMRB LA105), the construction dust risk is considered to be 'high' in accordance with Table 2.58b of DMRB LA 105.

6.8.5 As per paragraph 2.59 of DMRB LA 105, the construction dust risk potential will be used to inform the development of appropriate construction dust mitigation measures as part of the Environmental Statement.

Operation

6.8.6 There is potential for the Proposed Scheme to adversely influence (i.e. increase) pollutant concentrations at sensitive human health receptors and rates of nitrogen deposition within designated ecological sites. As per DMRB LA 105, such effects may occur where any of the traffic scoping criteria in Section 6.6 are triggered on roads within 200m of sensitive receptors.

6.8.7 In accordance with DMRB LA 105, PCM receptors have been modelled for LV compliance assessment, to determine if the Proposed Scheme will affect the UK's ability to comply with the LVs in the shortest timescale possible. This assessment has been completed where any ARN road is located on a PCM Census ID road with qualifying features. The results from the compliance risk assessment are outlined in Section 6.10.

6.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

6.9.1 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the scheme design. This is referred to as embedded (or design) mitigation. Chapter 3: Assessment of alternatives details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

6.9.2 The Proposed Scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where possible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

Essential mitigation

6.9.3 Essential mitigation would occur as a matter of course due to legislative requirements or standard sector practices. Examples of essential mitigation for this aspect are given below.

Construction

6.9.4 The 2nd Iteration of the Environmental Management Plan (EMP) would adopt measures to control fugitive dust (and hence avoid or reduce potential impacts) in compliance with DMRB LA 105. The contractor would enter into pre-works discussions with affected local authorities to consult on the method of works and appropriate dust mitigation measures outlined within the 2nd Iteration of the EMP. Mitigation measures would include the dampening down of surfaces, planning the site layout so that machinery and dust-causing activities occur as far from receptors as possible, erecting screens or barriers around the dust-causing activities or the site boundary, covering stockpiles to prevent entrainment by wind and undertaking regular monitoring.

6.9.5 Essential mitigation will be included in the 1st Iteration of the EMP, which will be prepared for the DCO submission (refer to Chapter 5: Environmental assessment methodology).

Enhancement

6.9.6 There are no opportunities for enhancement identified in this assessment.

6.10 Assessment of likely significant effects

Construction

6.10.1 With standard construction phase mitigation measures in place, it is unlikely there would to be significant air quality effects resulting from construction dust.

Operation

6.10.2 This section summarises the potential effects of the Proposed Scheme on air quality during operation. The full assessment results for all human health, designated ecological habitat and PCM compliance receptors can be found in Appendix 6.2.

Human Health Receptors

6.10.3 The results presented throughout this section are based on the values predicted using the gap analysis methodology detailed in Appendix 6.1, and LTT_{E6} for NO_2 (Highways England, 2013).

6.10.4 A total of 519 worst-case human health receptors were included in the modelling. The results of the human health assessment can be seen in Figure 6.6. There the receptors have been labelled with the corresponding modelled NO_2 concentration in the DS Opening Year scenario and colour coded by the magnitude of change criteria detailed in Table 6.3. The full results for receptors included in the human health air quality assessment can be seen in Appendix 6.2.

6.10.5 The annual mean NO_2 AQO is modelled to be exceeded at 15 receptors in the DS Opening Year scenario. All of these receptors are located immediately to the north of M60 J17, primarily along the eastern side of the A56/Bury New Road, but also along the western side of this road and at two residential properties on Sycamore Place to the northwest of the junction. Although these receptors are modelled to exceed the NO_2 AQO, they are modelled to experience an 'imperceptible' change in concentration (i.e. <±0.4µg/m^3), between the DS and DM scenarios, as defined by the DMRB LA 105 significance criteria in Table 6.3. Note that, as none are above 60µg/m^3, there is not considered to be a risk at any receptors (based on LAQM TG(16)) of exceedances of the hourly mean NO_2 AQO.

6.10.6 Overall, 336 of the 519 human health receptors are modelled to experience an increase in annual mean NO_2 concentrations (DS – DM) as a result of the Proposed Scheme. However, none of these receptors have been included in the assessment of significant effects as none of those with a DS-DM change of >0.4µg/m^3 are modelled to exceed the NO_2 AQO in either the DM or DS scenarios.

6.10.7 As shown in Figure 6.6, the largest increases in annual mean NO_2 concentrations are modelled to occur at receptors R89 (+4.8µg/m^3), R160 (+2.9µg/m^3) and R161 (+2.0µg/m^3). All of these receptors are situated in close proximity to M60 J18 and form part of the transect directly to the north-west of the junction modelled to represent the possible locations of potential housing. The modelled NO_2 concentrations in the DS scenario at these locations are predicted to increase due to the introduction of the Northern Loop, as a result of the Proposed Scheme, positioning traffic flows in closer proximity to these receptors. None of these receptors, however, are modelled to exceed the NO_2 AQO in either the DM or DS scenarios. These increases can be described as being of 'medium' (2-4µg/m^3) or 'large' (>4.0µg/m^3) magnitude in accordance with the criteria described in Table 6.3. All other modelled increases at receptors in this assessment are of 'small' (0.5-2µg/m^3) or negligible (≤0.4µg/m^3) magnitude.

6.10.8 The Proposed Scheme is also modelled to result in a reduction in NO_2 concentrations at 171 human health receptors, seven of which are modelled to experience a DS-DM change of <-0.4µg/m^3 and to exceed the NO_2 AQO in the DM scenario. As shown in Figure 6.6, these seven receptors are also those at which the largest reductions are modelled to occur: receptors R3 (-3.2µg/m^3), R81 (-3.1µg/m^3), R441 (-3.2µg/m^3), R447 (-3.1µg/m^3), R599 (-3.2µg/m^3), R600 (-3.1µg/m^3) and R601 (-3.1µg/m^3). These changes can be described as being of 'medium' (2-4µg/m^3) magnitude. These receptors are located along Kensington Street, to the north of and within 15m of the eastbound carriageway the M60 between J17 and J18 which is modelled to experience a substantial reduction in congestion as a result of the Proposed Scheme. Specifically, whilst eastbound traffic flows on this section of the M60 are modelled to increase by approximately 4,000 AADT as a result of the Proposed Scheme, traffic conditions are modelled to change from Heavy Congestion in the AM, IP and PM periods to High Speed in the AM and IP periods and Light Congestion in the PM period.

6.10.9 In order to inform a judgement on whether the Proposed Scheme has the potential to result in a significant effect on air quality at human health receptors, the results of the assessment have been compiled for comparison to the criteria outlined in Table 6.4. Table 6.10 details the number of receptors where the AQO is modelled to be exceeded and where the modelled change in concentration is greater than ±0.4µg/m^3 to constitute a worsening or improvement.

Table 6.10: Number of receptors where mean NO_2 AQO is exceeded modelled to experience a small, medium or large change

Magnitude of change in annual mean NO_2 concentration	Number of receptors with:	
	Worsening of NO_2 at sensitive receptor already above AQO or creation of a new exceedance	Improvement of NO_2 at sensitive receptor already above AQO or the removal of an existing exceedance
Large	0	0
Medium	0	7 (R3, R81, R441, R447, R599, R600, R601)
Small	0	0

6.10.10 Annual mean PM_{10} concentrations are modelled to be well within both the PM_{10} and $PM_{2.5}$ annual mean AQO (i.e. 40µg/m^3 and 20µg/m^3, respectively) at all receptors, with the highest concentration predicted in the Opening Year to be 16.6µg/m^3. All of the receptors were modelled to experience either an 'imperceptible' or 'small' change in concentration as a result of the Proposed Scheme. Therefore, there are no predicted exceedances of either the PM_{10} or $PM_{2.5}$ AQOs.

Ecological assessment

6.10.11 Nitrogen deposition calculations were undertaken, in line with DMRB LA 105 for all modelled ecological receptors. The results suggest that three of the modelled receptors, across two ecological sites, have a predicted total deposition rate above the minimum critical load and a predicted change in nitrogen deposition of more than 1% of the minimum critical load and of more than 0.4 kg N/ha/year (see Figure 6.7). These receptors are located in Clifton Country Park LNR and Rhodes Farm Sewage Works LWS. As the results indicate ecological receptors have the potential to be affected by changes in air quality, the potential significance of these impacts will assessed by the project ecologist within the Environmental Statement. The potential impact of the Proposed Scheme on designated habitats is discussed further in Chapter 8: Biodiversity in line with DMRB LA 105 guidance.

6.10.12 The full results for receptors included in the ecological air quality assessment can be seen in Appendix 6.2.

Compliance risk assessment

6.10.13 A total of 73 receptors were modelled at positions 4m from the edge of PCM road links as well as an additional 49 receptors at qualifying features in the air quality study area, all modelled at 2m in height. The results of the compliance assessment can be seen in Appendix 6.2 and on Figure 6.8.

6.10.14 Whilst modelled annual mean NO_2 concentrations alongside PCM links are in all cases substantially higher than those suggested by the national scale PCM model (which is not unusual), annual mean NO_2 concentrations are still modelled to be within the LV (40µg/m^3) adjacent to all links. The highest predicted NO_2 concentration was 29.2µg/m^3 without and 29.3µg/m^3 with the Proposed Scheme in the Opening Year.

6.10.15 Annual mean PM_{10} concentrations were also modelled to be below the $PM_{2.5}$ LV of 20µg/m^3, with the highest concentration predicted to be 16.2µg/m^3 without and 16.3µg/m^3 with the Scheme in the Opening Year.

6.10.16 As such, it is considered that there is no risk of the Proposed Scheme affecting the UK's reported ability to comply with the LVs in the shortest timescale possible.

Summary of assessment

6.10.17 Effects on air quality during the construction phase of the Proposed Scheme are considered likely to be '**not significant**'.

6.10.18 In accordance with DMRB LA 105 criteria on significance, the effect of the operation of the Proposed Scheme on air quality at human health receptors and on compliance with EU LVs is considered to be '**not significant'**. Changes in nitrogen deposition as a result of the operation of the Proposed Scheme have the potential to impact sensitive habitats within designated ecological sites, the potential significance of which will be considered further within the biodiversity chapter of the Environmental Statement.

7. Cultural heritage

7.1 Topic introduction

7.1.1 This chapter addresses the likely significant effects of the Proposed Scheme on cultural heritage. The chapter considers the known heritage baseline, alongside a consideration of magnitude of impacts (change) on heritage assets that may occur due to the construction and operation of the Proposed Scheme and the resultant potential effects.

7.1.2 Cultural heritage includes archaeological remains, built heritage and historic landscapes. This chapter considers the historic evolution of the landscape and the potential effects on the setting of heritage assets. The likely change to the existing landscape, people's views and visual amenity is addressed within Chapter 8: Landscape and visual.

7.1.3 This chapter is supported by the following figures:

- Figure 7.1: Cultural Heritage Designated Assets
- Figure 7.2: Cultural Heritage Non-Designated Assets
- Figure 7.3: Cultural Heritage Historic Landscape Character Types

7.1.4 A gazetteer will be included in the Environmental Statement.

7.2 Stakeholder engagement

7.2.1 Table 7.1 summarises the key requirements from the Planning Inspectorate's Scoping Opinion (2021) as relevant to the scope of the cultural heritage assessment, and identifies any matters scoped out of the assessment as agreed with Planning Inspectorate and other stakeholders. This table also explains any changes to the assessment methodology as a result of this engagement.

7.2.2 Scoping Opinion responses included matters that are indirectly relevant to the cultural heritage aspect (e.g. Landscape and Visual). These comments have not been included in Table 7.1 as they are not directly related to the aspect scope and methodology and are being assessed by other environmental aspects.

Table 7.1: Key stakeholder feedback for cultural heritage aspect

Stakeholder	Comment	Response
Planning Inspectorate	ID 4.2.1 Inspectorate agrees that physical impacts on historic buildings and archaeological remains during operation can be scoped out	Operational impacts to historic buildings and archaeological remains will be excluded from the Environmental Statement.
Planning Inspectorate	ID 4.2.2 Regarding new land take, PINS (Planning Inspectorate) does not agree that effects on archaeological remains due to new land take can be scoped out at this stage and that such matters should be considered as part of the construction phase assessment	Archaeological remains within new land-take area is included in this PEIR and will be included in the Environmental Statement.

Stakeholder	Comment	Response
Planning Inspectorate	ID 4.2.3 PINS stated that the Environmental Statement should consider the effects of vibration or other construction activities on non-designated historic buildings adjacent to the site boundary	Potential impacts to non-designated historic buildings adjacent to the Proposed Scheme will be included in the Environmental Statement
Planning Inspectorate	ID 4.2.4 Paragraph 7.5.2: not clear to PINS if trial trenching will inform the Environmental Statement or will be carried out prior to construction, and acknowledge data limitations without it	The need for archaeological trial trenching has been highlighted, pending geotechnical ground investigation results. It is proposed that trial trenching commence during the Environmental Statement preparation and informs the DCO submission
Planning Inspectorate	ID 4.2.5 Mitigation through enhancement measures such as information boards is not likely to be practical in this environment	Archaeological mitigation measures will focus on preservation by record, where appropriate
Planning Inspectorate	ID 4.3.1 Figure 8.2 of the Applicant's interactive scoping Report appears to show a total of 21 conservation areas as being 'Scoped In' on the basis that they are "Located within [the] overarching 5km study area". This would appear to contradict the Applicant seeking to scope out assessing effects on conservation areas outside of the 2km study area. The Inspectorate agrees that conservation areas outside of 2km from the Proposed Development are unlikely to be significantly affected and that this matter can be scoped out.	It is noted that the Inspectorate agrees with scoping out of conservation areas beyond 2km. Further work is to be undertaken and clarity provided for the justification for scoping out conservation areas within the 2km Detailed Study area.

7.2.3 In addition to the statutory consultation process, there is ongoing engagement with stakeholders to steer the development of the Proposed Scheme in terms of heritage considerations.

7.3 Legislative and policy framework

7.3.1 The National Policy Statement for National Networks (NPS NN) (Department for Transport (DfT), 2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NPS NN as the primary basis for making decisions on DCO applications.

7.3.2 Key policy from the NPS NN relevant to this aspect is set out below:

- Paragraph 5.120 of the NPS NN states that the construction and operation of national networks infrastructure has the potential to result in adverse impacts on the historic environment.
- Paragraph 5.122 defines heritage assets as those elements of the historic environment that hold value to current and future generations because of their historic, archaeological, architectural or artistic interest. The sum of the heritage

interests that a heritage asset holds is referred to as its significance (heritage value). Significance derives not only from a heritage asset's physical presence, but also from its setting.

- Paragraph 5.124 requires that non-designated heritage assets of archaeological interest that are demonstrably of equivalent significance to scheduled monuments should be considered subject to the policies for designated heritage assets.
- Paragraph 5.127 states that the applicant should describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the asset's importance and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum, the relevant Historic Environment Record should have been consulted and the heritage assets assessed using appropriate expertise. Where a site on which development is proposed includes or has the potential to include heritage assets with archaeological interest, the applicant should include an appropriate desk-based assessment and, where necessary, a field evaluation.
- Paragraph 5.129 requires that in considering the impact of a proposed development on any heritage asset, the SoS should take into account the particular nature of the significance of the heritage asset.
- Paragraph 5.130 states that the SoS should take into account the desirability of sustaining and, where appropriate, enhancing the significance of heritage assets, the contribution of their settings and the positive contribution that their conservation can make to sustainable communities, including their economic vitality.
- Paragraph 5.131 states that substantial harm to or loss of grade II listed buildings and grade II registered parks and gardens should be exceptional and that substantial harm to, or loss of, scheduled monuments, grade I and II* listed buildings and grade I and II* registered parks and gardens should be wholly exceptional.
- Paragraph 5.132 states that any harmful impact on the significance of a designated heritage asset should be weighed against the public benefit of development, recognising that the greater the harm to the significance of the heritage asset, the greater the justification that will be needed for any loss.

7.3.3 In addition to the national policy set out in the NPS NN, the Proposed Scheme must also have regard to relevant legislation and local plans and policy. Legislation and local planning policy will be complied with. Full details of legislation and local planning policy relevant to this aspect are appended to this report (Appendix 1.1).

7.4 Assessment methodology

7.4.1 A scoping exercise was undertaken in 2021 to establish the form and nature of the cultural heritage assessment, and the approach and methods to be followed.

7.4.2 The Design Manual for Roads and Bridges (DMRB) LA 106: Cultural Heritage Assessment (Highways England, Revision 1, 2020b; hereafter referred to as DMRB LA 106) section 3.6 states that a study area for new roads '*shall include the footprint of the scheme plus any land outside that footprint which includes any heritage assets which could be physically affected*' and that should include '*the setting of any designated or other cultural heritage resource in the footprint of the scheme or within the zone of visual influence or potentially affected by noise*'.

7.4.3 Assessment has been undertaken in accordance with DMRB LA 106 with consideration of guidance such as the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG), 2019) and The Setting of Heritage Assets (Historic England, 2017). Where appropriate, the value of heritage assets has also been determined with Historic England's Conservation Principles guidance (Historic England, 2008).

7.4.4 The assessment of value (sensitivity) of assets will be undertaken based on the assessment criteria set out in Appendix 5.2 of this PEIR and summarised in Table 7.2 (see Section 7.7) below. These criteria are set out as per DMRB LA 104 Environmental assessment and monitoring (Highways England, Revision 1, 2020a; hereafter referred to as DMRB LA 104) Ref. 4.N as presented above (see Chapter 5: Environmental assessment methodology).

7.4.5 This assessment will inform the need for, and scope of archaeological and/ or geoarchaeological investigation necessary to inform the Environmental Statement. In turn, this intervention will determine the need for, and scope of any mitigation required for the same resources and ensure that these are robust to meet the requirements of the NPS NN and NPPF.

7.5 Assessment assumptions and limitations

7.5.1 The information presented in this assessment reflects that obtained and evaluated at the time of reporting and is based on an emerging design for the Proposed Scheme. This includes the maximum likely extents of land required for its construction and operation.

7.5.2 It is assumed that data provided by third parties are accurate and up to date at the time of reporting.

7.5.3 The Historic Environment Record (HER) consulted as part of this assessment only lists known archaeological sites or significant historic landscape features. The potential exists for previously unrecorded archaeological remains to be present within the provisional Order Limits. These will be examined more fully in the Environmental Statement. The findings of this preliminary assessment may be subject to change as the design of the Proposed Scheme is developed and refined further through the assessment and consultation process, and as further research and investigative surveys are completed to fully understand its potential effects.

7.5.4 The assessment of effects on built heritage assets presented in this PEIR takes into account embedded and essential mitigation. This includes landscape planting (see Landscape and Visual chapter, Section 8.5.5), which has been outlined and incorporated into asset setting assessment in this PEIR.

7.5.5 The Environmental Statement will benefit from a cultural heritage desk-based assessment (DBA) which will include sources such as historic maps and the examination of historic geotechnical ground investigation data, taking previous land use and disturbance into consideration. An initial phase of archaeological and/ or geoarchaeological investigation to inform the ES is standard practice to inform mitigation. It is only when a full suite of such evaluation work is undertaken can the presence, extent and significance of such buried remains be accurately quantified. The need for archaeological investigation has been determined and scoped in consultation

with the greater Manchester Archaeological Advisory Unit (GMAAU). Consultation will continue to discuss the implementation of the trial trenching following the DCO submission.

7.5.6 The Environmental Statement will present the full assessment on built heritage taking into consideration the final landscape design and planting proposals.

7.6 Study area

7.6.1 The size of the study area is informed by the methodological principles in DMRB (LA 106, Section 3.5) and considers the likely extent of physical impacts and setting changes on non-designated assets. A 300m study area proposed in the Environmental Scoping Report (Highways England, 2021). The study area includes the zone potentially affected by noise (see LA 111, Ref 13.I). In that respect it is deemed proportionate to the environment surrounding the Proposed Scheme. This is due to the fact that it reflects a heavily urbanised modern settlement with extensive mid-to-late 20th century housing and transport infrastructure within which non-designated assets have a limited capacity to change from the Proposed Scheme. The 300m study area also gives sufficient scope for existing data to inform the archaeological context of the Proposed Scheme. This aids professional judgement on the potential for the presence of hitherto unknown archaeological assets. A larger study area would capture a wider developed environment and potentially an excessive amount of data that would be surplus to requirements in determining context and potential. A smaller study area might be deficient in this regard. The study area is also sufficient in establishing the setting of assets in the receiving environment, given its overall lack of sensitivity within (for the most part) a modern urban environment. Assets directly affected by the Proposed Scheme will therefore be assessed in terms of how far setting contributes to their value, allowing an understanding of their susceptibility to change.

7.6.2 A second larger study area has been utilised purely for the purpose of assessing the setting of designated heritage assets. Designated heritage assets comprise scheduled monuments, registered battlefields, registered parks and gardens, and grade I, II* and II listed buildings, all of which are assessed as being of high (national) value. The data for such an asset class was collated within a study area extending up to 1km in all directions from the provisional Order Limits. After internal consultation, it was recognised that significant effects on the value of heritage assets arising from changes to setting are unlikely beyond 1km, given that no designated assets have been identified as having visual relationships with the Proposed Scheme over 1km from the Order Limits. The cultural heritage site walkover survey visited key viewpoints determined by the Landscape and Visual (Chapter 8) study as well as visiting assets such as conservation areas and listed buildings with theoretical visibility of the Proposed Scheme. The walkover survey indicated that no designated assets outside the 1km study area have any strong visual relationship with the Proposed Scheme. The 1km study area for the Proposed Scheme was originally conceived due to the nature of the existing motorway infrastructure, and the anticipated sensitivity of the receiving environment. The presence of intervening urban areas also precludes intervisibility with the Proposed Scheme by designated heritage assets beyond 1km from the Order Limits.

7.6.3 The study area for the cultural heritage assessment is shown on Figures 7.1 and 7.2.

7.7 Baseline conditions

7.7.1 For the purposes of this report, cultural heritage comprises three matters, defined as:

- Archaeological remains: the material remains of human activity from the earliest periods of human evolution to the present. These could be buried traces of human activities, sites visible above ground, or moveable artefacts.
- Historic buildings: architectural, designed or other structures with a significant historical value. These could include structures that have no aesthetic appeal or structures not usually thought of as buildings, such as milestones or bridges. Conservation areas are considered within the historic building subject area.
- Historic landscapes: the current landscape, whose character is the consequence of the action and interaction of natural and human factors. This includes designed landscapes and parkland and the areas defined by the Historic Landscape Characterisation process undertaken by most local authority areas.

Baseline sources

7.7.2 To inform the baseline for the study area the following sources of information were consulted:

- The Historic England Archive (HEA) for relevant unpublished archaeological reports
- Archaeological Data Service (ADS) for relevant unpublished archaeological reports
- The Historic England website for the latest datasets for designated heritage assets (scheduled monuments, listed buildings, registered parks and gardens, registered battlefields, World Heritage Sites, and protected wrecks)
- Designated conservation areas from the Bury Council website
- The Greater Manchester Historic Environment Record (HER) for information on non-designated heritage assets and previous archaeological investigations
- The Greater Manchester Urban Historic Landscape Characterisation (HLC) Project for information on the historic landscape character of the 300m study area

7.7.3 In the baseline below, assets are identified by their unique Historic England, HER or HLC reference numbers.

7.7.4 The locations of the designated and non-designated assets discussed below are shown on Figures 7.1 and 7.2.

Baseline conditions

Archaeological remains

7.7.5 There are no scheduled monuments recorded within 1km of the Proposed Scheme.

7.7.6 Within the provisional Order Limits of the Proposed Scheme, seven non-designated archaeological assets are recorded. Divided into archaeological time period, from earliest to latest these comprise:

Prehistoric (c.12700 BP – 43 AD)

7.7.7 No known non-designated assets lie within the provisional Order Limits.

7.7.8 One asset from these periods lies outside of provisional Order Limits within the 300m study area; a possible Bronze Age settlement at Castle Brook Farm (HER 2894.2.0) 300m east of the Proposed Scheme.

Romano-British (43 AD - 410 AD)

7.7.9 The projected alignment of the Roman road from Manchester to Ribchester (HER 14.1.1) is the only known asset from this period which is within the proposed development boundary. There are no surviving above-ground remains of this asset which crosses the western limit of the Proposed Scheme on an approximate north-west to south-east alignment.

7.7.10 The site of a Roman bow brooch (HER MGM17742) lies approximately 150m to the south of the Proposed Scheme, immediately south of the M60 J18.

Early Medieval (410 AD – 1066 AD) and Medieval (1066 AD – c.1540)

7.7.11 There are no known non-designated assets.

Post-Medieval (c.1540 AD – 1900 AD)

7.7.12 The following nine assets are within and overlapping with the provisional Order Limits:

- The site of a possible oven (HER 3921.1.0) identified from a historic field name ‘Owen Hill’. A watching brief conducted within Pike Fold Golf Club to the east of the Proposed Scheme in 1996 and 1997 did not identify any evidence of this asset
- The site of structures south of Mode Hill Lane (HER 3919.1.0) identified from 19th century historic mapping. Two structures are shown on the historic mapping to the north-west of M60 J18. No trace of the buildings was identified during archaeological assessments undertaken in 1993
- Unsworth Moss (3878.1.0) is a natural feature dating from the prehistoric periods. It is now generally pasture land with sandy soil and a prominent hill at Back o-the moss Farm. Likely to contain buried organic remains and ecofactual/artefactual material
- The site of structures off Corday Lane (HER 3915.1.0) identified from 19th century historic mapping to the north-west of M60 J18
- The site of Den House (3919.1.1) appears on a 1786 map as an elongated structure fronting on to Pole Lane on its western side. The HER point is outside the provisional Order Limits but the extent of the original house is likely to extend into it. The site was vacant on the 1895 OS map but a single pair of stone gateposts were noted as surviving in 1993
- The site of Limbrick House (3920.1.0) is another property formerly fronting on to Pole Lane (like Den House above). The property is on the same 1786 map as the above but, unlike Den House, is present on the 1895 OS map but evidently between then and 1932 was removed, given it does not factor on the latter. There

are no visible remains but the likely property extents overlap into the provisional Order Limit boundary around Pole Lane

- The site of Gravel Hill House (HER 3914.1.0) identified from 19th century historic mapping. An irregularly shaped building is shown on the historic mapping to the north-west of M60 J18. No trace of the building was identified during archaeological assessments undertaken in 1993 and geotechnical ground investigation (Ian Farmer Associates, 2022) for the Proposed Scheme has indicated that no buried remains are likely to survive. The proximity to the M60 and M66 junction has likely erased all buried traces of the buildings
- The site of Hughes i'th' Wood (HER 3941.1.0) which is a structure noted from historic maps, including the 1842 Tithe Map and 1848 Ordnance Survey, but is not present by the time of the 1909 OS sheet. The Tithe apportionment names the building as ‘Homestead’ and owned by the Earl of Derby and occupied by George Horrocks. Buried archaeology associated with the feature may exist in the area proposed for attenuation pond creation (Whitefield Golf Course) at the western end of the Proposed Scheme
- A field system at Heywood Farm (HER 3517.2.0) remains on the archaeological record as the possible remains of early strip field, with irregular width caused by "reversed S" pattern resulting from medieval ploughing. The western end has been destroyed by the M60 motorway and it is uncertain if any remains exist within the provisional Order Limits

7.7.13 Within the 300m study area, a further 50 non-designated archaeological assets are recorded. Most of the non-designated assets recorded within the 300m study area by the HER comprise the sites of post-medieval buildings or places identified from 19th century historic mapping. These will be itemised in the Environmental Statement.

7.7.14 Due to the likely magnitude of impacts during groundworks for the construction of the original motorway and associated junctions, the potential for previously unknown archaeological assets to exist within the footprint of the majority of the Proposed Scheme is negligible. However, for works in lesser developed areas at distance from the existing highways boundary, there is a greater potential for the survival of archaeological remains from the Roman, post-medieval and medieval periods, though the potential is still low. This level of potential has been arrived at through study of the archaeological records throughout the study area where Romano-British activity is poorly represented. In addition, the extents of modern activity in terms of development has probably removed any such evidence, should it have existed.

Historic buildings

7.7.15 There are no designated historic buildings within the provisional Order Limits. Three listed historic buildings and structures fall within 300m of the Proposed Scheme boundary as follows:

- The Grade II listed Unsworth War Memorial (NHLE 1440257) at the northern end of the Proposed Scheme, 300m from the provisional Order Limits.
- The Grade II listed Philips Park Road Lodge (NHLE 1067248) and its separately designated Gate Piers and curved flanking walls (NHLE 1163724) lie at the western extent of the Proposed Scheme, 280m from the provisional Order Limits

7.7.16 There are 38 other listed buildings recorded between the 300m study area and the wider 1km study area of the Proposed Scheme comprising:

- Two Grade I listed buildings (Heaton Hall - NHLE 1200809) and Church of St Mary (NHLE 1067252), both of which are located approximately 1km to the south of the Proposed Scheme
- Three Grade II* listed buildings (Temple to north-east of Heaton Hall - NHLE 1200813), Smithy Lodge to east of Heaton Hall (NHLE 1282994), and Monument to John Brooks to west of Church of St Mary (NHLE 1067254) all also located towards the southern limit of the 1km study area
- 33 Grade II listed buildings

7.7.17 There are no conservation areas within the Proposed Scheme or its 300m study area. There are however three designated conservation areas in the wider 1km study area, comprising:

- Poppythorn Conservation Area located approximately 350m to the south of the Proposed Scheme. The asset encompasses a fine and well-preserved example of mainly residential development in the south of the borough (Bury), which grew after the construction of the new turnpike roads and the coming of the railway during the 19th century
- All Saints, Whitefield, Conservation Area located approximately 760m to the north of the Proposed Scheme at its nearest point. The asset encompasses a fine and well-preserved example of mainly residential development in the south of the borough (Bury) which, like the Poppythorn Conservation Area above, grew after the construction of the new turnpike roads and the coming of the railway during the 19th century
- St Mary's, Prestwich, Conservation Area located approximately 850m to the south of the Proposed Scheme. The asset encompasses part of a pleasant, wooded landscape. The area is dominated by St Mary's Church which dates to the 15th century, and the mature treescape within Prestwich Clough. The residential parts of the Conservation Area are typified by tree-lined streets with substantial properties in large grounds mostly dating from the mid-19th century. The combination of large private grounds and public open spaces results in a lush and heavily tree-lined appearance

7.7.18 A 2km study area was originally intended for conservation areas following comments in the Scoping Opinion. No conservation areas are present in between 1km-2km from the Order Limits.

7.7.19 There are no non-designated historic buildings recorded within the provisional Order Limits.

7.7.20 Within the 300m study area, 14 non-designated historic buildings are recorded as being present, comprising:

- Cold Gate Farm (HER 3918.1.0), also referred to as Cowl Gate Farm, is a 19th century two-storey house, with slate roof, ridge stack and rendered exterior located to the immediate west of the Proposed Scheme. The asset is shown on historic mapping dating from the early 19th century and is recorded as a homestead. There is a modern extension on the west side of the asset. The asset is bounded to the

north, south and west by undulating pasture fields and to the east by the M66 motorway from which it is screened by a bank of mature trees and vegetation

- Droughts Farm (HER 3934.1.0) is a 19th century farm complex located to the immediate south-east of M60 J18. The farmhouse is built of brick in the English garden wall bond. The threshing barn is also made of brick. This asset is shown on the historic mapping dating from the mid-19th century and is recorded as 'site of buildings and fold'. The asset is bounded to the north and west by M60 J18, to the east by an area of undeveloped land, and to the south by residential dwellings. Aerial images indicate that there is a derelict extension on the east side of the property
- Egypt Farm (formerly Higher Egypt) (HER 3931.1.0) is a 19th century farmstead located to the north of the M60 at the eastern limit of the Proposed Scheme. It has since been extensively re-built from its original state
- Hills Nook (HER 10101.1.0) comprises two 18th or 19th century buildings located on Pole Lane approximately 70m to the west of the Proposed Scheme. The asset is a two-storey, rectangular plan building, with a slate roof. The asset is surrounded by undulating pasture fields. The M66 motorway is located within a cut to the east of the asset and is not visible
- Coach and Horses Public House (HER 9961.1.0) is a 19th century inn located on Bury Old Road approximately 70m to the south of the Proposed Scheme. The asset comprises three-storey brick-built rectangular plan building with a blue slate roof. The asset is bounded by residential and commercial properties. The M60 motorway is located within a cut to the north of this asset
- The Hills (HER 3926.1.0) is an 18th century farmstead located approximately 120m to the east of the Proposed Scheme off Hills Lane. The asset is surrounded by the Pike Fold Golf Club. The M66 motorway is located within a cut to the west of the asset and is not visible
- St George's Church (HER 2931.1.0) is an 18th century church located approximately 130m to the west of the Proposed Scheme. The church comprises a rectangular brick-built building with stone-capped buttresses to the northern and southern elevations. The fenestration is placed centrally between the buttresses. The windows are brick-built lancets with keystones to the lancet window heads. The western gable has a five-sided porch which is brick built with stone upper band and a stone parapet. The entranceway has a brick moulded doorway surround
- 122 Hollins Lane (HER 2927.1.0) is a two-storey 19th century townhouse located approximately 220m to the west of the Proposed Scheme
- Pike Fold Golf Club (HER 3925.1.0), previously known as Back o'th' Moss Farm, is an 18th century farm complex located 260m to the east of the Proposed Scheme. The asset has been subject to extensive redevelopment and is currently the club house of the Pike Fold Golf Club. The asset is surrounded by the landscaped golf course. The M66 motorway is located within a cut to the west of the asset and is not visible
- Former General Store at Hollins Lane (HER 2926.1.0) is a possibly early 18th century shop building located approximately 260m to the west of the Proposed Scheme

- Beehive Dyeworks (HER 3889.1.0) is a former 19th century cotton mill located approximately 300m to the west of the Proposed Scheme
- Pumping Station (HER 11008.1.0) is a two-storey mid-20th century building located on the north bank of the Hollins Brook approximately 300m to the north-east of the Proposed Scheme. The building is now used to house a generator
- Cuckoo Nest (HER 9963.1.0) is a modern building on the site of former buildings recorded to be named as Cuckoo's Nest. It is clear from the HER that the original 19th century building has been replaced. This asset is located approximately 250m to the south of the Proposed Scheme
- Mount Pleasant Farm (HER 9947.1.0) is a 19th century farm building which is visible as a complex on 19th century historic maps. This lies within the study area 180m to the east of Nutt Lane

Historic landscapes

7.7.21 There is one designated historic landscape asset recorded within both the 300m and 1km study areas; the Grade II Heaton Park Registered Park and Garden (NHLE 1000854). This asset forms the park and pleasure gardens of the Heaton Estate and was probably designed by William Emes and John Webb in 1770-72. It was an area designed within the Heaton estate which had been consolidated by the early 17th century. The park covers an area of approximately 240ha and is varied topographically. It is situated on land which rises from the south and west, and there is a valley running through the northern and north-eastern part of the site, which lie closest to the Proposed Scheme boundary. The setting is urban in character, characterised mostly by modern, post-war residential settlement. There are views over partially open country to the east and south-east and to the Pennines to the north and north-west. There is partial mature vegetation coverage. The site was acquired by the Manchester Corporation in 1902 and subsequently used as a public park. In terms of Historic Landscape Character types (HLTs) there are 12 within and just overlapping into the Proposed Scheme boundary:

- The existing M60 and M62 Junction 18 (Junction with M66) at Whitefield
- The M66 Unsworth Moss, dating from 1973
- M60 Between Junctions 18 and 19, North of Heaton Park dating from 1980
- M60 Between Junctions 17 and 18, Prestwich dating from 1959
- M60 West of Junction 17, Prestwich, dates from 1955
- Playing Fields, Griffe Lane, Unsworth, dating from 1959
- Pike Fold Golf Club, Unsworth, dating from 1956
- Fields off Heywood Road and Corday Lane, West of Simister were agglomerated fields dating from 1848 to 1950
- Playing Fields, Sandgate Road, Prestwich dating to 1959
- Streets Between Sandgate Road, Warwick Avenue and Cuckoo Lane, Kirkhams, Prestwich, from 1959 – 1980
- Whitefield Golf Course, off Higher Lane, Whitefield, dating from 1938 – 1954
- Philips Park, Prestwich, dating from 1846 – 1948

HLTs are not assets in their own right, but rather areas characterised to reflect their changing historic character and time-depth profiles.

Future baseline

7.7.22 The future baseline for cultural heritage is very much dependent on the actions of others to conserve and manage heritage assets (both designated and non-designated) in future years. Current policies and laws are likely to continue to require the conservation and enhancement of heritage assets. However, in the absence of action to maintain them or keep them in active use, the condition of such assets will likely deteriorate. Such a scenario might come about via radical changes in the planning process that resulted in less protection afforded historic assets than is presently the case.

7.7.23 The future baseline might also change given natural occurrences which might constitute '*force majeure'*. Climate change is one such occurrence. A changing climate, whether increased heating or cooling, will affect the natural environment including such areas as water tables, increased ranges of temperature and could result in changes to vegetation types and growth rates. There might be a range of adverse or positive effects from these climatic changes on the archaeological and built heritage resource.

7.7.24 Many historic assets benefit from regular maintenance. This is particularly true for historic buildings, including civic architecture such as statues and war memorials. In the event of changes in maintenance regimes such assets might well be neglected, leading to terminal decline.

7.7.25 Future development is the most likely source of changing baseline. Development within the provisional Order Limits or in the immediate vicinity of it have the potential to remove or damage heritage assets, together with changing setting. The changes to setting will be permanent during the operational phase. There are 31 planning applications in a 2km study area around the provisional Order Limits. These comprise major developments only and mostly comprise residential, commercial and educational developments, and a recycling facility. Within the same area are 24 areas designated for strategic housing allocation in Bury and Rochdale Council's local plans. National Highways have three NSIPs in the wider Manchester region, including further along the M60. Collectively, these schemes are likely to involve some impacts to the historic environment. The extent of these changes to archaeology and built heritage will be determined through project-specific assessments. In general, there is likely to be some removal of some historic assets and changes to the setting of others, which will affect their significance.

Value / sensitivity of receptors

7.7.26 A preliminary assessment of the value of the heritage assets within the study areas (1km for designated assets and 300m for non-designated assets) has been undertaken. This has used professional judgement and standards contained within DMRB LA 104 on a scale of negligible, low, medium, high and very high.

7.7.27 In this report, the term value is used when describing the significance of heritage assets as set-out in the requirements of the NPS NN. This is to avoid any confusion when describing effects that are significant later in the assessment process.

Table 7.2: Value of receptors in the study area for cultural heritage

Value / sensitivity	Description	Identified receptors within the study areas
Very high	Assets of very high importance and rarity, international scale and very limited potential for substitution.	None
High	Assets of high importance and rarity, national scale, and limited potential for substitution.	Listed Buildings (all grades)
Medium	Assets of medium or high importance and rarity, regional scale, limited potential for substitution.	Grade II Heaton Park Registered Park and Garden Conservation Areas
Low	Assets of low or medium importance and rarity, local scale.	Non-designated archaeological remains with potential for contributing to local research agendas Non-designated historic buildings HLC areas with potential for contributing to local research agendas
Negligible	Assets of very low importance and rarity, local scale.	Non-designated archaeological remains such as field boundaries, undated cropmark features Sites of non-designated archaeological assets that have now been removed or identified from historic mapping Findspots HLC areas of modern origin

7.8 Potential impacts

Construction

7.8.1 Potential impacts on heritage assets during construction can be divided into physical impacts and impacts arising from changes in an asset's setting (if the setting is relevant to understanding and appreciating the heritage value of the asset).

7.8.2 Potential physical impacts on heritage assets which may occur during construction of the Proposed Scheme comprise:

- Partial or complete removal of archaeological remains or historic landscape elements (such as hedgerows) within the footprint of the Proposed Scheme through groundworks associated with construction. This could include widening of the existing highway boundary or the creation of new offline sections, in addition to any service trenches and drainage features, topsoil stripping for compounds, the excavation of borrow pits and attenuation ponds and landscaping features
- Impacts on archaeological remains within the footprint of the Proposed Scheme through their compression during construction, through the movement of machinery or within site compound or spoil storage areas
- Impacts on archaeological remains through changes to groundwater levels caused by engineering activities associated with the Proposed Scheme
- Impacts to historic buildings through subsidence due to groundwater dewatering

7.8.3 Potential impacts where the Proposed Scheme may affect the contribution made by setting to an assets value (if the setting is relevant to understanding and appreciating the heritage value of the asset) which may occur during construction comprise:

- The physical removal of, damage to, or severance of associated archaeological remains which form the setting of a heritage asset
- The alteration to the setting of archaeological remains and historic buildings through the removal of vegetation or associated above-ground elements during construction
- Temporary changes in the way in which sound and noise currently contribute to the heritage value of assets and changes to the setting of archaeological remains, historic buildings, where that setting is relevant to understanding and appreciating its heritage value, during construction activities such as groundworks, placement of site compounds, and from increased construction traffic

7.8.4 An initial assessment of potential impacts indicates that:

- No physical impacts are predicted on any designated heritage assets
- No adverse changes to setting are predicted on designated heritage assets
- There is the potential for construction activities to have a temporary impact on the value of historic buildings, both designated and non-designated, (where the setting is relevant to understanding and appreciating the heritage value of the asset) due to increases in the way in which sound and noise currently contribute to the heritage value of assets, and from dust
- There is a low potential for previously unknown archaeological assets to be present within the footprint of the Proposed Scheme that may be physically affected/removed during construction activities
- There are non-designated HLC areas within the footprint of the Proposed Scheme that may be physically affected

7.8.5 Based on the above, impacts on archaeological remains, historic buildings, and historic landscapes during construction are included in the preliminary assessment below.

Operation

7.8.6 Potential impacts on heritage assets during operation can be divided into physical impacts and where the Proposed Scheme may affect the contribution made by setting to an assets value (if the setting is relevant to understanding and appreciating its' heritage value).

7.8.7 Potential physical impacts on heritage assets which may occur during operation of the Proposed Scheme comprise:

- Removal of, or damage to, archaeological remains during maintenance works
- Damage to archaeological remains, historic buildings, or HLC areas through pollutants

7.8.8 Potential impacts on the value of heritage assets, where the Proposed Scheme would alter the setting and its contribution to an asset's value (if the setting is relevant to understanding and appreciating its heritage value) during operation, comprise:

- Alterations to the setting of historic buildings where new infrastructure is present in key views towards, through and across an asset
- Alterations to an asset's setting due to increases in the way in which sound and noise currently contribute to the heritage value of assets and light currently contribute to the heritage value of assets caused by the Proposed Scheme
- Severance of identifiable interrelationships due to a new length of road causing physical divisions between previously related heritage assets

7.8.9 In line with the objectives in DMRB LA 106 Section 3.2, an initial assessment of potential impacts during the operational phase indicates:

- The negligible potential for significant physical impacts on historic buildings and archaeological remains during operation
- The value of historic buildings (where setting is relevant to the appreciation and understanding of that heritage value) has the potential to be impacted due to alteration to setting through increases in the way sound, noise and light currently contribute to the heritage value of assets during operation
- While archaeological remains have the potential for their setting to be changed, the initial assessment of the archaeological remains within the study area is that their value is primarily derived from their physical remains and any intrusion on their setting during operation would have limited to no impact on our understanding and appreciation of these heritage assets. This is determined by considering the current local environment of motorway and modern settlement adjacent to it along much of the Proposed Scheme

7.8.10 Based on the above, impacts to historic buildings and historic landscapes (designated assets only) during operation are scoped in for the preliminary assessment below. Archaeological remains would be sensitive only to the potential for changes in the way in which sound and noise currently contribute to their heritage value.

7.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

7.9.1 Embedded mitigation (that is, mitigation through engineering design) would include the provision of features like earthen embankments and other landscaping to avoid impacts from the Proposed Scheme on both heritage assets and local human settlement. Utilising earth banks or changes to route alignment can soften the visual intrusion and therefore reduce impacts to historic assets. An outline of the landscape mitigation is given in the Landscape and Visual chapter (Chapter 8).

7.9.2 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the scheme design. Chapter 3: Assessment of alternatives, details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

7.9.3 The Proposed Scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the Proposed Scheme description and assessment of alternatives chapters. The preliminary assessment presented in this

report indicates that no design solutions are necessary to avoid impacts to designated assets. Potential impacts identified to buried archaeology can be likely dealt with through the measures outlined below rather than changes to design, given that no significant effects are anticipated.

Essential mitigation

7.9.4 For archaeological remains, the need for and scope of archaeological mitigation is determined after the completion of a programme of intrusive archaeological investigation, in the areas where it is warranted. The locations of archaeological potential have been arrived at through desk study and the analysis of historic maps. A programme of archaeological trial trenching would be the standard way to accurately assess archaeological risk. This is a technique to establish the presence, extent and significance of buried archaeological remains in line with NPS NN requirements. In this instance, given the proposed project programme, archaeological trial trenching is proposed in the immediate wake of the DCO submission. Once field investigation is completed, the post-fieldwork programme of assessment and reporting will supply the necessary amount of information to inform a robust mitigation strategy.

7.9.5 Based on these results, further mitigation may be required where archaeological remains are encountered. This will be followed by a further phase of post-excavation assessment, analysis, reporting and, where appropriate, publication.

7.9.6 Archaeological mitigation would take the form of preservation by record. This comprises archaeological hand excavation and recording of archaeological remains usually in the pre-enabling works and enabling works phases of a development project (PCF Stages 5 and 6). This destructive process generates the required information to:

- Create an archive of the results.
- Inform an interpretive report.
- Answer specific local, regional and national research questions.
- Allow the discharge of any condition of planning consent.

7.9.7 Through this form of mitigation, the recorded archaeology will be subject to analysis and reproduced in interpretive reports, as per National Highways obligations to the historic environment as given in DMRB (LA 106, Section 3.15). These will ultimately be released into the public domain via submission to the local HER service, in this case the data managers at the Greater Manchester Archaeological Advisory Service based at the University of Salford. The need to produce interpretive reports will be set out in detailed method statements (Written Schemes of Investigation (WSI)) approved by the local planning authority archaeological advisory services.

7.9.8 It is unlikely that mitigation measures will need to be employed on historic buildings, owing to their distance from the scheme. However, should the design change and buildings are identified as being at risk, there are a range of mitigation measures possible, including structural survey and monitoring during groundwork, or preservation by record, when physically affected by road schemes, are subject to a programme of historic building recording. These might be measures employed on the non-designated historic buildings adjacent to Simister roundabout.

7.9.9 Adverse impacts to historic buildings can be mitigated through the employment of design solutions which include avoidance of the asset(s). Despite this, the asset values of heritage assets such as historic buildings are adversely affected owing to the impact to their setting. Setting can also be affected by artificial light, additional noise, vibration and dust. Design solutions limiting these impacts include dust suppression, limits on artificial lighting during evening and night-time hours, and matting and noise barriers to reduce noise. The Proposed Scheme is incorporated into land which has to a large extent been subject to development for the existing motorway network. The impact on surviving historic landscape signatures has therefore been minimised. The Environmental Statement will expand on the design measures taken to achieve this.

7.9.10 All archaeological and historic building intervention at any stage in the planning process is carried out to a detailed WSI approved prior to implementation by the relevant local planning authority advisory services.

7.9.11 Measures taken by the Principal Contractor during pre-enabling, enabling and construction phases can also mitigate impacts to archaeology and historic buildings. This can include measures such as implementing the right kind of site security fencing around historic buildings to provide an additional temporary screening function and keep plant away from the assets.

7.9.12 An outline proposal of required mitigation will be included in a 1st iteration of the Environmental Management Plan (EMP), in the absence of archaeological trial trenching results. The 1st Iteration of the EMP will be prepared for the Environmental Statement.

7.9.13 Further mitigation solutions would comprise landscape design such as vegetation screening. Vegetation screens can block or filter views from designs that present more visual intrusion into an asset.

7.9.14 The extent of mitigation will be fixed following the results of archaeological trial trench investigation, which is due for completion during the post-submission but pre-examination period.

Enhancement

7.9.15 The Proposed Scheme will generate archaeological information through intrusive investigation and mitigation, where warranted. The results of such activity will provide an opportunity for communicating any finds, or even the absence of archaeological remains, to the wider public. Interpretation of archaeological information will be informed by the reported fieldwork results. If warranted by the results of investigation, appropriate outreach and engagement opportunities would be identified throughout the construction and operational phases of the project and could include activities such as presentations, Science, Technology, Engineering, and Mathematics (STEM) and scientific outreach activities at local schools, volunteering programmes, media coverage, web-based initiatives, information and progress signage at appropriate locations, and permanent heritage interpretation at relevant sites.

7.10 Assessment of likely significant effects

Construction

Archaeological remains

7.10.1 There are no scheduled monuments within the Proposed Scheme boundary or wider study area.

7.10.2 There are no anticipated impacts to buried archaeology associated with the projected alignment of the Roman road from Manchester to Ribchester (HER 14.1.1) at the western end of the Proposed Scheme. Given the extent of enabling works and construction associated with the existing M60, it could reasonably be assumed that any buried remains associated with it have been erased. Its presence has never been confirmed by archaeological intervention or documentary research, and consequently the asset can be ascribed a negligible heritage value. Lying at the western end of the Proposed Scheme, the design would result in a negligible impact to any buried soils not previously disturbed by the creation of the M60. This would amount to a negligible adverse impact and **a neutral effect** to this asset.

7.10.3 The site of a possible oven (HER 3921.1.0), identified from a historic field name 'Owen Hill', lies adjacent to the provisional Order Limits on the Pike Fold golf course. The aforementioned watching brief to the east of the Proposed Scheme did not identify any evidence of this asset. Should any remains lie within the Proposed Scheme boundary, it is likely that these have been erased from construction of the M66 and its estate. This asset can therefore be assigned a negligible heritage value. The proposed southbound filter land extending from the M66 carriageway would result in a major adverse impact on any buried remains at this location. This would result in a **slight adverse effect**, assuming there were any remains left to be disturbed. If required, archaeological mitigation would result in a **neutral residual effect**.

7.10.4 The site of two structures south of Mode Hill Lane (HER 3919.1.0) identified from historic mapping were not identified during archaeological assessments dating to 1993. However, their presence or absence cannot be determined through desk-based research (assuming the 'assessment' did not include archaeological evaluation) and require intrusive investigation to confirm presence or absence. Assuming they have a buried presence, their survival in a buried state should warrant a low asset value. This area may be a compound or materials storage area to support the road construction. The degree of impact can be estimated as a moderate adverse one, resulting in a **slight adverse effect**.

7.10.5 The site of former structures off Corday Lane (HER 3915.1.0) is likely to have been erased or heavily degraded by the construction of the M66 and therefore probably warrants a negligible asset value. The major adverse impact of the Proposed Scheme will result in a **slight adverse effect**, should remains exist. If required, archaeological mitigation would result in a **neutral residual effect**.

7.10.6 The site of Gravel Hill House (HER 3914.1.0) identified from historic mapping warrants a negligible value, owing to the likely removal of buried remains from the construction of the M60 J18 confirmed by geotechnical ground investigation. It is highly unlikely buried remains survive. The major adverse impact arising from the Proposed Scheme would

result in a **slight adverse effect** assuming a negligible asset value. There will be no requirement for archaeological mitigation.

7.10.7 Den House (HER 3919.1.1) was apparently demolished in the late 19th century but buried remains associated with the asset may still survive, especially given the survival of its former gate posts up until 1993. The remains would warrant a low asset value. The proposed tree planting along Pole Lane is on the east side of the lane, with the potential archaeological remains of the house lying on the west side. This would constitute no change to the asset and a **neutral effect**.

7.10.8 Limbrick House (HER 3920.1.0) is approximately 170m north-west of Den House (mentioned above) and first featured on a map of 1786. As with Den House, buried remains might exist amounting to a low archaeological value. The proposed tree planting along Pole Lane is on the east side of the lane, with the potential archaeological remains of the house lying on the west side. This would constitute no change to the asset and a **neutral effect**.

7.10.9 The Moss (HER 3878.1.0) lies within the provisional Order Limits and will be within an area of construction related activity but not directly affected by the Proposed Scheme design. The asset is quite amorphous by nature as the presence of organic remains and artefacts is possible. This would warrant a low value. The nature of the activity at this location within the provisional Order Limits comprises the creation of the new junction design, a haul route around it and storage areas. Aside from these impacts none other has been identified that might compromise the survival of buried archaeology. The work would potentially amount to minor adverse impact, assuming compression of soil horizons from plant activity and construction areas, and a **slight adverse effect**, assuming the possible presence of the type of resource described. After mitigation, this would be reduced to a **neutral effect**.

7.10.10 The site of Hughes i'th' Wood (HER 3941.1.0) may represent the existence of buried remains on Whitefield Golf Course. Archaeological remains are not directly at risk of being removed by the proposed creation of attenuation ponds (Pond 6) at this location. However, if buried remains survive they would be at risk of damage from plant movement and compression from spoil storage etc. This would amount to a moderate adverse impact on an asset of low value, resulting in a **slight adverse effect**. After mitigation (archaeological recording) this effect would be reduced to **neutral**.

7.10.11 Although low, the potential exists for hitherto unidentified archaeological remains to exist within the buried environment within parts of the Proposed Scheme boundary. It is assumed that the areas immediately adjacent to the existing roads will be archaeologically sterile. These areas would have been most heavily disturbed by historic construction of the M60, M66 and M62. Archaeological potential at this location is negligible. Further away from the existing carriageway disturbance would likely have been less pronounced, for instance as use for construction compounds and material storage areas. The area might be less damaged and therefore contain buried remains. The area of the proposed Northern Loop, north-east of M60 J18 contains undulating ground, which geotechnical ground investigation has proven to be dumped surplus soil from the historic motorway construction, with 9m of dumped material towards the top of the mound. The archaeological potential is unknown.

Historic buildings

7.10.12 There are no designated and non-designated historic buildings within the Proposed Scheme boundary.

7.10.13 The three Grade II structures within 300m of the Proposed Scheme have a high asset value. These are Philips Park Road Lodge (NHLE 1067248) and its Gate Piers and curved flanking walls (NHLE 1163724) to the west of the Proposed Scheme, with Unsworth War Memorial (NHLE 1440257) to the north. At the western end of the Proposed Scheme, the proposals involve the use of land nearer Philips Park Road Lodge for pond creation. The lodge is set in wooded surroundings and visually screened from the Proposed Scheme. Additional noise, lighting and dust might occur during construction, amounting to temporary minor adverse impact. This would result in **no change** to the lodge. The construction at the northern end of the Proposed Scheme would have less adverse impacts given the setting of the War Memorial. There would be no change to this asset and a **neutral effect**.

7.10.14 One of the 38 listed buildings further afield in the 1km study area, Brick Farmhouse (NHLE 1067266) north of Pike Fold Golf Club has a limited visual relationship with the Proposed Scheme. Whilst there is inter-visibility between the Proposed Scheme and the property, construction would result in a negligible adverse impact in terms of visual change, given the distance between the two. This would result in a **neutral effect**. This is because of the approximately 850m distance between the Proposed Scheme and the property, which eliminates visual impact.

7.10.15 The remaining 37 listed buildings in the wider 1km study area have no inter-visibility with the Proposed Scheme, resulting in no visual impacts arising. These high value assets will have no change to their setting and there will be a **neutral effect** from construction.

7.10.16 The three Conservation Areas are set within urban surroundings with the M60 motorway noise, lighting, and pollution as a constant background. Any additional impacts relevant to the Conservation Areas from construction will relate to temporary lighting, additional noise, dust and pollution but when taken into the context of the status quo, where such impacts are part of the designation's permanent setting, these impacts will be negligible adverse. The assets, which have a medium asset value, will not be affected visually by Scheme construction. These impacts will result in a **neutral effect**.

7.10.17 The 14 non-designated buildings listed below in the 300m study area have a low asset value. Most of them have no inter-visibility with the Proposed Scheme. Those that do have visual relationships might suffer temporary visual impacts because of their proximity to construction areas. The assets are assessed in turn below:

- Cold Gate Farm (HER 3918.1.0), also referred to as Cowlgate Farm is bounded to the north, south and west by undulating pasture fields and to the east by the M60 motorway from which it is screened by a bank of mature trees and vegetation. The principal laydown area is located immediately adjacent to the property. Furthermore, excavation will occur near the property due to the creation of an attenuation pond and associated landscaping mitigation and to provide additional road capacity. This will have a moderate temporary impact in visual terms, resulting in a **slight adverse** effect

- Droughts Farm (HER 3934.1.0) is bounded to the north and west by M60 J18, and the property boundary abuts the provisional Order Limits. The slight encroachment of the National Highways estate would require some work on the embankment adjacent to the property. Given the proximity of the work this would result in temporary visual impacts amounting to minor adverse. A temporary **slight adverse** effect has been estimated as a worst-case scenario
- Egypt Farm (formerly Higher Egypt) (HER 3931.1.0) is set within mature vegetation which excludes inter-visibility the Proposed Scheme. The Proposed Scheme activity would have no change on this asset, resulting in a **neutral effect**
- Hills Nook (HER 10101.1.0) on Pole Lane approximately 70m to the west of the Proposed Scheme has no scheme inter-visibility with the M66 motorway located within a cut to the east of the asset. The Proposed Scheme activity would have no change on this asset and a **neutral effect**
- Coach and Horses Public House (HER 9961.1.0) is a 19th century inn located on Bury Old Road approximately 70m to the south of the Proposed Scheme is bounded by residential and commercial properties. The M60 motorway is located within a cut to the north of this asset. The Proposed Scheme activity would have no change on this asset and a **neutral effect**
- The Hills (HER 3926.1.0) off Hills Lane is partially enclosed by mature vegetation and surrounded by the Pike Fold Golf Club. The M66 motorway is located within a cut to the west of the asset and is not visible. There is no scheme inter-visibility. The Proposed Scheme activity would have no change on this asset and a **neutral effect**
- St George's Church (HER 2931.1.0) is an 18th century church located approximately 130m to the west of the Proposed Scheme but within the semi-urban surroundings of Unsworth and with the M60 in a cutting to the east. There is no inter-visibility with the Proposed Scheme. The Proposed Scheme activity would have no change on this asset and a **neutral effect**
- 122 Hollins Lane (HER 2927.1.0) is a two-storey 19th century townhouse located approximately 220m to the west of the Proposed Scheme within the urban environment of Unsworth, with no inter-visibility with it. The Proposed Scheme activity would have no change on this asset and a **neutral effect**
- Pike Fold Golf Club (HER 3925.1.0), the redeveloped Back o'th' Moss Farm is surrounded by the landscaped golf course with the M66 motorway located within a cut to the west of the asset and no inter-visibility with the Proposed Scheme. The Proposed Scheme activity would have no change on this asset and a **neutral effect**
- Former General Store at Hollins Lane (HER 2926.1.0) is set within the urban surroundings of Unsworth and as such would have no visual impacts from construction. The Proposed Scheme activity would have no change on this asset and a **neutral effect**
- Beehive Dyeworks (HER 3889.1.0) has a lack of inter-visibility with the Proposed Scheme given its urban location and position relative to the M60. There would be no change and a **neutral effect** arising from construction
- Pumping Station (HER 11008.1.0) approximately 300m to the north-east of the Proposed Scheme has no inter-visibility with the Proposed Scheme and there would be no change arising from construction, and a **neutral effect**
- Cuckoo Nest (HER 9963.1.0) is located approximately 250m to the south of the Proposed Scheme with no inter-visibility with it. There would be no change during construction and a **neutral effect**.

7.10.18 The assets above have historic setting which has been subject to periodic evolution ever since their original construction from extensive modern (mostly 20th century) development. The assets have therefore been subject to historic events which have removed, or heavily eroded the original rural or semi-rural setting that characterised them. The extents to which setting contributes to their current value as assets is generally minimal, given the surrounding urbanisation. Construction activity will comprise the occupation of certain plots of unbuilt land within the Order Limits which will temporarily change the character of the existing 'urban edge' landscape, where the city meets the countryside. This will amount to a temporary urbanising effect within the context of a periodically changing environment throughout the modern period. This would amount to a negligible adverse impact and a temporary **slight adverse effect** on all the listed properties above.

Historic landscape

7.10.19 In terms of impact to the Grade II Heaton Park Registered Park and Garden (NHLE 1000854) there are some visual relationships between some locations in the northern half of the registered area and the Proposed Scheme, particularly those parts of the park immediately to the east of Heaton Park Reservoir. The construction impacts would temporarily change the visual and historic setting of that one part of the park, with the addition of unsightly working areas. This would also result in a limited form of temporary urbanisation, with unoccupied land being occupied for construction compounds, laydown and working areas, which would temporarily change the park's historic setting. The limited extents of change to the entirety of the park would amount to a temporary negligible adverse impact and a **neutral effect**.

7.10.20 The HLT units within and partly overlapping into the Proposed Scheme boundary are likely to undergo varying degrees of change. The HLT units relating to historic amenity use and identified chiefly from historic map regression can be given a low cultural heritage value. The Proposed Scheme will have a minimal impact on these in terms of temporary land-take and the degree of change, as most of the HLTs just have a small part of their area overlapping with the Proposed Scheme boundary. Construction impacts would amount to negligible adverse, resulting in a **neutral effect**. The HLT units associated with the existing motorway system can be assigned a negligible value. The units clustered around the M60 J18 will undergo the greatest degree of change, amounting to a temporary moderate adverse one, resulting in a **slight adverse effect**.

Table 7.3: Likely Significant Effects During Construction

Cultural Heritage Asset	Likely effects during construction
Roman road from Manchester to Ribchester (HER 14.1.1)	No change
Hughes i'th' Wood (HER 3941.1.0)	Slight adverse
The site of a possible oven (HER 3921.1.0)	Neutral
The site of two structures south of Mode Hill Lane (HER 3919.1.0)	Slight adverse
The former site of Den House (HER 3919.1.1)	Neutral
The former site of Limbrick House (HER 3920.1.0)	Neutral
The site of former structures off Corday Lane (HER 3915.1.0)	Slight adverse
The site of Gravel Hill House (HER 3914.1.0)	Neutral

Cultural Heritage Asset	Likely effects during construction
The site of Grundy Fold (HER 10097.1.0)	Neutral
Hitherto unidentified archaeological remains	Unknown
Philips Park Road Lodge (NHLE 1067248) and its Gate Piers and curved flanking walls (NHLE 1163724)	Neutral
Unsworth War Memorial (NHLE 1440257)	Neutral
Grade II* listed structures in Heaton Park and listed buildings within the outlying conservation areas	Neutral
The Conservation Areas in Kirkhams, Prestwich and Prestwich	Neutral
Cold Gate Farm (HER 3918.1.0)	Slight adverse
Droughts Farm (HER 3934.1.0)	Slight adverse
The 12 other non-designated buildings in the 300m study area	Neutral
Grade II Heaton Park Registered Park and Garden (NHLE 1000854)	Neutral
The HLT Units	Slight adverse

Operation

Archaeological remains

7.10.21 Den House (HER 3919.1.1) was apparently demolished in the late 19th century but buried remains associated with the asset may still survive, especially given the survival of its former gate posts up until 1993. The remains would warrant a low asset value. The proposed tree planting along Pole Lane is along the east side of the lane, with the asset being on the west side. Even with the proven capacity for tree roots to damage buried archaeological remains over time through expansion of the tree-root network, it is unlikely any damage would occur to remains associated with the house. There would therefore be no change to the asset and a **neutral effect**. The same effect is anticipated for Limbrick House (HER 3920.1.0) immediately to the north.

7.10.22 No archaeological remains will suffer adverse effects during operation, as the operational scheme does not have the capacity to affect them more than the construction phase will have done. There will be **no change** to this resource.

Historic buildings

7.10.23 The operational impact on the setting of designated and non-designated historic structures has utilised the results of a heritage walkover survey and setting assessment, as well as a landscape and visual impact assessment (LVIA). The permanent land-take will not adversely affect the setting of the four listed buildings closest to the Proposed Scheme, within the 300m study area. Furthermore, the listed buildings have no inter-visibility with the Proposed Scheme and there would be no changes in visual terms to the assets. This is the case with the two listings at Philips Road (Philips Park Road Lodge and its separately listed flanking walls) where the design would amount to no change and a **neutral effect**. There would be no change to the war memorial by the M66 at the northern end of the Proposed Scheme, and the same lack of impact to Brick Farmhouse east of the M66. Operation would result in no change and **neutral effects**.

7.10.24 The changes in the setting of non-designated historic buildings have been assessed using the available ZTV. For the two historic properties nearest the Proposed Scheme; Drought's Farm (HER 3934.1.0) and Cold Gate Farm (HER 3918.1.0) the operational impacts might amount to minor adverse effects owing to the permanent land-take necessary. This would result in an encroachment on the properties, amounting to additional visual intrusion over the existing environment, resulting in minor adverse impacts and **slight adverse effects**. For the remainder of the non-designated historic properties their location in relation to the Proposed Scheme would mean no change and a **neutral effect**.

Historic landscape

7.10.25 Operational impacts on the Heaton Park Grade II Registered Park and Garden were established in the ZTV produced for this PEIR. There are some limited views from the Registered Park and Garden to the Proposed Scheme from some viewpoints within the northern half of the designation. There will be minor visual and historic changes to the park's setting in both visual terms from Proposed Scheme, given the enlarged road layout. This would amount to a negligible adverse impact. The addition of ecological mitigation adjacent to the park will represent a continuation of the presently unoccupied, grassed area currently existing, with the addition of a small pond. This will complement the park's setting. In terms of historic setting the addition of a relatively small amount of road infrastructure would amount to a negligible adverse impact, resulting in a **slight adverse effect** to this asset of high value.

7.10.26 The HLTs within and overlapping with the Proposed Scheme will experience setting change during operation. As areas of broad characterisation, they contain multiple landscape elements which each HLT unit which represent particular episodes of historic change. The HLT units within and partly overlapping into the Proposed Scheme boundary are likely to undergo setting change. The HLT units relating to historic amenity use have been assigned a low cultural heritage value, and the ones representing the current road network a negligible one. The Proposed Scheme will have a minimal impact on these in terms of the amendments to the existing road layout, amounting to a negligible adverse impact and a **neutral effect**. The ecological mitigation will result in gradually maturing vegetation during the operational period which will help to restore some of the more rural aspects of the environment on this urban edge. The addition of ponds at locations like Whitefield Golf Club (Pond 6) will mark a permanent landscape change and represent one a sequence of changes that have occurred since the piecemeal enclosure of this area in the post-medieval era. This would amount to a negligible adverse impact and a **slight adverse effect**, in historic terms. The effect score is warranted considering actual landscape changes in the form of ponds in an area where there are no records of any previously existing.

Table 7.4: Likely Significant Effects During Operation

Cultural Heritage Asset	Likely effects during operation
All archaeological remains	Neutral
Philips Park Road Lodge (NHLE 1067248) and its Gate Piers and curved flanking walls (NHLE 1163724)	Neutral
Unsworth War Memorial (NHLE 1440257)	Neutral
Grade II Heaton Park Registered Park and Garden (NHLE 1000854)	Slight adverse
The HLT units	Slight adverse

8. Landscape and visual

8.1 Topic introduction

8.1.1 Potential effects on landscape character and visual amenity likely to arise due to the Proposed Scheme are considered in this chapter. Landscape and visual impact assessment (LVIA) is defined in the Guidelines for Landscape and Visual Impact Assessment, Third Edition (GLVIA3) (Landscape Institute and Institute of Environmental Management and Assessment, 2013) as '*a tool used to identify and assess the significance of and the effects of change resulting from development*'.

8.1.2 LVIA addresses two separate but related matters as defined by DMRB LA 107 Landscape and Visual Effects (Highways England, Revision 2, 2020b; hereafter referred to as DMRB LA 107), namely:

- *'effects on the landscape as a resource; and*
- *effects on views and visual amenity.'*

8.1.3 This chapter provides a summary of the landscape and visual-related stakeholder engagement carried out to date, legislative and policy framework relevant to landscape, and the assessment methodology for the landscape and visual assessment in this Preliminary Environmental Information Report (PEIR). This chapter also presents baseline conditions relevant to landscape and visual effects; an outline of potential landscape and visual impacts; design and mitigation; and an assessment of likely significant effects that would be caused by the Proposed Scheme.

8.1.4 This chapter is supported by the following figures:

- Figure 8.1: Zone of Theoretical Visibility (ZTV)
- Figure 8.2: Key Landscape Designations and Features
- Figure 8.3: Local Landscape Character Areas
- Figure 8.4: Representative Viewpoints and Photomontage Locations

8.2 Stakeholder engagement

8.2.1 Landscape planning officers at the following local planning authorities were consulted in July 2021 on the location of proposed representative viewpoints for the assessment of visual effects, and the location of proposed viewpoints for photomontages, for inclusion in the Environmental Statement:

- Bury Metropolitan Borough Council (BMBC)
- Rochdale Borough Council (RBC)
- Manchester City Council (MCC)

8.2.2 Some viewpoint locations considered in this PEIR are additions or alternatives to those presented in the Environmental Scoping Report (Highways England, 2021) and consultation in July 2021.

8.2.3 Responses regarding the location of viewpoints or photomontage locations that would affect the proposed scope and methodology of the LVIA will be incorporated into the Environmental Statement. Also, any further changes to viewpoints resulting from

refinement of the Proposed Scheme or site verification will be agreed through ongoing consultation with local planning authorities.

8.2.4 Planning officers at BMBC were consulted in July 2021 on the approach to undertaking the arboricultural surveys and the scope of the Arboricultural Impact Assessment (AIA). The proposed assessment follows BS 5837:2012 (Trees in relation to design, demolition and construction – Recommendations). Responses to the consultation will be incorporated into the assessment methodology and AIA. BMBC confirmed they had no tree officer in residence.

8.2.5 Table 8.1 summarises the key requirements from the Planning Inspectorate's Scoping Opinion (2021) as relevant to the scope of the landscape and visual assessment, and identifies any matters scoped out of the assessment as agreed with the Planning Inspectorate and other stakeholders. This table also explains any changes to the assessment methodology as a result of this engagement.

Table 8.1: Key stakeholder feedback for landscape and visual aspect

Stakeholder	Comment	Response
Planning Inspectorate	ID 4.3.1 **Conservation Areas** Figure 8.2 of the Applicant's interactive scoping Report appears to show a total of 21 conservation areas as being 'Scoped In' on the basis that they are "Located within [the] overarching 5km study area". This would appear to contradict the Applicant seeking to scope out assessing effects on conservation areas outside of the 2km study area. The Inspectorate agrees that conservation areas outside of 2km from the Proposed Development are unlikely to be significantly affected and that this matter can be scoped out.	It is noted that the Inspectorate agrees with scoping out of conservation areas beyond 2km. Further work is to be undertaken and clarity provided for the justification for scoping out conservation areas within the 2km Detailed Study area.
Planning Inspectorate	ID 4.3.2 **Effects on the night sky** Based on the existing environment the Inspectorate agrees that an assessment of effects on the night skies in their own right is not required. In addition, no dark skies have been identified by the Campaign for the Protection of Rural England (CPRE) The Countryside Charity, within the study area and that night-time changes for landscape and visual receptors will be considered as part of the construction and operational assessments.	It is noted that the Inspectorate agrees that an assessment of effects on the night skies is not required. Following DMRB LA 107 paragraph 2.6, the LVIA authors will undertake an assessment of the *'potential effects of both day and night-time situations with or without the project'.* This will consider the night-time baseline, and its influence on landscape character and visual amenity and an assessment of effects at each assessment stage.
Planning Inspectorate	ID 4.3.3 **Key receptors** Figure 8.2 details that the Proposed development is partially located within an area of green belt, however the approach to the assessment of greenbelt is not referenced anywhere within Chapter 8 of the Scoping Report (other than paragraph 8.3.4). The Inspectorate considers that the effect of	It is noted that the Inspectorate requires that green belt is considered within the ES. The LVIA authors will acknowledge in the assessment of landscape character both the green belt designation and the effects of increased urbanisation on landscape character. As green belt is a policy designation rather than a landscape designation, it will also be assessed separately in the case for the scheme under the NPS policy assessment.

Stakeholder	Comment	Response
	increased urbanisation / built form on the Green belt should be considered within the ES.	
Planning Inspectorate	ID 4.3.4 **Mature vegetation** The ES should clarify the definition of mature vegetation and confirm whether any ancient woodland or veteran trees are to be affected by the Proposed Development (with cross reference to any arboricultural assessment), plus any assumptions made in that regard in relation to year 1 and year 15 assessments of effects. The legend on figure 8.2 shows sub-categories of woodland within "Existing Significant Linear tree belts", there are no categories showing ancient woodland or veteran trees.	It is noted that the Inspectorate requires clarity of the definition of 'mature vegetation'. The LVIA authors will refer to the AIA to inform the LVIA and the landscape design. Arboricultural mitigation measures intended to avoid, reduce or prevent impacts will be outlined in the Environmental Statement and in the 1st iteration of the of the Environmental Management Plan (EMP) and detailed in the 2nd iteration of the EMP. Figure 8.2 will include ancient woodland within the 2km study area, and veteran trees where they exist, at least within the defined AIA study area, normally 15m beyond the provisional Order Limits.
Planning Inspectorate	ID 4.3.5 **Screening effects of existing and proposed vegetation** Justification should be provided as the validity of the assumption that the screening or filtering effect of existing vegetation outside the Proposed Development boundary will be as per its 'current condition', and at what point the 'current condition' will be defined for the purposes of the assessment. Whilst the Inspectorate appreciates that the management and retention of such vegetation is outside the control of the Applicant, key assumptions in this respect should be clearly set out such that the implications for the assessment of effects of the Proposed Development can be understood.	It is noted that the Inspectorate requires clarity of the 'current condition' of vegetation cover and implications for the assessment of landscape and visual effects. The LVIA methodology will describe the baseline date for the LVIA, which will be winter and summer 2021, the year at which data gathering and site visits were undertaken to determine the 'current condition'. The LVIA methodology will also include the approach to cumulative assessment following guidance set out in DMRB LA 104, which will help to determine potential change to the current and future baseline.
Natural England	Ref. TR010064-000004 Natural England would wish to see details of local landscape character areas mapped at a scale appropriate to the development site, any relevant management plans or strategies pertaining to the area. The EIA should include assessments of visual effects on the surrounding area and landscape together with any physical effects of the development, such as changes in topography. The EIA should include a full assessment of the potential impacts of the development on local landscape character using landscape assessment methodologies. We encourage the use of Landscape Character Assessment, based on the good practice guidelines produced jointly by the Landscape Institute and Institute of Environmental Assessment in 2013.	It is noted that Natural England wishes to see Landscape Character Areas (LCA) mapped appropriately and effects assessed based on good practice guidelines produced jointly by the Landscape Institute and Institute of Environmental Assessment in 2013. A LVIA methodology will be developed. It is also noted that assessments should refer to relevant National Character Areas (NCA) and local level LCAs. The greater part of the study area lies within the eastern part of NCA 54, Manchester Pennine Fringe. Paragraph 8.3.11of the Scoping Report states '*Due to their broad geographical coverage the effects on character of the NCAs will not be considered as part of the LVIA. The regional-level Greater Manchester Landscape Character and Sensitivity Assessment is more related to the scale and extent of the landscape character in the assessment area.'* Therefore, the Greater

Stakeholder	Comment	Response
		Manchester assessment will be used to consider local landscape impacts.
Natural England	Ref. TR010064-000004 Natural England encourages all new development to consider the character and distinctiveness of the area, with the siting and design of the proposed development reflecting local design characteristics and, wherever possible, using local materials. The Environmental Impact Assessment process should detail the measures to be taken to ensure the building design will be of a high standard, as well as detail of layout alternatives together with justification of the selected option in terms of landscape impact and benefit.	It is noted that Natural England encourages 'good design' that consider the character and distinctiveness of the area. The landscape design will be guided by Highways England's 'The road to good design' principles and apply 'good design' as embedded mitigation measures developed through 'design principles' described in the National Policy Statement for National Networks (NPS NN) document and 'design objectives' described in the Design Manual for Roads and Bridges (DMRB) LD 117. Also, essential mitigation measures defined through the process of assessment.
Natural England	Ref. TR010064-000004 The assessment should also include the cumulative effect of the development with other relevant existing or proposed developments in the area. In this context Natural England advises that the cumulative impact assessment should include other proposals currently at Scoping stage. Due to the overlapping timescale of their progress through the planning system, cumulative impact of the proposed development with those proposals currently at Scoping stage would be likely to be a material consideration at the time of determination of the planning application.	It is noted that Natural England requires an assessment of cumulative effects. Proposed developments surrounding the Proposed Scheme will be considered in the Environmental Statement. DMRB LA 104 and DMRB LA 107 will be followed in the assessment of cumulative effects.
Rochdale Borough Council	Ref. TR010064 The council can confirm it has also been contacted separately by the applicant's consultants to provide input on the detailed proposals for preparation of the Landscape and Visual Impact Assessment.	It is noted that Rochdale Borough Council will make available any relevant information and will provide direct feedback and correspondence with the applicant where this will aid in the preparation of the Environmental Statement.

8.3 Legislative and policy framework

8.3.1 The National Policy Statement for National Networks (NPS NN) (Department for Transport, 2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NPS NN as the primary basis for making decisions on DCO applications.

8.3.2 Key policy from the NPS NN relevant to this aspect is set out below:

- Paragraph 5.144 of the NPS NN states that, '*where the development is subject to EIA, the applicant should undertake an assessment of any likely significant landscape and visual impacts in the environmental impact assessment and describe these in the environmental assessment. A number of guides have been produced to assist in addressing landscape issues. The landscape and visual assessment should include reference to any landscape character assessment and*

associated studies, as a means of assessing landscape impacts relevant to the proposed project. The applicant's assessment should also take account of any relevant policies based on these assessments in local development documents in England'.

- Paragraph 5.145 states that, '*the applicant's assessment should include any significant effects during construction of the project and/or the significant effects of the completed development and its operation on landscape components and landscape character (including historic landscape characterisation)'.*
- Paragraph 5.146 states that' '*the assessment should include the visibility and conspicuousness of the project during construction and of the presence and operation of the project and potential impacts on views and visual amenity. This should include any noise and light pollution effects, including effects on local amenity, tranquillity and nature conservation'.*
- Paragraph 5.149 states that, *'landscape effects depend on the nature of the existing landscape likely to be affected and the nature of the effect likely to occur. Both of these factors need to be considered in judging the impact of a project on landscape. Projects need to be designed carefully, taking account of the potential impact on the landscape. Having regard to siting, operational and other relevant constraints, the aim should be to avoid or minimise harm to the landscape, providing reasonable mitigation where practicable and appropriate'*.
- Paragraph 5.160 states that, *'adverse landscape and visual effects may be minimised through appropriate siting of infrastructure, design (including choice of materials), and landscaping schemes, depending on the size and type of proposed project. Materials and designs for infrastructure should always be given careful consideration'*.
- Paragraph 5.161 states that, '*depending on the topography of the surrounding terrain and areas of population it may be appropriate to undertake landscaping off-site, although if such landscaping was proposed to be consented by the development consent order, it would have to be included within the order limits for that application. For example, filling in gaps in existing tree and hedge lines would mitigate the impact when viewed from a more distant vista'.*

8.3.3 In addition to the national policy set out in the NPS NN, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents set out in Appendix 1.1 of this PEIR, as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

8.4 Assessment methodology

Introduction

8.4.1 The methodology used to assess landscape and visual effects in this PEIR follows the criteria set out in the DMRB LA 104 Environmental assessment and monitoring (Highways England, Revision 1, 2020a; hereafter referred to as DMRB LA 104) and DMRB LA 107 Landscape and Visual Effects. The assessment criteria for sensitivity and magnitude of effects and the methodology for determining landscape and visual effects is described in Appendix 5.2 of this PEIR.

8.4.2 The significance of effects will be determined by combining judgements on the sensitivity of landscape receptors and visual receptors with the magnitude of landscape effects and visual effects. In accordance with DMRB LA 107, the matrix in Chapter 5 (Table 5.4), which is consistent with the matrix in DMRB LA 104, will be used to assist professional judgement when determining the significance of landscape and visual effects.

8.4.3 An overall statement of the combined effects on the landscape and visual amenity resulting from the Proposed Scheme will be included in the Environmental Statement for the final design.

8.4.4 In accordance with DMRB LA 104 Design and Mitigation paragraphs 3.23 to 3.24.2, the magnitude of effects and significance of effect will be assessed taking into consideration the proposed embedded and essential mitigation.

8.4.5 The landscape and visual assessment in this PEIR comprise a high-level assessment to identify likely significant effects based on the design shown on Figure 2.1: Overview of the Proposed Scheme, and survey information available to date. Scheme details, including the proposed heights of the Simister Pike Fold Viaduct and Simister Pike Fold Bridge, are included in Section 2.4, Chapter 2: The Scheme. A description of the scheme components and how they would affect landscape as a resource, and people's views and visual amenity are included in Section 8.8, Potential Impacts.

8.4.6 A description of mitigation measures likely to be included are described in Section 8.9 Design, mitigation and enhancement measures. Figure 2.2: Preliminary Environmental Design includes locations of proposed essential landscape mitigation measures that have been considered in the assessment of landscape and visual effects. These measures include grassland with intermittent trees and shrubs, linear tree belts, woodland planting, and aquatic and marginal planting.

8.4.7 An initial Zone of Theoretical Visibility map (ZTV), shown on Figure 8.1, has been generated for the Proposed Scheme and is based on a ‘bare earth’ scenario to illustrate the full theoretical extent of visibility. The ZTV has been prepared using digital terrain modelling to display the areas from which the Proposed Scheme would be theoretically visible. The selection of representative viewpoints has been informed by review of the ‘bare earth’ ZTV map. Further information about how the ZTV has been used to inform the study area is described in Section 8.6.

8.4.8 A further ZTV map will be developed as part of the LVIA based on the final design and incorporating buildings and significant woodland blocks. This follows requirements in DMRB LA 107 and will be based on buildings from OS MasterMap and woodland blocks from the National Forest Inventory Woodland Map. The ZTV map will be modelled using the same methodology as used for the ‘bare earth’ ZTV map. The detailed scope of the LVIA will be adjusted following a review of the ZTV and in further consultation with relevant stakeholders.

Landscape assessment

8.4.9 The study area extends over three local authority areas which are BMBC, RBC and MCC. The majority of the study area is within the administration of BMBC.

8.4.10 BMBC and RBC have produced Landscape Character Assessments which comprise a framework of Landscape Character Types (LCT) and their component landscape character areas (LCA). However, the Greater Manchester Landscape Character and Sensitivity Assessment (produced for Greater Manchester Combined Authority by LUC,

2018) covers the whole of the Greater Manchester Combined Authority. It consolidates previously published Landscape Character Assessments into a single assessment with continuity across district boundaries which provides a baseline to inform the analysis of landscape.

8.4.11 The assessment of landscape effects has, therefore, been made on the local LCAs defined in the Greater Manchester Landscape Character and Sensitivity Assessment. As part of the LVIA, further follow up surveys will be undertaken to verify the characteristics described in the Greater Manchester Landscape Character and Sensitivity Assessment. The landscape baseline is described in Table 8.2. The assessment of landscape effects is described in the Section 8.10.

Local townscape character assessments

8.4.12 Townscape Character Areas (TCAs) are areas where the built environment is dominant. There are no published townscape character assessments for the study area; therefore, a desk-based townscape character assessment with verification on site has been undertaken for the parts of the study area not within an LCA. The townscape character assessment has been informed by GLVIA3, An Approach to Landscape Character Assessment and Townscape Character Assessment Technical Information Note 05/2017. The townscape baseline is described in Table 8.2. The assessment of townscape effects is described in the Section 8.10.

8.4.13 In line with DMRB LA 107, the effect on the constituent landscape/townscape features and elements/components of the LCAs and TCAs, such as trees, woods, hedgerows, hedgerow trees, landform and landscape/townscape pattern, will be considered in combination as part of the effects on landscape/townscape character rather than as individual receptors. The assessment of impacts on perceptual and aesthetic aspects, is also considered in the assessment of impacts on landscape character and townscape character

8.4.14 The assessment of impacts on historic environment features in the study area, such as Heaton Park Registered Park and Garden, will be addressed in the cultural heritage aspect (see Chapter 7: Cultural Heritage). Historic landscape characterisation will also be considered within the cultural heritage aspect.

Visual assessment

8.4.15 The assessment of visual effects is based on a selection of representative viewpoints for different receptor groups within the study area and informed by the ZTV map. Representative viewpoints have been selected through a review of the ZTV map shown on Figure 8.1, a study of aerial photography, topographical mapping and winter and early spring site surveys.

8.4.16 In accordance with DMRB LA 107 paragraph 3.31, a proportionate assessment approach and the use of representative viewpoints has been adopted. These are viewpoints that represent a number of local and similar individual receptors. Therefore, the visual impact assessment does not identify effects on every potential individual receptor, and the number and locations of representative viewpoints are considered appropriate for the nature of likely effects. Where representative viewpoints were located close to receptors of varying sensitivities, the receptor with the highest sensitivity has been assessed to represent the potential worst-case change to visual amenity.

8.4.17 Potential photomontage locations have been selected where a visualisation would help understand a more complex changed view or where the Proposed Scheme would result in a very notable change in the view. Locations also represent views from a range of receptor types. The selection of representative viewpoints and potential photomontage locations will be agreed through consultation with local planning authorities and National Highways. Table 8.3 summarises the selected representative viewpoints and photomontage locations. Representative Viewpoints are shown on Figure 8.4 in the context of the ZTV.

8.4.18 The Proposed Scheme design is undergoing refinement, and consultation with local planning authorities regarding the location of representative viewpoints and locations for photomontages is ongoing (refer to Section 8.2). Therefore, the location of viewpoints for assessment in the Environmental Statement is potentially subject to change.

Photomontage methodology

8.4.19 Photomontages will be prepared in accordance with the Visual Representation of Development Proposals Technical Guidance Note 06/19 (TGN 06/19) (Landscape Institute, 2019).

8.4.20 The type of photomontage, or visualisation, considered both appropriate and proportionate would be Type 3, as defined in the TGN 06/19. This type of visualisation is suggested to offer an appropriate level of detail and accuracy for a range of EIA projects. TGN 06/19 paragraph 4.4.3 states that, '*Type 3 visualisations are intended to represent design, form and context to a reasonable degree of objectivity and accuracy, one which can be understood and relied on by competent authorities and others.*' The Type 3 visualisations would include an indication of the mitigation for the Proposed Scheme. A detailed methodology will be provided in an appendix to the Environmental Statement.

Assessment criteria and assessment timeframes

8.4.21 The matrix in Appendix 5.2: Assessment criteria, has been used to assist professional judgement when determining the likely significance of landscape and visual effects. Significance of effect categories are replicated from DMRB LA 104 Table 3.7. DMRB LA 107, paragraph 3.27 states that, '*significant effects comprise of effects that are/remain within the moderate, large or very large categories once design development has identified the necessary mitigation to be taken into account.'*

8.4.22 DMRB LA 107 Table 3.22 provides typical descriptions for landscape sensitivity and DMRB LA 107 Table 3.41 provides typical descriptions for visual receptors. These have been used to help inform sensitivity.

8.4.23 DMRB LA 107 Table 3.24 provides typical descriptions for magnitude of effects on landscape receptors and DMRB LA 107 Table 3.43 provides typical descriptions for magnitude of effects on visual receptors. These have been used to help inform magnitude of effects.

8.4.24 This PEIR considers whether landscape and visual effects are likely to be significant at the following timeframes in accordance with DMRB LA 107 Paragraph 2.6, and considers the day and night-time scenarios:

- **Construction phase:** Considers construction activities, temporary works (including compounds and haul roads) and construction traffic during the construction period. Assessments for each landscape and visual receptor will be considered for a worst-

case scenario at a time of peak construction activity when there is likely to be the greatest change for an individual receptor.

- **Operation year 1 (opening year):** Considers impacts on a winter's day during year 1 following completion of all construction, but before mitigation planting would have sufficiently established to provide landscape integration or visual screening, or both. Other vegetation, which may interrupt, filter or otherwise influence the view will be considered in the assessment of effects including the seasonal differences in summer with foliage (In accordance with DMRB LA 107 paragraph 3.19 and paragraph 3.42). The completed scheme and traffic using the scheme will be considered.
- **Operation year 15 (design year):** Considers the impacts on a summer's day in the fifteenth year after opening, when mitigation planting becomes sufficiently established to provide beneficial integration and screening. Other vegetation, which may interrupt, filter or otherwise influence the view will be considered in the assessment of effects including the seasonal differences in winter without foliage (In accordance with DMRB LA 107 paragraph 3.19 and paragraph 3.42). Both the completed scheme and the traffic using it will be considered.

8.4.25 In accordance with DMRB LA 107, the magnitude of effects and significance of effect are assessed taking into consideration the proposed embedded mitigation and essential mitigation.

Arboricultural Impact Assessment

8.4.26 The National Planning Policy Framework (NPPF) gives ancient and veteran trees the same status as Ancient Woodland (i.e. loss of irreplaceable habitat).

8.4.27 Paragraph 5.144 of the NPS NN recognises irreplaceable habitats including ancient woodland and veteran trees and states that, '*Ancient woodland is a valuable biodiversity resource both for its diversity of species and for its longevity as woodland. Once lost it cannot be recreated. The Secretary of State should not grant development consent for any development that would result in the loss or deterioration of irreplaceable habitats including ancient woodland and the loss of aged or veteran trees found outside ancient woodland, unless the national need for and benefits of the development, in that location, clearly outweigh the loss. Aged or veteran trees found outside ancient woodland are also particularly valuable for biodiversity and their loss should be avoided. Where such trees would be affected by development proposals, the applicant should set out proposals for their conservation or, where their loss is unavoidable, the reasons for this.'*

8.4.28 Therefore, an Arboriculture Impact Assessment (AIA) will be undertaken following BS5837:2012 to determine if trees would meet the criteria to be included in the Ancient Tree Inventory (Woodland Trust's web-based database). The Ancient Tree Inventory includes a small number of notable trees within Philips Park, although these are located outside the provisional Order Limits and would not be affected by the Proposed Scheme. With regard to local planning policy, Policy EN8 – Woodland and Trees (Bury UDP) states that it '*will support the retention of trees, woodland, copses and hedgerows'*.

8.4.29 The full AIA methodology is included as Appendix G of the Environmental Scoping Report (Highways England, 2021).

8.4.30 A concise section will be included in the LVIA to consider the impacts on veteran, ancient and notable trees (as defined by the Woodland Trust), and further potential veteran and ancient trees identified in the scheme-specific arboricultural survey.

8.4.31 The AIA (which will include a tree retention and removal plan) will be included as an appendix to the Environmental Statement.

8.5 Assessment assumptions and limitations

8.5.1 This PEIR provides a high-level summary of the likely landscape and visual effects at each assessment timeframe based on the design shown on Figure 2.1 and survey information available to date. Conclusions have been reached on whether landscape and visual effects are likely to be significant or not. This PEIR considers landscape effects on the LCAs and TCA presented in Table 8.2. The scope of the landscape assessment is subject to ongoing consultation with local planning authorities. This PEIR also considers visual effects from the viewpoints presented in Table 8.3, which are subject to ongoing consultation with local planning authorities. No photographs or photomontages are included in this PEIR as these will be based on the final viewpoints and the final design for assessment.

8.5.2 The assessment of effects during construction has been based on the design shown on Figure 2.3, Temporary Works, and includes information such as locations of compounds, temporary working areas, storage areas and haulage routes. Figure 2.1 includes permanent features including the Northern Loop, new motorway network links and attenuation ponds. Further details and design refinements, together with fieldwork verification could potentially change the conclusions drawn in the future LVIA.

8.5.3 The PEIR includes an assessment of '*both day and night time situations with or without the project',* in accordance with DMRB LA 107 paragraph 2.6. The assessment is based on a design for lighting available at the time of the PEIR and the updated design will be reviewed for the LVIA*. The assessment of night-time effects with also consider lighting other than the designed lighting scheme, including vehicle headlights effects from tree clearance and lighting of other new motorway infrastructure.*

8.5.4 Data gathered from the surveys in March 2021 (winter surveys) and October 2022 (summer surveys), together with aerial photography and Google Street View has been used to inform potential impacts. The winter survey data has enabled the assessment to be undertaken based on a worst-case situation when trees would not be in leaf. The LVIA will be informed by further fieldwork carried out during summer, therefore the Environmental Statement will incorporate up-to-date information.

8.5.5 Assessment of receptors and viewpoints to be assessed has been undertaken from publicly accessible areas, e.g. a public right of way (PRoW), Open Green Space or highway. Descriptions of baseline views and the assessment of changes to views from private and inaccessible viewpoints, including upper storey views from properties, has therefore been made using the professional judgement of Chartered Landscape Architects, based on an assessment from a nearby representative viewpoint.

8.5.6 Visual effects tend to diminish with distance. Where a receptor, such as the user of a PRoW, could view the Proposed Scheme from a range of distances, the assessment of visual effects likely to be experienced is generally based on the worst-case situation. This may vary depending on the existing views that include the road or more distant views which may be impacted by a larger area of new road infrastructure. Viewpoint locations from footpaths have been selected to consider both scenarios.

8.5.7 An Arboricultural Impact Assessment is currently being developed for the Proposed Scheme and will be available for the Environmental Statement. For this PEIR assessment, assumptions regarding vegetation loss resulting from this scheme have been based on professional judgement of Arboricultural specialists and knowledge of similar highway schemes, alongside design development. Vegetation is likely to require removal where it falls within the development footprint of the Proposed Scheme, for example, for gantries and road widening along the existing motorway corridor, for the construction of the Northern Loop, M60 free flow link and for attenuation ponds.

8.5.8 The screening or filtering effect of existing vegetation within the study area has been taken into account when reviewing baseline characteristics and people's views. Growth or other changes to this vegetation would potentially alter the baseline conditions. However, the management and retention of existing vegetation is outside the control of National Highways.

8.5.9 The Environmental Statement will assess views from final viewpoints confirmed with local planning authorities. All viewpoints will be checked and refined on site to assess the most open views towards the Proposed Scheme, close to the locations of the viewpoints indicated.

8.5.10 Proposed developments surrounding the Proposed Scheme are considered in Chapter 16: Assessment of cumulative effects. The future baseline of this PEIR assessment does not include all proposed developments as these are not guaranteed to be built and the date at which potential future development would be completed is often unknown. Also, details are often in outline so that the design, form and layout of future development is unknown, which makes it difficult to accurately incorporate in the assessment of landscape and visual effects.

8.5.11 Committed developments are considered as part of the future baseline in this PEIR landscape and visual assessment. Of relevance to the location of representative viewpoints (illustrated on Figure 8.4) and assessment of visual effects are areas of infill housing and retail in Whitefield and Prestwich. Where committed future development has the potential to block views of the Proposed Scheme, viewpoints will be refined on site to determine the most open view for inclusion in the LVIA. The LVIA in the Environmental Statement will review and confirm major committed developments that will be considered in the detailed assessment of landscape and visual effects.

8.5.12 Certain features are proposed to be scoped out the Environmental Statement and are listed in the Environmental Scoping Report (Highways England, 2021). These features have also been scoped out of the PEIR subject to confirmation in the Scoping Opinion responses from the consulted parties. The features which are unlikely to be affected by the Proposed Scheme, and are therefore not considered in the LVIA, include conservation areas and certain trees. The conservation areas are located away the Proposed Scheme, within dense urban areas, and would not be influenced by the Proposed Scheme. Trees and groups of trees protected by Tree Preservation Orders, that are located more than 15m beyond the Proposed Scheme boundary and are unlikely to be affected.

8.5.13 National Character Areas (Natural England, 2014) have been scoped out due to their broad geographical coverage. As described in Section 8.4, the BMBC Landscape Character Assessment and the RBC UDP Landscape Character Assessment have also been scoped out as the Greater Manchester Landscape Character and Sensitivity Assessment consolidates previously published Landscape Character Assessments for the Greater Manchester Combined Authority.

8.6 Study area

8.6.1 DMRB LA 107 paragraph 3.11 (abbreviated here) states that the study area for the Landscape aspect should be *'proportionate'* in terms of the *'project boundary'*, *'wider landscape setting'*, *'extent of the area visible'* and *'the full extent of adjacent or affected landscape receptors of special value'.*

8.6.2 DMRB LA 107 paragraph 3.31 (abbreviated here) states that the study area for the Visual aspect should be *'proportionate'* in terms of the *'project/construction visual footprint, 'the wider visual envelope', 'the extent of representative viewpoints visible',* and *'the extent of adjacent or affected visual receptors and the visual amenity of the area'*.

8.6.3 The study area for the Proposed Scheme has initially covered a radius up to 5km from the provisional Order Limits. This distance includes the more defined topographical features at a higher elevation within the wider area, the extent of directly affected landscape character areas and the extent of the Special Landscape Area. The 5km radius also considers the potential for views of the Proposed Scheme, the nature of the Proposed Scheme, the lack of tall structures and its context with similar developments and infrastructure. Desk-based study, including interrogation of topographic mapping, determining the extents of urban areas and significant woodland, and including highway linear tree belts has also been considered in the identification of the initial 5km study area.

8.6.4 Through site work it was found that topography (as indicated on the ZTV), vegetation and built form limit the influence of the existing motorway network and also the potential influence of the Proposed Scheme. Areas to the north of Pilsworth Road and Moss Hall Road near the Heywood Distribution Centre are mostly screened by intervening buildings within the very gently rising landform. The same occurs for areas to the east at Langley and around Moss Hall Road, although vegetation also provides some screening in these more rural areas. West of M60 J18, the density of development in the relatively flat landform substantially limits the existing motorway infrastructure and that of the Proposed Scheme. Linear tree belts between the M60 / M62 / M66 junction 18 and Heaton Park Registered Park and Garden, and dense woodland within Heaton Park, screen views from Heaton Park. With reference to the ZTV and initial site survey, it is considered unlikely that the Proposed Scheme would result in significant adverse effects beyond 2km. The ZTV, therefore, has been used to help define a more proportionate study area.

8.6.5 The LVIA will focus on a detailed study area within a 2km radius. However, receptors outside the 2km study area could be subject to cumulative effects with other development. These will be considered for the landscape and visual aspect following guidance in DMRB LA 104 and GLVIA3. Desk-based study and site-survey work has also informed the LVIA scope, such as the indicative viewpoint list. Where applicable, longer distance views will also be considered at notable or highly sensitive locations where these may be subject to significant effects. This approach is considered to be reasonable and proportionate.

8.7 Baseline conditions

Baseline sources

8.7.1 The following sources have been used to inform the baseline through a review of existing desktop studies:

- National Character Area Profiles (Natural England, 2014)
- BMBC Adopted Bury Unitary Development Plan (1997)
- Rochdale BC's Local Development Framework (LDF): Biodiversity and Development Supplementary Planning Document (SPD 2017)
- Rochdale Unitary Development Plan (UDP 2006)
- Greater Manchester Landscape Character and Sensitivity Assessment (Greater Manchester Combined Authority/LUC, 2018)
- England's Light Pollution and Dark Skies (CPRE The Countryside Charity, 2019)
- Tranquillity Map England (CPRE The Countryside Charity, 2007)
- MAGIC Map application (Defra, 2020)

Baseline conditions

8.7.2 Key designations and features relevant to landscape and visual effects are illustrated on Figure 8.2. There are no nationally designated National Parks or Areas of Outstanding Natural Beauty within the study area.

Green belt

8.7.3 A large proportion of the study area is located within the Green Belt as defined by the relevant local planning authorities. The purpose of Green Belt is to safeguard open land from urban sprawl, including the maintenance of open character seeking 'to assist in safeguarding the countryside from encroachment'.

Special Landscape Area

8.7.4 A local landscape designation is identified in the Bury Unitary Development Plan 1997 as Special Landscape Areas under Policy EN9/1. The policy states that '*any development which is permitted will be strictly controlled and required to be sympathetic to its surroundings in terms of its visual impact. High standards of design, siting and landscaping will be expected. Unduly obtrusive development will not be permitted in such areas'*. It explains that this is to protect and enhance the character of areas where the landscape is of high quality and help safeguard the pleasant environment of the area.

Registered Parks and Gardens

8.7.5 Heaton Park, a Grade II listed Registered Park and Gardens, is in the south of the study area adjacent to the M60 between J18 and J19, although the park falls outside the provisional Order Limits.

Statutory listed buildings

8.7.6 There are a number of statutory listed buildings and features located within the landscape study area including several at Heaton Park and the Grade II Listed Church of St George at Simister and the Grade II Listed Brick Farmhouse at Unsworth. Listed buildings are generally distinctive and valued features within a landscape or townscape and have limited ability to accommodate change. Effects on the setting of statutory

listed buildings will be addressed in the cultural heritage aspect (see Chapter 7, Cultural Heritage).

Ancient Woodland and Tree Preservation Orders

8.7.7 Ancient woodland is located within the study area, mainly within undisturbed river valleys. An area of ancient woodland, Mid Wood in Philips Park, is partially located within the provisional Order Limits.

8.7.8 There are a number of Tree Preservation Orders (TPOs) within the study area although these are all located outside the provisional Order Limits, and none would be affected by the Proposed Scheme.

Local landscape character assessments (LCA)

8.7.9 The Environmental Scoping Report (Highways England, 2021) identified the local LCAs that fall within the 2km study area and has defined which would potentially be affected by the Proposed Scheme. Although LCA 16: River Irwell (south Bury) and River Croal falls within the 2km study area, the LCA is not directly or indirectly affected by the Proposed Scheme and has been scoped out. The remaining local LCAs are presented along with their key characteristics in Table 8.2 and are illustrated on Figure 8.3.

8.7.10 The following LCAs and TCA are likely to be affected by the Proposed Scheme:

- LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands
- LCA 25: River Roch
- LCA 26: Prettywood, Pilsworth and Unsworth Moss (LCA 26 falls within two LCTs)
- LCA 27: Simister, Slattocks and Healds Green
- TCA Prestwich, Whitefield, Radcliffe and Unsworth Residential.

Table 8.2: Local landscape character areas - Greater Manchester Landscape Character and Sensitivity Assessment

Landscape Character Area	Key characteristics (Greater Manchester Landscape Character and Sensitivity Assessment)
LCT Historic Parks and Wooded Estate Farmland, LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands	Elevated hills and ridges, which form a backdrop to lower-lying river valleys and urban / suburban areas. 16th to 19th century estate landscapes with open parkland, plantation woodland and small lakes, some of which are of national importance (Heaton Park Registered Park and Garden), and the numerous Listed Buildings. Deep, steep-sided wooded valleys or ‘cloughs’ and a network of streams, ponds and lakes, which are often recognised for their ecological importance as Sites of Biological Importance or Local Nature Reserves (LNR). A strong landscape structure of broadleaved estate woodland, including some small areas of Ancient Woodland. The sense of naturalness and tranquility which can be experienced from some areas of parkland and woodland, away from major transport corridors and the urban fringe.
LCT Incised Urban Fringe Valleys, LCA 25: River Roch	Areas of complex varying topography with steep valley sides, flatter valley floors and undulating land overlain by a pattern of small-scale farming practices, rough wet pasture, woodland and water bodies. The valleys’ role as important wildlife corridors running between densely populated urban areas, with locally designated semi-natural habitats and networks, including a

Landscape Character Area	Key characteristics (Greater Manchester Landscape Character and Sensitivity Assessment)
	relative abundance of ancient and riparian woodland interspersed with areas of parkland and regenerating post-industrial land. The strong connections the valleys have to the area's industrial past, including historic landmark mills, workers' housing, canals, railways, weirs. Opportunities to access and enjoy the green corridors formed by the valleys via the strong public rights of way network, linking with adjacent urban areas and the elevated foothills beyond. The secluded and relatively tranquil character of the narrow valleys that contrast with adjoining urban areas.
LCT Mosslands and Lowland Farmland and LCT Reclaimed Land/Wetlands, LCA 26: Prettywood, Pilsworth and Unsworth Moss	Landform generally flat to gently undulating overall, with some locally distinctive artificial landforms as a result of past mineral extraction and landfill (e.g. Pilsworth). Mainly medium scale, rectangular fields delineated by a network of drainage ditches and species poor hedgerows. Network of lowland wetland habitats surrounded by a matrix of mixed farmland (pasture and cereal crops). Some recreational provision including golf courses (e.g. Pike Fold Golf Club). A landscape profoundly influenced by its industrial past, which includes surface coal mining, sand and clay extraction and peat extraction, providing a sense of time-depth. Road, motorway corridors and railway lines bisect the landscape, often on raised embankments. Motorways are audibly and visually dominant in some areas, reducing tranquility. A network of public footpaths mainly follows tracks and lanes, occasionally crossing fields. In lower-lying areas views tend to be restricted by landform, although there are some distant views from higher open ground (e.g. Prettywood towards the West Pennines).
LCT Urban Fringe Farmland, LCA 27: Simister, Slattocks and Healds Green.	Locations of elevated, open character with some prominent rural skylines forming a backdrop to views from adjacent urban areas. Intact lengths of hedgerows and tree clumps along field boundaries forming ecological networks and bringing definition to the 18th and 19th century and post-medieval field patterns. Opportunities to access and enjoy the rural landscape, cycle routes and a strong public rights of way network crossing the farmland and emanating from adjacent urban areas. The LCT's role as an immediate rural backdrop to development and its important function in separating discrete urban areas, preventing coalescence.
TCA Prestwich, Whitefield, Radcliffe and Unsworth Residential	Landform ranges between 80m and 110m AOD with very gradual changes between levels. Waterbodies include the River Roch, River Irwell which define the northern edge of the TCA, and also the local Parr Brook which weaves through Unsworth. The underlying solid geology is carboniferous sandstones of the Millstone Grit and the Pennine Coal Measures of Greater Manchester. Buildings often use a local material palette of red brick and Millstone Grit. Settlement pattern is dominated by mixture of Victorian terraces and post-war suburban estates. The post war- suburban estates are the dominant housing type, although there is a wide variety of styles and sizes.

Landscape Character Area	Key characteristics (Greater Manchester Landscape Character and Sensitivity Assessment)
	Industrial and commercial buildings are clustered together and noticeable for the difference in scale and usually the modern building style. The area contains three conservation areas and numerous listed buildings that are mostly concentrated within the conservation areas. The Grade I listed Church of All Saints, Stand and the Parish Church of St Mary are notable heritage features. Local landmarks include the Whitefield Methodist Church, Church of All Saints in Stand and the Greater Manchester Police, Sedgley Park Training Centre. Open spaces include pocket parks, playing fields, gardens, civic spaces, cemeteries, churchyards and golf courses. High levels of disturbance from major transport routes, including the A56 Bury New Road, Metrolink, M60 and M66.

8.7.11 Landscape planning and land management guidelines identified in the Greater Manchester Landscape Character and Sensitivity Assessment of relevance to the Proposed Scheme include:

- Consider additional woodland planting to screen existing industrial areas and motorway corridors as appropriate (LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands).
- Ensure any new development respects the character and historic qualities of the Registered Parks and Gardens (Grade II Heaton Park) and their settings (LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands).
- Ensure that any development is in keeping with the mainly rural character of the landscape in terms of form, density and vernacular (LCA 26: Prettywood, Pilsworth and Unsworth Moss).
- Utilise areas of existing woodland to integrate new development into the landscape, avoiding sites designated for their nature conservation importance (LCA 26: Prettywood, Pilsworth and Unsworth Moss).
- Consider additional woodland planting to enhance landscape structure, soften the urban fringe, screen industrial areas and reduce the noise and visual impacts of motorway corridors, where appropriate (LCA 26: Prettywood, Pilsworth and Unsworth Moss).
- Restore and enhance areas of deteriorating farmland including additional, species-rich, hedgerow planting to fill gaps and replace post and wire fencing. Reintroduce hedgerow trees where appropriate (LCA 26: Prettywood, Pilsworth and Unsworth Moss).
- Design-in the introduction of SuDS to any new development (LCA 26: Prettywood, Pilsworth and Unsworth Moss and LCA 27: Simister, Slattocks and Healds Green).
- Utilise dips in the landform, including valley slopes, and existing tree/woodland cover to integrate new development into the landscape (LCA 27: Simister, Slattocks and Healds Green).
- Encourage woodland creation schemes on areas of low-grade agricultural land, including through the Northern Forest initiative. Woodland planting along motorways and staggered blocks of planting should be used to help screen views of traffic and reduce noise (LCA 27: Simister, Slattocks and Healds Green).

Perceptual qualities

8.7.12 CPRE has undertaken a study of tranquillity in England and has mapped and published the results. CPRE highlights new roads as one of the greatest threats to remaining levels of tranquillity. The Tranquillity Map for England (CPRE, 2007) identifies tranquillity zones based on sources of noise and visual intrusion and the zones over which intrusion may be felt. Within the study area, Bury and north Manchester urban area are indicated to be among the least tranquil areas, whilst the rural parts of the study area are indicated to be more tranquil, although even here tranquillity levels are influenced by noise and visual intrusion.

8.7.13 The CPRE mapping of England's light pollution and dark skies illustrates the influence of light pollution on the night skies within the study area. The study area is affected by night-time light pollution, especially associated with the urban areas of Bury, Rochdale and Prestwich, as well as the M60 corridor and J18. The night skies within the more rural part of the study area to the north-east of M60 J18 are darker. However, there are no dark skies located within the study area, with the darkest skies located over the Pennines, approximately 20km to the north-east.

Lighting baseline

8.7.14 The night-time landscape is heavily influenced by the lighting of the existing M60 J18 and mainline M60, M62 and M66 lighting. The surrounding area is predominantly residential with lit residential streets. The darkest areas within the study area are in the vicinity of the Pike Fold Golf Course although even here, the influence of existing motorway lighting would be noticeable.

Visibility and potential visual receptors

8.7.15 Transport corridors are dominant within the area, with M60 J18 Simister Island being the intersection of the M60, M62 and M66. The density of urban areas also has a substantial influence on the views within the study area.

8.7.16 The landscape within the study area to the west, north and east is generally low-lying and relatively flat, with very gentle undulations. To the south, including within Heaton Park and the settlement of Simister, the topography becomes more undulating allowing opportunities for longer distance views to the north.

8.7.17 To the west of the study area around Whitefield/Prestwich, adjacent to the M60 corridor, there is a high density of residential areas. However, a combination of highways fencing and linear tree belts within the highway boundary reduces the visibility of the nearby motorway corridor. Visibility reduces further with distance from the highway boundary due to the density of residential development enclosing the corridor. As such, the range of available views is generally near distance within urban areas.

8.7.18 The linear tree belts within the highway boundary, and occasional highways fencing, continue to the east and south of M60 J18 along the M62 and M60 respectively. Linear tree belts are also in place approximately 750m to north of M60 J18 on the M66. These provide some screening of the M60, M62 and M66 for surrounding residential areas within Prestwich, Simister Island, Whitefield and Unsworth.

8.7.19 At M60 J18, the motorway becomes more visually prominent with near and middle-distance views from the eastern fringes of Whitefield and Prestwich. To the north-east of M60 J18, where the M62 and M66 are predominantly at grade or on low embankment, the landscape is more open, comprising pastoral land with fewer tree

belts. While there are open views within these areas towards the motorway network, intervening hedgerows, tree belts and woodlands limit some near and middle-distance views from rural properties.

8.7.20 The study area includes several Public Rights of Way (PRoW) on overbridges crossing the M60/M62/M66 north, west and east of the M60 J18. West of M60 J17, footpaths crossing Whitefield Golf Course and Prestwich Country Park afford views to the M60, although visibility quickly reduces with distance due to intervening topography and vegetation. Elevated areas within Heaton Park allow views to the M60, although woodland within Heaton Park and along the highway boundary provides a high level of screening. Footpaths within open areas to the north-west and north-east of M60 J18, including within Pike Fold Golf Course, provide more open views to the motorway network.

8.7.21 The proximity of the parks and footpaths to urban areas suggests that their levels of use would be high.

8.7.22 Motorway lighting is visually prominent from urban areas located near the motorway corridors and M60 J18 and from the more undeveloped rural area to the east.

8.7.23 Potential visual receptors within the study area include:

- Residents within settlements of Prestwich, Simister, Whitefield and Unsworth
- Residents within the rural area to the north-east of the M60
- Users of the PRoW network
- Visitors to Heaton Park Registered Park and Garden, Prestwich Country Park (including Prestwich Forest Park)
- Visitors to public open spaces -Thatch Leach Lane Playground, Fusilier's Meadow, Boz Park
- Visitors to private open space including allotments, playing fields, Heaton Park Golf Course, Whitefield Golf Course, Pike Fold Golf Course
- People at their places of work, such as within nearby school and businesses on the peripheries of the motorway corridor
- Travellers on the road network, including the M60, M62, M66 and the surrounding local road network.

8.7.24 Representative viewpoints and proposed photomontage locations for consideration in this PEIR are presented in Table 8.3 and illustrated on Figure 8.4, although these will be reviewed and updated for the Environmental Statement following consultation feedback and the final design.

8.7.25 As described in Section 8.4 selected representative viewpoints represent a number of local and similar individual receptors of varying sensitivities, the receptor with the highest sensitivity has been assessed to represent the potential worst-case change to visual amenity.

Table 8.3: Summary of Representative viewpoints and potential photomontage points

Reference - Representative viewpoint (VP), Photomontage location (PM)	Representative viewpoints and location	Receptor type
VP1	Broom Hill Farm, Higher Barn Farm, Footpath 4WHI	Residential, recreational
VP2	Castlebrook Farm, Whitegate Bungalow on Castle Road, Restricted Byway 85BUR	Residential, recreational
VP3	Brickhouse Farm, four residential properties on Killy Lane, Footpath 6WHI, Footpath 8WHI, users of Pike Fold Golf Course	Residential, recreational
VP4	Four residential properties on Killy Lane, Footpath 8WHI	Residential, recreational
VP5	Unsworth Moss Farm, Unsworth Moss Bungalow, Moss Top Farm, Footpath WHI8, Footpath WHI10	Residential, recreational
VP6	Footpath 9WHI on Hills Lane	Recreational
VP7 (PM1)	Proposed photomontage location Footpath 9WHI, Footpath 46WHI, users of Pike Fold Golf Course	Recreational
VP8	Simister Green residential properties, Simister	Residential
VP9	Droughts Lane residential properties, Simister	Residential
VP10	Heywood Road, M60 overbridge, travellers on the M60 motorway network	Road users
VP11	Roch Crescent, Douglas Walk east of Douglas Close	Residential
VP12	Boz Park public open space	Recreational
VP13	Mersey Drive, Oak Lane residential properties, Boz Park public open space	Residential, recreational
VP14	Cowl Gate Farm, Footpath 12WHI	Residential, recreational
VP15 (PM2)	Proposed photomontage location Residential properties on Marston Close	Residential
VP16	Residential properties on Rothay Close, Brathay Close, Heybrook Close	Residential
VP17 (PM3)	Proposed photomontage location Residential properties on Derwent Avenue, Duddon Close, Leven Walk, permissive path via Haweswater Underpass	Residential, recreational
VP18	Eastview and No. 7, 9 and 11 Corday Lane, Heywood Road	Residential, road users
VP19 (PM4)	Proposed photomontage location Parrenthorn High School, Heywood Road	Community, road users
VP20	Bridle Way 27aPRE on the Heaton Park Registered Park and Garden boundary	Recreational
VP21	Residential properties on Parrenthorn Road, St. Margaret's Church of England Primary School	Residential, community
VP22	Residential properties on Sandgate Road, St. Joseph's Avenue, Prestwich Heys FC, Footpath 12 WHI	Residential, recreational
VP23	Residential properties on Warwick Avenue	Residential

Reference - Representative viewpoint (VP), Photomontage location (PM)	Representative viewpoints and location	Receptor type
VP24	Footpath 12 WHI, Sandgate Road, travellers on the M60 eastbound	Recreational, road users
VP25	Fusiliers Memorial Meadow, Thatch Leach Lane Play Area,	Residential
VP26	Residential properties on Thatch Leach Lane, Conisborough Place and Glendevon Place	Residential
VP27	Residential properties on Prestfield Road, Kensington Street	Residential
VP28	Residential properties on Warwick Close	Residential
VP29	Residential properties on Kenilworth Avenue	Residential
VP30	Residential properties on Philips Park Road	Residential
VP31 (PM5)	Proposed photomontage location Footpath 32 WHI, 33WHI, 34aWHI, 34bWHI (view north)	Recreational
VP32	Footpath 33WHi (view west)	Recreational
VP33	Ross Avenue, Oak Avenue, Beech Avenue, Chestnut Avenue	Residential

Future baseline

8.7.26 Future development, such as areas of infill housing and retail in Whitefield and Prestwich, and other proposed development may lead to alterations to the baseline environment.

8.7.27 Proposed developments will be included in the consideration of cumulative effects.

Sensitivity of receptors

8.7.28 DMRB LA 107 considers landscape and visual ‘sensitivity’ which incorporates judgements on ‘value’ and ‘susceptibility’. Landscape and visual sensitivity are established by assessing the value attached to a receptor’s view and its susceptibility to the particular form of change likely to result from the individual development. Refer to Table 8.4 for landscape sensitivity and Table 8.5 for visual sensitivity.

8.7.29 Local LCAs, the TCA and representative viewpoints identified for assessment in this PEIR have been assigned a sensitivity based on criteria in DMRB LA 107 and using professional judgement.

8.7.30 Landscape features identified in the baseline have been used to inform the value and the overall landscape sensitivity of each local LCA and TCA in accordance with DMRB LA 107. It is recognised that localised areas of landscape are of high sensitivity, including Heaton Park Registered Park and Garden and the Special Landscape Area, and these have been taken into account when assessing the overall landscape sensitivity of local LCAs.

8.7.31 The Greater Manchester Landscape Character and Sensitivity Assessment has determined the sensitivity of LCAs based on two scenarios: residential development and commercial/industrial development.

8.7.32 An assessment of sensitivity has not been made for major road schemes; therefore, a judgement of sensitivity has been made by considering value and susceptibility described in Appendix 5.2 Table 1.2: Topic-specific interpretation of the DMRB value (sensitivity) criteria for the Proposed Scheme. The judgement of sensitivity has also been made following analysis of the detailed sensitivity ratings for each LCA contained within the Greater Manchester Landscape Character and Sensitivity Assessment. LCA sensitivity judgement is described in terms of negligible, low, medium, high and very high sensitivity following DMRB LA 107.

Table 8.4: Sensitivity (susceptibility and value) of LCAs within the study area

Landscape Character Area	Landscape sensitivity of receptor/resource	Description (from DMRB LA 107 Table 3.22)	Justification
LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands	High Localised areas of high sensitivity include: Heaton Park Registered Park and Garden	Landscapes of high national importance containing distinctive features/elements with limited ability to accommodate change without incurring substantial loss/gain (i.e. designated areas, areas of strong sense of place - registered parks and gardens, country parks).	High sensitivity reflects the national recognition of Heaton Park Registered Park and Garden, listed buildings and conservation areas, country parks and ancient woodland within the LCA. High sensitivity also reflects the limited ability to accommodate the Proposed Scheme due to the susceptibility those features described above to the type of change proposed. The provisional Order Limits are outside the Heaton Park boundary.
LCA 25: River Roch LCA 26: Prettywood, Pilsworth and Unsworth Moss LCA 27: Simister, Slattocks and Healds Green	Medium	Landscapes of local or regional recognition of importance able to accommodate some change (i.e. features worthy of conservation, some sense of place or value through use/perception)	Medium sensitivity reflects that there is no national recognition of these landscapes, with the exception of heritage assets including listed buildings and conservation areas, designated sites including Special Areas of Conservation, Sites of Special Scientific Interest, Sites of Biological Importance and Local Nature Reserves, within the study area. Medium sensitivity also reflects the ability to accommodate the nature of the Proposed Scheme to some extent due to presence of the existing motorway network and other existing development within the landscape. The Special Landscape Area is located entirely within LCA 26: Prettywood, Pilsworth and Unsworth Moss. The policy notes that it is a landscape of high quality, and the policy is designed to help safeguard the pleasant environment of the area. However, over time, the Special Landscape Area has been influenced by expanding adjacent industrial development including the Heywood Distribution Park, Birch Industrial Park and the Viridor Pilsworth South Landfill. The motorway corridor also has an influence on the special qualities of the Special Landscape Area.

Landscape Character Area	Landscape sensitivity of receptor/resource	Description (from DMRB LA 107 Table 3.22)	Justification
TCA Prestwich, Whitefield, Radcliffe and Unsworth Residential	Low	Local landscape areas or receptors of low to medium importance with ability to accommodate change (i.e. non-designated or designated areas of local recognition or areas of little sense of place).	Townscape characteristics are of medium importance with ability to accommodate the type of change as the existing motorway already has an influence on the TCA. There are three conservation areas and a number of listed buildings and few other notable features within the broad TCA which consists largely of 20th century housing, and commercial and industrial development.

8.7.33 The criteria identified in DMRB LA 107 have been used to determine the sensitivity of visual receptors. The PEIR has summarised the value and susceptibility of each receptor. Full details will be provided in the Environmental Statement.

Table 8.5: Sensitivity (susceptibility and value) of visual receptors within the study area

Sensitivity (susceptibility and value)	Typical descriptions	Examples within the study area
Very high	Static views from and of major tourist attractions Views from and of very important national/ international landscapes, cultural/historical sites (e.g. National Parks, UNESCO World Heritage sites) Receptors engaged in specific activities for enjoyment of dark skies	None of the viewpoints are assessed as being of very high sensitivity.
High	Views by users of nationally important PRoW / recreational trails (e.g. national trails, long distance footpaths) Views by users of public open spaces for enjoyment of the countryside (e.g. country parks) Static views from dense residential areas, longer transient views from designated public open space, recreational areas Views from, and of, rare, designated landscapes of national importance	Views from residential properties, users of PRoWs, public open space such as Heaton Park Registered Park and Garden, Philips Park LNR are considered to have high sensitivity. This reflects their high susceptibility to the nature of the Proposed Scheme and the high value of their views. The following viewpoints are assessed as being of high sensitivity: • Representative viewpoints VP1 – VP10, VP12 – VP21, VP23 – VP33 which are representative of views from residential properties, Heaton Park Registered Park and Garden, Philips Park Country Park and from PRoWs.
Moderate	Static views from less populated residential areas, schools and other institutional buildings and their outdoor areas Views by outdoor workers Transient views from local/regional areas such as public open space, scenic roads, railways or waterways, users of local/regional designated tourist routes of moderate importance Views from and of landscapes of regional importance	Views experienced by users of locally identified Public Open Space such as Boz Park and from Parrenthorn High School. Recreational viewers and school users in these locations are likely to have moderate susceptibility to the nature of the Proposed Scheme where views are locally valued. The following viewpoints are assessed as being of moderate sensitivity: • Representative Viewpoint VP22

Sensitivity (susceptibility and value)	Typical descriptions	Examples within the study area
Low	Views by users of main roads or passengers in public transport on main arterial routes Views by indoor workers Views by users of recreational/formal sports facilities where the landscape is secondary to enjoyment of the sport Views by users of local public open spaces of limited importance with limited variety or distinctiveness	Views experienced by travellers on Heywood Road are considered to have low sensitivity, reflecting their low susceptibility to the nature of the Proposed Scheme where views unlikely to be valued. The following viewpoints are assessed as being of low sensitivity: • Representative Viewpoint VP10
Negligible	Quick transient views such as from fast-moving vehicles Views from industrial areas or land awaiting redevelopment Views from landscapes of no importance with no variety or distinctiveness	The highways linear tree belts along most sections of the motorway network around J18 and occasional open views across the rural areas north and east of J18 contribute to a sense of place over a very short section of the local network. Travelers would have a negligible susceptibility to the Proposed Scheme. Transient views experienced by motorway travellers have negligible sensitivity. Travellers on the motorway network are considered for assessment at VP11.

8.8 Potential impacts

8.8.1 The following section describes the potential features of the Proposed Scheme that are likely to result in landscape and visual effects.

Construction

8.8.2 The principal elements which would result in landscape and visual effects at the construction stage include:

- Widening of the existing M60 Mainline J17-J18 from four lanes to five lanes in both directions and installation of an intermittent hard shoulder resulting in alterations to landform and loss of vegetation, and opening up people's views to the motorway
- Construction of the Northern Loop resulting in alterations to landform from excavation, soil stripping and earthworks across a wide area
- Construction of the M66 southbound diverge resulting in alterations to landform and loss of vegetation, and opening up people's views to the motorway
- Construction of the M60 northbound to M60 westbound free flow link resulting in alterations to landform and loss of vegetation and the opening up of people's views to the motorway corridors
- Construction of the Simister Pike Fold Viaduct and Simister Pike Fold Bridge

8.8.3 Other construction activities which would result in landscape and visual effects include:

- Temporary soil stockpiles
- Temporary contractors' compounds

- Movement of vehicles on temporary haul routes
- Construction activity and operation of plant such as excavators, cranes and site vehicles with beacons visible to nearby receptors
- Upgrading works on the existing motorway network
- Night-time closures including temporary lighting and traffic management operations

Operation

8.8.4 The principal elements which would result in landscape and visual effects at the operational stage include:

- Operation of the widened M60 Mainline J17-J18, bringing moving traffic nearer to residential properties
- Extending the M60 J18 and the Northern Loop into the local landscape, eroding the rural character, and increasing the prominence of M60 J18 in people's views
- Simister Pike Fold Viaduct and Simister Pike Fold Bridge. New, large scale motorway infrastructure within the urban edge landscape
- Operation of the M66 southbound diverge, eroding the rural character, and increasing the prominence of M60 J18 in people's views from the rural area to the north-east
- Operation of the M60 northbound to M60 westbound diverge, increasing the prominence of M60 J18 in people's views.

8.8.5 Other elements associated with the operational stage which would result in landscape and visual effects include:

- New lighting columns, gantries, road signals and signage
- Residual effects from vegetation clearance to accommodate construction of new structures
- Permanent fencing and areas of tree guards to protect planting.

8.9 Design, mitigation and enhancement measures

8.9.1 DMRB LA 104, paragraph 3.23 describes a hierarchical approach to environmental assessment and design. Firstly, through avoidance and prevention, then reduction (and mitigation) where avoidance is not possible. Where it is not possible to avoid or reduce a significant adverse effect, remediation measures are used to offset the effect. Mitigation and enhancement is described in Chapter 5: Environmental assessment methodology.

Embedded mitigation

8.9.2 The Environment Team is working in close collaboration with the Infrastructure Design Team to avoid or prevent environmental impacts through the scheme design. This is referred to as embedded (or design) mitigation. Chapter 3: Assessment of alternatives, details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

8.9.3 In line with DMRB LD 117, embedded mitigation relevant to this aspect aims to integrate the road into the local context and minimise the impact of the Proposed Scheme on the landscape. The eastern part of the Proposed Scheme is within the Special Landscape Area. Design measures to help safeguard the pleasant environment and reduce visual impact include reduction in the heights of embankments and retention of some areas of vegetation. The use of the existing high earth mound for part of the Northern Loop has reduced the requirement of a new purpose-built structure and provides greater opportunity for landscape integration.

8.9.4 Embedded mitigation is likely to include, but would not be limited to:

- Considerate design of major structures, signage and gantries to limit visual intrusion
- Use of sensitive lighting design such as the use of sharp cut-off lanterns to stop upwards light and directional lanterns to direct lighting to the highway
- The integration of highways fencing, fences and walls with their surroundings
- Existing vegetation within the Proposed Scheme boundary and within temporary works areas would be retained as far as practicable. Particular attention would be given to the retention of mature vegetation including individual trees, linear tree belts and woodlands
- Use of native species in appropriate layout and design to reflect the distinctive local character, such as increasing hedgerow and hedgerow trees
- Safeguarding of individual trees/woodland as well as ecological interests where practicable.

Essential mitigation

8.9.5 Essential mitigation measures required to reduce and, if possible, offset likely significant adverse environmental effects include:

- Refinement of the design of earthworks to create natural gradients and slopes that achieve better integration with the surrounding landform, where space and material are available
- Native tree and shrub planting on and adjacent to highway earthworks to reinstate linear tree belts, create woodlands, copses and shelterbelts to break up the scale of the new Proposed Scheme elements, integrate the existing motorway infrastructure and the Proposed Scheme into the existing landscape pattern, help screening of new highways structures, traffic and lighting. Locations include:
  - Planting along the Pike Fold Simister Viaduct embankment west of the M66 to provide greater landscape integration, and screening or filtering for viewers within nearby residential areas of Whitefield
  - Planting on the Pike Fold Simister Bridge embankments and Northern Loop embankments and within the Northern Loop to provide screening or filtering for viewers along Pole Lane footpath and to break up the scale of the new Proposed Scheme elements for motorway travellers
  - Additional planting along Pole Lane and along the nearby northbound M66 verge to provide screening or filtering of views of traffic and Pike Fold Simister Bridge and Northern Loop within Whitefield and from the footpath along Pole Lane

- New planting of linear tree belts along the M60 northbound to M60 westbound on-slip to provide screening and filtering for viewers along Heyward Lane
- Reinstatement planting along the M60 mainline verges and embankments between junction 17 and junction 18 to provide screening and filtering from adjacent residential areas
- Reinstatement planting of trees and shrubs, and species rich grassland creation, within land adjacent to Whitefield Golf Course to recreate similar landscape characteristics, landscape integration similar recreational opportunities
- Aquatic and marginal planting to the six attenuation ponds and other swales to improve landscape integration and biodiversity.

Enhancement

8.9.6 Enhancement measures (measures that have been identified that provide benefits to the Proposed Scheme, and not directly associated with requirements for mitigating adverse effects) include:

- Creation of ecological enhancement areas to the north of the Heaton Park boundary and to the south of Pike Fold Golf Course, adjoining Egypt Lane. Areas would provide improved biodiversity opportunities within the wider landscape and are designed to reflect local landscape characteristics and pattern including new woodland and shrub planting to integrate with the surrounding landscape character
- New hedgerow planting and improvement of existing hedgerows in areas adjacent to the ecological enhancement areas, along new National Highway boundaries and around attenuation ponds to strengthen the local landscape pattern and provide wider opportunities for habitat connection
- New hedgerow tree planting to strengthen new and existing hedgerows and further help integrate the motorway infrastructure into the local landscape.

8.9.7 A Preliminary Environmental Design (Figure 2.2) has been developed, guided by the design principles, essential mitigation, embedded mitigation and enhancement measures described above. The Preliminary Environmental Design aims to integrate the road into the local context, reducing the need for essential mitigation measures and seeking enhancement opportunities where possible, in line with DMRB LD 117.

8.10 Assessment of likely significant effects

8.10.1 The assessment of effects described below assumes opportunities will be fully explored during the final design stage to implement embedded mitigation and essential mitigation measures as described in Section 8.9.

8.10.2 Landscape and visual effects during construction would be caused by construction activity, including movement of plant and equipment, and the loss of vegetation. Landscape and visual effects during operation would result from the increased extent of highway infrastructure, lighting, signage and gantries. Significant landscape and visual effects during construction and during operation, particularly in the short term before mitigation planting becomes established, are likely.

8.10.3 Some residual landscape and visual effects during operation could remain significant in the long term despite mitigation. For example, the rural character of the landscape

would be permanently altered by the Proposed Scheme, and views from some highly sensitive receptors, such as nearby residents and users of footpaths, are also likely to permanently alter.

Construction

Landscape and townscape effects

8.10.4 The following LCAs and TCA would be directly impacted by construction activity:

- LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands
- LCA 26: Prettywood, Pilsworth and Unsworth Moss
- LCA 27: Simister, Slattocks and Healds Green
- TCA Prestwich, Whitefield, Radcliffe and Unsworth Residential.

8.10.5 Small areas of these broad LCAs would be directly impacted by construction of the Northern Loop, Simister Pike Fold Viaduct and Simister Pike Fold Bridge; the widening of the M60 Mainline J17-J18; the construction of the M66 southbound diverge, the construction of the M60 northbound to M60 westbound free flow link and the construction of six attenuation ponds.

8.10.6 Landscape quality within the LCAs and TCA would be impacted by the removal of linear tree belts most notably north-east of M60 J18 on the M66 southbound verge and along the M60 between Balmoral Avenue and Sandgate Road, north of the M60, and Kenilworth Avenue and Sandgate Road, south of the M60. The removal of vegetation would alter the relatively enclosed character of this part of the study area making the construction works, material stockpiles, construction of attenuation ponds, and the existing motorway infrastructure more perceptible. Land reprofiling for the Northern Loop, Simister Pike Fold Viaduct and Simister Pike Fold Bridge and the M66 southbound diverge would substantially alter local landform to the north-west and north-east of J18. The attenuation pond 6 near Whitefield Golf Course would also substantially alter local landform and the character of the public open space.

8.10.7 Disturbance from construction plant within compounds and movement along haulage routes would also be noticeable, although vehicle movement is typically characteristic of the study area.

8.10.8 Together, these elements would introduce change by virtue of localised alterations to the landform, landcover, character and pattern of the landscape. The physical disruption and the presence of uncharacteristic elements within these LCAs would cause greatest change to LCA 26: Prettywood, Pilsworth and Unsworth Moss. Large scale infrastructure elements and intensive construction activity would be noticeable within the agricultural landscape, east of the M60 J18. The construction of embankments and presence of material stockpiles would result in alterations to the landscape's flat lowland landform character.

8.10.9 It is likely that there would be **significant landscape effects** on the medium sensitivity LCA 26: Prettywood, Pilsworth and Unsworth Moss (identified on Figure 8.3) during construction. Refer to Table 8.6.

8.10.10 Similar changes would occur to the Special Landscape Area EN Policy EN9/1 (Bury UDP), resulting in the loss of part of the high-quality landscape and erosion of the pleasant environment of the area due to the obtrusive nature of construction activities.

8.10.11 Whilst the high sensitivity, LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands and medium sensitivity LCA 27: Simister, Slattocks and Healds Green character would be directly affected by construction activity, including construction of three attenuation ponds, the more localised and smaller scale construction works set within the context of the transport corridor, and where the influence of the construction activity would be largely limited by the surrounding landform, are **unlikely to be significant**.

8.10.12 The removal of sections of linear tree belts for the construction of the M60 Mainline J17-J18 would reduce levels of enclosure and separation provided by the vegetation within the low sensitivity TCA Prestwich, Whitefield, Radcliffe and Unsworth Residential. Although the loss would be localised and within the context of a motorway corridor, the influence of the construction activity would result in noticeable change to a key characteristic feature resulting in moving traffic and infrastructure along the M60 becoming more perceptible, although effects are **unlikely to be significant**.

8.10.13 LCA 25: River Roch would be indirectly impacted by construction activity in adjacent LCAs which would result in a very minor alteration of the rural characteristics although, due to the nature and influence from urban development and highway infrastructure on the LCA, the overall landscape effects during construction are **unlikely to be significant**.

8.10.14 Lighting during construction of the Proposed Scheme would be required for night-time security. The clearance of highway linear tree belts for the Northern Loop is likely to result in some light spill from existing lighting into surrounding landscape areas. However, the lighting has directional cowls which would limit light spill from the motorway corridor.

8.10.15 Table 8.6 summarises the likely significance of landscape effects on each local LCA during construction.

Table 8.6: Likely landscape effects during construction

Local landscape character area	Sensitivity	Magnitude of effect	Significance of effect
LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands	High	Minor - Adverse	Slight
LCA 25: River Roch	Medium	Negligible - Adverse	Slight
LCA 26: Prettywood, Pilsworth and Unsworth Moss	Medium	Moderate - Adverse	Moderate
LCA 27: Simister, Slattocks and Healds Green	Medium	Minor - Adverse	Slight
TCA Prestwich, Whitefield, Radcliffe and Unsworth Residential	Low	Moderate - Adverse	Slight

Visual effects

8.10.16 Representative viewpoint locations have been selected to include views from dense residential areas and areas that are less populated to the east of M60 J18, also from recreational routes and public open spaces and the road network.

8.10.17 Whilst construction activity would largely be set within the context of the existing motorway infrastructure, the disruption from construction activities and the presence of construction infrastructure, embankment reprofiling and widening of the mainline, construction compounds and extensive earthworks for the construction of the Northern

Loop and overbridges would be prominent in people's views close to the Proposed Scheme. Visual disturbance from the movement of construction plant on haul routes and working areas, temporary construction lighting and the removal of linear tree belts on the M60 and M66 would also alter views.

8.10.18 The greatest change in people's views would be from the residential settlement edges between Glendevon Place off Thatch Leach Lane and Heybrook Walk off Derwent Avenue, to the north of the M60, and between Kenilworth Avenue and Sandgate Road, to the south of the M60. Also, from individual residential properties within the rural area to the east of M60 J18, viewers with views of the attenuation pond construction, and also footpaths that are adjacent to, or cross, the Proposed Scheme and users of Pike Fold Golf Club. The Proposed Scheme is likely to result in **significant visual effects** on people's views in the locations described in Table 8.7:

- Brickhouse Farm, four residential properties on Killy Lane, Footpath 6WHI, Footpath 8WHI, users of Pike Fold Golf Course (VP3)
- Two residential properties on Killy Lane, Footpath 8WHI (VP4)
- Unsworth Moss Farm, Unsworth Moss Bungalow, Moss Top Farm, Footpath WHI8, Footpath WHI10 (VP5)
- Footpath 9WHI on Hills Lane (VP6)
- Footpath 9WHI, Footpath 46WHI, users of Pike Fold Golf Course (VP7 (PM1))
- Roch Crescent, Douglas Walk east of Douglas Close (VP11)
- Boz Park public open space (VP12)
- Cowl Gate Farm, Footpath 12WHI (VP14)
- Residential properties on Marston Close (VP15 (PM2))
- Residential properties on Rothay Close, Brathay Close, Heybrook Close (VP16)
- Residential properties on Derwent Avenue, Duddon Close, Leven Walk, permissive path via Haweswater Underpass (VP17 (PM3))
- Eastview and No. 7, 9 and 11 Corday Lane, Heywood Road (VP18)
- Parrenthorn High School, Heywood Road (VP19 (PM4))
- Bridle Way 27aPRE on the Heaton Park Registered Park and Garden boundary (VP20)
- Residential properties on Parrenthorn Road, St. Margaret's Church of England Primary School (VP21)
- Residential properties on Sandgate Road, St. Joseph's Avenue, Prestwich Heys FC, Footpath 12 WHI (VP22)
- Residential properties on Warwick Avenue (VP23)
- Footpath 12 WHI, Sandgate Road, travellers on the M60 eastbound (VP24)
- Residential properties on Thatch Leach Lane, Conisborough Place, Glendevon Place (VP26)
- Residential properties on Prestfield Road and Kensington Street (VP27)
- Residential properties on Warwick Close (VP28)

- Residential properties on Kenilworth Avenue (VP29)
- Residential properties on Philips Park Road (VP30)
- Footpath 32 WHI, 33WHI, 34aWHI, 34bWHI from Philips Park Road (VP31 (PM5))
- Footpath 33WHI (view north) (VP32)
- Ross Avenue, Oak Avenue, Beech Avenue, Chestnut Avenue (VP33)

8.10.19 Generally, visibility of the motorway corridor, including M60 J18, quickly decreases with distance due to intervening housing, linear tree belts and other vegetation. However, wide-ranging views are available from slightly higher elevations to the north-east of M60 towards Heywood. Topographical changes as well as woodland within the Simister settlement area substantially limit views from the south-east towards M60 J18.

8.10.20 It is also unlikely that visual receptors beyond 2km of the provisional Order Limits would potentially experience significant visual effects due to the nature and context of existing views towards M60 J18 and distance, combined with intervening features such as topography, vegetation and built development as described in Section 8.6. It is therefore unlikely that there would be significant effects for visual receptors beyond Moss Hall Road, Heywood to the east of the Proposed Scheme.

8.10.21 Table 8.7 summarises the likely significance of visual effects on each representative viewpoint during construction.

Table 8.7: Likely visual effects during construction

Reference - Representative viewpoint (VP) photomontage location (PM)	Representative viewpoints and location	Sensitivity	Magnitude of effect	Significance of effect
VP1	Broom Hill Farm, Higher Barn Farm, Footpath 4WHI	High	Minor - Adverse	Slight
VP2	Castlebrook Farm, Whitegate Bungalow on Castle Road, Restricted Byway 85BUR	High	Negligible - Adverse	Slight
VP3	Brickhouse Farm, four residential properties on Killy Lane, Footpath 6WHI, Footpath 8WHI, users of Pike Fold Golf Course	High	Moderate - Adverse	Moderate
VP4	Two residential properties on Killy Lane, Footpath 8WHI	High	Moderate - Adverse	Moderate
VP5	Unsworth Moss Farm, Unsworth Moss Bungalow, Moss Top Farm, Footpath WHI8, Footpath WHI10	High	Moderate - Adverse	Moderate
VP6	Footpath 9WHI on Hills Lane	High	Major - Adverse	Large
VP7 (PM1)	Footpath 9WHI, Footpath 46WHI, users of Pike Fold Golf Course	High	Major - Adverse	Large
VP8	Simister Green residential properties, Simister	High	Minor - Adverse	Slight
VP9	Droughts Lane residential properties, Simister	High	Negligible - Adverse	Slight

Reference - Representative viewpoint (VP) photomontage location (PM)	Representative viewpoints and location	Sensitivity	Magnitude of effect	Significance of effect
VP10	Heywood Road, M60 overbridge, travellers on the M60 motorway network	Low	Minor - Adverse	Slight
VP11	Roch Crescent, Douglas Walk east of Douglas Close	High	Moderate - Adverse	Moderate
VP12	Boz Park public open space	High	Moderate - Adverse	Moderate
VP13	Mersey Drive, Oak Lane residential properties, Boz Park public open space	High	Minor - Adverse	Slight
VP14	Cowl Gate Farm, Footpath 12WHI	High	Major - Adverse	Large
VP15 (PM2)	Residential properties on Marston Close	High	Major - Adverse	Large
VP16	Residential properties on Rothay Close, Brathay Close, Heybrook Close	High	Major - Adverse	Large
VP17 (PM3)	Residential properties on Derwent Avenue, Duddon Close, Leven Walk, permissive path via Haweswater Underpass	High	Major - Adverse	Large
VP18	Eastview and No. 7, 9 and 11 Corday Lane, Heywood Road	High	Moderate - Adverse	Moderate
VP19 (PM4)	Parrenthorn High School, Heywood Road	Medium	Moderate - Adverse	Moderate
VP20	Bridle Way 27aPRE on the Heaton Park Registered Park and Garden boundary	High	Moderate - Adverse	Moderate
VP21	Residential properties on Parrenthorn Road, St. Margaret's Church of England Primary School	High	Moderate - Adverse	Moderate
VP22	Residential properties on Sandgate Road, St. Joseph's Avenue, Prestwich Heys FC, Footpath 12 WHI	High	Moderate - Adverse	Moderate
VP23	Residential properties on Warwick Avenue	High	Major - Adverse	Large
VP24	Footpath 12 WHI, Sandgate Road, travellers on the M60 eastbound	High	Major - Adverse	Large
VP25	Fusiliers Memorial Meadow, Thatch Leach Lane Play Area,	High	Minor - Adverse	Slight
VP26	Residential properties on Thatch Leach Lane, Conisborough Place and Glendevon Place	High	Major - Adverse	Large
VP27	Residential properties on Prestfield Road, Kensington Street	High	Moderate Adverse	Moderate
VP28	Residential properties on Warwick Close	High	Major - Adverse	Large
VP29	Residential properties on Kenilworth Avenue	High	Major - Adverse	Large

Reference - Representative viewpoint (VP) photomontage location (PM)	Representative viewpoints and location	Sensitivity	Magnitude of effect	Significance of effect
VP30	Residential properties on Philips Park Road	High	Moderate - Adverse	Moderate
VP31 (PM5)	Footpath 32 WHI, 33WHI, 34aWHI, 34bWHI from Philips Park Road (view north)	High	Major - Adverse	Large
VP32	Footpath 33WHi (view west)	High	Minor - Adverse	Slight
VP33	Ross Avenue, Oak Avenue, Beech Avenue, Chestnut Avenue	High	Moderate - Adverse	Moderate

Operation

8.10.22 Potential climate effects are considered in Chapter 15: Climate. Future assessment of landscape and visual effects is based on years 1 (opening year) and 15 (design year) during operation, and it is not anticipated that climate change would substantially affect the baseline landscape within this timeframe. However, rising temperatures could affect vegetation both directly through drought or flooding and susceptibility to pests and disease, and indirectly through lack of resilience. During the design development consideration will be given to the use of appropriate species and maintenance in response to potential changes to climatic conditions.

Landscape and townscape effects

Winter (Year 1)

8.10.23 Chapter 3 (Section 3.3: Further scheme development) describes the design of the Proposed Scheme and the consideration given to environmental features.

8.10.24 Motorways are audibly and visually dominant in some areas of the LCA and are therefore a characteristic but detracting feature of the LCA although the elevated Northern Loop, Simister Pike Fold Viaduct and Simister Pike Fold Bridge would be consistent in scale and built form to the adjacent M60 J18.

8.10.25 During operation in winter year 1, but before essential mitigation and enhancement measures described in section 8.9 would have sufficiently established it is likely that there would continue to be **significant landscape effects** on LCA 26: Prettywood, Pilsworth and Unsworth Moss.

8.10.26 The Northern Loop, Simister Pike Fold Viaduct and Simister Pike Fold Bridge would increase the extent of highway infrastructure and encroach on a small part of the flat landscape character and the Special Landscape Area, as well as locally altering land use and field pattern. Vegetation removed during construction would increase the visual prominence of the motorway corridor and traffic movement within the landscape, and partially alter the pleasant environment and high quality of the Special Landscape Area. Planting provided within the ecological enhancement area; within the Northern Loop and on the Simister Pike Fold Bridge embankments and new hedgerow and hedgerow tree planting would not have sufficiently established to provide beneficial landscape integration or visual screening by year 1. Given that the Northern Loop, Simister Pike Fold Viaduct and Simister Pike Fold Bridge and M66 southbound diverge would extend

development further into rural fringe landscape the Proposed Scheme is likely to result in a **significant effect** during operation in winter year 1.

8.10.27 The M60 northbound to M60 westbound free flow link would slightly alter the configuration of M60 J18 and would result in new characteristic but detractive infrastructure within the motorway corridor. Vegetation removed during construction would increase the prominence of the motorway corridor and traffic flow within the landscape. Mitigation planting proposed to provide landscape integration into the Special Landscape Area, including the new area of ecological enhancement planting, would not have established by year 1. However, the changes to LCA 27: Simister, Slattocks and Healds Green would introduce local change and are **unlikely to result in significant effects** during operation in winter year 1.

8.10.28 Attenuation pond 6 west of M60 J17 would result in a change to the landform, recreational accessibility and vegetation cover within open ground adjacent to Whitefield Golf Course, although the changes to LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands are **unlikely to result in significant effects** during operation in winter year 1 (or year 15).

8.10.29 Within TCA Prestwich, Whitefield, Radcliffe and Unsworth Residential the loss of sections of linear tree belts along the M60 Mainline J17-J18 that provides separation would remain notable, as mitigation planting would not provide any enclosure by year 1. However, the change to the TCA is **unlikely to be significant** given the small areas affected within the much broader TCA.

8.10.30 New lighting requirements for the Northern Loop and the M66 southbound diverge within LCA 26: Prettywood, Pilsworth and Unsworth Moss and the M60 northbound to M60 westbound diverge within LCA 27: Simister, Slattocks and Healds Green would extend lighting into previously unlit rural areas, detracting from the rural characteristics. The effects would be more perceptible due to light spill from the removed highway linear tree belts. Headlights from traffic on the elevated Northern Loop and Simister Pike Fold Viaduct would further extend areas of lighting into the rural landscape. However, the landscape areas are already influenced by motorway lighting and from lights from moving traffic on elevated sections of J18.

8.10.31 The development boundary extends into LCA 25: River Roch, although no construction activity would take place within it. Construction activity, resulting in localised changes to landform and vegetation cover in the adjacent LCA would potentially indirectly result in a very minor alteration to landscape character although there would be no intervisibility with the Proposed Scheme, and therefore, **unlikely to result in significant effects** during year 1 (or year 15).

Summer (Year 15)

8.10.32 In summer year 15, essential mitigation planting and enhancement measures would have established to help integrate the Proposed Scheme into the landscape. Whilst established mitigation planting and enhancement measures would reduce effects on LCA 26: Prettywood, Pilsworth and Unsworth Moss, the Northern Loop, Simister Pike Fold Viaduct, Simister Pike Fold Viaduct and M66 southbound diverge would remain as detracting highway infrastructure within the relatively flat rural fringe landscape and the Special Landscape Area. Lighting on the elevated Northern Loop, Simister Pike Fold Viaduct and Simister Pike Fold Bridge would increase the prominence of highway infrastructure at night-time. However, by the summer of year 15, it is likely that the areas of establishing essential mitigation planting and enhancement measures would

provide integration and reduce the prominence of the Proposed Scheme, and therefore, **unlikely to result in residual significant effects** on LCA 26: Prettywood, Pilsworth and Unsworth Moss.

8.10.33 By year 15, reinstated linear tree belts along the M60 Mainline J17-J18 and the M60 northbound to M60 westbound free flow link would provide some integration of the Proposed Scheme consistent with the infrastructure and **unlikely to result in residual adverse effects** on LCA 27: Simister, Slattocks and Healds Green and TCA Prestwich, Whitefield, Radcliffe and Unsworth Residential during operation in summer year 15.

8.10.34 Due to the small scale of the attenuation pond 6 within much broader LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands, and the landscape integration provided by the establishing mitigation planting and seeding, and the rerouting of the local footpath network, the Proposed Scheme is **unlikely to result in residual adverse effects** by summer year 15. As described above, due to the nature of the indirect effects on LCA 25: River Roch, the Proposed Scheme is **unlikely to result in significant effects**.

8.10.35 By year 15, the essential mitigation planting and enhancement measures along the motorway verges and embankments would have provided some screening of new lit sections of the Proposed Scheme. However, the required lighting columns would be tall and lighting from the Northern Loop, Simister Pike Fold Viaduct and Simister Pike Fold Bridge is likely to result in some localised light spill into the rural landscape and the Special Landscape Area. Mitigation planting would mostly screen headlight glare from traffic using the Northern Loop, retaining the rural qualities of the Special Landscape Area during night time.

8.10.36 Table 8.8 summarises the likely significance of landscape effects on each local LCA during operation in winter year 1 and summer year 15.

Table 8.8: Likely landscape effects during operation year 1 and year 15

Local landscape character area	Sensitivity	Year of assessment	Magnitude of effect	Significance of effect
LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands	High	Year 1	Minor - Adverse	Slight
		Year 15	Minor - Adverse	Slight
LCA 25: River Roch	Medium	Year 1	Negligible - Adverse	Negligible
		Year 15	Negligible - Adverse	Negligible
LCA 26: Prettywood, Pilsworth and Unsworth Moss	Medium	Year 1	Moderate - Adverse	Moderate
		Year 15	Minor - Adverse	Slight
LCA 27: Simister, Slattocks and Healds Green.	Medium	Year 1	Minor - Adverse	Slight
		Year 15	Negligible - Adverse	Negligible
TCA Prestwich, Whitefield, Radcliffe and Unsworth Residential	Low	Year 1	Moderate - Adverse	Slight
		Year 15	Negligible - Adverse	Negligible

Visual effects

Winter (Year 1)

8.10.37 During operation in winter year 1, but before but before essential mitigation planting and enhancement measures would have sufficiently established to provide visual screening, it is likely that there would continue to be significant visual effects on people's views.

8.10.38 Whilst the Proposed Scheme would be set within the context of the existing motorway corridor, vegetation loss, including widening between M60 J17-J18 mainline, would increase the visual prominence of new and existing highway infrastructure. This would include day and night-time effects from lighting, headlights and signage, as well as disruption due to greater visibility of motorway traffic where linear tree belts have been removed during construction. The extent of highway infrastructure would be increased and the Northern Loop, Simister Pike Fold Viaduct and Simister Pike Fold Viaduct, M66 southbound and M60 northbound to M60 westbound free flow link would be prominent within the relatively flat and low-lying landscape, particularly where these are elevated structures. Environmental barriers would remain in the same locations and would also provide similar levels of screening of the motorway corridor.

8.10.39 It is likely that there would continue to be **significant visual effects** on people's views during operation in winter year 1 in the following locations:

- Brickhouse Farm, four residential properties on Killy Lane, Footpath 6WHI, Footpath 8WHI, Pike Fold Golf Course (VP3)
- Unsworth Moss Farm, Unsworth Moss Bungalow, Moss Top Farm, Footpath WHI8, Footpath WHI10 (VP5)
- Footpath 9WHI on Hills Lane (VP6)
- Footpath 9WHI, Footpath 46WHI on Egypt Lane (VP7 (PM1))
- Roch Crescent, Douglas Walk east of Douglas Close (VP11)
- Boz Park public open space (VP12)
- Cowl Gate Farm, Footpath 12WHI on Pole Lane (VP14)
- Residential properties on Marston Close (VP15 (PM2))
- Residential properties on Rothay Close, Brathay Close, Heybrook Close (VP16)
- Residential properties on Derwent Avenue, Duddon Close, Leven Walk, permissive path via Haweswater Underpass (VP17 (PM3))
- Residential properties Eastview and No. 7, 9 and 11 Corday Lane (VP18)
- Parrenthorn High School, Heywood Road (VP19 (PM4))
- Bridle Way 27aPRE on the Heaton Park Registered Park and Garden boundary (VP20)
- Residential properties on Parrenthorn Road, St. Margaret's Church of England Primary School (VP21)
- Residential properties on Sandgate Road, St. Joseph's Avenue, Prestwich Heys FC, Footpath 12 WHI (VP22)
- Residential properties on Warwick Avenue (VP23)
- Footpath 12 WHI, Sandgate Road, travellers on the M60 eastbound (VP24)
- Residential properties on Thatch Leach Lane, Conisborough Place and Glendevon Place (VP26)
- Residential properties on Warwick Close (VP28)
- Residential properties on Kenilworth Avenue (VP29)

- Footpath 32WHI, 33WHI, 34aWHI, 34bWHI from Philips Park Road near Whitefield Golf Course (VP31 (PM5))
- Footpath 33WHI (view west) (VP32)

8.10.40 Once the scheme becomes operational it is **unlikely that there would be significant effects** on people's views during operation in winter year 1 from the remaining viewpoint locations. This is due to a number of factors including completion of construction activities, distance from the Proposed Scheme, the influence of topography and vegetation which lessens visibility of the Proposed Scheme and the nature of existing views, some of which include views of the existing motorway corridor. Existing intervening trees and shrubs in leaf during the summer months of year 1 would further reduce visibility from most locations.

Summer (Year 15)

8.10.41 In summer year 15 essential mitigation planting and enhancement planting would have established to help integrate the Proposed Scheme into the landscape and to help screen views of the highway corridor.

8.10.42 There would be **no residual significant adverse effects** from representative viewpoints. This would be partially due to the effectiveness of established mitigation planting combined with establishment of enhancement planting and other surrounding vegetation during the summer of year 15 when vegetation is in full leaf. Without leaf cover during the winter months of year 15 there are likely to be some remaining views of the Northern Loop, the Simister Pike Fold Viaduct, Simister Pike Fold Bridge and moving traffic. However, the density of the trees and shrubs would provide some filtering to reduce views of the road and moving traffic. Due to the constraints on reinstating linear planting within the embankments the density of linear tree belts is likely to be reduced compared to prior to the scheme. Environmental barriers would remain in the same locations and would also provide similar levels of screening of the motorway corridor.

8.10.43 Table 8.9 summarises the likely significance of visual effects on each representative viewpoint during operation in winter year 1 and summer year 15.

Table 8.9: Likely visual effects during operation winter year 1 and summer year 15

Reference - Representative viewpoint (VP)	Representative viewpoints and location	Sensitivity	Year of assessment (Winter Year 1, Summer Year 15)	Magnitude of effect	Significance of effect
VP1	Broom Hill Farm, Higher Barn Farm, Footpath 4WHI	High	Year 1	Minor - adverse	Slight
			Year 15	Negligible - adverse	Slight
VP2	Castlebrook Farm, Whitegate Bungalow on Castle Road, Restricted Byway 85BUR	High	Year 1	Negligible - adverse	Slight
			Year 15	Negligible - adverse	Slight
VP3	Brickhouse Farm, four residential properties on Killy Lane, Footpath 6WHI, Footpath 8WHI, users of Pike Fold Golf Course	High	Year 1	Moderate - adverse	Moderate
			Year 15	Negligible - adverse	Slight
VP4	Two residential properties on Killy Lane, Footpath 8WHI	High	Year 1	Minor - adverse	Slight
			Year 15	Negligible - adverse	Slight
VP5	Unsworth Moss Farm, Unsworth Moss Bungalow, Moss Top Farm, Footpath WHI8, Footpath WHI10	High	Year 1	Moderate - adverse	Moderate
			Year 15	Minor - adverse	Slight
VP6	Footpath 9WHI on Hills Lane	High	Year 1	Moderate - adverse	Moderate
			Year 15	Minor - adverse	Slight
VP7 (PM1)	Proposed photomontage location Footpath 9WHI, Footpath 46WHI, users of Pike Fold Golf Course	High	Year 1	Major - adverse	Large
			Year 15	Minor - adverse	Slight
VP8	Simister Green residential properties, Simister	High	Year 1	Minor - adverse	Slight
			Year 15	Negligible - adverse	Slight
VP9	Droughts Lane residential properties, Simister	High	Year 1	No change	Neutral
			Year 15	No change	Neutral
VP10	Heywood Road, M60 overbridge, travellers on the M60 motorway network	Low	Year 1	Minor - adverse	Slight
			Year 15	Negligible - adverse	Slight
VP11	Roch Crescent, Douglas Walk east of Douglas Close	High	Year 1	Moderate - adverse	Moderate

Reference - Representative viewpoint (VP)	Representative viewpoints and location	Sensitivity	Year of assessment (Winter Year 1, Summer Year 15)	Magnitude of effect	Significance of effect
			Year 15	Minor - beneficial	Slight
VP12	Boz Park public open space	High	Year 1	Moderate - adverse	Moderate
			Year 15	Minor - beneficial	Slight
VP13	Mersey Drive, Oak Lane residential properties, Boz Park public open space	High	Year 1	Minor - adverse	Slight
			Year 15	Negligible - beneficial	Slight
VP14	Cowl Gate Farm, Footpath 12WHI	High	Year 1	Major - adverse	Large
			Year 15	Negligible - beneficial	Slight
VP15 (PM2)	Proposed photomontage location Residential properties on Marston Close	High	Year 1	Major - adverse	Large
			Year 15	Minor - adverse	Slight
VP16	Residential properties on Rothay Close, Brathay Close, Heybrook Close	High	Year 1	Major - adverse	Large
			Year 15	Minor - adverse	Slight
VP17 (PM3)	Residential properties on Derwent Avenue, Duddon Close, Leven Walk, permissive path via Haweswater Underpass	High	Year 1	Major - adverse	Large
			Year 15	Minor - adverse	Slight
VP18	Eastview and No. 7, 9 and 11 Corday Lane, Heywood Road	High	Year 1	Moderate - adverse	Moderate
			Year 15	Minor - beneficial	Slight
VP19 (PM4)	Proposed photomontage location Parrenthorn High School, Heywood Road	Medium	Year 1	Moderate - adverse	Moderate
			Year 15	Negligible - adverse	Slight
VP20	Bridle Way 27aPRE on the Heaton Park Registered Park and Garden boundary	High	Year 1	Moderate - adverse	Moderate
			Year 15	Minor - adverse	Slight
VP21	Residential properties on Parrenthorn Road, St. Margaret's Church of England Primary School	High	Year 1	Moderate - adverse	Moderate
			Year 15	Negligible - adverse	Slight
VP22		High	Year 1	Moderate - adverse	Moderate

Reference - Representative viewpoint (VP)	Representative viewpoints and location	Sensitivity	Year of assessment (Winter Year 1, Summer Year 15)	Magnitude of effect	Significance of effect
	Residential properties on Sandgate Road, St. Joseph's Avenue, Prestwich Heys FC, Footpath 12 WHI		Year 15	Negligible - adverse	Slight
VP23	Residential properties on Warwick Avenue	High	Year 1	Major - adverse	Large
			Year 15	Minor - adverse	Slight
VP24	Footpath 12 WHI, Sandgate Road, travellers on the M60 eastbound	High	Year 1	Moderate - adverse	Moderate
			Year 15	Minor - adverse	Slight
VP25	Fusiliers Memorial Meadow, Thatch Leach Lane Play Area,	Medium	Year 1	Minor - adverse	Slight
			Year 15	No change	Neutral
VP26	Thatch Leach Lane, Conisborough Place, Glendevon Place	High	Year 1	Major - adverse	Large
			Year 15	Minor - adverse	Slight
VP27	Residential properties on Prestfield Road, Kensington Street	High	Year 1	Minor - adverse	Slight
			Year 15	Minor - adverse	Slight
VP28	Residential properties on Warwick Close	High	Year 1	Major - adverse	Large
			Year 15	Minor - adverse	Slight
VP29	Residential properties on Kenilworth Avenue	High	Year 1	Major - adverse	Large
			Year 15	Minor - adverse	Slight
VP30	Residential properties on Philips Park Road	High	Year 1	Minor - adverse	Slight
			Year 15	Negligible - adverse	Slight
VP31 (PM5)	Footpath 32 WHI, 33WHI, 34aWHI, 34bWHI from Philips Park Road (view north)	High	Year 1	Moderate - adverse	Moderate
			Year 15	Minor - adverse	Slight
VP32	Footpath 33WHi (view west)	High	Year 1	Minor - adverse	Slight
			Year 15	Negligible - adverse	Slight
VP33		High	Year 1	No change	Neutral

Reference - Representative viewpoint (VP)	Representative viewpoints and location	Sensitivity	Year of assessment (Winter Year 1, Summer Year 15)	Magnitude of effect	Significance of effect
	Ross Avenue, Oak Avenue, Beech Avenue, Chestnut Avenue		Year 15	No change	Neutral

9. Biodiversity

9.1 Topic introduction

9.1.1 This chapter presents the findings of the preliminary environmental assessment undertaken for the biodiversity aspect.

9.1.2 Biodiversity is the biological variety and variability of life on earth and the ecological complexes that they are a part of. Construction, improvement and maintenance of roads can result in environmental effects on biodiversity. In addition, biodiversity is the subject of a wide variety of legislation and policies; impacts to ecological receptors could constitute an offence under relevant legislation as well as comprising material considerations within the planning system.

9.1.3 The preliminary environmental assessment considers the potential for impacts to the following matters:

- Designated sites (statutory or non-statutory) including: Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar sites, Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Local Nature Reserves (LNRs), and Sites of Biological Importance (SBIs)
- Protected or priority habitats – habitats of conservation importance such as priority habitats or habitats of principal importance
- Protected or priority species – these include animal and plant species protected by legislation, and species of conservation importance such as priority species or species of principal importance

9.1.4 This chapter is supported by the following figures:

- Figure 9.1: Designated sites and Affected Road Network (ARN)
- Figure 9.2: Ancient woodland and Priority Habitats
- Figure 9.3: UK Habitats Map
- Figure 9.4: Habitat Suitability Index (HSI) Scores of Ponds within 500m

9.2 Stakeholder engagement

9.2.1 Table 9.1 summarises the requirements from the Planning Inspectorate's Scoping Opinion (2021) as relevant to the scope of the biodiversity assessment, and identifies any matters scoped out of the assessment as agreed with the Planning Inspectorate and other stakeholders. This table also explains any changes to the assessment methodology as a result of this engagement.

9.2.2 A number of the responses to the Scoping Opinion include matters that are indirectly related to the biodiversity aspect (e.g. comments relating to landscaping proposals). These comments have not been included in the table below as they are not directly related to the aspect scope and methodology and are being assessed by other environmental aspects.

Table 9.1: Key stakeholder feedback for biodiversity aspect

Stakeholder	Comment	Response
Planning Inspectorate	(ID 4.4.1) European sites and SSSI should be scoped in until the traffic screening exercise has been carried out. On this basis Rochdale Canal SAC and SSSI should be scoped in. Agree that all other European sites and SSSI and other pathways of effect can be scoped out of the assessment of effects during construction.	Rochdale Canal SAC and SSSI are scoped in for consideration due to potential impacts from changes in air quality.
	(ID 4.4.2) Agree NNR can be scoped out of assessment.	N/A
	(ID 4.4.3) Agree that significant effects from spread of invasive non-native species during operation are not likely and that this matter can be scoped out of the assessment.	N/A
	(ID 4.4.4) Where matters scoped in at the Scoping Opinion Stage are later scoped out further evidence to justify the approach should be clearly cited alongside agreement with relevant consultees and presented as part of the Environmental Statement.	Where matters are scoped out evidence to support the decision to scope the matter out will be included in the Environmental Statement.
	(ID 4.4.5) Chapters 10 and 15 of the Scoping Report describe the potential presence of peat deposits within the study area and their removal. The ecological/biodiversity value of peat as a resource is not specifically considered nor is the potential loss of peat described as part of the scope of the biodiversity assessment. The biodiversity chapter of the ES should therefore specifically outline the potential ecological significance of the effect of peat loss.	Added loss of peat and considered impact on peat-dependent habitats.
	(ID 4.4.6) The ES should be clear in establishing pathways of effect to European sites and ensure any HRA is coordinated with the EIA.	HRA will be undertaken and the outcome reported in the Environmental Statement.
Canal and Rivers Trust	Agree that the Rochdale Canal SAC and SSSI should be scoped into the report for further assessment.	N/A
Environment Agency	Due to the scheme's construction being planned for 2025 the Environment Bill is likely to be enacted before this date and the scope of the project should look into considering how biodiversity gains will be achieved either through protection and enhancement of existing habitats, the creation of new ones, and/or the strengthening of connections between them.	Biodiversity Metric calculations are being carried out and will be reported.

Stakeholder	Comment	Response
Natural England	Report is unclear on whether the Rochdale Canal SAC is scoped in. Advise that the HRA cannot conclude no likely significant effect at this stage	Rochdale Canal SAC is scoped in for consideration and an HRA will be carried out.
	European and nationally designated sites should be included as receptors to air quality changes.	European sites and nationally significant sites are being included where there is potential for impacts from air quality changes.
	Commend reference to biodiversity enhancement but suggest this could be strengthened through a commitment to an ambitious biodiversity net gain target. Natural England advocate the use of Defra Metric to calculate any potential biodiversity losses and compensation to be measured	The most recent version of the Defra Metric (3.1 or later) will be used to calculate biodiversity losses and compensation. Net loss and gain figures will be summarized within the Environmental Statement; a separate report containing details on biodiversity losses and gains report will be provided with the DCO application. The Proposed Scheme, as part of the wider Highways England Delivery Plan (2020f), would aim to achieve no net loss of biodiversity (with an aspiration to provide a net gain), in line with the requirements of the National Planning Policy Framework (paragraph 174) and NPS NN (paragraph 5.33 and 5.36)

9.3 Legislative and policy framework

9.3.1 The National Policy Statement for National Networks (NPS NN) (Department for Transport (DfT), 2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NPS NN as the primary basis for making decisions on DCO applications.

9.3.2 Key policy from the NPS NN relevant to this aspect is set out below:

- Paragraph 5.22 of the NPS NN states that the applicant's assessment should describe any likely significant effects on internationally, nationally and locally designated sites of ecological conservation importance; protected species; habitats (including irreplaceable habitats such as ancient woodland and veteran trees); and other species identified as being of principal importance for the conservation of biodiversity
- Paragraph 5.23 states that the applicant should describe how the project plans to conserve and enhance biodiversity conservation interests
- Paragraph 5.25 states that development should avoid significant harm to biodiversity conservation interests, including through appropriate mitigation and consideration of alternatives
- Paragraph 5.32 states that development should not result in the loss or deterioration of irreplaceable habitats including ancient woodland and veteran trees
- Paragraph 5.35 states that other habitats and species identified as being of principal importance should be protected from adverse effects of development

- Paragraph 5.36 states that appropriate mitigation measures are considered an integral part of a proposed development and the applicant should include these in their assessment, including identifying how these measures will be secured. The applicant should demonstrate that:
  - they will seek to ensure that activities will be confined to the minimum areas required for works during construction
  - best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised during construction and operation
  - developments and landscaping will be designed to provide green corridors and minimise habitat fragmentation
  - opportunities will be taken to enhance existing habitats and create new habitats within the site landscaping proposals
- Changes in air quality, light pollution, noise, and the water environment due to project construction or operation should be assessed for their potentially adverse impacts on wildlife, biodiversity, and nature conservation

9.3.3 In addition to the national policy set out in the NPS NN, the Proposed Scheme must also have regard to relevant legislation and local plans and policy. Legislation and local planning policy will be complied with. Full details of legislation and local planning policy relevant to this aspect are detailed in Appendix 1.1 and will also be detailed in the Environmental Statement.

9.4 Assessment methodology

9.4.1 The biodiversity assessment will be undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) LA 104 Environmental Assessment and Monitoring (Highways England, Revision 1, 2020a; hereafter referred to as DMRB LA 104) and DMRB LA 108 Biodiversity (Highways England, Revision 1, 2020b; hereafter referred to as DMRB LA 108).

9.4.2 Assessment of the potential air quality impacts on designated sites and habitats which are sensitive to nitrogen deposition, including SACs, SPAs, Ramsar sites, SSSIs, LNRs, SBIs, nature improvement areas, ancient woodland and veteran trees within 200m of the Affected Road Network (ARN) will be undertaken in accordance with DMRB LA 105 Air Quality (Highways England, Revision 0, 2019; hereafter referred to as DMRB LA 105).

9.4.3 Assessment of effects on biodiversity resources will be informed by relevant information collated on other environmental aspects including DMRB LA 111 Noise and vibration (Highways England, Revision 2, 2020c; hereafter referred to as DMRB LA 111) and DMRB LA 113 Road drainage and the water environment (Highways England, Revision 1, 2020d; hereafter referred to as DMRB LA 113).

9.4.4 Mitigation will be designed and implemented in line with Section 5.4 of Chapter 5: Environmental assessment methodology. The Proposed Scheme will also investigate mechanisms and opportunities to deliver enhancement measures as part of the embedded design and/or essential mitigation proposals. At the time of writing, mitigation design is in a preliminary phase. As such, this chapter sets out the mitigation principles for the biodiversity aspect, which will be fully developed for the Environmental Statement in consultation with stakeholders.

9.4.5 The requirements of protected and controlled species legislation will be detailed in an appendix to allow the Environmental Statement chapter to focus on potential significant effects, in terms of EIA.

9.4.6 Appendix 5.2 of this PEIR sets out the biodiversity resource importance (i.e., International/European, UK/National, Regional, County/equivalent authority or Local) and magnitude of impact criteria which was used to assess significance for this aspect (using the significance matrix from Table 3.13 of LA 108).

9.4.7 In parallel with the EIA process, the effects of the Proposed Scheme on the national site network (i.e. SPA, SAC, and Ramsar sites) will be assessed in accordance with DMRB LA 115 Habitats Regulations Assessment (Highways England, Revision 1, 2020e; hereafter referred to as DMRB LA 115), Advice Note Ten: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects (Planning Inspectorate, 2017), and legislative requirements.

9.4.8 The Habitats Regulations Assessment (HRA) is a separate legal process from the EIA, although there is an overlap in relation to the potential impact on the national site network and the processes are undertaken in parallel.

9.5 Assessment assumptions and limitations

9.5.1 At the time of writing, surveys for some habitats and protected species are still ongoing, or are scheduled to be undertaken. This is to reflect updates and refinements to the provisional Orders Limits based on recent design changes. The assessment undertaken for this PEIR is therefore based on survey data collated in 2021 and early 2022 which was available at the time of writing. Full survey results will be available and incorporated into the Environmental Statement.

9.5.2 Further ecology surveys that will be undertaken to inform the Environmental Statement are listed below:

- UK Habitat Classification System survey update (including additional habitat condition assessments to inform BNG metric)
- Ground level assessments of trees for bat roost suitability
- Barn owl *Tyto alba* potential surveys (building and tree inspections)
- Terrestrial invertebrate surveys

9.5.3 Updated ground level assessments of trees for bat roost potential (BRP) will inform the scope for any further bat surveys required (i.e., climb and inspect surveys and/or dusk emergence/dawn re-entry), which will be incorporated into the Environmental Statement.

9.5.4 Surveys that have been completed are detailed in Section 9.7 of this report.

9.5.5 The assessments undertaken in this chapter are therefore a preliminary assessment and may alter based on findings of ongoing surveys.

9.5.6 Assessment of changes in air quality on biodiversity resources has been undertaken and reported upon in Chapter 6: Air Quality of the PEIR. The air quality assessment was undertaken in line with Design Manual for Roads and Bridges (DMRB) LA 105 Air

Quality (Highways England, Revision 0, 2019). . Based on the modelling results in Chapter 6 a list of ecological receptors within 200m of the ARN with sensitivities to nitrogen deposition has been identified and these are detailed within Section 9.7. In the Environmental Statement, the air quality models will be used to provide further detail on the effects of changes in air quality on sensitive habitats at each site.

9.5.7 In the Environmental Statement, information on the areas of habitats lost and new habitats created will be presented so that net habitat loss and gain can be clearly identified.

9.5.8 This report has been based on the preliminary scheme design Preliminary Environmental Design (Figure 2.2). Certain elements of the design have yet to be finalised, including potential works within Philips Park, details of impacts around gantry and sign locations, design of drainage ponds and access routes for maintenance of these ponds. The Preliminary Environmental Design (Figure 2.2) has been developed to show outline landscaping proposals. Elements within this design may change as the design is developed.

9.6 Study area

9.6.1 Study areas for biodiversity are based on distances from the Proposed Scheme, ARN or provisional Order Limits and vary depending on the ecological feature being assessed. The main areas of construction activity, including the Proposed Scheme, construction compounds, storage areas, haul roads and outfalls are included in the provisional Order Limits.

9.6.2 A desk-based assessment of designated sites, and records of protected and notable habitats and species was undertaken, comprising the following:

- SACs, SPAs, and Ramsar sites where the Proposed Scheme:
  - Is within 2km of a European site or where there is land that may be important ecologically in supporting the populations for which the site has been designated or classified (also known as “functionally linked land”)
  - Is within 30km of a SAC, where bats are noted as one of the qualifying interests
  - Crosses or lies adjacent to, upstream of, or downstream of, a watercourse which is designated in part or wholly as a Ramsar or European site
  - Has a potential hydrological or hydrogeological linkage to a Ramsar or European site containing a groundwater-dependent terrestrial ecosystem (GWDTE). Initial screening buffer of 250m is applied for GWDTE as set out in Chapter 14: Road Drainage and the Water Environment. This distance will be increased (where appropriate) if potential impacts on groundwater flows, levels, or quality are expected to extend beyond this distance, due to, for example, new design elements
  - Has an ARN within 200m of a Ramsar or European site
  - Will have a direct pathway to effects
- SSSIs and LNRs within 2km of the Proposed Scheme and 200m of the ARN, or which have hydrological connectivity to the Proposed Scheme

- SBIs and notable habitats such as ancient woodland and groundwater-dependent terrestrial ecosystems within 1km of the Proposed Scheme and 200m of the ARN
- Records of protected and notable species within 2km of the Proposed Scheme requested from Greater Manchester Ecology Unit (GMEU)

9.6.3 Surveys for habitats and species have varying study areas as follows:

- UK Habitat Classification System survey (including invasive species, and habitat condition assessment to inform Biodiversity Metric 3.1) up to 500m from the provisional Order Limits
- Botanical surveys of designated sites potentially impacted by air quality where present within 200m of the ARN
- Bat surveys:
  - Ground-based assessments of trees up to 100m from the Provisional Order limits
  - Emergence and dawn re-entry surveys of trees up to 100m from the Provisional Order limits
  - Tree-climbing inspect surveys up to 100m from the Proposed Scheme
  - Transect surveys extend up to 1km from the Proposed Scheme and vantage point surveys and static bat detector surveys are within the provisional Order Limits
- Badger *Meles meles* surveys within 100m of the provisional Order Limits
- Barn owl surveys (tree and building inspections) up to 50m from the provisional Order Limits
- Breeding bird surveys up to 250m from the provisional Order Limits
- Wintering bird surveys up to 500m from the provisional Order Limits
- River condition assessment of waterbodies within the provisional Order Limits
- GCN surveys including HSI assessment, presence/absence survey, population size class assessment and environmental Deoxyribonucleic acid (eDNA) surveys within 500m of the provisional Order Limits
- Otter surveys of all watercourses/bodies within 200m of the provisional Order Limits
- Water vole surveys of all watercourses/bodies within 200m of provisional Order Limits
- Reptile surveys of suitable habitat identified within the within provisional Order Limits (i.e., north-east of existing M60 J18)
- Terrestrial invertebrate surveys of sites identified as having optimal habitats within the provisional Order Limits
- Aquatic invertebrate surveys of watercourse/bodies that may be impacted by the Proposed Scheme

9.7 Baseline conditions

Baseline sources

9.7.1 GMEU provided records of protected and notable species, SBIs, and priority habitats within 2km of the provisional Order Limits in May 2021.

9.7.2 International and national statutory designated sites, priority habitats and granted EPSM Licences were identified on the Multi-Agency Geographic Information for the Countryside (MAGIC) website (Defra, 2021).

9.7.3 The Ancient Woodland Inventory (Natural England, 2021) was reviewed to identify ancient woodland habitats, and aerial photography and Ordnance Survey (OS) maps were reviewed. Ancient and veteran trees were identified via a combination of desk-based sources including: Woodland Trust's ancient tree inventory (Woodland Trust, n.d.) and field surveys.

9.7.4 The following field surveys were undertaken and have been used to form the basis of the assessment within this PEIR:

- UK Habitat Classification System survey including invasive species, and habitat condition assessments to inform Biodiversity Metric 3.1 were undertaken in 2021 with land not previously accessible surveyed in February 2022. As stated in Paragraph 9.5.2 additional habitat surveys and condition assessments to update the baseline will be undertaken in from Autumn 2022 onwards to account for refinements to the provisional Orders Limits based on recent design changes.
- Botanical surveys of designated sites that may be impacted through changes in air quality were undertaken in 2021, including surveys for floating water plantain *Luronium natans*.
- Bat surveys which were undertaken in 2022 include:
  - Ground-based assessments of trees
  - Emergence and dawn re-entry surveys of trees
  - Tree-climbing inspect surveys
  - Bat activity surveys, including transects, vantage point surveys and static bat detector surveys.
- Badger surveys were undertaken 2021
- Barn owl surveys were undertaken in November 2021
- Breeding bird surveys were undertaken from April – June 2021
- Wintering bird surveys were undertaken in winter 2020/21 and were completed in January 2022
- River condition assessment has been undertaken for the following watercourses within or adjacent to the provisional Order Limits:
  - Bradley Brook
  - Parr Brook

- Blackfish
- Castle Brook tributary
- Tributary of Castle Brook tributary

- GCN surveys were undertaken in April to June 2021
- Otter surveys were undertaken in September 2021
- Water vole surveys were undertaken in May and September 2021
- Reptile surveys were undertaken in September 2021
- Terrestrial invertebrate surveys were undertaken in July 2022

9.7.5 Full survey methodologies for the above are shown in the Environmental Scoping Report (Highways England, 2021) and will be detailed in survey reports which will be prepared for the Environmental Statement. As indicated in Paragraph 9.5.2 a number of the surveys listed above will be updated in 2022/2023 to ensure the baseline is accurate and suitable for the assessments that will be contained within the Environmental Statement.

Baseline conditions

Designated sites - desk study

9.7.6 There are no SAC, SPA, SSSI or Ramsar sites within 2km of the provisional Order Limits, or that are designated for bats within 30km of the provisional Order Limits or hydrologically connected to the provisional Order Limits. One SAC/SSSI is located within 200m of the ARN, which is Rochdale Canal. It is designated for its population of floating water plantain. The designated site is within 200m of the ARN in two different locations: one along the M62 and one along the M60. The site is located approximately 6.5km east and 6.5km south-east of the provisional Order Limits (Figure 9.1).

9.7.7 There are seven LNRs identified, five of which are within 2km of the provisional Order Limits and four that are within 200m of the ARN as shown in Table 9.2.

Table 9.2: LNRs within 2km of the provisional Order Limits or within 200m of the ARN

Site	Interest/designated features	Approximate distance and direction from the provisional Order Limits	Within 200m of ARN
Philips Park LNR (NGR SD 79745 03852)	Mixed woodland, grassland, streams, ponds, and lodges.	0m south	Yes
Hollins Vale LNR (NGR SD 81502 08603)	Species-rich grassland, hedgerows.	30m west	Yes
Mere Clough LNR (NGR SD 80135 03923)	Woodland and watercourse.	50m south	Yes
Blackley Forest LNR (NGR SD 84125 04092)	Broadleaved and plantation woodland, grassland, lake, marsh, and a river.	1.0km south-east	No

Site	Interest/designated features	Approximate distance and direction from the provisional Order Limits	Within 200m of ARN
Chapelfield LNR (NGR SD 78972 06155)	Woodland, reservoirs, aquatic plants	1.9km north	No
Clifton Country Park LNR (NGR SD 77191 04304)	Woodland, meadow, lakes	2km west	Yes
Alkrington Woods LNR (NGR SD 86140 05478)	Woodland, meadow, lake, fishing lodges	1.9km south-east	Yes

9.7.8 There are 18 SBIs identified in Table 9.3. Of these, nine are within 1km of the provisional Order Limits and 11 are within 200m of the ARN (Table 9.3).

Table 9.3: SBIs within 1km of the provisional Order Limits or 200m of the ARN

Site	Reason for designation											Distance and direction from provisional Order Limits	Within 200m of ARN
	Large standing water (Fw3)	Small lodges[1] (Fw2)	Other broadleaved woodland (Ws1)	Grassland (Gr2)	Reedbed, swamp, and fen (Fw1)	Aquatic invertebrates (AI1)	Birds (Br6)	Ancient Woodland (Wd1)	Scrub (Wd3)	Floating plantain and American waterweed	Habitat Mosaic (HM1)		
Philips Park and North Wood (NGR SD 80495 04532)		X		X				X				0m south	Yes
Hollins Plantation (NGR SD 80495 04532)								X				30m north-west	No
Hazlitt Wood (NGR SD 83505 05325)		X			X	X		X				3m south-east	Yes
Hollins Vale (NGR SD 82045 08270)		X		X								210m north-west	Yes
Heaton Park Reservoir (East) (NGR SD 82621 05016)							X					43m south-west	No
Heaton Park Reservoir (West) (NGR SD 82424 05052)							X					500m south-west	No
Pilsworth (NGR SD 82539 08337)	X	X										354m north-east	No
Parr Brook (NGR SD 81559 07296)				X								628m west	No
Prestwich Clough (NGR SD 80981 03514)								X				924m south	No
Ringley Woods (NGR SD 78981 04783)				X				X				2.4km west	Yes
Rhodes Farm Sewage Works (NGR SD 78933 03879)	X				X		X					1.3km south-west	Yes
Boardman Brook (NGR SD 85913 05099)								X				2km south-east	Yes
Alkrington Woods and Rhodes Lodges (NGR SD 86140 05478)											X	2km east	Yes

[1] Lodges are man-made waterbodies, with most examples originating from the industrial revolution. These were created to hold water for industrial processes - notably in Greater Manchester for the textile industry.

Site	Reason for designation											Distance and direction from provisional Order Limits	Within 200m of ARN
	Large standing water (Fw3)	Small lodges[1] (Fw2)	Other broadleaved woodland (Ws1)	Grassland (Gr2)	Reedbed, swamp, and fen (Fw1)	Aquatic invertebrates (AI1)	Birds (Br6)	Ancient Woodland (Wd1)	Scrub (Wd3)	Floating plantain and American waterweed	Habitat Mosaic (HM1)		
Clifton Country Park (NGR SD 77191 04304)		X					X	X				2.1km west	Yes
Clifton Moss (South) (NGR SD 76484 03305)	X	X						X	X			3.4km south-west	Yes
Rochdale Canal (Scowcroft to Warland) (NGR SD 88273 09861)	X											6km east	Yes
Rochdale Canal - Lock at Scowcroft Farm to Stott's Lane (NGR SD 89481 03514)	X									X		6km east	Yes
Sudden Brook (West) (NGR SD 91055 10472)				X								8km east	Yes

Habitats - desk study

9.7.9 There are five Ancient Woodland Inventory sites located within the 1km study area and four sites within 200m of the ARN (Table 9.4) (Figure 9.2). These are ancient semi-natural woodland habitats. The closest Ancient Woodland Inventory site is Philips Park Wood, part of which lies within the provisional Order Limits.

Table 9.4: Ancient woodland sites within 1km or within 200m of the ARN

Ancient Woodland site	Woodland type	Distance and direction from provisional Order Limits	Within 200m of ARN
Philips Wood (NGR SD 80495 04532)	Ancient and semi-natural woodland	Partly within provisional Order Limits	Yes
Mere Clough (NGR SD 80135 03923)	Ancient and semi-natural woodland	42m south	Yes
Clifton Wood (NGR SD 79502 04380)	Ancient and semi-natural woodland	2.4km west	Yes
North Wood (NGR SD 79502 04380)	Ancient and semi-natural woodland	505m west	Yes
Prestwich Clough Wood (NGR SD 80981 03514)	Ancient and semi-natural woodland	899m south	No

9.7.10 The desk-based study identified a number of priority habitats within 1km of the provisional Order Limits. However, the confidence in these classifications as detailed on the MAGIC website is 'low', likely indicating that they have been identified remotely through aerial imagery or remote sensing and have not been ground-truthed (Defra, 2021). The following priority habitats were identified as being present within 1km of the provisional Order Limits:

- Good quality semi-improved grassland
- Lowland mixed deciduous woodland
- Purple moor grass and rush pastures
- Lowland dry acid grassland
- Lowland fens
- Traditional orchards
- Wood pasture and park
- Open mosaic on previously developed land
- Lowland heath

9.7.11 Several areas identified as deciduous woodland located along the existing motorway verges are located within the provisional Order Limits.

9.7.12 There were no veteran trees identified within 1km of the provisional Order Limits. Four notable trees were identified within 1km of the provisional Order Limits. They were all

located within Philips Park and North Wood SBI to the west of the provisional Order Limits.

9.7.13 The following sites or priority habitats were identified as being groundwater dependent:

- Hazlitt Wood SBI
- Hollins Vale LNR and SBI
- Hollins Plantation SBI
- Philips Park and North Wood LNR and SBI
- Lowland fen priority habitat in Pike Fold Golf Club
- Heaton Park Reservoir (West) SBI

Habitats – field survey

9.7.14 The survey area is predominately urbanised, with motorways, working industrial sites, housing estates and buildings present. Broadleaved plantation woodlands ("other broadleaved woodland" following UK Habitat Classification nomenclature) were recorded throughout the survey area and were adjoined by modified grassland associated with golf courses and agricultural sileage/grazing fields. Four watercourses were recorded within the survey area. These were Hollins Brook, Whittle Brook, Castle Brook and Bradley Brook. The majority of the watercourses had observable man-made influences and sections where there was extensive coverage of invasive species. Mosaic habitats of other neutral grassland, scattered scrub and tall herb were also identified throughout the survey area (Figure 9.3). The condition of each habitat was assessed against the relevant Biodiversity Metric 3.1 habitat condition sheet.

9.7.15 The UK Habitat Classification system survey identified the following habitats within 500m of the provisional Order Limits:

- Lowland mixed deciduous woodland
- Other broadleaved woodland
- Mixed scrub and bramble scrub
- Lowland acid grassland
- Other neutral grassland
- Modified grassland
- Lowland fens
- Non-cereal cropland
- Native hedgerow
- Other rivers and streams
- Eutrophic standing water

9.7.16 Of these lowland mixed deciduous woodland, lowland acid grassland, lowland fen, and native hedgerow are priority habitats as defined in Section 41 of the Natural Environment and Rural Communities Act (NERC Act) requiring conservation action. These habitats are also listed on the Greater Manchester Local Biodiversity Action Plan

(LBAP). The eutrophic standing water habitat is also an LBAP habitat, however this habitat is not a priority habitat.

9.7.17 There were five areas of lowland mixed deciduous woodland identified within the survey area: Mid Wood and North Wood, Hazlitt Wood, Hollins Plantation and woodland near Pilsworth.

9.7.18 Mid Wood and North Wood form part of Philips Park LWS and are identified as being ancient and semi-natural woodland on MAGIC. The canopy of the woodland in Mid-Wood was dominated by pedunculate oak *Quercus robur*, common beech *Fagus sylvatica*, occasional silver birch *Betula pendula*, and sycamore *Acer pseudoplatanus*. The understorey was well established and diverse comprising occasional common beech, hawthorn *Crataegus monogyna*, hazel *Corylus avellana*, holly *Ilex aquifolium* and rhododendron *Rhododendron ponticum* scattered throughout. The ground layer included several ancient woodland indicator species such as native bluebell *Hyacinthoides non-scripta*, ramsons *Allium ursinum*, wood anemone *Anemone nemorosa* and remote sedge *Carex remota*. Throughout the ground layer Himalayan balsam *Impatiens glandulifera* was present with particular abundance following Bradley Brook. In addition, Japanese knotweed *Reynoutria japonica* was identified in isolated locations following Bradley Brook. Due to the abundance on non-native invasive species within the ground layer and understorey the woodland was categorised as being in poor condition.

9.7.19 North Wood had an open canopy with wetland glade areas dominated by yellow flag iris *Iris pseudacorus* and Himalayan balsam. The canopy was dominated by silver birch, goat willow *Salix caprea* and pedunculate oak. Throughout the woodland historic coppicing was evident with over mature coppiced specimens of goat willow and silver birch throughout. The understorey is sparse with occasional hawthorn and pedunculate oak located in isolated patches. The ground layer comprised native bluebell, Yorkshire fog *Holcus lanatus*, bramble *Rubus fruticosus* agg. and Himalayan balsam. An isolated stand of Japanese knotweed was identified close to the golf course edge. Due to the abundance of invasive non-native species (INNS) the woodland was categorised as being in poor condition.

9.7.20 Other areas of lowland mixed deciduous woodland included Hazlitt Wood within Heaton Park, which was assessed as being in a good condition overall but was very variable in terms of species composition throughout its extent. The northern area of this woodland was oak dominated with occasional stands of beech. There was secondary woodland growth in the understorey, holly occurred rarely. The ground layer contained broad buckler fern *Dryopteris dilatata*, bluebell, and bramble. At the far north of the woodland alder *Alnus glutinosa*, sycamore and sweet chestnut *Castanea sativa* were present around the stream that runs through the area. The central area of the woodland was dominated by common beech with little diversity and a sparse understorey and bare ground layer.

9.7.21 Hollins Plantation lowland mixed deciduous woodland to the north of the scheme was also identified as being in good condition. This was a pedunculate oak dominated woodland with hawthorn, ash *Fraxinus excelsior* saplings, and horse chestnut *Aesculus hippocastanum*. Bramble dominated the ground flora layer with occasional bluebell, rough meadow grass *Poa trivialis*, ramsons, pendulous sedge *Carex pendula*, and remote sedge also present. Most trees were mature, with some semi-mature trees also present. There were signs of regeneration and stands of deadwood were also present.

9.7.22 The final area of lowland mixed deciduous woodland was an unnamed area of woodland along Castle Road near to Whittle Brook (near Pilsworth). This was a small woodland block close to a watercourse. The canopy was dominated by common beech with occasional oak and ash and holly present in the understory. Rhododendron was growing around the edges of the woodland. The woodland was assessed as being in a moderate condition due to the prevalence of non-native garden variety species spreading into the understorey from the adjacent industrial area.

9.7.23 Other broadleaved woodland habitat was predominantly highways screening woodland planted along the soft estate of the existing motorways. The canopies were dominated by silver birch, alder, pedunculate oak, occasional Scot's pine *Pinus sylvestris*, ash and larch *Larix decidua*. The understories were unestablished with occasional hawthorn, blackthorn *Prunus spinosa,* and holly. The ground layer was indicative of plantation woodland with numerous nutrient favouring species present such as common nettle *Urtica dioica*, common clever *Gallium aparine*, wood avens *Geum urbanum* and bramble. The woodland represented a recently establishing woodland community that lacks overall diversity with high proportions of nutrient enrichment and non-native species. As such the highway screening woodlands were categorised as being in poor condition.

9.7.24 Areas of other broadleaved woodland were also present within the various golf courses that were present within the survey area. Woodland in these areas predominately comprised oak species *Quercus* sp., silver birch, and wild cherry *Prunus avium*. Most of the woodlands did not have any understorey with the ground layer dominated by rank grassland with an abundance of Himalayan balsam. All woodland associated with the golf courses were categorised as being in poor condition due to the recent plantation status and high abundance of invasive species.

9.7.25 Mixed scrub was present along the highway boundaries and within fields across the surveys area. Species present include dominant bramble, occasional hawthorn, blackthorn and pedunculate oak. Ruderal species were also abundant comprising nutrient favouring species such as common nettle and willow herb *Epilobium* sp. Due to the presence of nutrient favouring species, lack of diversity and age range these areas were categorised as being in poor condition.

9.7.26 One area of lowland acid grassland was recorded within the survey area. It was located within Hollins Vale SBI. Species present included wavy hairgrass *Avenella flexuosa*, common bent *Agrostis capillaris*, sheep fescue *Festuca ovina*, tormentil *Potentilla erecta* and hard fern *Blechnum spicant*. Mosses indicative of acid grassland included springy turf-moss *Rhytidiadelphus squarrosus* and common haircap *Polytricum commune*. The grassland was a clear example of the lowland acid grassland habitat, had a varied sward height, had little bare ground, no bracken cover and was free from invasive species and damage and as such was categorised as being in good condition.

9.7.27 Neutral grassland is present in isolated locations across the survey area. Most of the areas of this habitat were dominated by species indicating nutrient enrichment and as such were considered to be in poor condition. Two areas of moderate condition habitat were present to the north-west of M60 J18 due to increased species diversity and the presence of lesser spearwort *Ranunculus flammula,* which is listed as vulnerable on the English red list for plants (Stroh et al., 2014).

9.7.28 Modified grassland accounts for the majority of grassland habitat within the survey area and is attributed to sileage and heavily grazed fields. Due to the areas being utilised as agricultural grasslands they are categorised as being in poor condition.

9.7.29 One area of lowland fen was identified within Hollins Vale SBI. The site is located within the floodplain valley leading down to Hollins Brook and is overwhelmingly dominated by meadowsweet *Filipendula ulmaria* with frequent wild angelica *Angelica sylvestris*. Other species present include occasional common valerian *Valeriana officinalis* and marsh marigold *Caltha palustris*. Throughout the area Himalayan balsam was abundant and as such results in the area being categorised as being in poor condition.

9.7.30 A network of hedgerows surrounding/following agricultural fields, access roads and footpaths was present in the survey area. The composition of the hedgerows varied from predominately heavily managed species-poor hawthorn dominated, to species-rich hedgerows with trees comprising a mix of hawthorn, blackthorn, hazel, oak, sycamore, ash, and dog rose *Rosa canina*. There was a single native species-rich hedgerow present, which was in a good condition. The other hedgerows were in moderate or poor condition.

9.7.31 Within the survey area four named watercourses were identified. These were Hollins Brook, Whittle Brook, Castle Brook and Bradley Brook. One additional watercourse was subsequently identified on OS maps. Blackfish flows south from near to the south of the provisional Order Limits, through Heaton Park and into the River Irk to the south-east. The condition of watercourses where they are within the provisional Order Limits will be carried out by hydrogeomorphologists. Main rivers in the wider landscape are the River Irwell and the River Irk. Watercourses within the survey area largely flow into the River Irwell, with Blackfish flowing into the River Irk.

9.7.32 Hollins Brook flowed east to west and passes through Hollins Vale SBI 280m north of the provisional Order Limits. The watercourse was approximately 3m wide with an average water depth of 30cm. The substrate consisted predominately of pebble and rock with sand banks. Little aquatic vegetation was identified with banking vegetation comprising soft rush *Juncus effusus* and yellow flag iris.

9.7.33 Whittle Brook was located 440m to the north-east of the provisional Order Limits and joined Hollins Brook and Castle Brook at Pilsworth Cottages. The watercourse flowed in a south to north direction and was approximately 5m wide with an average water depth of 60cm.

9.7.34 Castle Brook was located 185m to the east of the provisional Order Limits within Pike Fold Golf Club and flowed in a south to north direction. The watercourse was heavily managed and had a silt and mud substrate. The water quality was poor and turbid within significantly managed banks.

9.7.35 Bradley Brook was located within the footprint of the provisional Order Limits and flowed south-west through Philips Park and North Wood SBI. The watercourse was approximately 4m wide with steep banks and a water level averaging 10-20cm. The banks were well vegetated and included several ancient woodland indicator species such as remote sedge, ramsons and wood anemone. Himalayan balsam was abundant along most of the watercourse with new stands of Japanese knotweed emerging.

9.7.36 Many ponds (40-50) containing eutrophic standing water were present across the survey area, however none were of a quality to be considered a priority habitat. The ponds may be GWDTE.

9.7.37 No peat dependent habitats were identified within the provisional order limits. The dominance of soft rush within some of the fields may be attributed to the presence of peat however the grassland habitats were overall not considered to be dependent on peat.

Protected and notable species – desk study

9.7.38 The desk study identified records for a range of protected and notable species within 2km of the provisional Order Limits. These include:

- Bats:
  - Brown long-eared bat *Plecotus auritus*
  - Common pipistrelle *Pipistrellus pipistrellus*
  - Daubenton's bat *Myotis daubentonii*
  - Natterer's bat *Myotis nattereri*
  - *Myotis species* (unspecified)
  - Noctule *Nyctalus noctula*
  - Soprano pipistrellus *Pipistrellus pygmaeus*
  - Whiskered/Brandt's bat *Myotis mystacinus/Myotis brandtii*
  - Unidentified pipistrelle species
- Badger
- Otter
- Birds, including Schedule 1 species:
  - Barn owl
  - Bittern *Botaurus stellaris*
  - Black-tailed godwit *Limosa limosa*
  - Common scoter *Melanitta nigra*
  - Hobby *Falco subbuteo*
  - Kingfisher *Alcedo atthis*
  - Little ringed plover *Charadrius dubius*
  - Peregrine falcon *Falco peregrinus*
  - Scaup *Aythya marila*
- Reptiles:
  - Slow worm *Anguis fragilis*
  - Common lizard *Zootoca vivipara*
- GCN
- Common toad *Bufo bufo*

- Brown hare *Lepus europaeus*
- Hedgehog *Erinaceus europaeus*
- Terrestrial invertebrates:
  - Knot grass moth *Acronicta rumicis*
  - Cinnabar moth *Tyria jacobaeae*
  - Common carpet *Epirrhoe alternata*

9.7.39 Additionally, a landowner reported sightings of water vole at a pond within Egypt Farm adjacent to the farm buildings (Grid Ref: SD83250640) during a GCN survey in April 2021. No additional signs of water vole were observed during field surveys undertaken at this pond.

Protected and notable species – surveys

Bats

9.7.40 Bat activity surveys undertaken in 2021 recorded a total of four bat species (common pipistrelle, soprano pipistrelle, noctule and brown long-eared). The results of the surveys identified bat activity across all surveyed locations around the Proposed Scheme, with a higher level of activity recorded in the woodland habitat present at the western side of the Proposed Scheme. The levels of bat activity were determined via the analysis of bat call data collected during a number of survey types including: activity transects, static automated detector surveys and vantage point surveys.

9.7.41 Surveys of trees with bat roost potential (BRP) did not record any roosts within the survey area. A total of 52 trees were identified within or directly adjacent to the survey area as displaying BRP. 11 trees had moderate BRP, 39 had low BRP, and the remaining two had negligible BRP. Surveys were a combination of climb and inspect and dusk emergence/dawn re-entry surveys.

9.7.42 Widespread, light-tolerant species (i.e., common pipistrelle and soprano pipistrelle) were the dominant bat species recorded based on results from transects, vantage point surveys and static bat detector data. This is likely due to the existing baseline of disturbance and light spill given the proximity to the existing road network.

9.7.43 Further ground level bat roost suitability assessments undertaken in February 2022 identified trees with moderate BRP on the motorway verges inside the provisional Order Limits. Further surveys are scheduled to inform the scope of any additional activity surveys required. These will include a dusk emergence/dawn re-entry and climb and inspect surveys.

Badger

9.7.44 Badger activity was recorded throughout the study area including setts, latrines, pathways and snuffle holes. Due to the sensitive nature of the data, sett locations are not detailed here. This information will be included within a technical report and shared with key stakeholders. Two main setts were recorded, and outlier setts and an incidental finding of a dead badger were recorded during other surveys undertaken.

Otter

9.7.45 No otter signs were recorded during the otter surveys undertaken in 2021. Otter prints were recorded incidentally during the UK Habitat Classification system survey on the bank of Hollins Brook, outside of the otter survey area. Hollins Brook passes beneath the M66 360m north of the provisional Order Limits.

Water vole

9.7.46 No signs of water vole were recorded during the initial water vole survey at any of the watercourses surveyed in 2021. Droppings and leaf piles were recorded but these did not have any of the characteristic features associated with water vole. No burrows were recorded. The droppings and leaf piles are therefore considered to have been created by other rodent species. Therefore, water vole is considered absent from the survey area and will not be discussed further in this assessment.

Other mammals

9.7.47 Brown hare, hedgehog and water shrew *Neomys fodiens* have been recorded within habitats to the north-east and north-west of the provisional Order Limits.

Breeding birds

9.7.48 Heaton Park Reservoir, which is an SBI designated for its population of birds, was found to support the Schedule 1 species goldeneye *Bucephala clangula*, black-necked grebe *Podiceps nigricollis* and little ringed plover *Charadrius dubius* as well as an assemblage of gulls, ducks and waders. No other Schedule 1 birds have been recorded during the surveys. Little ringed plover is thought be breeding within the grounds of the reservoir. Across the wider survey area, a number of red and amber listed species (as listed in the Birds of Conservation Concern (Eaton et al., 2015)) were recorded. These included house sparrow *Passer domesticus*, starling *Sturnus vulgaris*, fieldfare *Turdus pilaris*, redwing *Turdus iliacus*, song thrush *Turdus philomelos*, lapwing *Vanellus vanellus*, oystercatcher *Haematopus ostralegus* and snipe *Gallinago gallinago*.

Wintering birds

9.7.49 There is one non-statutory site designated for birds located 400m south of the Proposed Scheme: Heaton Park (East and West) SBI. The site is designated for its wintering wildfowl, it is one of the most important sites in Greater Manchester for goldeneye *Bucephala clangula* and one of the most important wintering roost sites in Greater Manchester for Goosander *Mergus merganser*. The site is also important for wintering tufted duck *Aythya fuligula*, teal *Anas crecca*, little grebe *Tachybaptus ruficollis*, great crested grebe *Podiceps cristatus* and coot *Fulica atra*.

9.7.50 In total, 68 bird species were recorded within the survey area. The most notable field records included relatively large numbers of lapwing, herring gull *Larus argentatus*, lesser black-backed gull *Larus fuscus* and redwing *Turdus iliacus*. The bird species using the survey area in relatively large numbers were not considered to be solely reliant on habitats within the survey area or the scheme footprint. In general, the number of birds recorded for each species were not considered to represent a significant proportion of the UK population and / or were considered to be using the survey area on an occasional and transitory basis.

9.7.51 Herring gull and lesser black-backed gull wintering bird populations associated with the survey area are considered to be significant at the County Level. With regards to the other species, none of the records are significantly high in relation to their known populations at a UK level (Musgrove et al., 2013) or in the context of what would be expected on similar habitats in the local area.

Reptiles

9.7.52 No reptiles have been recorded during any of the surveys carried out to date. Therefore, reptiles are considered likely absent from the survey area and will not be discussed further in this assessment.

GCN

9.7.53 A total of 42 ponds were scoped in for further survey following HSI assessment (Figure 9.4).

9.7.54 During the first presence/absence eight of these were found to have dried up and could not be surveyed. One additional pond was reassessed due to the presence of a large population of fish and was scoped out and another pond could not be surveyed due to access issues.

9.7.55 Four of the remaining 32 ponds were subject to eDNA survey due to health and safety concerns that arose after the first presence/absence survey. No further presence/ absence survey were carried out on these first ponds after the first visit. Three of the four ponds subject to eDNA survey returned a negative result for GCN eDNA, indicating that GCN were not present within these ponds. The fourth pond returned an inconclusive result. An inconclusive result meant that no GCN DNA was detected in the sample, but the internal controls failed to amplify as expected. This means that any GCN DNA in the sample might also have failed to amplify properly. Inconclusive results can be caused by the degradation of the DNA (when the DNA marker contained in the ethanol in the kits fails to amplify) or by inhibition of the reaction (when the marker added in the lab fails to amplify) caused by certain chemicals or organic compounds that may be present in the water sample. The pond with the inconclusive result was located within the same field as two of the ponds with negative results and had very similar characteristics as these ponds. The pond was shallow, located in a grazed field, was poached by livestock and lacked aquatic vegetation. Based on the similarity of the pond to the two in the same field that returned a negative result, it is considered highly unlikely that GCN are present within this waterbody. Additional surveys to confirm this are not currently planned as survey data is not required to be able to obtain a District Level Licence (DLL).

9.7.56 GCN were recorded within 13 ponds surveyed. These ponds were located to the north-east of M60 J18 in Pike Fold Golf Course and in ponds located along Egypt Lane. The closest pond with GCN confirmed present was located 20m north-east of the provisional Order Limits.

Other amphibians

9.7.57 Smooth newt *Lissotriton vulgaris* were recorded within 21 of the ponds surveyed for GCN. Palmate newts *Lissotriton helveticus* were recorded in six of the ponds surveyed. Common frog *Rana temporaria* was also recorded during GCN surveys, and nine ponds

had newts that could not be differentiated between smooth or palmate recorded. Common toad *Bufo bufo* were recorded during reptile surveys underneath reptile mats placed within fields around Egypt Lane to the north-east of M60 J18.

Terrestrial invertebrates

9.7.58 Terrestrial invertebrate surveys were undertaken in the lowland deciduous woodland of Philips Park that is within and adjacent to the provisional Order Limits, and within the other neutral grassland dominated by rushes along Egypt Lane on areas of habitat within the provisional Order Limits. The invertebrate survey location within Philips Park identified species which are generally widespread and typical of the habitats present on site. From the current results, the survey location interest lies with species diversity within open habitats such as the woodland glades, and potentially the sand banks present throughout the site. Further surveys are recommended with specialist input to ascertain a reliable reflection of the woodlands value to invertebrates. Given the diverse age structure and habitat mosaics present throughout the survey location (deadwood/fungi, open glades, streams, bare ground), the survey location is likely of high value for invertebrates in the local area.

9.7.59 The survey location along Egypt Lane identified species that are generally widespread and typical of the habitats present on site. The survey location interest lies with species diversity rather than species rarity, particularly those associated with open grassland habitats such as tall ruderal vegetation. When considering the mosaic of habitats together, overall, the site is of moderate value to a wide range of commonly occurring invertebrates.

Aquatic invertebrates

9.7.60 No aquatic invertebrate surveys have been undertaken. A review of desk-based information and existing habitat survey data to determine sensitive features (i.e., watercourses or waterbodies) that would be impacted by the Proposed Scheme was undertaken. Based on this review, and the assumption that the Proposed Scheme would utilize existing culverts, there would be no predicted significant direct impacts on suitable features (watercourses or waterbodies) or aquatic invertebrates. Although there may be adverse effects through water quality changes and pollution of watercourses. This is considered further in Tables 9.6 and 9.7.

Invasive species

9.7.61 Invasive species Japanese knotweed *Rhododendron ponticum*, Nuttall's waterweed *Elodea nuttallii* and variegated yellow archangel *Lamiastrum galeobdolon*, and Himalayan balsam have been recorded within the provisional Order Limits.

White-clawed crayfish

9.7.62 No watercourses within the study area were suitable for white-clawed crayfish having muddy substrates. White-clawed crayfish are therefore scoped out of this assessment.

Future baseline

9.7.63 Increasing development and housing in the area is likely to put more pressure on the remaining natural habitats which may affect the local population and distribution of species and alter habitats present around the provisional Order Limits. It is likely that

some areas of grassland used recreationally and for agriculture will remain but may become increasingly fragmented as infill housing development and large-scale housing developments occur in the area.

9.7.64 Any effect from climate change would be unlikely to significantly alter the land use, and therefore the habitats, prior to construction of the Proposed Scheme. Long term impacts from climate change could alter the species composition and types of habitats in and around the site, and therefore types and diversity of fauna. However, it is not anticipated that the combined impact of the Proposed Scheme and climate change would be any different to the impact of climate change in isolation (i.e. without the Proposed Scheme) as the habitats that will be created as part of mitigation proposals will be the same types as those found in the local area at the current time.

Value / sensitivity of receptors

9.7.65 The value/sensitivity of receptors within the study area is shown in Table 9.5.

Table 9.5: Value/sensitivity of receptors

Value/ sensitivity	Features within the study area	Justification
Designated sites and habitats		
International or European	Rochdale Canal SAC	European site within 200m of PCF Stage 2 ARN
UK or National	• Rochdale Canal SSSI • Five Ancient Woodland Inventory sites: - Philips Wood - Mere Clough - Clifton Wood - North Wood - Prestwich Clough Wood • Priority habitats: - Lowland deciduous woodland - Lowland acid grassland - Lowland fen - Native hedgerow	• SSSI are considered to be of UK or national importance • Irreplaceable habitat • Has been selected as nationally important through expert consensus according to national criteria
Regional	No features present within the study area at this level of importance	N/A

Value/ sensitivity	Features within the study area	Justification
County	• Seven LNRs: - Philips Park LNR - Hollins Vale LNR - Mere Clough LNR - Blackley Forest LNR - Chapelfield LNR - Clifton Country Park LNR - Alkrington Woods LNR • 18 SBIs - Philips Park and North Wood SBI - Hollins Plantation SBI - Hazlitt Wood SBI - Hollins Vale SBI - Heaton Park Reservoir (East) SBI - Heaton Reservoir (West) SBI - Pilsworth SBI - Parr Brook SBI - Prestwich Clough SBI - Ringley Woods SBI - Rhodes Farm Sewage Works SBI - Boardman Brook SBI - Alkrington Woods and Rhodes Lodges SBI - Clifton Country Park SBI - Clifton Moss (South) SBI - Rochdale Canal (Scowcroft to Warland) SBI - Rochdale Canal – Lock at Scowcroft Farm to Stott's Lane SBI - Sudden Brook (West) SBI	Wildlife / nature conservation sites designated at a county (or equivalent) level
	• Eutrophic standing water • Acid grassland • Lowland fen • Hedgerows • Broadleaved woodland	Areas of habitats identified in county or equivalent authority plans or strategies
Local	Non-priority habitats: • Other broadleaved woodland • Mixed scrub and bramble scrub • Other neutral grassland • Other rivers • Streams	Not priority habitats or not high-quality examples of their types, but provide benefits to wildlife and have intrinsic biodiversity value

Value/ sensitivity	Features within the study area	Justification
Less than local	Non-priority habitats: • Modified grassland • Non-cereal cropland	Not priority habitats and of limited biodiversity value
Species		
International or European	No features present within the study area at this level of importance	N/a
UK or National	No features present within the study area at this level of importance	N/a
Up to regional	Bat species	Potential for a presence of a breeding roost of a regionally importance bat species to be present
County	Breeding bird assemblage and wintering bird assemblage in habitats around the provisional Order Limits. Little ringed plover recorded at the Heaton Reservoir SBI	A locally designated site for its bird population is present in the area. Habitats around the provisional Order Limits could support a population of species that could be important at a UK level at a critical phase in its life cycle (breeding or over-wintering)
	Great crested newts	A population of breeding GCN, a European Protected species is present at a critical phase in its life cycle
	Brown hare	Populations / communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange
	Hedgehog	
	Common toad	
Up to county	Terrestrial invertebrates	A species of national importance may be present within the area and may be at a critical phase of its life cycle
Local	Otter	No evidence of otter within the provisional Order Limits but there was evidence of an otter population present in the wider area that may utilise resources within the provisional Order Limits occasionally
	Badger	Populations / communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange
	Water shrew	Populations / communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange
Up to local	Water vole	A population of water vole may be present however currently no water vole signs have been recorded and the watercourses within the survey area were sub-optimal for water vole with limited depth of water. The local authority has a biodiversity action plan for the species

Value/ sensitivity	Features within the study area	Justification
	Aquatic invertebrate	An assemblage of aquatic invertebrate may be present in streams and ponds around the Proposed Scheme that may be considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange
	Notable vascular plants: • Marsh orchid *Dactylorhiza* sp.	Populations / communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange.

9.8 Potential impacts

Construction

9.8.1 The Proposed Scheme would require the temporary and permanent loss of terrestrial habitats, including priority habitats, and habitats likely to be used by or to support protected and notable species.

9.8.2 Construction could potentially lead to the loss of features directly used by protected and notable species for shelter, including badger setts, bat roosts and terrestrial habitat used by GCN, breeding and wintering birds, invertebrates, brown hare, common toad, and water shrew.

9.8.3 Habitat fragmentation would potentially result from the severance of linear habitat features such as hedgerows and lines of trees. This could potentially affect protected or notable species that rely upon such habitats for foraging, commuting, or dispersing.

9.8.4 During the construction phase, the following activities could potentially result in mortality and injury of species receptors: site clearance, earthworks, and other temporary works e.g. entrapment in excavations. Significant effects could arise if protected or notable species are present within the footprint of the provisional Order Limits, especially if they could not avoid the works.

9.8.5 Disturbance to important receptors could result from changes in noise, light, vibration, or visual stimuli. During construction, disturbance could arise from the following activities: fencing, earthworks, compound set up, construction, and reinstatement.

9.8.6 Air quality changes could occur through dust and changes in pollutant levels caused by emissions from construction plant and machinery, with resulting effects on sensitive habitats. Chapter 6: Air Quality provides additional detail on air quality. Modelling assessment is required to assess the impact of nitrogen oxide (NO_x) deposition on sensitive habitats; this is described in Chapter 6. See Chapter 16: Assessment of cumulative effects for the ZOI for air quality impacts.

9.8.7 There is potential for hydrological changes to cause significant effects during construction where works would directly or indirectly affect watercourses. Hydrological changes are detailed in Chapter 14: Road Drainage and the Water Environment; and include changes to both water quality and quantity within nearby watercourses and

GWDTE. Changes in hydrology, fluvial geomorphology and hydrogeology are important to terrestrial and freshwater ecology due to the following factors:

- Water quality has an important role in structuring the flora and fauna communities in watercourses, ponds and wetlands
- Sediment and other pollutant releases have the potential to adversely affect sensitive ecological receptors
- Ecological receptors can be sensitive to alterations of runoff regimes changing the quality of surface and groundwater

9.8.8 Any introduction or spread of INNS could potentially cause significant adverse effects to sensitive habitats. This is because of the dominance that these species can have over native species. During the construction works, topsoil and subsoil potentially containing plant INNS would be disturbed. Such soil or seed and 'propagules' could be spread during construction activities, including excavation and machinery movements. Works within water can also introduce and spread animal INNS.

Operation

9.8.9 Mortality in the operation phase relates to the fact that animals may be attempting to cross a wide road, used by fast traffic, which bisects the landscape. Unlike the risk of construction direct mortality, which is of a temporary nature, the risk of direct morality through operation of the Proposed Scheme is effectively permanent.

9.8.10 Sources of disturbance in the operational phase relate to road noise and lighting. Noise has the potential to impact upon receptors, potentially reducing the suitability of habitat close to the road, and therefore reducing the habitat available to receptors in the vicinity of the site.

9.8.11 Impacts from operational road lighting may occur. The effects of road lighting are complex but include disturbance and roost abandonment; habitat severance, loss of foraging habitats for light-shy species due to light-spill; a decline in prey availability, and potential to increase traffic collisions by altering foraging behaviour. Habitats where the impact of lighting can be particularly severe include along river corridors, woodland edges, and hedgerows.

9.8.12 The key receptors that may be sensitive to changes in vehicle emissions are sensitive priority habitats and ancient woodland habitats, and any species that depend on this. Chapter 6: Air Quality provides additional detail on air quality. Modelling assessment is required to assess the impact of nitrogen oxide (NO_x) deposition on sensitive habitats. The DMRB standard requires that designated sites within 200m of the ARN need to be considered during air quality assessments. The air quality assessment currently includes one SAC, one SSSI, four AW sites, five LNRs and 11 SBIs within 200m of the ARN (Figure 9.1). This is described in Chapter 6: Air Quality.

9.8.13 Operational effects to watercourses are possible in relation to surface water road drainage and unexpected pollution events. The Water Framework Directive (WFD) Regulations Assessment will aim to determine the effects of the Proposed Scheme on ecological quality, identifying any potential impacts that could cause deterioration in the assigned status of a water body or prevent a water body from meeting its WFD objectives. WFD assessment is covered in Chapter 14: Road Drainage and the Water Environment.

9.9 Design, mitigation, and enhancement measures

Embedded (design) mitigation

9.9.1 The Environment Team is working in close collaboration with the Infrastructure Design Team to avoid or prevent environmental impacts through the Proposed Scheme design. This is referred to as embedded (or design) mitigation in DMRB LA 104 (paragraph 3.24).

9.9.2 Chapter 3: Assessment of Alternatives details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision-making process.

9.9.3 In addition, the design of the Proposed Scheme has taken into account the locations of valuable and priority habitats including important connective habitats (i.e. hedgerows, watercourses and tree lines) and the locations of protected species. Where practicable the design has been modified to avoid impacts to these features.

9.9.4 Attenuation ponds will be provided to mitigate for flood risk and enable road runoff to be treated prior to discharge into receiving watercourses, mitigating pollution of surface water. These have been designed to mimic natural water bodies where possible by providing varying depths including shallow margins, native wetland plant species and macrophytes, and will be surrounded by wildflower and grassland areas seeded from an appropriate species-rich seed mix.

9.9.5 Groundwater pollution will be mitigated by lining ponds situated on permeable strata to prevent road runoff discharging into the ground and groundwater.

9.9.6 The Proposed Scheme preliminary design has been influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the Proposed Scheme description and Chapter 3: Assessment of alternatives.

Essential mitigation

9.9.7 Essential mitigation is measures that are required to reduce and if possible offset likely significant adverse effects. Best practice mitigation would occur as a matter of course due to legislative requirements or standard sector practices. Examples of best practice mitigation for this aspect include the following:

- Landscape planting has been designed to reduce visual and lighting impacts to habitats, and species, and in general to provide guide planting where possible to maintain connectivity and encourage use of new/existing crossing structures (Figure 2.2).
- The design of linear habitats such as hedgerows and lines of trees aims to increase connectivity along the provisional Order Limits, linking with retained woodland and hedgerows where possible.
- Fencing will be incorporated within the Proposed Scheme where necessary (and where this would not conflict with requirements for other species and with road user safety) to minimise the risk of wildlife road casualties.

- Works would be timed to avoid sensitive periods for protected species where possible, for example: timing works to avoid impacts to bat roosts (i.e. avoiding works in proximity to a maternity roost within of the maternity period); avoiding night working near sensitive features such as badger setts, bat roosts and watercourses; and avoiding removal or disturbance of any nesting bird habitat during bird breeding season (generally between 1 March and 31 August).
- Clearance of habitats within the construction area under ecological supervision where there is potential for impacts to protected species, for example, where bird nesting habitat would be removed in the bird breeding season, a suitably competent person would check vegetation and habitats no more than 24 hours prior to work occurring. Any vegetation and habitats found to contain active nests would not be removed or disturbed until the young birds have fledged and the nest is no longer active.
- Clear demarcation of construction areas, compounds and material storage in order to avoid encroachment onto surrounding habitats; and avoiding the creation of features which could attract wildlife into works areas, for example large stockpiles of earth in areas of known badger activity to prevent the excavation of new setts.
- Leaving important commuting features such as mammal pathways clear of obstruction and raising temporary fencing slightly off the ground (150mm) or providing gaps at regular intervals to allow wildlife to move freely throughout their normal territories where appropriate.
- Any trenches, trial pits and excavations would be covered overnight or fenced off to prevent animals falling in and becoming trapped. Where excavations would not be able to be closed or filled on a nightly basis, a means of escape would be provided.
- Implementing appropriate buffer zones and stand-off distances from sensitive features such as confirmed bat roosts, badger setts, or birds' nests and watercourses, to be demarcated using physical barriers such as Heras fencing to prevent encroachment of works.
- Control of lighting at night near to light-sensitive features such as watercourses where otters and fish species, badger setts, and bat roosts and commuting habitats are present. Temporary and permanent lighting would be designed to avoid light spill on important bat foraging habitats, which could reduce foraging resource through disturbance in accordance with best practice guidance (Bat Conservation Trust, 2018).
- Control of noise and vibration from construction and operation of the Proposed Scheme using noise barriers or landscaping, for example bunding, around sensitive features such as confirmed bat roosts, badger setts, barn owl nests and watercourses.
- Implementation of the Invasive Species Management Plan (ISMP) to control and prevent the spread of INNS.
- General protective and control measures to be detailed in the 2nd Iteration of the Environmental Management Plans (EMP), risk assessments and method statements during the construction phase.
- Water pollution would be avoided through standard mitigation measures to be detailed in the 2nd Iteration of the EMP (see Chapter 14: Road drainage and the water environment, for more information).

- Construction Industry Research Information Association (CIRIA) guidance would be adopted as good practice (see Chapter 14 for more information).

9.9.8 Essential mitigation will be prepared for the Environmental Statement and included in the 1st iteration of the EMP which will be included in the DCO submission (Chapter 5: Environmental assessment methodology).

Habitat

9.9.9 The Proposed Scheme, as part of the wider Highways England Delivery Plan (2020f), would aim to achieve no net loss of biodiversity (with an aspiration to provide a net gain), in line with the requirements of the National Planning Policy Framework (paragraph 174) and NPS NN (paragraph 5.33 and 5.36).

9.9.10 Calculations to determine the exact areas and extent of habitats post-construction are ongoing, however one of the general aspirations of the Proposed Scheme is to create net gains to biodiversity, and in principle, where habitats are lost as a result of the Proposed Scheme, new habitats of equal or greater value will be created.

9.9.11 This includes the creation of wildflower and grassland areas around drainage ponds and on embankments, seeded from an appropriate species-rich seed mix, as well as the planting of new trees and woodland and species-rich hedgerows and scrub comprising locally native tree, shrub and herbaceous species of local provenance. Where practicable, hedgerows will be planted at a ratio of 2:1 in relation to those lost, and planting has been designed to maintain and increase connectivity around the Proposed Scheme and within the wider landscape. Indicative landscaping is shown on Figure 2.2.

Great crested newts

9.9.12 Based on current the current design the Proposed Scheme would affect GCN terrestrial habitat only. A DLL application would be submitted to allow works to be undertaken within proximity of GCN breeding ponds. This process moves mitigation from a site-based focus to a wider county or district-level. The Proposed Scheme would fund the creation of breeding ponds and terrestrial habitat for GCN to mitigate the loss of habitats with the aim of connecting and expanding existing GCN populations at a landscape scale rather than just within the Proposed Scheme. These compensatory habitats for GCN are delivered offsite so that the conservation status of GCN in the region is maintained. Pond and habitat creation would be delivered by Natural England and its delivery partners. Mitigation ponds would be created in advance of construction of the Proposed Scheme.

Bats

9.9.13 Owing to their legal status, a Natural England European Protected Species (EPS) licence would be required to destroy or disturb any bat roost. All EPS licences required would be applied for following the grant of the DCO, with mitigation work, such as the provision of replacement roosting habitat, preceding the works where necessary. The EPSM licence applications would provide details of the works proposed (including programme), replacement roost creation, and the working methods to ensure avoidance of harm to bats and any additional survey and monitoring work that would be undertaken as part of each EPSM licence as described in more detail below.

9.9.14 Where impacts to a roost from noise and vibration are unavoidable and likely to cause disturbance, a suitable EPSM licence will be sought from Natural England.

9.9.15 Landscaping and habitat planting will be designed to increase connectivity across the landscape and avoid fragmentation of foraging and commuting habitats. A particular focus has been applied within the Preliminary Environmental Design (Figure 2.2) to areas of the Proposed Scheme that directly impact or are adjacent to important habitats (including designated/protected sites). This is notable in the environmental design proposals in the following areas: areas of reinstated woodland/tree planting around Philips Park to link habitats north and south of the M60, environmental mitigation areas north of Heaton Park linking the park with the wider landscape and environmental mitigation areas adjacent to Castle Brook linking the proposals with Pike Fold Golf Course and the wider landscape.

9.9.16 Impacts to important bat foraging and commuting habitats, such as woodlands, hedgerows and watercourses, would be avoided in the first instance.

9.9.17 Where this cannot be avoided, habitat lost as a result of the Proposed Scheme would be mitigated by the provision of newly created habitat especially within environmental mitigation areas shown on Figure 2.2. This would be designed so that connectivity across the Proposed Scheme is maintained with the wider landscape.

9.9.18 Across the environmental design proposals creation of new habitat within landscaping and mitigation areas would be designed to enhance bat foraging, for example through the provision of native flowering trees and shrubs which would attract invertebrate prey species.

Badger

9.9.19 Construction of the Proposed Scheme would result in damage to or destruction of one sett. A Natural England ghost licence would be sought as part of the DCO application for the closure of the sett. Usage of setts can be highly changeable, and badgers are able to quickly colonise new areas. Pre-construction surveys would be undertaken to confirm the status of all setts and identify any new setts prior to start of works.

9.9.20 Exclusion of badger setts would follow standard procedures under licence and overseen by a suitably experienced ecologist.

Otter

9.9.21 Construction of the Proposed Scheme may result in direct mortality of otter due to construction traffic in proximity to suitable habitat around Castle Brook. In addition, loss of suitable otter habitat through water quality changes due to pollution of watercourses as a result of construction activities may occur. These impacts would be addressed through best practice construction measures as described in the essential mitigation section of this report. Especially measures to implement appropriate buffer zones and stand-off distances from sensitive features such as watercourses and water pollution avoidance measures that would be detailed in the 2nd Iteration of the EMP (see details within Chapter 14: Road drainage and the water environment, for more information).

9.9.22 Impacts on otter foraging or commuting habitat through disturbance from noise, vibration, and lighting would be addressed through best practice construction measures as previously detailed in the essential mitigation section of this report. Especially

measures to implement the avoidance of lighting/light spill at night near to light-sensitive features such as watercourses and the appropriate use of noise barriers or landscaping, for example bunding, around sensitive features such as watercourses.

Other mammals

9.9.23 No additional mitigation for other mammals species is recommended. Measures included in the embedded (design) mitigation and essential mitigation for the Proposed Scheme such as sensitive construction methodologies, the proposed landscaping and habitat planting design and the implementation of the EMP will also protect small mammal species.

Other amphibians

9.9.24 No additional mitigation for other amphibian species is recommended. Measures included in the embedded (design) mitigation and essential mitigation for the Proposed Scheme, such as sensitive construction methodologies, the proposed landscaping and habitat planting design and the implementation of the EMP, will also protect amphibian species.

9.9.25 Should other amphibian species be discovered during vegetation clearance, they would be removed to suitable terrestrial habitat outside of the working area by a suitably experienced ecologist.

Terrestrial invertebrates

9.9.26 Measures to mitigate impacts on invertebrate assemblages would comprise the following:

- Felled vegetation and dead timber would be retained and made into habitat piles within retained vegetation and proposed landscaping and mitigation areas under direction of a suitably experienced ecologist. The exact number and location of habitat piles would be identified ahead of the DCO submission and included within the 1st iteration of the EMP.
- Mitigation areas, as well as broader landscaping, will be designed with benefits to invertebrates in mind. Designs may include the creation of new wildflower and grassland areas seeded from a species-rich seed mix, new ponds and ditches, trees and woodland, species-rich hedgerows and scrub comprising native tree, shrub and herbaceous species of local provenance.
- Planting of new habitats will be designed in line with preferences of notable invertebrate species, for example the provision of grasses such as fescues *Festuca* sp., meadow-grasses *Poa* sp., and bents *Agrostis* sp. which are the favoured food plants of small heath butterfly caterpillars.

Aquatic species

9.9.27 Appropriate stand-off distances would be implemented around watercourses where suitable, using physical barriers during construction works to protect aquatic plant and invertebrate species from destruction and disturbance.

Enhancement

9.9.28 Options for enhancements for biodiversity are being investigated and may include the following:

- A net gain of new habitats within landscape and mitigation areas, including new wildflower and grassland areas seeded from a species-rich seed mix, as well as trees and woodland and species-rich hedgerows and scrub comprising native tree, shrub and herbaceous species of local provenance.
- Provision of bat roosting boxes (over and above any that may be required for mitigating roost losses) suitable for supporting roosts of various species ranging from summer roosts for low numbers of non-breeding male crevice-dwelling species (i.e. common pipistrelle) to larger boxes suitable for maternity roosts and hibernation boxes. Bat boxes would be made of woodcrete which is hard wearing and long lasting (20-25 years). These would be installed within retained vegetation, for example attached to tall trees, or to new or existing buildings or structures, or installed on free-standing posts as appropriate.
- Provision of bird nesting boxes (over and above the numbers required for mitigating habitat losses) suitable for a variety of species including cavity nesting species with entrance holes of different sizes, open-fronted boxes, and larger boxes to accommodate birds of prey.
- Creation of habitat piles and hibernacula from felled vegetation and dead wood, would be installed within retained habitat and designated landscaping and mitigation areas.

9.9.29 Enhancements will be discussed and agreed with stakeholders. It may be possible to make use of Designated Funds to deliver additional enhancements, however these would be delivered through discrete projects outside of the Proposed Scheme (i.e. not included in the DCO application).

9.10 Assessment of likely significant effects

9.10.1 The likely significance of each effect during construction and operation is assessed in Table 9.6 and Table 9.7 respectively. All effects have been qualitatively assessed based on the application of professional judgement to the DMRB LA 108 significance criteria.

9.10.2 Where effects have been identified, these have been reduced where practicable by implementing the mitigation measures outlined in Section 9.9 and by ensuring that the construction of the Proposed Scheme responds to the national regulatory or policy standards and local policy requirements relevant to this aspect. While the tables below set out the significance of individual impacts, consideration has been given to in-combination effects when assessing the impact on receptors.

Construction

9.10.3 Table 9.6 provides an assessment of likely significant effects on biodiversity receptors during construction.

9.10.4 As it has not been confirmed that it will be possible to avoid impacts to the ancient woodland in Philips Park during construction, there is potential for a **moderate adverse**

significant residual effect due to the potential loss of ancient woodland. This assessment assumes that there is no current direct loss of ancient woodland anticipated at this time, however proposed works to install a new culvert are close to (i.e., within 15m), but not within, the ancient woodland site itself (as shown on Figure 2.3 which shows temporary working areas for the Proposed Scheme). The ancient woodland site itself is within the provisional Order Limits as access may be required to implement protection measures for the woodland itself and/or to gain access to the watercourse for water monitoring and silt protection. Therefore, potential impacts cannot be ruled out at this stage. In addition, the extent of Philips Park Ancient Woodland site that is within the provisional Order Limits (0.03ha) represents 0.8% of the ancient woodland site as a whole. Loss of this small area of woodland would not fragment the woodland nor adversely affect its functionality.

9.10.5 Policies detailed within the NPS NN and the National Planning Policy Framework (NPPF) state that development consent for any development that would result in the loss or deterioration of irreplaceable habitats including ancient woodland should not be granted unless the national need for and benefits of the development, in that location, clearly outweigh the loss. At this stage the proposed temporary works detailed above are not anticipated to result in loss or deterioration of ancient woodland habitat. An Arboricultural Impact Assessment is currently being developed for the Proposed Scheme and will be available for the Environmental Statement. Arboricultural mitigation measures intended to avoid, reduce or prevent impacts will be outlined in the Environmental Statement.

9.10.6 **Slight adverse residual effects** from construction phase impacts also remain for the following receptors:

- Alkrington Woods LNR
- Clifton Country Park LNR/SBI
- Clifton Moss (South) - Ancient Woodland
- Clifton Wood - Ancient Woodland
- Hollins Plantation SBI
- Hollins Vale LNR/SBI
- Philips Park LNR/SBI
- Priority habitats - lowland deciduous woodland
- Rhodes Farm Sewage Works SBI
- Ringley Woods (East) SBI
- Rochdale Canal (Scowcroft to Warland) SBI

9.10.7 The majority of these impacts result from current uncertainty around changes in air quality and hydrological impacts during construction. Ongoing surveys and further work will be carried out to understand these potential effects in the Environmental Statement.

Table 9.6: Assessment of likely significant effects during construction

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
Rochdale Canal SAC (NGR SD 88273 09861)	International	Air quality changes – dust	The Rochdale Canal SAC is over 5km from the provisional Order Limits. DMRB LA105 – Air Quality states that only sites within 200m of construction activity could be impacted by construction dust. Therefore, air quality impacts from dust are scoped out on this site	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	The Rochdale Canal SAC is within 200m of the ARN. Currently there is no anticipated likely significant effects through air quality changes or nitrogen deposition	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There is no hydrological link between the watercourses on or around the provisional Order Limits and the Rochdale Canal, therefore no impacts from hydrological and water quality changes are expected. It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	Best practice pollution prevention measures	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated.	Scoped out	NA	N/A	N/A	N/A
Rochdale Canal SSSI (NGR SD 88273 09861)	National	Air quality changes – dust	The Rochdale Canal SSSI is over 5km from the provisional Order Limits. DMRB LA105 – Air Quality states that only sites within 200m of construction activity could be impacted by construction dust. Therefore, air quality impacts from dust are scoped out on this site	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	The Rochdale Canal SSSI is within 200m of the ARN. Currently there is no anticipated likely significant effects through air quality changes or nitrogen deposition	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There is no hydrological link between the watercourses on or around the provisional Order Limits and the Rochdale Canal, therefore no impacts from hydrological and water quality changes are expected. It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site.	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated.	Scoped out	N/A	N/A	N/A	N/A
Philips Park Ancient Woodland site (NGR SD 80495 04532)	National	Air quality changes – dust	Construction of the Proposed Scheme within 200m of the site could lead to dust produced during the construction period impacting vegetation within the site through impeding plants biological functions including gas exchange and photosynthesis. Dust may also alter soil pH which may impact certain species ability to survive and reproduce. Some effects from dust would however be temporary as natural rainfall will clean dust from plants leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Air quality changes – construction traffic	Philips Park Ancient Woodland site is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Hydrological and water quality changes to surface and groundwater	Bradley Brook flows north-south underneath the Proposed Scheme and there may be a pathway for impacts through water quality changes to the habitats within the ancient woodland	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Loss of habitat	Approximately 0.03 hectares of the ancient woodland site is within the provisional Order Limits. There is potential for loss of a small area of this ancient woodland to enable access to install a new culvert. These works are close to (i.e., within 15m), but not within, the ancient woodland site itself (as shown on Figure 2.3 which shows temporary working areas for the Proposed Scheme). The ancient woodland site itself is within the provisional Order Limits as access may be required to implement protection measures for the woodland itself and/or to gain access to the watercourse for water monitoring and silt protection.. Therefore potential impacts cannot be ruled out at this stage. The 0.03ha that is within the provisional Order Limits represents 0.8% of the ancient woodland site as a whole. Loss of this area of woodland will not fragment the woodland nor affects its functionality In addition, the area of woodland that will be lost is small in extent and is a poor condition due to the presence of invasive species. Policies detailed within the NPPS NN and the National Planning Policy Framework (NPPF) state that development consent for any development that would result in the loss or deterioration of irreplaceable habitats including ancient woodland should not be granted unless the national need for and benefits of the development, in that location, clearly outweigh the loss. At this stage the proposed temporary works detailed above are not anticipated to result in loss or deterioration of ancient woodland habitat. An Arboricultural Impact Assessment is currently being developed for the Proposed Scheme and will be available for the Environmental Statement. Arboricultural mitigation measures intended to avoid, reduce or prevent impacts will be outlined in the Environmental Statement and in the 2nd iteration of the EMP.	Scoped in	Design will attempt to avoid any impacts to ancient woodland. Where ancient woodland is lost a specific mitigation and management plan will be designed and implemented. The mitigation and management plan will be confirmed once the precise area of loss is known and the mitigation strategy will be confirmed with Natural England. Although the area of habitat lost is small and is in poor condition woodland takes many years to re-establish and ancient woodland is considered irreplaceable therefore residual effects remain	Moderate - adverse	Permanent	Moderate
		Spread of INNS	Japanese knotweed and Himalayan balsam is present in the area and may be spread by construction activities	Scoped in	Invasive species management plan	No change	N/A	Neutral
Philips Park LNR (NGR SD 80495 04532)	County	Air quality changes – dust	Construction of the Proposed Scheme within 200m of the site could lead to dust produced during the construction period impacting vegetation within the site through impeding plants biological functions including gas exchange and photosynthesis. Dust may also alter soil pH which may impact certain species ability to survive and reproduce. Impacts on the woodland would be temporary as natural rainfall will wash dust from the leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Air quality changes – construction traffic	Philips Park LNR is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Hydrological and water quality changes to surface and groundwater	Bradley Brook flows north-south underneath the Proposed Scheme and there may be a pathway for impacts through water quality changes to the habitats within the LNR	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Loss of habitat	Approximately 0.27 hectares of the LNR is within the provisional Order Limits and therefore habitat may be lost. The habitat within this area of the LNR is broadleaved semi-natural woodland in a poor condition. The area of habitat that is within the provisional Order Limits and may be lost is 0.03% of the total LNR area. Loss of this area of woodland will not fragment woodland within the wider LNR nor affect its functionality	Scoped in	Replacement woodland planting within the area where it has been lost will be undertaken. Woodland takes time to establish and therefore there will be a residual effect. A habitat management plan will also be created and implemented	Negligible adverse	Permanent	Slight
		Spread of INNS	Japanese knotweed and Himalayan balsam is present in the area and may be spread by construction activities	Scoped in	Invasive species management plan.	No change	Permanent	Neutral
Philips Park and North Wood SBI (NGR SD 80495 04532)	County	Air quality changes – dust	Construction of the Proposed Scheme within 200m of the site could lead to dust produced during the construction period impacting vegetation within the site through impeding plants biological functions including gas exchange and photosynthesis. Dust may also alter soil pH which may impact certain species ability to survive and reproduce. Impacts on the woodland would be temporary as natural rainfall will wash dust from the leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution prevention measures.	No change	N/A	Neutral
		Air quality changes – construction traffic	Philips Park and North Wood SBI is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Bradley Brook flows north-south underneath the Proposed Scheme and there may be a pathway for impacts through water quality changes to the habitats within the SBI	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Loss of habitat	Approximately 0.27 hectares of the woodland within the SBI is within the provisional Order Limits and therefore may be lost. The habitat within this area of the SBI is broadleaved semi-natural woodland in a poor condition. The area of habitat that is within the provisional Order Limits and may be lost is 0.04% of the total SBI area. Loss of this area of woodland will not fragment woodland within the wider SBI nor affect its functionality	Scoped in	Replacement woodland planting within the area where it has been lost will be undertaken. Woodland takes time to establish and therefore there will be a residual effect.	Negligible adverse	Permanent	Slight
		Spread of INNS	Japanese knotweed and Himalayan balsam are present in the area and may be spread by construction activities	Scoped in	Invasive species management plan	No change	N/A	Neutral
Mere Clough Ancient Woodland site (NGR SD 80467 04382)	National	Air quality changes – dust	Construction of the Proposed Scheme within 200m of the site could lead to dust produced during the construction period impacting vegetation within the site through impeding plants' ability to photosynthesize and/or altering soil pH which may impact certain species ability to survive and reproduce. Impacts on the woodland would be temporary as natural rainfall will wash dust from the leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Air quality changes – construction traffic	Mere Clough Ancient Woodland site is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated.	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Bradley Brook flows north-south underneath the Proposed Scheme and there may be a pathway for impacts through water quality changes to the habitats within the LNR	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Loss of habitat	No loss of habitat is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Japanese knotweed is present in the area and may be spread by construction activities	Scoped in	Invasive species management plan.	No change	N/A	Neutral
Mere Clough LNR (NGR SD 80467 04382)	County	Air quality changes – dust	Construction of the Proposed Scheme within 200m of the site could lead to dust produced during the construction period impacting vegetation within the site through impeding plants' ability to photosynthesize and/or altering soil pH which may impact certain species ability to survive and reproduce. Impacts on the woodland would be temporary as natural rainfall will wash dust from the leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Air quality changes – construction traffic	Mere Clough LNR is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	It may not be possible to fully mitigate for impacts from increased nitrogen deposition. Potential mitigation to reduce impacts includes reduced speed limits and fencing	Negligible adverse	Temporary	Slight
		Hydrological and water quality changes to surface and groundwater	Bradley Brook flows north-south underneath the Proposed Scheme and there may be a pathway for impacts through water quality changes to the habitats within the LNR	Scoped in	Best practice pollution prevention measures.	No change	N/A	Neutral
		Loss of habitat	The site is outside if the provisional Order Limits and therefore there will be no loss of habitat	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Japanese knotweed is present in habitats that will be impacted by construction activities that are linked to Mere Clough through Bradley Brook. Construction activity in the wider area may therefore spread invasive species into the site	Scoped in	Invasive species management plan	No change	N/A	Neutral
Clifton Wood Ancient Woodland Site (NGR SD 77191 04304)	National	Air quality changes – dust	Clifton Wood is located 2.6km from the provisional Order Limits. DMRB LA105 – Air Quality states that only sites within 200m of construction activity could be impacted by construction dust. Therefore, air quality impacts from dust are scoped out on this site	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Clifton Wood Ancient Woodland Site is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Hydrological and water quality changes to surface and groundwater	There are no hydrological links between the provisional Order Limits and the designated site, therefore no impacts to the site are anticipated. It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No loss of habitat is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from spread of INNS are anticipated.	Scoped out	N/A	N/A	N/A	N/A
Clifton Country Park LNR (NGR SD 77191 04304)	County	Air quality changes – dust	Clifton Country Park LNR is located 2.6km from the provisional Order Limits. DMRB LA105 – Air Quality states that only sites within 200m of construction activity could be impacted by construction dust. Therefore, air quality impacts from dust are scoped out on this site	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Clifton Country Park LNR is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There are no hydrological links between the provisional Order Limits and the designated site, therefore no impacts to the site are anticipated. It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No loss of habitat is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
North Wood Ancient Woodland site (NGR SD 79502 04380)	National	Air quality changes – dust	Construction of the Proposed Scheme within 200m of the site could lead to dust produced during the construction period impacting vegetation within the site through impeding plants' ability to photosynthesize and/or altering soil pH which may impact certain species ability to survive and reproduce. Impacts on the woodland would be temporary as natural rainfall will wash dust from the leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Air quality changes – construction traffic	North Wood Ancient Woodland site is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated.	N/A	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No loss of habitat is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
Prestwich Clough Ancient Woodland (NGR SD 80981 03514)	National	Air quality changes – dust	Prestwich Clough is located more than 200m from the ARN and therefore air quality impacts from dust are scoped out on this site	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance the provisional Order Limits (899m south) and that the site is >200m from the ARN no impacts from change in quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No loss of habitat is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Prestwich Clough SBI (NGR SD 80981 03514)	County	Air quality changes – dust	Prestwich Clough is located more than 200m from the ARN and therefore air quality impacts from dust are scoped out on this site	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (924m south) no impacts from changes in air quality due to construction traffic are anticipated.	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No loss of habitat is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Priority habitats: • Lowland deciduous woodland • Native hedgerow • Acid grassland • Lowland fen • Eutrophic standing water	National	Loss of habitat	There will be loss of lowland deciduous woodland habitat and hedgerows. No loss of acid grassland, eutrophic standing water or lowland fen habitats is anticipated	Scoped in.	Hedgerow planting will be undertaken and where possible, retained hedgerows will be improved through infill planting. Woodland planting will be carried out with new areas of woodland created to screen the new roads and to reinstate the area of woodland in Philips Park that will be lost to facilitate construction. These habitats take time to establish and therefore there is a residual effect. Indicative locations are shown on Figure 2.2	Negligible adverse	Permanent	Slight

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Air quality changes – dust	There may be impacts to lowland deciduous woodland, native hedgerows, and acid grassland through dust from construction. Dust may impede plants' ability to photosynthesize and may alter soil pH which may affect plants ability to survive and/or reproduce and may alter the species composition of the habitat. No impacts to the lowland fen habitat are anticipated due to the habitats distance from the provisional Order Limits. Impacts on the plants within the habitats would be temporary as natural rainfall will wash dust from the leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Air quality changes – construction traffic	There may be air quality impacts to lowland deciduous woodland, acid grassland and native hedgerow due to increased nitrogen deposition caused by construction traffic. The lowland fen habitat is not considered likely to be impacted due to their distance from the provisional Order Limits	Scoped in	It may not be possible fully to mitigate for increased nitrogen deposition. Potential mitigation to reduce impacts includes reduced speed limits and fencing	Negligible adverse	Temporary	Slight
		Hydrological and water quality changes to surface and groundwater	There may be impacts to lowland deciduous woodland, lowland fen, and hedgerow habitats through water pollution or changes in the hydrological regime	Scoped in	It may not be possible to prevent impacts from groundwater changes but best practice pollution prevention measures and design changes should minimise impacts	Negligible adverse	Permanent	Slight
		Spread of INNS	Areas of acid grassland shouldn't be impacted by spread of INNS due to their distance from the Proposed Scheme. Other habitats may be affected	Scoped in	Invasive species management plan	No change	N/A	Neutral
Hollins Plantation SBI (NGR SD 82126 08026)	County	Air quality changes – dust	Construction of the Proposed Scheme within 200m of the site could lead to changes in air quality, due to the impacts of dust produced during the construction period. Dust may affect plants' ability to photosynthesize and may alter soil pH which may affect plants' ability to survive and/or reproduce and may alter the species composition of the habitat. Impacts on the plants within the SBI would be temporary as natural rainfall will wash dust from the leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Air quality changes – construction traffic	Hollins Plantation SBI site is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated.	N/A	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There may be impacts to habitats through changes in ground water flows caused by construction activities	Scoped in	It may not be possible to prevent impacts from groundwater changes but best practice pollution prevention measures and design changes should minimise impacts	Negligible adverse	Temporary	Slight
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Japanese knotweed is present in the area and may be spread by construction activities	Scoped in	Invasive species management plan	No change	N/A	Neutral

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
Hollins Vale LNR (NGR SD 81998 08360)	County	Air quality changes – dust	Construction of the Proposed Scheme within 200m of the site could lead to changes in air quality, due to the impacts of dust produced during the construction period. Dust may affect plants' ability to photosynthesize and may alter soil pH which may affect plants' ability to survive and/or reproduce and may alter the species. Impacts on the plants within the SBI would be temporary as natural rainfall will wash dust from the leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Air quality changes – construction traffic	Hollins Vale LNR is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated.	N/A	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Hollins Vale SBI (NGR SD 81998 08360)	County	Air quality changes – dust	Construction of the Proposed Scheme within 200m of the site could lead to changes in air quality, due to the impacts of dust produced during the construction period. Dust may affect plants' ability to photosynthesize and may alter soil pH which may affect plants' ability to survive and/or reproduce and may alter the species composition of the habitat. Impacts on the plants within the SBI would be temporary as natural rainfall will wash dust from the leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution prevention measures.	No change	N/A	Neutral
		Air quality changes – construction traffic	Hollins Vale SBI is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	N/A	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Blackley Forest LNR (NGR SD 83958 04131)	County	Air quality changes – dust	Blackley Forest LNR is 1.6km from the provisional Order Limits. DMRB LA105 – Air Quality states that only sites within 200m of construction activity could be impacted by construction dust. Therefore, air quality impacts from dust are scoped out on this site	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (1km south-east) no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Chapelfield LNR (NGR SD 78972 06155)	County	Air quality changes – dust	Chapelfield LNR is located 1.9km from the provisional Order Limits. DMRB LA105 – Air Quality states that only sites within 200m of construction activity could be impacted by construction dust. Therefore, air quality impacts from dust are scoped out on this site	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (1.9km north) no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There are no hydrological links between the provisional Order Limits and the designated site, therefore no impacts to the site are anticipated. It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Alkrington Woods LNR (NGR SD 86140 05478)	County	Air quality changes – dust	Alkrington Park LNR is located 2.2km from the provisional Order Limits. DMRB LA105 – Air Quality states that only sites within 200m of construction activity could be impacted by construction dust. Therefore, air quality impacts from dust are scoped out on this site	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (1.9km south-east) no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
Hazlitt Wood SBI (NGR SD 83505 05325)	County	Air quality changes – dust	Hazlitt Wood SBI is located less than 200m from the provisional Order Limits and therefore may be impacted by air quality changes caused by construction dust. Dust may impede plants' ability to photosynthesize and may alter soil pH which may affect plants' ability to survive and/or reproduce and may alter the species composition of the habitat. Impacts on the plants within the SBI would be temporary as natural rainfall will wash dust from the leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution prevention measures	No change	N/A	Neutral
		Air quality changes – construction traffic	Hazlitt Wood SBI is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Blackfish flows from directly adjacent to the provisional Order Limits and through the SBI. There may therefore be impacts to the habitats within the SBI through water quality changes. There are also potential impacts through changes to groundwater flows as habitats within the SBI may be GWDTE	Scoped in	It may not be possible to prevent impacts from groundwater changes but best practice pollution prevention measures and design changes should minimise impacts	Negligible adverse	Permanent	Slight
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	There is potential for spread of INNS into the site through hydrological links	Scoped in	Invasive species management plan	No change	N/A	Neutral
Pilsworth SBI (NGR SD 82539 08337)	County	Air quality changes – dust	Pilsworth SBI is over 400m from the provisional Order Limits. DMRB LA105 – Air Quality states that only sites within 200m of construction activity could be impacted by construction dust. Therefore, air quality impacts from dust are scoped out on this site	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (354m north-east) no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Clifton Country Park SBI (NGR SD 77191 04304)	County	Air quality changes – dust	Clifton Country Park SBI is located less than 200m from the ARN but a considerable distance from the provisional Order Limits and therefore impacts from construction dust area scoped out	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Clifton Country Park SBI is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Clifton Moss (South) SBI (NGR SD 76484 03305)	County	Air quality changes – dust	Clifton Moss SBI is located less than 200m from the ARN but a considerable distance from the provisional Order Limits and therefore impacts from construction dust area scoped out	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Clifton Moss SBI is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	N/A	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Heaton Park Reservoir (East and West) SBIs (NGR SD 82621 05016 and SD 82424 05052)	County	Disturbance (from changes to noise, vibration, visual and light stimuli)	There may be disturbance impacts through noise, dust, and vibration that may affect birds associated with the SBI	Scoped in	Best practice pollution prevention measures and use of noise prevention barriers	No change	Temporary	Neutral
		Air quality changes – dust	Construction of the Proposed Scheme within 200m of the site could lead to changes in air quality, due to the impacts of dust produced during the construction period. There are no habitats present in the SBI that are considered to be sensitive to dust	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (43m south-west) no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Rhodes Farm Sewage Works SBI (NGR SD 78933 03879)	County	Air quality changes – dust	The site is located less than 200m from the ARN but a considerable distance from the provisional Order Limits and therefore impacts from construction dust are scoped out	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (1.3km south-west) no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Rochdale Canal (Scowcroft to Warland) SBI (NGR SD 88273 09861)	County	Air quality changes – dust	The site is located less than 200m from the ARN but a considerable distance from the provisional Order Limits and therefore impacts from construction dust area scoped out	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (6km east) no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Rochdale Canal - Lock at Scowcroft Farm to Stott's Lane SBI (NGR SD 89481 03514)	County	Air quality changes – dust	The site is located less than 200m from the ARN but a considerable distance from the provisional Order Limits and therefore impacts from construction dust area scoped out	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (6km east) no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Sudden Brook (West) SBI (NGR SD 91099 10394)	County	Air quality changes – dust	The site is located less than 200m from the ARN but a considerable distance from the provisional Order Limits and therefore impacts from construction dust area scoped out	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (8km east) no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Boardman Brook SBI	County	Air quality changes – dust	The site is located less than 200m from the ARN but a considerable distance from the provisional Order Limits and therefore impacts from construction dust area scoped out	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
(NGR SD 86078 04859)		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (2km south east) no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Ringley Woods SBI (NGR SD 78981 04783)	County	Air quality changes – dust	The site is located less than 200m from the ARN but a considerable distance from the provisional Order Limits and therefore impacts from construction dust area scoped out	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (2.4km west) no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site.	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated.	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated.	Scoped out	N/A	N/A	N/A	N/A
Parr Brook SBI (NGR SD 81559 07296)	County	Air quality changes – dust	The site is located more than 200m from the ARN and therefore impacts from construction dust area scoped out	Scoped out	N/A	N/A	N/A	N/A
		Air quality changes – construction traffic	Given the distance from the provisional Order Limits (628m west) and that the site is >200m from the ARN no impacts from changes in air quality due to construction traffic are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	It is considered unlikely that this site would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the site	Scoped out	N/A	N/A	N/A	N/A
		Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Spread of INNS	Given the distance of the site from the provisional Order Limits no impacts from the spread of INNS are anticipated	Scoped out	N/A	N/A	N/A	N/A
Local Biodiversity Action Plan habitats: Eutrophic standing water	County	Habitat loss	No habitat loss is anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Potential impacts to Eutrophic standing water around the provisional Order Limits through run-off or other pollution events. No impacts to the habitats through hydrological and water quality changes to surface and groundwater are anticipated	Scoped in	Best practice pollution prevention measures	No change	Temporary	Neutral

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
Non-priority habitats: • Other broadleaved woodland • Mixed scrub • Bramble scrub • Other neutral grassland • Other rivers and stream	Local	Habitat loss	Construction of the Proposed Scheme will lead to a loss of other broadleaved woodland, mixed scrub, bramble scrub, and other neutral grassland. No loss of other rivers and streams habitat is anticipated No habitats dependent on peat are anticipated to be affected by removal of peat	Scoped in	Habitat reinstatement and habitat re-creation to achieve overall net gain of habitats	No change	Permanent	Neutral
		Air quality changes – dust	Habitats may be impacted by construction dust where they are within 200m of the provisional Order Limits. Impacts on the plants within the habitats would be temporary as natural rainfall will wash dust from the leaves, and the amount of dust needed to cause changes in the vegetation structure due to pH changes would be considerable	Scoped in	Best practice pollution measures	No change	N/A	Neutral
		Air quality changes – construction traffic	Habitats within 200m of the provisional Order Limits may be impacted through increased nitrogen deposition from construction traffic	Scoped in	It may not be possible to fully mitigate for impacts from increased nitrogen deposition Potential mitigation to reduce impacts includes reduced speed limits and fencing	Negligible adverse	Temporary	Neutral
		Hydrological and water quality changes to surface and groundwater	Potential impacts to other rivers and stream habitats around the provisional Order Limits through run-off or other pollution events. No impacts to the habitats through hydrological and water quality changes to surface and groundwater are anticipated	Scoped in	Best practice pollution measures	N/A	No change	Neutral
Bat assemblage	Up to regional	Direct mortality	There is potential for direct mortality of bats if they are present within roosts during vegetation clearance	Scoped in	Where bat roosts need to be removed to facilitate construction a European Protected Species licence will be obtained, and the roosts will be excluded or bats removed from the roost to ensure there is no mortality of bats caused by removing the roost	No change	Permanent	Neutral
		Loss of roosts	Construction of the Proposed Scheme may result in loss of bat roosts through direct loss or through loss due to light spill, noise and vibration from construction activities	Scoped in	Alternative roosting locations in the form of bat boxes will be provided and any bats removed from roosts will be placed safely within these boxes. This will ensure continued favourable conservation status of the bats in the area	No change	Permanent	Neutral
		Loss of foraging habitat	Construction may result in the loss of habitats which bats use as foraging areas, as well as potentially impacting invertebrate species which bats prey on. There may be permanent loss of foraging habitat within the construction footprint and temporary loss within the temporary work areas during construction. Light spill from construction activities may also result in loss of foraging habitat	Scoped in	Landscaping will be designed to provide alternative foraging habitat	No change	Permanent	Neutral

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Fragmentation of habitat	Construction of the Proposed Scheme will require the loss of hedgerows that may be used as commuting routes for bats leaving roosts to access foraging territory. Light spill from construction activities may lead to fragmentation of habitat	Scoped in	Landscaping will be designed to provide alternative foraging habitat. Best practice measures will be put in place to prevent light spill onto surrounding habitats	No change	Permanent	Neutral
		Disturbance from noise, vibration, and lighting	Bats present in the area may be disturbed by noise, vibration and lighting associated with construction activities while foraging or commuting	Scoped in	Best practice measures will be put in place to minimise disturbance caused by construction activities	No change	Temporary	Neutral
Wintering and breeding bird assemblage	County	Direct mortality	Movement of construction traffic could potentially lead to direct mortality to breeding birds or over-wintering, either through increased likelihood of collisions or through an activity which damages or destroys a nest while in use. This would be most marked for ground-nesting birds which often nest in open fields and are camouflaged which may reduce their ability to be seen by site traffic	Scoped in	Where possible works involving clearance of vegetation or soil strip should be timed to avoid the nesting bird season (March-August). If this is not possible a nesting bird check should be undertaken by a suitably qualified ecologist no more than 24 hours prior to works being carried out to identify any nests present and to ensure they are not destroyed. Ground nesting birds may also be present within habitats around the Proposed Scheme and therefore they may be impacted by movement of machinery and areas of land suitable for ground nesting birds will need to be checked before any machinery is allowed to move around the area. Similarly vegetation clearance and movement of machinery in areas within or adjacent to sensitive wintering bird habitat will be undertaken under the direct supervision suitably qualified ecologist	No change	Temporary	Neutral
		Disturbance	Construction activities may cause disturbance to nesting or over-wintering birds though noise, vibration, and lighting	Scoped in	Best practice measures will be put in place to minimise disturbance caused by construction activities	No change	Temporary	Neutral
		Loss of habitat	There will be loss of woodland, hedgerow and grassland habitats that are used by nesting and foraging birds	Scoped in	Habitat creation and reinstatement will lead to a net gain in habitats	No change	Temporary	Neutral
Great crested newt	County	Direct mortality	There is the potential of mortality or injury to GCN in their terrestrial habitat during removal of vegetation, site clearance, groundworks, and movement of construction traffic around the site	Scoped in		No change	Permanent	Neutral

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Loss of habitat	There will be loss of suitable resting, commuting, and foraging habitats for GCN including other neutral grassland, modified grassland, woodland, scrub, and hedgerows	Scoped in	A District Level Licence will be obtained prior to works commencing that will create alternative habitat within the local area for great crested newts and ensure their favourable conservation status. Best practice measures during construction will avoid direct mortality of great crested newts	No change	Permanent	Neutral
		Habitat fragmentation	Construction may lead to fragmentation of terrestrial habitat used by GCN	Scoped in		No change	Permanent	Neutral
		Hydrological and water quality changes to surface and groundwater	There is potential for changes in water quality through pollution resulting from construction activities to impact GCN. Water quality changes may also affect the availability of prey species upon which the GCN feed	Scoped in	Best practice pollution prevention measures	No change	Temporary	Neutral
Brown hare	County	Direct mortality	Brown hare may be killed through vegetation clearance, earthworks and moving machinery	Scoped in	Pre-commencement checks	No change	Temporary	Neutral
		Loss of habitat	Construction will result in loss of grassland foraging habitat for brown hare	Scoped in	Habitat creation and reinstatement	No change	Permanent	Neutral
		Disturbance from noise, vibration, and lighting	Construction activities could impact on hares through disturbance from lighting, noise and vibration which could discourage commuting, resting and/or accessing foraging habitat	Scoped in	Best practice measures followed during construction should prevent mortality of brown hares	No change	Temporary	Neutral
Hedgehog	County	Direct mortality	Hedgehog may be killed through vegetation clearance, earthworks and moving machinery. Hedgehogs may seek shelter in brush piles, and then be killed when the piles are moved/removed	Scoped in	Pre-commencement checks	No change	Temporary	Neutral
		Loss of habitat	Construction will result in loss of grassland, hedgerow, and woodland foraging habitat for hedgehogs.	Scoped in	Habitat creation and reinstatement	No change	Permanent	Neutral
		Disturbance from noise, vibration, and lighting	Construction activities could impact on hedgehogs through disturbance from lighting, noise and vibration which could discourage commuting, resting and/or accessing foraging habitat	Scoped in	Best practice measures followed during construction should prevent mortality of hedgehogs	No change	Temporary	Neutral
Common toad	County	Direct mortality	Mortality or injury to common toad could potentially occur during removal of vegetation, site clearance, groundworks, and movement of construction traffic around the site.	Scoped in	Pre-commencement checks	No change	Temporary	Neutral
		Loss of habitat	There will be loss of suitable resting, commuting, and foraging habitat used by common toad; including other neutral grassland, hedgerows, and scrub	Scoped in	Habitat creation and reinstatement	No change	Permanent	Neutral
		Habitat fragmentation	Construction may lead to fragmentation of terrestrial habitat used by common toad	Scoped in	Habitat creation and reinstatement	No change	Permanent	Neutral
		Hydrological and water quality changes to surface and groundwater	There is potential for changes in water quality through pollution resulting from construction activities to impact breeding common toads. Water quality changes may also affect the availability of prey species upon which they feed	Scoped in	Best practice pollution prevention measures	No change	Temporary	Neutral
Terrestrial invertebrates	Up to county	Direct mortality	Mortality or injury to invertebrates would occur during removal of vegetation, site clearance, groundworks, and movement of construction traffic around the site	Scoped in	If any dead wood areas are found supporting species dependent on this habitat the dead wood should be carefully moved out of the area of works	Negligible adverse	Permanent	Neutral

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Loss of habitat	Loss of neutral grassland, hedgerow and woodland habitat may impact invertebrates.	Scoped in	A landscaping plan for the Proposed Scheme should be produced to establish habitats that would of benefit to invertebrates	Negligible adverse	Temporary	Neutral
		Fragmentation of habitat	Light spill from construction activities may lead to fragmentation of habitat, reduction in local invertebrate abundance and adversely affect the feeding behavior of certain species	Scoped in	Best practice measures will be put in place to prevent light spill onto surrounding habitats	Negligible adverse	Temporary	Neutral
Aquatic invertebrates	Up to local	Hydrological and water quality changes to surface and groundwater	There is potential for changes in water quality through pollution resulting from construction activities to impact aquatic invertebrates	Scoped in	Best practice pollution prevention measures	No change	Temporary	Neutral
Otter	Local	Direct mortality	Otter may be killed by construction traffic around Castle Brook	Scoped in	Best practice measures	No change	Temporary	Neutral
		Loss of habitat through water quality changes	Pollution of watercourses from construction activity may reduce the amount of suitable foraging habitat for otter	Scoped in	Best practice pollution prevention measures	No change	Temporary	Neutral
		Disturbance from noise, vibration, and lighting	Construction could impact on otters foraging or commuting along Castle Brook through disturbance from lighting, noise and vibration which could discourage commuting, resting and/or accessing foraging habitat	Scoped in	Best practice measures	No change	Temporary	Neutral
Badger	Local	Direct mortality	Badgers may be killed through collisions with construction traffic or while in a sett which is damaged or modified.	Scoped in	Works to exclude badgers from the sett will be undertaken before the sett is destroyed or damaged.	No change	Permanent	Neutral
		Habitat Fragmentation	Vegetation clearance for the Proposed Scheme potentially leading to changes in habitat use including fragmentation of foraging, commuting and resting habitats	Scoped in	Best practice measures will be put in place to prevent light spill onto surrounding habitats. Leaving important commuting features such as mammal pathways clear of obstruction. Implementing appropriate buffer zones and stand-off distances from sensitive features such as badger setts. Control of noise and vibration from construction and operation of the Proposed Scheme using noise barriers or landscaping, for example bunding, around sensitive features such as badger setts.	No change	Temporary	Neutral
		Loss of setts	Construction of the Proposed Scheme may result in the loss of one main sett	Scoped in	Licenses will be obtained to allow closure of the setts. There is suitable habitat for sett creation available in the wider area	No change	Permanent	Neutral
		Disturbance from noise, vibration, and lighting	The Proposed Scheme could impact badgers through disturbance from nearby noise and vibration from construction activity which may discourage foraging or accessing setts	Scoped in	Best practice measures	No change	Temporary	Neutral

Biodiversity resource	Importance	Impact during construction	Characterisation of impact	Impact scoped in/out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Loss of foraging habitat	Loss of foraging habitat including grasslands is likely during construction of the Proposed Scheme	Scoped in	Habitat creation and reinstatement	No change	Permanent	Neutral
Water shrew	Local	Direct mortality	Water shrew may be killed through vegetation clearance or other construction activities around watercourses and waterbodies. A small area of bank around a single pond is within the provisional Order limits and therefore the amount of suitable habitat for water shrew that may be impacted is approximately 0.13 hectares and there is abundant suitable habitat for the species across ponds in Pike Fold Golf Course to the north of the provisional Order Limits	Scoped in	Precautionary checks of the banks of the one pond that will be impacted will be carried out prior to any works in the area to prevent impacts to water shrew that may be present. An EcoW will carry out a fingertip search of any section of bank are affected to look for burrows Where burrows are found they will be excavated by hand and any animals within them encouraged to move away from the area of work to safety	No change	Permanent	Neutral
		Loss of habitat and impacts through water quality changes	Loss of pond habitat may impact water shrew and changes in water quality due to construction activities may also reduce available suitable habitat for the species.	Scoped in	Best practice measures pollution prevention measures	No change	Temporary	Neutral
		Disturbance from noise, vibration, and lighting	Construction activities may disturb water shrew present in waterbodies	Scoped in	Best practice measures	No change	Temporary	Neutral
Notable vascular plants: Marsh orchid	Up to local	Air quality changes – dust	There may be impacts to the plants through construction dust as they are within 200m of the provisional Order Limits	Scoped in	Best practice pollution prevention measures	No change	Temporary	Neutral
		Air quality changes – construction traffic	There is potential for negative impacts to the plants due to increased nitrogen deposition resulting from construction traffic	Scoped in	It may not be possible to mitigate for the impacts of increased nitrogen deposition	No change	Temporary	Neutral
		Hydrological and water quality changes to surface and groundwater	There may be impacts to the plants through water quality changes either through surface runoff or groundwater	Scoped in	Best practice pollution prevention measures	No change	Temporary	Neutral
		Loss of plants	Earthworks, movement of machinery and storage of material will result in the loss of individual plants in grassland to the east and west of the Proposed Scheme	Scoped in	Translocation of turves containing orchids into areas of suitable habitat that are not impacted by the Proposed Scheme. Turves will be relocated to locations that are as close to their original location as is possible. The landscaping design incorporates areas of grassland suitable for orchids to colonise once construction is completed	No change	Temporary	Neutral

Operation

9.10.8 Table 9.7 provides an assessment of likely significant effects on biodiversity receptors during operation.

9.10.9 **Slight adverse residual effects** from operational phase impacts remain for the following receptors:

- Philips Park LNR/Ancient Woodland
- Philips Park and North Wood SBI
- Clifton County Park LNR/SBI
- Clifton Moss (South) Ancient Woodland
- Mere Clough SBI/ Ancient Woodland
- Rhodes Farm Sewage Works SBI
- Deciduous woodland
- Badger

9.10.10 The majority of these impacts result from current uncertainty around changes in air quality and hydrological impacts during operation. Ongoing surveys will inform the assessment in the Environmental Statement, and the drainage design will have been further developed which may allow the significance of these effects to be reassessed and potentially reduced.

Table 9.7: Assessment of likely significant effects during operation

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
Rochdale Canal SAC (NGR SD 88273 09861)	International	Air quality changes – nitrogen deposition	The Rochdale Canal SAC is within 200m of the ARN. Currently there is no anticipated likely significant effects through air quality changes or nitrogen deposition.	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There is no hydrological link between the watercourses on or around the provisional Order Limits and the Rochdale Canal, therefore no impacts from hydrological and water quality changes are expected	Scoped out	N/A	N/A	N/A	N/A
Rochdale Canal SSSI (NGR SD 88273 09861)	National	Air quality changes – nitrogen deposition	The Rochdale Canal SSSI is within 200m of the ARN. Currently there is no anticipated likely significant effects through air quality changes or nitrogen deposition	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There is no hydrological link between the watercourses on or around the provisional Order Limits and the Rochdale Canal, therefore no impacts from hydrological and water quality changes are expected	Scoped out	N/A	N/A	N/A	N/A
Philips Park Ancient Woodland site (NGR SD 80495 04532)	National	Air quality changes – nitrogen deposition	Philips Park Ancient Woodland site is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Bradley Brook flows north-south underneath the Proposed Scheme and may be a pathway for impacts through water quality changes to the habitats within the site(s)	Scoped in	Drainage design should be developed to prevent impacts to watercourses	Negligible adverse	Long-term	Slight
North Wood Ancient Woodland site (NGR SD 79502 04380)	National	Air quality changes – nitrogen deposition	North Wood Ancient Woodland site is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There is no hydrological link between the watercourses on or around the provisional Order Limits and North Wood therefore no impacts from hydrological and water quality changes are expected	Scoped out	N/A	N/A	N/A	N/A
Philips Park LNR (NGR SD 80495 04532)	County	Air quality changes – nitrogen deposition	Philips Park LNR is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Bradley Brook flows north-south underneath the Proposed Scheme and may be a pathway for impacts through water quality changes to the habitats within the site(s)	Scoped in	Drainage design should be developed to prevent impacts to watercourses	Negligible adverse	Long-term	Slight

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
Philips Park and North Wood SBI **(NGR SD 80495 04532)**	County	Air quality changes – nitrogen deposition	Philips Park and North Wood SBI is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Bradley Brook flows north-south underneath the Proposed Scheme and may be a pathway for impacts through water quality changes to the habitats within the site(s)	Scoped in	Drainage design should be developed to prevent impacts to watercourses but it may not be possible to mitigate for impacts	Negligible adverse	Long-term	Slight
Mere Clough Ancient Woodland Site **(NGR SD 80467 04382)**	National	Air quality changes – nitrogen deposition	Mere Clough Ancient Woodland Site is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Bradley Brook flows north-south underneath the Proposed Scheme and may be a pathway for impacts through water quality changes to the habitats within the site(s)	Scoped in	Drainage design should be developed to prevent impacts to watercourses but it may not be possible to mitigate for impacts	Negligible adverse	Long-term	Slight
Mere Clough LNR **(NGR SD 80467 04382)**	County	Air quality changes – nitrogen deposition	Mere Clough LNR is within 200m of the ARN however no significant changes to air quality that may alter habitats are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Bradley Brook flows north-south underneath the Proposed Scheme and may be a pathway for impacts through water quality changes to the habitats within the site(s)	Scoped in	Drainage design should be developed to prevent impacts to watercourses but it may not be possible to mitigate for impacts	Negligible adverse	Long-term	Slight
Clifton Wood Ancient Woodland Site **(NGR SD 77191 04304)**	National	Air quality changes – nitrogen deposition	Clifton Wood Ancient Woodland Site is within 200m of the ARN and may be negatively impacted by changes in air quality. Currently there is no anticipated likely significant effects through air quality changes or nitrogen deposition	Scoped out	It may not be possible to fully mitigate for the negative impacts caused through nitrogen deposition. Potential mitigation to reduce impacts includes reduced speed limits and fencing	Negligible adverse	Long-term	Slight
		Hydrological and water quality changes to surface and groundwater	There are no hydrological links between the provisional Order Limits and the designated site, therefore no impacts to the site are anticipated	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
Clifton Country Park LNR **(NGR SD 77191 04304)**	County	Air quality changes – nitrogen deposition	Clifton Country Park LNR is within 200m of the ARN and may be negatively impacted by changes in air quality	Scoped in	It may not be possible to fully mitigate for the negative impacts caused through nitrogen deposition. Potential mitigation to reduce impacts includes reduced speed limits and fencing	Negligible adverse	Long-term	Slight
		Hydrological and water quality changes to surface and groundwater	There are no hydrological links between the provisional Order Limits and the designated site, therefore no impacts to the site are anticipated	Scoped out	N/A	N/A	N/A	N/A
Clifton Country Park SBI **(NGR SD 77191 04304)**	County	Air quality changes – nitrogen deposition	Clifton Country Park SBI is within 200m of the ARN and may be negatively impacted by changes in air quality	Scoped in	It may not be possible to fully mitigate for the negative impacts caused through nitrogen deposition. Potential mitigation to reduce impacts includes reduced speed limits and fencing	Negligible adverse	Long-term	Slight
		Hydrological and water quality changes to surface and groundwater	There are no hydrological links between the provisional Order Limits and the designated site, therefore no impacts to the site are anticipated	Scoped out	N/A	N/A	N/A	N/A
Prestwich Clough Ancient Woodland Site **(NGR SD 80981 03514)**	National	Air quality changes – nitrogen deposition	Given the distance from the provisional Order Limits (899m south) and that the site is >200m from the ARN no impacts from changes in air quality due to nitrogen deposition are anticipated.	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There are no hydrological links between the provisional Order Limits and the designated site, therefore no impacts to the site are anticipated	Scoped out	N/A	N/A	N/A	N/A
Prestwich Clough SBI **(NGR SD 80981 03514)**	County	Air quality changes – nitrogen deposition	Given the distance from the provisional Order Limits (924m south) and that the site is >200m from the ARN no impacts from changes in air quality due to nitrogen deposition are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There are no hydrological links between the provisional Order Limits and the designated site, therefore no impacts to the site are anticipated	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
Priority habitats: • **Broadleaved woodland** • **Acid grassland** • **Lowland fen** • **Hedgerows** • **Eutrophic standing water**	County	Air quality changes – nitrogen deposition	Areas of habitat are within 200m of the ARN and may therefore be affected by changes in air quality	Scoped in	It may not be possible to fully mitigate for the negative impacts caused through nitrogen deposition on some areas of broadleaved woodland habitat. Potential mitigation to reduce impacts includes reduced speed limits and fencing	Negligible adverse	Long-term	Slight
		Hydrological and water quality changes to surface and groundwater	Potential impacts to ponds and rivers and streams habitat around the provisional Order Limits through run-off or other pollution events. Inclusion of additional detention ponds into the design may improve water quality in some waterbodies	Scoped in	Drainage design should be developed to prevent impacts to ponds but it may not be possible to mitigate for impacts	Negligible adverse	Long-term	Slight
Hollins Vale LNR **(NGR SD 80495 04532)**	County	Air quality changes – nitrogen deposition	The provisional Order Limits of the Proposed Scheme are near the site however no impacts from nitrogen deposition are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Castle Brook flows into Hollins Brook which flows through the LNR. Changes to the water quality could result from the Proposed Scheme and this may impact the habitats within the site(s)	Scoped in	Drainage design should be developed to prevent impacts to watercourses but it may not be possible to mitigate for impacts	Negligible adverse	Long-term	Slight
Hollins Vale SBI **(NGR SD 80495 04532)**	County	Air quality changes – nitrogen deposition	The provisional Order Limits of the Proposed Scheme are near the site however no impacts from nitrogen deposition are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Castle Brook flows into Hollins Brook which flows through the LNR. Changes to the water quality could result from the Proposed Scheme and this may impact the habitats within the site(s)	Scoped in	Drainage design should be developed to prevent impacts to watercourses but it may not be possible to mitigate for impacts	Negligible adverse	Long-term	Slight
Hollins Plantation SBI **(NGR SD 82126 08026)**	County	Air quality changes – nitrogen deposition	The provisional Order Limits of the Proposed Scheme are near the site however no impacts from nitrogen deposition are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There are no hydrological links to habitats in the SBI	Scoped out	N/A	N/A	N/A	N/A
Alkrington Wood LNR	County	Air quality changes – nitrogen deposition	The site is within 200m of the ARN however no negative impacts because of nitrogen deposition are anticipated	Scoped out	N/A	N/A	N/A	N/A

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
(NGR SD 86140 05478)		Hydrological and water quality changes to surface and groundwater	There are no hydrological links to habitats in the SBI	Scoped out	N/A	N/A	N/A	N/A
Alkrington Woods SBI **(NGR SD 86140 05478)**	County	Air quality changes – nitrogen deposition	The site is within 200m of the ARN however no negative impacts because of nitrogen deposition are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	There are no hydrological links to habitats in the SBI	Scoped out	N/A	N/A	N/A	N/A
Hazlitt Wood SBI **(NGR SD 83505 05325)**	County	Air quality changes – nitrogen deposition	The site is within 200m of the ARN however no negative impacts because of nitrogen deposition are anticipated	Scoped out	N/A	N/A	N/A	N/A
		Hydrological and water quality changes to surface and groundwater	Blackfish flows from directly adjacent to the provisional Order Limits and through the SBI. There may therefore be impacts to the habitats within the SBI though water quality changes	Scoped in	Drainage design should be developed to prevent impacts to watercourses but it may not be possible to mitigate for impacts	Negligible adverse	Long-term	Slight
Heaton Park Reservoir (East and West) SBIs **(NGR SD 82621 05016 and SD 82424 05052)**	County	Disturbance	There may be a small level of additional disturbance to birds present within the SBI however the SBI is already near a motorway network and the effect is not considered to be significant	Scoped in	N/A	Neutral	Long-term	Neutral
		Direct mortality	There may be additional mortality of birds associated with the SBI, however the SBI is already near a motorway and the effect is not considered to be significant	Scoped in	N/A	Neutral	Long-term	Neutral
Clifton Moss (South) SBI **(NGR SD 76484 03305)**	County	Air quality changes – nitrogen deposition	The SBI is within 200m of the ARN. Its habitat and species may be impacted by changes in the nitrogen deposition. Currently there is no anticipated likely significant effects through air quality changes or nitrogen deposition	Scoped out	N/A	N/A	N/A	N/A
Rhodes Farm Sewage Works SBI **(NGR SD 78933 03879)**	County	Air quality changes – nitrogen deposition	The SBI is within 200m of the ARN. Its habitat and species may be impacted by changes in the nitrogen deposition	Scoped in	It may not be possible to fully mitigate for the negative impacts caused through nitrogen deposition. Potential mitigation to reduce impacts includes reduced speed limits and fencing.	Negligible adverse	Long-term	Slight

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
SBIs: • **Ringley Woods** • **Boardman Brook** • **Alkrington Woods and Rhodes Lodges** • **Clifton Country Park** • **Rochdale Canal (Scowcroft to Warland)** • **Rochdale Canal - Lock at Scowcroft Farm to Stott's Lane** • **Sudden Brook (West)**	County	Air quality changes – nitrogen deposition	Several sites are within 200m of the ARN however no negative impacts are anticipated	Scoped out	N/A	N/A	N/A	N/A
Non-priority habitats: • **Other broadleaved woodland** • **Mixed scrub** • **Bramble scrub** • **Other neutral grassland** • **Other rivers and stream**	Local	No impacts	N/A	N/A	N/A	N/A	N/A	N/A
Bats	Up to regional	Direct mortality	Increased likelihood of collision with traffic	Scoped in	The landscaping scheme has been designed to provide alternative suitable habitat away from the Proposed Scheme and to direct bat flightlines away from the roads to try and minimise the chance of bats dying due to collision with traffic However there would be a short to medium term affect as the planting matures and establishes.	Minor Adverse	Permanent	Slight

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Fragmentation of habitats	Operation of the Proposed Scheme potentially leading to changes in habitat due to changes in lighting use, including fragmentation of foraging, commuting and resting habitats	Scoped in	Lighting for the scheme will be designed to limit impacts on the surrounding habitat The landscaping scheme has been designed to create alternative suitable habitat away from the Proposed Scheme and provide a buffer for existing suitable bat commuting and foraging habitats that would address potential adverse impacts from noise.	No change	Permanent	Neutral
		Disturbance (from changes in noise and light stimuli)	Operation of the Proposed Scheme could lead to disturbance caused by increased traffic noise and lighting. Lighting and noise may decrease the amount of available foraging habitat as bats will avoid heavily lit and noisy areas	Scoped in		No change	Permanent	Neutral
Birds	County	Direct mortality	Increased likelihood of collision with traffic	Scoped in	The landscaping scheme has been designed to provide alternative suitable habitat away from the Proposed Scheme and to direct bird flightlines routes away from the roads to try and minimise the chance of birds dying due to collision with traffic. However, there would be a short to medium term affect as the planting matures and establishes.	Minor Adverse	Permanent	Neutral
		Fragmentation of habitats	Operation of the Proposed Scheme potentially leading to changes in habitat use including fragmentation of foraging, commuting and resting habitats	Scoped in	N/A	No change	Permanent	Neutral

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Disturbance (from changes in noise, vibration, visual and light stimuli)	Operation of the Proposed Scheme could lead to disturbance caused by increased traffic noise, vibration, and lighting	Scoped in	Any lighting scheme designed for the Proposed Scheme should be sensitively designed to avoid disturbance impacts on surrounding habitat. In addition, the landscaping scheme has been designed to create alternative suitable habitat away from the Proposed Scheme and provide a buffer for existing suitable bird habitats that would address potential adverse impacts from noise and vibration	No change	Permanent	Neutral
Great crested newt	County	Direct mortality	There is the potential of mortality or injury to GCN while foraging on terrestrial habitat if they become trapped in gully pots or enter the carriageway	Scoped in	Offset gully pots or escape ladders within gully pots will be incorporated into the design to prevent great crested newts from becoming trapped. Landscaping will provide alternative terrestrial habitat for the species to attract them away from the carriageway	No change	Permanent	Neutral
Brown hare	County	Direct mortality	Increased likelihood of collision with traffic	Scoped in	The landscaping scheme has been designed to provide alternative suitable habitat away from the Proposed Scheme to try and minimise the chance of brown hare dying due to collision with traffic. However, there would be a short to medium term affect as the planting matures and establishes.	Slight Adverse	Permanent	Neutral
		Fragmentation of habitats	Operation of the Proposed Scheme potentially leading to changes in habitat use including fragmentation of foraging, commuting and resting habitats	Scoped in	N/A	No change	Permanent	Neutral

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Disturbance (from changes in noise, vibration, visual and light stimuli)	Operation of the Proposed Scheme could lead to disturbance caused by increased traffic noise, vibration, and lighting	Scoped in	Any lighting scheme designed for the Proposed Scheme should be sensitively designed to avoid disturbance impacts on surrounding habitat. In addition, the landscaping scheme has been designed to create alternative suitable habitat away from the Proposed Scheme and provide a buffer for existing suitable habitats that would address potential adverse impacts from noise and vibration	No change	Permanent	Neutral
Hedgehog	County	Direct mortality	Increased likelihood of collision with traffic	Scoped in	The landscaping scheme has been designed to provide alternative suitable habitat away from the Proposed Scheme to try and minimise the chance of hedgehogs dying due to collision with traffic. However, there would be a short to medium term affect as the planting matures and establishes.	Slight Adverse	Permanent	Neutral
		Fragmentation of habitats	Operation of the Proposed Scheme potentially leading to changes in habitat use including fragmentation of foraging, commuting and resting habitats	Scoped in	N/A	No change	Permanent	Neutral

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Disturbance (from changes in noise, vibration, visual and light stimuli)	Operation of the Proposed Scheme could lead to disturbance caused by increased traffic noise, vibration, and lighting	Scoped in	Any lighting scheme designed for the Proposed Scheme should be sensitively designed to avoid disturbance impacts on surrounding habitat. In addition, the landscaping scheme has been designed to create alternative suitable habitat away from the Proposed Scheme and provide a buffer for existing suitable habitats that would address potential adverse impacts from noise and vibration	No change	Permanent	Neutral
Common toad	County	Direct mortality	Mortality or injury to common toad could potentially occur if they enter the carriageway or become trapped in gully pots	Scoped in	Offset gully pots or escape ladders within gully pots will be incorporated into the design to prevent toads becoming trapped. Landscaping will provide alternative terrestrial habitat for the species to attract them away from the carriageway	Negligible adverse	Permanent	Neutral
Terrestrial invertebrates	Up to county	Direct mortality	Increased likelihood of collision with traffic	Scoped in	The landscaping plan for the Proposed Scheme has included habitats that would be of benefit to invertebrates including grassland, hedgerows and trees with habitat piles included that will benefit invertebrates	Negligible adverse	Permanent	Neutral
		Fragmentation of habitat	Light spill from construction activities may lead to fragmentation of habitat, reduction in local invertebrate abundance and adversely affect the feeding behavior of certain species	Scoped in	Landscaping will be designed to provide alternative foraging habitat. Best practice measures will be put in place to prevent light spill onto surrounding habitats	Negligible adverse	Permanent	Neutral

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
Aquatic invertebrates	Up to local	Hydrological and water quality changes to surface and groundwater	Potential impacts to ponds and rivers and streams habitat around the provisional Order Limits through run-off or other pollution events may impact aquatic invertebrates	Scoped in	Drainage design should be developed to prevent impacts to watercourses but it may not be possible to mitigate for impacts	Negligible adverse	Long-term	Slight
Otter	Local	N/A	No impacts from operation are anticipated as no new watercourse crossings are planned and therefore there is no increased risk of otters colliding with traffic	N/A	N/A	N/A	N/A	N/A
Badger	Local	Direct mortality	Increased likelihood of collision with traffic	Scoped in	The landscaping scheme has been designed to provide alternative suitable habitat away from the Proposed Scheme to try and minimise the chance of badger dying due to collision with traffic. However, there would be a short to medium term affect as the planting matures and establishes.	Negligible adverse	Permanent	Neutral
		Fragmentation of habitats	Operation of the Proposed Scheme potentially leading to changes in habitat use including fragmentation of foraging, commuting and resting habitats	Scoped in	N/A	No change	Permanent	Neutral
		Disturbance (from changes in noise, vibration, visual and light stimuli)	Operation of the Proposed Scheme could lead to disturbance caused by increased traffic noise, vibration, and lighting	Scoped in	Landscaping and lighting designs minimise any impacts on surrounding habitats from lighting.. In addition, the landscaping scheme has been designed to create alternative suitable habitat away from the Proposed Scheme and provide a buffer for existing suitable habitats that would address potential adverse impacts from noise and vibration	No change	Permanent	Neutral
Water shrew	Local	Hydrological and water quality changes to surface and groundwater	Potential impacts to ponds and rivers and streams habitat around the provisional Order Limits through run-off or other pollution events may impact water shrew through reducing prey abundance	Scoped in	Drainage plans should seek to minimise impacts from surface water to the waterbodies where the water shrew are present but it may not be possible to mitigate for these impacts	Negligible adverse	Permanent	Neutral

Biodiversity resource	Importance	Impact during operation	Characterisation of impact	Impact scoped in /out	Mitigation	Magnitude of impact	Scale of impact	Residual significance of effect
		Disturbance (from changes in noise, vibration, visual and light stimuli)	Operation of the Proposed Scheme could lead to disturbance caused by increased traffic noise, vibration, and lighting	Scoped in	Landscaping and lighting designs to minimise any impacts on surrounding habitats from lighting, noise, and vibration. In addition, the landscaping scheme has been designed to create alternative suitable habitat away from the Proposed Scheme and provide a buffer for existing suitable habitats that would address potential adverse impacts from noise and vibration	No change	Permanent	Neutral

10. Geology and soils

10.1 Topic introduction

10.1.1 This chapter provides a preliminary assessment of the likely significant effects of the provisional Order Limits with respect to geology (bedrock geology and superficial deposits, including geological designations and valuable non-designated features), soil resources (mostly agricultural) and land contamination (effects on human health, surface water and groundwater), in accordance with Design Manual for Roads and Bridges (DMRB) LA 109 Geology and Soils (Highways England, Revision 0, 2019; hereafter referred to as DMRB LA 109). Mineral resources are covered in Chapter 11: Material assets and waste. Hydrogeology, where not associated with land contamination, is covered in Chapter 14: Road drainage and the water environment.

10.1.2 This chapter identifies and assesses the potential effects of the construction and operational phases of the provisional Order Limits with respect to geology and soils, and outlines the proposed design, mitigation and enhancement measures that would be put in place. This chapter considers:

- Effects on bedrock geology and superficial deposits, including geological designations and sensitive / valuable non-designated features.
- Effects on soil resources.
- Effects from contamination on human health, surface waters and groundwater.
- For surface water and groundwater quality, this chapter only considers the effects from land contamination. Detailed assessment of potential effects of the provisional Order Limits on water quality is given in Chapter 14: Road drainage and the water environment.

10.1.3 This chapter is supported by the following figures:

- Figure 10.1: Bedrock Geology.
- Figure 10.2: Superficial Geology.
- Figure 10.3: Agricultural Land Classification.
- Figure 10.4: Potential Current and Historical Contamination Sources.

10.2 Stakeholder engagement

10.2.1 Table 10.1 summarises the key requirements from the Planning Inspectorate's Scoping Opinion (2021) as relevant to the scope of the geology and soils assessment, and identifies any matters scoped out of the assessment as agreed with the Planning Inspectorate and other stakeholders. This table also explains any changes to the assessment methodology as a result of this engagement.

Table 10.1: Key stakeholder feedback for geology and soils aspect

Stakeholder	Comment	Response
Planning Inspectorate	ID 4.5.1 Impacts to geology are proposed to be scoped out on the basis that no sensitive geological receptors are identified within the study area. Considering the baseline geological information presented, and the description of the Proposed Development, the Inspectorate is content that this matter can be scoped out.	Agreed.
	ID 4.5.2 On the basis that impacts to soil will be assessed during construction (as permanent and temporary losses), the Inspectorate considers that effects on soils during operation can be scoped out.	A soil survey has been undertaken to understand the soil loss during construction. However, soils will not be disturbed during the operational phase and therefore have been scoped out.
	ID 4.5.3 This matter is proposed to be scoped out as contamination is anticipated to be removed during construction therefore, contact with contamination from residents or construction workers during operation is unlikely to occur. Additionally, site-specific risk assessments and method statements will reduce exposure. The Inspectorate agrees to this matter being scoped out, with the exception of ground gas as set out below. However, impacts are scoped in for maintenance and residential properties located in close proximity to the Proposed Development due to the possibility of being affected by ground gas during operation. Elaboration on this is not provided. The ES should explain the type, extent and sources of ground gas contamination anticipated during operation and assess the significant effects on receptors likely to be impacted by it. Any appropriate mitigation should be detailed and secured via the DCO.	Ground gases are being monitored as part of the ground investigations, which will enable further explanation for the residential risks during construction and operation.
	ID 4.5.4 Operational effects on surface water and groundwater from contaminated land are scoped out of further assessment on the basis that potential contaminated land linkages would have been assessed as part of the construction phase assessment and contaminated land would only be disturbed during construction. The Inspectorate is content that this matter can be scoped out of the operational assessment.	Potential contaminated land linkages would be assessed with further information from the ground investigation.
Planning Inspectorate	ID 4.5.5 There are multiple references to a programme of ground investigations leading to production of a Ground Investigation (GI) report in Chapter 5 and Chapter 10 of the Scoping Report. Paragraph 10.5.2 states that a GI is to be completed in 2021. The Inspectorate understands that a GI report will be provided in support of the Application and as part of the ES. The scope of the assessment presented in Chapter 10 of the Scoping Report is, in many places, caveated by the statement that no ground investigation data were available at the time of preparing the report (e.g. paragraphs 10.4.10, 10.4.12 and 10.6.1). The location, extent and method of the proposed GI should be described in the ES and be supported by relevant figures. Effort should	Information from the GI will be included in the Environmental Statement. Note, the first phase of GI has been completed, however a second phase of GI is planned for November 2022 to January 2023 in response to the revised provisional Order Limits. The results from the second phase of GI will also be included in the Environmental Statement.

Stakeholder	Comment	Response
	be made to agree these surveys with the relevant consultation bodies so as to ensure a robust baseline from which to assess the significance of effects. The ES should also be clear about any additional ground investigation that may be proposed as mitigation and which is to be delivered post-consent. Where “ground investigation data are unavailable at the time of drafting the Environmental Statement” (paragraph 10.8.2), the assessment should be clear as to methodological assumptions and inherent limitations and implications for the confidence of the assessment of residual effects.	
Environment Agency	The Environment Agency will be contacted to confirm the nature of wastes received by historical landfills within the provisional Order Limits.	The response from the Environment Agency noted new guidance on remediating or redeveloping historic landfills, this however is not yet available.
	We have no information on groundwater levels on the site, however we do not expect shallow groundwater to be present. The BGS mapping and modelling suggests that around 30m of superficial drift soils will be present before bedrock is reached in this area. The Glacial Till deposits are classed as a Secondary (Undifferentiated) Aquifer and this has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In the case of Glacial Till in this area, we are aware that sand bands may exist which can provide a source of groundwater. We have no specific information about this at the site, however GI should be completed to ascertain whether sand bands which may store water exist.	The GIs will provide further information on the ground and groundwater conditions.
	The southern half of the site, which will be developed by new road connections bypassing junction 18 of the M60, is also underlain by Glacial Till deposits which are classed as a Secondary (Undifferentiated) Aquifer, and may include sand bands which could contain significant groundwater. Glaciofluvial Ice Contact Deposits, Devensian - Sand And Gravel and Peat deposits are also present in this area. These are both classed as Secondary A Aquifers. The bedrock in this area is mapped as Chester formation – Sandstone. This is classed as a Principal Aquifer.	The GIs will provide further information on the ground and groundwater conditions.
Environment Agency	Our limited information does not suggest that there has been extensive historical development on the site, however we would recommend that a contaminated land assessment in accordance with Land Contamination Risk Management (LCRM) guidance is followed in this case to identify any possible risk. Previous GIs as part of the current motorway island have not been made available, however some borehole data is available from the BGS which corroborates the above assessment, although the quality of the data on the website is poor for the area of interest. Any further GI will need to ascertain whether there are any large sand bands in the Glacial Till deposits which could contain significant groundwater.	The GIs will provide further information on the ground and groundwater conditions.
Bury Metropolitan	Bury Metropolitan Borough Council was contacted by the water team for resources on landfills and soils information in	Response from Bury council noted two Greater Manchester Waste

Stakeholder	Comment	Response
Borough Council	conjunction with requests for information on water resources.	Disposal Applications for the sites adjacent to the Proposed Scheme. It was confirmed that Bury Council does not own either site and therefore, no permission would be required from the Bury Council

10.3 Legislative and policy framework

10.3.1 The National Policy Statement for National Networks (NPS NN) (Department for Transport (DfT), 2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NPS NN as the primary basis for making decisions on DCO applications.

10.3.2 Key policy from the NPS NN relevant to this aspect is set out below:

- Paragraph 5.168 of the NPS NN states that *'applicants should take into account the economic and other benefits of the best and most versatile (BMV) agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification (ALC) system). Where significant development of agricultural land is demonstrated to be necessary, applicants should seek to use areas of poorer quality land in preference to that of a higher quality. Applicants should also identify any effects, and seek to minimise impacts, on soil quality, taking into account any mitigation measures proposed. Where possible, developments should be on previously developed (brownfield) sites provided that it is not of high environmental value.'*
- Paragraph 5.176 states that *'the decision-maker should take into account the economic and other benefits of the best and most versatile agricultural land. The decision-maker should give little weight to the loss of agricultural land in grades 3b, 4 and 5, (as defined in the ALC system) except in areas (such as uplands) where particular agricultural practices may themselves contribute to the quality and character of the environment or the local economy.'*
- Paragraph 5.168 states that *'for developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination and how it is proposed to address this. The policy makes reference to the Model Procedures for Management of Land Contamination (CLR11), however this guidance was superseded in October 2020 by Environment Agency guidance Land Contamination Risk Management (LCRM).'*
- Paragraph 5.22 states that *'where the project is subject to EIA the applicant should ensure that the Environmental Statement clearly sets out any likely significant effects on internationally, nationally and locally designated sites of ecological or geological conservation importance (including those outside England).'*
- Paragraph 5.23 states that *'the applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.'*
- Paragraph 5.25 states that *'as a general principle, and subject to the specific policies, development should avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives.'*

10.3.3 In addition to the national policy set out in the NPS NN, the Proposed Scheme will also have regard to relevant legislation and local plans and policy. Legislation and local planning policy will be complied with. Full details of legislation and local planning policy relevant to this aspect are appended to this report (Appendix 1.1) and will be included in the Environmental Statement.

10.4 Assessment methodology

10.4.1 The assessment of the potential effects on the geology and soils takes into account the DMRB standards LA 104 Environmental Assessment and Monitoring (Highways England, Revision 1, 2020a; hereafter referred to as DMRB LA 104), LA 109 Geology and Soils (Highways England, Revision 0, 2019) and LA 113 Road Drainage and the Water Environment (Highways England, Revision 1, 2020b; hereafter referred to as DMRB LA 113). The Land Contamination Risk Management (LCRM) guidance (Environment Agency, 2020) has also been considered.

10.4.2 The criteria that will be used to assess the value (sensitivity) of receptors and magnitude of impacts are based upon those in Table 3.11 in DMRB LA 109. Sensitivity which is related to this chapter for Road and Water drainage fall under LA 113. Please see note in paragraph 10.7.34 for sensitivity of groundwater and surface water.

10.4.3 Appendix 5.2 of this PEIR sets out the value (sensitivity) and magnitude of impacts criteria which will be used to assess significance for this aspect.

10.4.4 The significance of effects will be determined by combining the sensitivity of geology and soils receptors, with the magnitude of impacts. In accordance with DMRB LA 109 Table 3.12 and DMRB LA 113 Table 3.71, the significance matrix in DMRB LA 104 (which is replicated in Table 5.4 in Chapter 5: Environmental assessment methodology) will be used to assist professional judgement when determining the significance of effects.

10.4.5 A Ground Investigation (GI) and post-fieldwork gas / groundwater monitoring was undertaken in 2021, and further GI is planned for November 2022 to January 2023 to address changes to the Proposed Scheme and provisional Order Limits. The results of this GI will be incorporated into an updated conceptual site model (CSM) and contaminated land risk assessment in accordance with LCRM. The potential risks to human health will be assessed using the CSM and soils will be screened against relevant human health screening criteria. The potential risks to controlled waters will also be assessed using the CSM and water monitoring data will be screened against relevant controlled waters screening criteria.

10.5 Assessment assumptions and limitations

10.5.1 An ALC soil survey has been undertaken based on the original provisional Order Limits (ADAS, 2022). It is assumed that this survey provides a good indication of soil quality within the scheme extents at the time of the assessment.

10.5.2 In the absence of complete GI data for the Proposed Scheme, potential impacts from the scheme on human health and controlled waters (groundwater and surface water) from land contamination cannot be fully assessed at this stage. As such, the assessment for PEIR is based on qualitative information gathered as part of the Preliminary Sources Study Report (PSSR) (CH2M, 2018) and Environmental Scoping Report (Highways England, 2021b).

10.5.3 It is proposed to undertake technical consultation with various statutory and non-statutory bodies, and external sources, to obtain the latest information on baseline

conditions. However, the information held by these sources may, in some cases, be limited and may be delayed. Where there is a lack of third-party data, professional judgement will be used in interpreting available desk study and GI information.

10.5.4 The following information should be collected before the ES is completed to allow for specific mitigation to be developed:

- Completion of a soil resource survey and development and implementation of a soil resource plan prior to commencement of construction works, consistent with Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2009).
- GI Surveys to be completed and land contamination risk assessment undertaken.

10.6 Study area

10.6.1 The DMRB LA 109 for geology and soils defines a study area as project dependant, therefore a buffer of 250m around the provisional Order Limits has been used to establish baseline conditions and identify potential impacts on receptors. Given local bedrock and superficial geology is classified as Secondary A at its most permeable (see Chapter 14), and most of these Secondary A deposits are superficial and often isolated from other higher permeability aquifers, 250m is considered to be the furthest that contamination would reasonably travel from the provisional Order Limits. The study area and key geological and land contamination constraints are shown in Figures 10.1 – 10.4.

10.7 Baseline conditions

Baseline sources

10.7.1 The following sources have been used to establish baseline conditions:

- British Geological Survey (BGS), Interactive Map Viewer – GeoIndex. Accessed October 2022.
- BGS, Lexicon of Named Rock Units. Accessed October 2022.
- CH2M, Preliminary Sources Study Report (PSSR) M60 Junction 18 Simister Island, Version P01, HA GDMS number 30640, 2018.
- Coal Authority, Coal Mining Report (reference: HMD-252-4559913), 2017.
- Cranfield University, LandIS Soilscapes Map. Accessed October 2022.
- Groundsure, EnviroInsight report (reference: HMD-252-4559910), 2017.
- Groundsure, GeoInsight report (reference: HMD-252-4559911), 2017.
- Groundsure, MapInsight report (reference: HMD-252-4559912), 2017.
- Highways England, Geotechnical Data Management System (HAGDMS). Accessed October 2022.
- Department for Environment, Food and Rural Affairs (Defra), MAGIC Map Application. Accessed October 2022.
- Natural England, ALC Grades – Post 1988 Survey. Accessed October 2022.
- Natural England, Provisional Agricultural Land Classification (ALC) Survey. Accessed October 2022.

Baseline conditions

Solid geology

10.7.2 BGS mapping (BGS, 2021) indicates that the study area is cross-cut by several faults. The throw (vertical separation across the fault) of these faults has often resulted in bedrock of the Triassic Chester Formation, which includes the Manchester Marls unit, being downthrown (sinking of rocks on one side of a fault) against the older Upper Carboniferous Pennine Middle Coal Measures (PMCM).

10.7.3 The BGS Lexicon of Named Rock Units (BGS, 2021) describes the Chester Formation as being part of the Triassic Sherwood Sandstone Group. The Manchester Marls Formation, part of the Cumbrian Coast Group, conformably underlie the Chester Formation. It is locally recorded to underlie the study area between 150m to 330m west of the centre of M60 J18.

10.7.4 The PMCM outcrop occur towards the western end of the study area where the Worsley Four Feet Coal seam is recorded to sub-crop below the drift deposits beneath the M60 mainline, approximately 100m to 150m east of the centre of M60 J17, 3.5km west of M60 J18. The Worsley Four Foot Coal seam dips to the west, underlying the western end of the study area.

10.7.5 The PMCM underlie the M66 north of M60 J18, increasing in age towards the north and transitioning into the Pennine Lower Coal Measures (PLCM) around 1.25km south of M66 J3. The PLCM underlie the PMCM. The Arley Coal seam is shown to sub-crop below the drift deposits beneath M66 J3. The sub-crop is broadly orientated northwest-southeast, with the seam dipping towards the west. It is therefore present beneath the M66 carriageway from the junction until being displaced by faulting. Although not shown to sub-crop, other coal seams may underlie the M66 carriageway, south of the faulting.

10.7.6 The PMCM underlie the M62 carriageway east of M60 J18, increasing in age towards the east and transitioning into the PLCM around 210m north-east of Egypt Lane bridge. Although not shown to sub-crop, coal seams may be present at shallow depth beneath this section of the M62. The M60 J18 to J19 is underlain by bedrock of the Chester Formation. Figure 10.1 shows the location of the BGS information considered pertinent to this review.

Superficial geology

10.7.7 BGS mapping (BGS, 2021) shows Glacial Till underlying the majority of M60 J18, and the M62 and M66 to the east and north, respectively. The north-west quadrant of the M60 J18 is shown to be underlain by Glaciofluvial Ice Contact Deposits. These also extend for approximately 400m north of the centre of M60 J18, beneath the M66. Elsewhere these deposits are recorded parallel to the north of the M60 mainline, from Sandgate Road bridge and continuing for around 150m west of the structure.

10.7.8 Glacial Till is also recorded beneath the M60 mainline west of J18, with peat recorded between 550m west of J18 and 40m east of Sandgate Road bridge. Glaciolacustrine deposits are recorded adjacent to the north-east of the peat, extending out towards the north-east. Glacial Till is also recorded to the west of the peat, extending to around 300m east of Bury Old Road bridge. Continuing west, Glaciofluvial Deposits and Glacial Till are shown beneath and adjacent to the M60 mainline.

10.7.9 Between M60 J18 and J19, hummocky Glacial Deposits are shown beneath the M60. These are shown to continue as a large east-west swath, running parallel to the south of the M60 mainline, between M60 J18 and J17. Consequently, pockets may be

encountered beneath the M60 mainline, east of Sandgate Road Bridge and Bury Old Road Bridge. These deposits are also recorded to underlie the M66 north of Roe Bank subway. Within these hummocky deposits are bands of Head Deposits, one of which underlies Hollins Vale Bridge on the M66. Head Deposits are recorded on both sides, but not beneath the M60 carriageway between J18 and J19. Descriptions typically classify the material as sand 1.5m to 4m thick, with some clay, silt and occasionally gravel and clayey peat.

10.7.10 BGS borehole SD80NW270 (NGR: 382060, 405500), located 220m east of Sandgate Road overbridge, recorded peat between 2.9 and 3.1m below ground level (bgl), 97 to 96.8m above ordnance datum (AOD). The underlying sand is very peaty in parts with an organic smell and was proven to 3.4mbgl (96.5 mAOD). Elsewhere within the study area, occasional reference is made to organic material or organic clay, suggesting that localised peat deposits may be present elsewhere within the study area.

10.7.11 Information on superficial deposits as a mineral resource is covered in Chapter 11: Material Assets and Waste.

Made ground

10.7.12 Highways England Geotechnical Data Management System (HAGDMS) (Highways England, 2021) records a number of embankments along the M60 carriageway. This indicates that made ground, comprising engineered fill, is present within the study area. Many of the historical boreholes sunk along the M60 carriageway and around M60 J18 recorded made ground. Often the base of the deposits has not been proven, with most exploratory holes having been sunk to depths of between 2 and 4mbgl.

10.7.13 Made ground deposits are predominantly granular, comprising sand or gravel with varying proportions of silt, cobbles and boulders, although Pulverised Fuel Ash (PFA) may be present in earthworks in the vicinity of Sandgate Road Overbridge.

10.7.14 During the site walkover undertaken by Jacobs after issue of the PSSR (CH2M, 2018) an area of raised ground was noted in the north-east quadrant of the M60 J18. This is not noted on any historical or geological mapping but is suspected to comprise made ground. The nature of this made ground is currently unknown.

Soils

10.7.15 The economic resource value of soil is primarily measured by its ability to support agricultural uses. This is quantified by its Agricultural Land Classification (ALC) grade, with six grades defined within the ALC for England and Wales as follows:

- Grade 1 (excellent quality)
- Grade 2 (very good quality)
- Subgrade 3a (good quality)
- Subgrade 3b (moderate quality)
- Grade 4 (poor quality)
- Grade 5 (very poor quality)

10.7.16 The Best and Most Versatile (BMV) agricultural land equates to grades 1, 2 and subgrade 3a of the ALC system, and is the most flexible land in terms of the range of crops that can be grown, the level and consistency of yield and the cost of obtaining yield.

10.7.17 A soil survey was undertaken in March 2022 (ADAS, 2022). The survey identified a range of soils within the original provisional Order Limits, including light, medium, heavy and organic soils. Predominantly clay loams over clayey subsoils with impeded drainage were observed. Lighter, sandy textured soils were observed in patches, with occasional sandy textured subsoils. The majority of the soils investigated form an ALC of Subgrade 3b (70%), with the remainder forming Grade 4 (11%), Subgrade 3a (16%) and Grade 2 (2%). The main limitations to the agricultural use of the land include soil wetness or soil groundwater, particularly for medium, heavy and organic soils.

10.7.18 The overall lack of clear definitions between the soil types, their predicted nature and evidence of disturbance, strongly suggest that the soils have been disturbed in the recent past.

10.7.19 Soils may also be of importance in supporting sites of ecological importance; thus, a high-level review of soil types has been undertaken. The LandIS Soilscapes Map (Cranfield University, 2021) identifies the majority of the area is marked as Soilscape 10, freely draining slightly acid sandy soils. There is a small area of Soilscape 17, slowly permeable seasonally wet acid loamy clayey soils, intersecting the study area towards the western end of the provisional Order Limits, but it should be noted that this area is outside of the 250m buffer for the study area.

10.7.20 Neither of these soil types is inherently particularly sensitive, but soils supporting sites of ecological importance identified within Chapter 9: Biodiversity, will be considered within the Environmental Statement in line with LA 109. Baseline information for these sites will not be repeated in this chapter.

Mining, quarrying and mineral resources

10.7.21 The Coal Authority Mining Report (Coal Authority, 2017) at PCF Stage 1 states that the study area is within an area that could be affected by underground mining in one seam of coal at 430 to 460m depth, which was last worked in 1970. Consequently, any associated ground movements should have ceased. The study area is not within an area where there are active or proposed underground mining, or within the boundary of a former, active or proposed opencast site. There are no recorded mine entries on or within 20m of the study area.

10.7.22 HAGDMS (Highways England, 2021) identifies the western and northern extents of the study area as being Grade C: Medium Hazard in terms of Coal Mining, which broadly correlates with the Coal Authority's designation that parts of the study area are within a Development High Risk area. East of Sandgate Road overbridge, and from 1.3km south of M66 J3; the rest of the study area is classified Grade B: Low, although it is predominantly within the coal field and, as such, the potential for underground coal mining, unrecorded mine workings, or shafts and adits, cannot be discounted.

Historical mineral extraction sites (potentially infilled)

10.7.23 The Groundsure Geo Insight report (Groundsure, 2017) identifies several ground workings within the study area, including unspecified ground workings and brick pits which have ceased operation. The two main ground workings within the provisional Order Limits are:

- A sand pit, located at Cold Gate adjacent to the north-western quadrant of M60 J18 Interchange
- A gravel pit, located on Hills Lane, to the east of Hills Lane Accommodation overbridge on the M66

Landfills

10.7.24 There are three historical landfills within the study area, all located in the vicinity of M60 J18. These are:

- Landfill directly east of the M60. Land to the south of Whitehouse farm. Inert waste deposited between 1993 – 1994.
- Landfill directly west of the M60, Bridle Road. Inert waste deposited in 1994.
- Landfill approximately 550m east of M60 J18. Land at Egypt Lane. Inert waste, licence Surrendered 1999. No issue date.

Potential sources of contamination

10.7.25 The study area is mixed with the west of the scheme dominated by houses and the east of the scheme rural land consisting of agricultural land use and golf courses. In addition to the landfill sites, and potentially infilled ground noted above, there are further potentially significant land uses within the study area, including:

- Railway infrastructure, including the Manchester Whitefield and Radcliffe branch lines shown on the late 19th century maps, crossing the M60 around 250m east of J17.
- Current and former industrial areas, including a historical brick works.
- Fuel station, immediately adjacent to the M60 and the A665.
- PFA and made ground within the existing highway embankments.
- Coal tar associated with the original carriageway construction, pre-dating the mid-1980s.
- Possible PFA and/or made ground within the area of raised ground immediately north of M60 Simister Island.

Soil assessment

10.7.26 Soil samples from the initial GI have been collected for chemical analysis, and further samples will be collected during the second phase of GI to determine ground contamination potentially caused by historical and current land uses. Please note no assessment of soils contamination has taken place yet as this will take place when the Geotechnical Interpretative Report (GIR) is written after the second phase of GI.

Ground gas assessment

10.7.27 Potential sources of ground gases, including historical landfill sites and peat, have been identified under and in close proximity to the Proposed Scheme. Gas monitoring standpipes were installed as part of the initial GI to enable an assessment of potential risks to human health, and further gas monitoring standpipes will be installed during the second phase of GI.

Surface water and groundwater

10.7.28 There is the potential for soil contaminants to impact groundwater and surface water quality. Information on surface water and groundwater receptors are covered in Chapter 14: Road drainage and the water environment. To avoid duplication, this section does not describe the water environment baseline.

10.7.29 Groundwater monitoring and sampling was undertaken during the initial GI to enable an assessment of the potential risks to controlled waters, and further monitoring and sampling will be undertaken following the second phase of GI.

10.7.30 Many of the historical exploratory holes reviewed do not include groundwater information or are recorded as dry. Seepages are generally reported within made ground, suggesting localised pockets of perched groundwater, particularly where more cohesive materials underlie granular deposits (ref. SD80NW271, 275 and 276). As many exploratory holes do not extend into the superficial deposits, there is limited information regarding groundwater within them. However, where groundwater has been recorded within the superficial deposits, it comprises a mix of seepages and strikes of medium flow, particularly within the glaciofluvial materials (ref. SD80SW284 and SD80SW1022). Occasional seepages have been recorded within the Glacial Till, associated with sand bands and pockets (ref. SD80SW1020).

Future baseline

Geology

10.7.31 Based on the likely evolution of the baseline environment without the implementation of the development the bedrock geology would not change.

Surface water and groundwater

10.7.32 Surface water and groundwater baseline conditions would not change if the development did not proceed given the existing use of the area is for a motorway with associated infrastructure.

Value/sensitivity of receptors

10.7.33 The criteria used to determine the value (sensitivity) of geology and soil receptors conforms to the criteria set out in Table 3.11 of DMRB LA 109, and provided in Table 5.2 in Chapter 5: Environmental assessment methodology. The value / sensitivity of surface water and groundwater receptors conforms to the criteria set out in DMRB LA 113. The description of the sensitivity criteria in Table 10.2 below is taken from LA 109 and LA 113 and has been used to compare against features within the study area.

10.7.34 All receptors within the baseline have been assigned a value following criteria in DMRB LA 109 and using professional judgement[2]. Table 10.2 summarises the value of receptors identified within the study area.

[2] It should be noted that Jacobs have had discussions with National Highways who have agreed in principle a departure from standard, removing the cross reference in LA 109 Table 3.11 (Environmental value (sensitivity) and descriptions) to Table 3.70 in LA 113. This would mean that the importance criteria for groundwater and surface water would be followed for Road Drainage and Water Environment (RDWE), Chapter 14. The classification for surface water and groundwater in Table 10.2 below has been copied from Table 14.20 in Chapter 14 RDWE. Please note that a formal departure is still in draft and is still formally to be agreed.

Table 10.2: Value (sensitivity) of receptors in the study area for geology and soils

Value / sensitivity	Aspect	Description	Features within the study area
Very high	Geology	International designated sites of geological value (e.g., UNESCO World Heritage Sites).	None identified within the study area.
	Human health	Very sensitive land use such as residential or allotments.	Residential properties are located immediately adjacent to the M60 between J17 and J18.
	Soil	ALC Grades 1 and 2. Soils directly supporting an EU designated site (e.g. Special Area of Conservation or Special Protection Area).	One small parcel of land within the provisional Order Limits, located immediately east of the M66, contains soil classed as ALC Grade 2, however this accounts for only 2% of soils surveyed within the provisional Order Limits.
	Groundwater quality	Principal aquifer providing a valuable resource because of its high quality and yield, or extensive exploitation for public and/or agricultural and/or industrial supply.	Chester Formation and Collyhurst Sandstone Formation
		Internationally designated sites of nature conservation dependent on groundwater.	No receptors of this type within the groundwater study area.
		Licensed potable abstractions	No receptors of this type within the groundwater study area.
		SPZ1.	No receptors of this type within the groundwater study area.
	Surface water quality	Watercourse having a WFD classification shown in the River Basin Management Plan (RBMP) and a $Q_{95} \geq 1.0 m^3/s$.	River Irwell River Roch[3]
High	Geology	Rare and of national importance with little potential for replacement (e.g. geological SSSI).	None within the study area.
	Human health	High sensitivity land use such as public open space.	Heaton Park, Philips Park and Pike Fold Golf Club are located within the study area.
	Soil	ALC Subgrade 3a. Soils directly supporting a UK designated site (e.g. SSSI).	Soils classed as ALC Subgrade 3a have been identified within the provisional Order Limits, accounting for 16% of soils surveyed.

[3] The River Irwell and River Roch are both outside of the Study Area, however, as per Paragraph 14.6.3 in Chapter 14 RDWE, these have been included as impacts may potentially occur beyond the Study Area. The surface water study area has been stated in Chapter 14, RDWE as 1km from the provisional Order Limits (see section 14.6.4).

Value / sensitivity	Aspect	Description	Features within the study area
	Groundwater quality	Principal or secondary A aquifer providing locally important resource or supporting a river ecosystem.	Coal Measures, Rossendale Formation, river terrace deposits, alluvium, glaciofluvial/glaciofluvial ice contact deposits.
		Licensed non-potable abstractions and unlicensed potable abstractions.	Seven licensed industrial/ commercial groundwater abstractions. Potable unlicensed abstractions to be confirmed following receipt of data from the local authority.
		Groundwater supporting a nationally designated or non-statutory locally designated site of nature conservation with high or moderate groundwater dependency.	Groundwater supporting parts of Hazlitt Wood Site of Biological Importance (SBI), Hollins Vale Local Nature Reserve (LNR) and SBI, and Hollins Plantation SBI*, that are classified as having a high or moderate groundwater dependency. Groundwater supporting Philips Park and North Wood LNR and SBI.
		SPZ2.	No receptors of this type within the groundwater study area.
	Surface water quality	Watercourse having a WFD classification shown in RBMP and a Q_{95}<1.0m^3/s.	Whittle Brook and River Irk.
Medium	Geology	Regionally Important Geological Sites with limited potential for replacement (e.g. RIGS).	None within the study area.
	Human health	Medium sensitivity land use such as commercial or industrial.	Commercial and industrial properties are located throughout the study area.
	Soil	ALC subgrade 3b. Soils supporting non-statutory designated sites (e.g. LNR).	Soils classed as ALC Subgrade 3b have been identified within the provisional Order Limits, accounting for 70% of soils surveyed.
	Groundwater quality	Aquifer providing water for agricultural or industrial use with limited connection to surface water.	Manchester Marls Formation, glacial till (diamicton), hummocky (moundy) glacial deposits, head.
		Unlicensed non-potable groundwater abstractions.	To be confirmed at the Environmental Statement stage.
		Groundwater supporting a nationally designated or non-statutory locally designated site of nature conservation with low groundwater dependency, or groundwater supporting a non-designated site, including Habitats of Principal Importance (HPI), with a moderate or high groundwater dependency.	Groundwater supporting parts of Hazlitt Wood SBI and Hollins Vale LNR and SBI, and Hollins Plantation SBI*, that are classified as having a low groundwater dependency.

Value / sensitivity	Aspect	Description	Features within the study area
		SPZ3.	No receptors of this type within the groundwater study area.
	Surface water quality	Watercourse not having a WFD classification shown in RBMP and a Q_{95}>0.001m^3/s.	Castle Brook and tributary, Parr Brook (downstream in open channel), Hollins Brook, Bradley Brook, Brightly Brook, Heaton Park Reservoir, Ponds (based upon precautionary approach).
Low	Geology	Geology of local importance / interest with potential for replacement (e.g. non designated geological exposures, former quarries / mining sites).	None within the study area.
	Human health	Low sensitivity land use such as highways and rail.	Railway line crosses the M60 east of J17. Numerous highways are located throughout the study area.
	Soil	ALC grades 4 and 5. Soils supporting non-designated notable or priority habitats.	Soils classed as ALC Subgrade 4 have been identified within the provisional Order Limits, accounting for 11% of soils surveyed.
	Groundwater quality	Unproductive strata.	Peat, glaciolacustrine deposits.
		Groundwater supporting a non-designated site (including HPI) with low groundwater dependency.	No receptors of this type identified at this stage within the groundwater study area.
	Surface water quality	Watercourse not having a WFD classification shown in RBMP and a Q_{95}≤0.001m^3/s.	Parr Brook headwaters/tributary, Unnamed Tributary of Bradley Brook, Unnamed Tributary of Whittle Brook, Blackfish Pond.
Negligible	Geology	No geological exposures, little / no local interest.	None within the study area.
	Human health	Undeveloped surplus land / no sensitive land use proposed.	None within the study area.
	Soil	Previously developed land formerly in ‘hard uses’ with little potential return to agriculture.	A number of areas within the study area have been previously developed.
	Groundwater quality	Not applicable.	Not applicable.
	Surface water quality	Not applicable.	Not applicable.

**** NB. Some Groundwater Dependent Terrestrial Ecosystem (GWDTE) sites will be repeated across multiple value classes listed above. This is due to the GWDTE value criteria being derived (in part) from the groundwater dependency of the GWDTE. Therefore, where a GWDTE is classified as having a range in groundwater dependencies, the value of different parts of the site will also vary. A detailed methodology used for assessing GWDTE is provided in Appendix 14.3: GWDTE Assessment.***

10.8 Potential impacts

Construction

Geology

10.8.1 No sensitive geological receptors have been identified within the study area.

Soils

10.8.2 Soils would be affected in two ways during construction, via:

- Physical removal or permanent sealing of agricultural land.
- Degradation during stripping, handling and storage, through mechanisms such as compaction and smearing.

10.8.3 It is assumed for the purposes of assessment at this stage that all soils identified within the Provisional Order Limits would be affected, therefore soils of very high to low quality are likely to be impacted.

10.8.4 Peat deposits are recorded within the provisional Order Limits at two locations: northeast of J18 (by the Northern Loop) and north of M60 (west of J18). Beneath the M60 west of J18; and, north of J18 immediately west of the M66. Due to its compressible nature, it is likely that peat deposits will need to be excavated and disposed of off-site as part of the works. BGS mapping suggests that the peat is localised and therefore could be considered to be a rarity at a local level. The resource value and sensitivity of this material will need to be assessed further.

10.8.5 It is anticipated that agricultural land would be sealed by development, or otherwise lost to agricultural production.

10.8.6 However, the permanent sealing or wastage of topsoil would be avoided as far as practicable via stripping and sustainable reuse elsewhere, as per embedded mitigation measures. In addition, by following best practice soil management measures, degradation during stripping, handling and storage would either be avoided, or would only be temporary in nature.

Human health

10.8.7 Made ground, engineered fill and natural soils underlying the provisional Order Limits may have been potentially contaminated by the historical and current land use activities identified along the Proposed Scheme, including historical landfill sites, infilled mineral extraction pits, petrol stations and industrial areas. Disturbance of potentially contaminated soils may cause an increase in dust and leaching of soils, mobilising contaminants along new or existing surface or sub-surface pollution pathways. These could create new pathways to adjacent land users around the Proposed Scheme.

10.8.8 There is potential for ground gases associated with historical landfills to migrate to residential properties in close proximity to the Proposed Scheme. The provisional Order Limit will cover one historic landfill west of the M66 on Bridle Road, which is expected to be an inert landfill. Whilst peat deposits are present within the provisional Order Limits, the potential for the generation and migration of ground gases toward residential properties is assessed to be low. Ground gas monitoring will be undertaken following completion of the initial and second phase of GI to assess ground gas risks.

10.8.9 Soil samples from the initial GI have been collected for chemical analysis, and further soil samples will be collected during the second phase of GI to determine ground

contamination potentially caused by historical and current land uses. There is a short-term risk to the health of construction workers exposed to potentially harmful contaminants close to the landfill sites.

10.8.10 During construction there is a risk to adjacent residential properties associated with contaminated soils and ground gas and so this will be scoped in for the assessment.

10.8.11 Risks to construction workers has been scoped out as mitigation/best practice to prevent impacts on workers would be undertaken prior to the construction period. This is in line with current Health and Safety Executive (HSE) CDM regulations (HSE, Construction (Design and Management) Regulations 2015).

Groundwater and surface water

10.8.12 Disturbance of potentially contaminated soils or landfill materials within the provisional Order Limits may cause an increase in the leaching of soils and mobilisation of contaminants along new or existing surface or sub-surface pollution pathways. This may lead to the quality of surface waters and groundwater aquifers being impacted through runoff, infiltration and sub-surface movement. Groundwater samples from the initial GI have been collected for chemical analysis, and further groundwater samples will be collected following the second phase of GI to establish baseline groundwater quality.

Operation

Geology

10.8.13 No sensitive geological receptors have been identified within the study area and therefore there are no potential impacts. Operational effects on geology are therefore scoped out of further assessment.

Soils

10.8.14 No additional impacts are predicted on soils during the operational phase. The permanent loss of agricultural land occurring during construction would persist during operation but is not considered an additional effect. Temporary effects arising during construction on soil quality in relation to degradation during handling may extend into operation but should not be persistent assuming that the best practice mitigation measures in Section 10.9 are applied. Operational effects on soils are therefore scoped out of further assessment.

Human health

10.8.15 It is understood that, on completion of the construction phase, the provisional Order Limits would predominantly comprise hardstanding. Hardstanding would remove the pathway of some ground contamination which reduces or may remove the impact to site users and adjacent residential properties during operation. Some areas will have landscape planting or green spaces; It is expected across the Proposed Scheme that there are limited sources of contamination which would impact human health during operation. Operational effects on human health from ground contamination are therefore scoped out of further assessment.

10.8.16 There is a residual risk of ground gas near former landfills to adjacent properties during the construction and operational phase and therefore this is scoped in.

10.8.17 There may be a risk to maintenance workers in the operational phase in contact with residual soil contamination and ground gases but this has been scoped out as detailed above in the construction phase. Relevant residual hazards should be noted in the health and safety file in line with the CDM regulation on completion of the construction phase to be passed on to the operator of the scheme.

Groundwater and surface water

10.8.18 During the operational stage, potential contaminated land linkages would have been broken due to the construction of the carriageway, therefore no additional impacts are predicted in relation to water receptors. Operational effects on surface water and groundwater from contaminated land are therefore scoped out of further assessment.

10.8.19 There is the potential for pollution incidents resulting from fuel and chemical leaks or spills on the new highway by road users. These are covered in Chapter 14: Road drainage and the water environment and are not addressed further in the geology and soils chapter.

10.9 Design, mitigation and enhancement measures

10.9.1 At this stage, the requirement for specific mitigation measures in respect of geology and soils cannot be meaningfully identified, particularly in relation to impacts from ground contamination, further mitigation will be noted after additional information is collected from the ground investigation.

10.9.2 Mitigation measures would include both embedded mitigation and essential mitigation measures.

Embedded (design) mitigation

10.9.3 Embedded mitigation would include design measures which may include the use of:

- Consolidated development footprints to reduce the loss of agricultural land.
- Minimisation of hardstanding to reduce impacts from agricultural soil loss.
- Stripping and suitable storage of topsoil as a minimum from the footprints of all permanent development (hardstanding and materials placement), followed by sustainable reuse within the provisional Order Limits or elsewhere, wherever practicable.

Essential mitigation

10.9.4 Essential mitigation measures may also be developed to address specific identified impacts. Mitigation that would be carried out regardless of contamination risk are:

- The waste hierarchy principle will be used at every stage of the project, as appropriate and proportionate, to identify enhancement opportunities with respect to the reuse of suitable excavated soils and materials on the scheme development.
- CDM regulations which govern the management of risks to construction and maintenance workers. The identification of hazards in the pre-construction information and the assessment of design measures to mitigation these risks are vital before the contractor develops their risk assessments.
- EMP to be developed, to include construction techniques to mitigate potential risks to construction workers, adjacent users and controlled waters prior to the start of

construction works. A 1st Iteration of the EMP will be prepared for the DCO submission (see Chapter 5: Environmental assessment methodology).

- It is anticipated that in order to promote sustainable reuse of soil and other geological arisings within the Proposed Scheme, a Materials Management Plan (MMP) would be prepared prior to construction, which would detail the proposed use of the arisings. It is anticipated that this will follow the protocols within the CL:AIRE Definition of Waste (2011) guidance so that excavated materials are reused appropriately and sustainably. This is covered in Chapter 11: Material assets and waste.

10.9.5 Once site-specific information has been obtained from the ground investigation, the following mitigation measures may be applied to further reduce the impacts if such risks are identified:

- Removal and treatment/disposal of contaminated soils where appropriate.
- Working methods incorporated during the works to mitigate against gas build up in voids, and to mitigate the negative effect of land contamination on potential receptors.
- Risk assessments and method statements to be completed as part of the construction process. A remediation strategy will be developed if significant contamination is encountered after the GI surveys.

Enhancement

10.9.6 No opportunities for enhancements have been identified for this topic; no soils will be released from current hardstanding use, and no new geological information will be collected on significant strata.

10.10 Assessment of likely significant effects

Construction

10.10.1 A full and updated review of potential impacts during construction will be undertaken for the Environmental Statement with further information from the GIs.

Soils and BMV Agricultural Land

10.10.2 The permanent sealing or wastage of topsoil would be avoided as far as practicable via stripping and sustainable reuse elsewhere, as per the embedded mitigation measures. In addition, by following best practice soil management measures, degradation during stripping, handling and storage would either be avoided, or would only be temporary in nature. Therefore, a moderate magnitude of impact is predicted for soils (the majority of soils within the provisional Order Limits comprise clay loams over clayey subsoils with impeded drainage)) of medium sensitivity in relation to degradation and loss of soil resource, resulting in likely **moderate adverse (significant)** significance for the soil receptors during construction.

10.10.3 However, a permanent loss of agricultural land associated with the provisional Order Limits would be unavoidable, much of which is BMV land (ALC Subgrade 3b) which has a medium sensitivity.

10.10.4 An ALC soil survey (ADAS, 2022) has been completed in support of the PEIR, based on the original provisional Order Limits. This survey provides an assessment of the various ALC grades within the provisional Order Limits. The majority of soils are

classed as ALC Subgrade 3b, and therefore of medium sensitivity, resulting in likely **Moderate** significance due to the loss of agricultural land during construction.

Human health

10.10.5 Based on the presence of some residential properties within the vicinity of the provisional Order Limits, the sensitivity of human health is assessed to be very high. It should be noted that the residential properties are outside the construction area, therefore there is unlikely to be direct source pathway receptor linkages. The likely magnitude of impact is assessed to be minor due to the low probability of encountering significant ground gas and soil contamination. As such, the significance of effects to human health is assessed to be **moderate adverse (significant)** rather than large due to the desk study undertaken and the sources of contamination identified so far**.**

10.10.6 Risks to construction workers have been scoped out as mitigation/best practice to prevent impacts on workers would be considered prior to the construction period in line with current CDM regulations.

Surface water

10.10.7 Due to several watercourses within the study area likely to be classified by the RBMP as having a very high sensitivity, and the potential for construction activities to impact these watercourses, the magnitude of which has been assessed as minor, the significance of effects to surface water quality is assessed to be **moderate adverse (significant)** rather than large, due to the limited number of sources of contamination identified so far, alongside the less mobile potential contaminants within these sources. Surface water quality information is pending from surveys by water / ecology teams, and further assessment will be needed when the data become available which will be included in the Environmental Statement.

Groundwater

10.10.8 In the absence of site-specific GI data and baseline groundwater monitoring data, the predicted significance of effects on groundwater is likely to be **moderate adverse (significant)** rather than large. This is on the basis of the classification of the Chester Formation and Collyhurst Sandstone Formation within the groundwater study area as a Principal Aquifer of very high sensitivity. The magnitude of impact is predicted to be minor on the basis of the proposed construction works and widespread cohesive superficial deposits. Further assessment will be needed when the data become available which will be included in the Environmental Statement.

Table 10.3: Significance categories for receptors during construction after mitigation

Receptor	Environmental value	Magnitude of Impact	Significance category
Geology	Scoped out. N/A.	Scoped out. N/A.	Scoped out. N/A.
Soils	Medium	Moderate	Moderate
BMV Agricultural land	Medium	Moderate	Moderate
Human health (residents of nearby housing)	Very high	Minor	Moderate
Human health (construction workers)	Scoped out. N/A.	Scoped out. N/A.	Scoped out. N/A.
Surface water	Very high	Minor	Moderate

Receptor	Environmental value	Magnitude of Impact	Significance category
Groundwater	Very high	Minor	Moderate

Operation

10.10.9 A full and updated review of potential operational impacts will be undertaken for the Environmental Statement with further information from the GI.

Soils and BMV Agricultural Land

10.10.10 No additional impacts are predicted on soils during the operational phase. The permanent loss of agricultural land occurring during construction would persist during operation but is not considered as an additional effect. Operational effects on soils are therefore scoped out of further assessment.

Human health

10.10.11 It is understood that on completion of the construction phase, the Proposed Scheme would predominantly comprise hardstanding. Therefore, site users (highways land use) have been scoped out.

10.10.12 Residual soil contamination and ground gas may remain within the Proposed Scheme after construction and the magnitude of impact is assessed to be negligible to residential properties due to the distance from the identified potential sources of ground gas and the residential receptors. The sensitivity of human health is assessed to be very high, therefore the significance of effects is assessed to be **slight adverse (not significant)**.

10.10.13 Impacts to maintenance workers have been scoped out as residual risks to people working on the scheme would be addressed in the CDM health and safety file to be consulted in future works.

Groundwater and surface water

10.10.14 During the operational stage, potential contaminated land linkages would have been broken due to the construction of the carriageway, therefore no additional impacts are predicted in relation to water receptors. Operational effects on surface water and groundwater from contaminated land are therefore scoped out of further assessment.

10.10.15 There is the potential for pollution incidents resulting from fuel and chemical leaks or spills on the new highway by road users. These are covered in Chapter 14: Road Drainage and the Water Environment and are not addressed further in the geology and soils chapter.

Table 10.4: Significance categories for receptors during operation after mitigation

Receptor	Environmental value	Magnitude of Impact	Significance category
Geology	Scoped out. N/A.	Scoped out. N/A.	Scoped out. N/A.
Soils	Scoped out. N/A.	Scoped out. N/A.	Scoped out. N/A.
BMV Agricultural land	Scoped out. N/A.	Scoped out. N/A.	Scoped out. N/A.
Human health (near-by residents)	Very High	Negligible	Slight
Human health (future users)	Scoped out. N/A.	Scoped out. N/A.	Scoped out. N/A.

Receptor	Environmental value	Magnitude of Impact	Significance category
Human health (maintenance workers)	Scoped out. N/A.	Scoped out. N/A.	Scoped out. N/A.
Surface water	Scoped out. N/A.	Scoped out. N/A.	Scoped out. N/A.
Groundwater	Scoped out. N/A.	Scoped out. N/A.	Scoped out. N/A.

11. Material assets and waste

11.1 Topic introduction

11.1.1 This chapter presents the findings of the preliminary environmental assessment undertaken for the material assets and waste aspect. This chapter considers the following matters:

- The use and consumption of 'material assets': this includes materials and products from primary, secondary, recycled, sustainable and renewable sources, and the use of excavated material and other arisings that fall within the scope of waste exemption criteria.
- The production and disposal of 'waste': this includes surplus materials which can become waste, as well as other substances which the holder discards, intends to discard, or is required to discard.

11.1.2 This chapter is supported by the following figure:

- Figure 11.1: Mineral Safeguarding Areas, Mineral Areas of Search and Peat Deposits

11.1.3 Constructing the Proposed Scheme would require the use of large quantities of material assets and hence may result in potential impacts on the environment through the depletion of non-renewable natural resources, and sterilisation of mineral safeguarding sites. Conversely, constructing the Proposed Scheme would also result in large quantities of surplus materials and waste, leading to potential impacts on the available landfill void capacity.

11.1.4 This chapter includes a preliminary environmental assessment of the potential environmental impacts and effects that can reasonably be anticipated from these matters during the construction of the Proposed Scheme (operational impacts have been scoped out of this assessment for the reasons identified in Section 11.8). It identifies measures for mitigating these effects where practicable and describes the significance of the residual effects that are likely to remain after mitigation.

11.1.5 Where practicable, those surplus materials and wastes that would arise during the construction of the Proposed Scheme would be re-used, recycled or otherwise recovered on or off-site, which would prevent the need for off-site disposal to landfill. Diverting materials and waste from landfill and maximising the use of re-used, recycled and responsibly sourced materials in the Proposed Scheme would potentially reduce the environmental impacts associated with materials production, thereby supporting a circular economy (as described in Section 11.9).

11.2 Stakeholder engagement

11.2.1 Table 11.1 summarises the key requirements from the Planning Inspectorate's Scoping Opinion (2021) as relevant to the scope of the material assets and waste assessment, and identifies any matters scoped out of the assessment as agreed with the Planning Inspectorate and other stakeholders. This table also explains any changes to the assessment methodology as a result of this engagement.

Table 11.1: Key stakeholder feedback for material assets and waste aspect

Stakeholder	Comment	Response
Planning Inspectorate	ID 4.6.1: The mineral safeguarding areas (MSA) identified in the study area are not resources that could be worked / extracted and therefore do not meet criteria to be defined as Mineral Safeguarding Sites required to be assessed by definition in DMRB LA 110; this is supported through consultation with Greater Manchester Minerals and Waste Planning Unit and the Coal Authority detailed in Scoping Report paragraph 11.4.10. On this basis, the Inspectorate is content that impacts to MSAs can be scoped out.	Impacts to MSAs will be scoped out of the material assets and waste assessment going forward.
	ID 4.6.2: The Applicant states that peat deposits present within the study area are not existing or potential peat extraction sites in terms of peat as material asset / resource. On the basis of the information provided, the Inspectorate agrees to scope out impacts to peat deposits as a material asset / resource. Comments have been made elsewhere in this Scoping Opinion about potential impacts on peat in terms of biodiversity, soils, carbon emissions and in terms of drainage.	Impacts to peat resources will be scoped out of the material assets and waste assessment going forward. Notwithstanding, impacts to peat will be considered in other environmental assessment aspects of as appropriate.
	ID 4.6.3: These matters are proposed to be scoped out of the assessment on the basis that maintenance activities would be undertaken in accordance with the requirements of DMRB LA 110 and are not expected in the first year of operation (timescale defined by DMRB LA 110) or beyond. The Inspectorate is content to agree to scope this matter out on this basis.	Operational impacts will be scoped out of the material assets and waste assessment going forward.
	ID 4.11.1: On the basis that the assessment proposed in the materials and waste aspect chapter will consider the impact of the Proposed Development on national material recovery targets, regional recycled aggregate targets, sub-regional minerals sterilisation and regional landfill capacity, the Inspectorate agrees that relevant consideration of cumulative effects will be inherent in that assessment. The Inspectorate therefore agrees that these can be scoped out of further specific consideration in the cumulative effects assessment.	Cumulative effects on material assets and waste will be scoped out of the cumulative effects assessment going forward.

11.3 Legislative and policy framework

11.3.1 The National Policy Statement for National Networks (NPS NN) (Department for Transport (DfT) (2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NPS NN as the primary basis for making decisions on DCO applications.

11.3.2 Key policy from the NPS NN relevant to this aspect is set out below:

- Paragraphs 4.28 and 4.29 of the NPS NN state that applicants should include design as an integral consideration from the outset of a proposal; and *inter alia* produce sustainable infrastructure efficient in the use of natural resources.
- Paragraph 5.169 of the NPS NN states that applicants should safeguard any mineral resources on the proposed site as far as possible.
- Paragraph 5.182 of the NPS NN states that, where a proposed development has an impact on a Mineral Safeguarding Area (MSA), the SoS should ensure that the applicant has put forward appropriate mitigation measures to safeguard mineral resources.
- Paragraph 5.42 of the NPS NN states that the applicant should set out the arrangements that are proposed for managing any waste produced. The arrangements described should include information on the proposed waste recovery and disposal system for all waste generated by the development. The applicant should seek to minimise the volume of waste produced and the volume of waste sent for disposal unless it can be demonstrated that the alternative is the best overall environmental outcome.

11.3.3 In addition to the national policy set out in the NPS NN, the Proposed Scheme must also have regard to relevant legislation, local plans and policy as well as any statutory guidance for this aspect. A summary of legislation and policy is provided in Appendix 1.1. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

11.4 Assessment methodology

11.4.1 The preliminary environmental assessment for this aspect focuses primarily on determining the likely significant effects of constructing the Proposed Scheme on the environment resulting from the consumption of material assets, and the production and disposal of waste.

11.4.2 The assessment has been prepared in accordance with DMRB LA 104 Environmental assessment and monitoring (Highways England, Revision 1, 2020) and DMRB LA 110 Material assets and waste (Highways England, Revision 0, 2019a; hereafter referred to as DMRB LA 110) which provide the published environmental assessment standards for assessing the impacts and effects associated with material assets and waste.

11.4.3 This assessment utilises and builds on the information and data gathered as part of the environmental scoping assessment and endeavours to collate additional information to qualify, and where possible quantify, the material assets required, and waste likely to be generated in constructing the Proposed Scheme.

11.4.4 The EIA, for the purposes of the material assets and waste aspect, is largely a desk-based qualitative study that aims to identify the following assessment information for the anticipated construction phase. It is assumed that the Proposed Scheme would largely be constructed between 2025 and 2027, with an assumed opening year of 2027. However, this will be reviewed as the scheme design is refined and the construction programme is developed. All dates will be confirmed in the Environmental Statement:

- For material assets:
  - Types and quantities of material assets required to construct the scheme
  - Information on materials that contain secondary and recycled content
  - Information on any known sustainability credentials of materials to be consumed
  - The type and volume of materials that would be recovered from on-site or off-site sources for use on the scheme
  - The cut and fill balance
  - The degree of sterilisation of mineral safeguarding sites and peat resources
  - Details of on-site storage and stockpiling arrangements, and any supporting logistical details
- For waste management:
  - Types and quantities of waste generated during the construction of the scheme
  - Amount of waste (by type and weight) that would be recovered and diverted from landfill either on-site or off-site (i.e. for use on other projects)
  - Types and quantities of waste arising from the scheme (demolition, excavation arisings and remediation) requiring disposal to landfill
  - Details of on-site storage and segregation arrangements for waste and any supporting logistical arrangements
  - Potential for generation of hazardous waste (type and quantity)

11.4.5 There is insufficient information available at this stage regarding the precise material requirements and waste quantities associated with constructing the Proposed Scheme. Therefore, there is insufficient information to undertake a detailed quantitative assessment of the Proposed Scheme against the DMRB LA 110 significance category descriptions at this stage (see next sub-section).

11.4.6 These limitations are not untypical for a Preliminary Environmental Information Report (PEIR), and the information presented in this chapter is considered to represent an appropriate level of detail in line with the available design information. The following published statistics, benchmarks and key performance indicators have been used to populate the data gaps that exist in relation to the DMRB LA 110 requirements for PEIR:

- Waste and Resources Action Programme (WRAP, 2008), Net Waste Tool – Dataset
- WRAP (2009), Construction Procurement Guidance: Delivering Higher Recycled Content in Construction Projects
- WRAP (2013), Resource Efficiency Benchmarks for Construction Projects

- Mineral Products Association (2020), Profile of the UK Mineral Products Industry Workbook
- Defra (2022), ENV23 - UK Statistics on Waste dataset

11.4.7 In accordance with paragraphs 3.13 of DMRB LA 110, these data sources have been used to undertake a qualitative assessment of the Proposed Scheme against the DMRB LA 110 significance category descriptions (see next sub-section). This qualitative assessment has described the main areas of construction including those that are likely to consume large quantities of material assets and generate large quantities of waste, and those which would generate likely significant effects according to DMRB LA 110.

11.4.8 These significance category descriptions have been used to assess the likely environmental effects of constructing the Proposed Scheme in relation to the following descriptors of effects:

- For material assets:
  - Percentage of non-hazardous construction and demolition (C&D) waste that will be recovered and diverted from landfill either within the first or second study areas (see Section 11.6 for study areas).
  - Percentage of aggregates required to be imported to site that comprise re-used or recycled content in relation to the north-west region target of 30%[4].
  - Likelihood of sterilising one or more mineral safeguarding sites or peat resources (as defined in the glossary), placing their future use at risk or rendering them inaccessible for current or future use or extraction.
- For waste:
  - Percentage reduction or alteration in regional landfill capacity as a result of managing C&D waste from the Proposed Scheme.
  - Percentage of C&D waste requiring disposal to landfill outside of the second study area.

11.4.9 Professional judgement has been used to determine which significant effect categories the Proposed Scheme is likely to fall within, with regards to the material assets and waste matters of this aspect, after an assessment of the effectiveness of the mitigation measures identified in Section 11.9.

11.4.10 Given the nature of the DMRB LA 110 significance category descriptions, the resulting significance of effect is unlikely to change between the PEIR and the Environmental Statement.

[4] This target is provided in DMRB LA 110 (paragraph E/1.1) and is taken from the Ministry of Housing, Communities & Local Government (2009) National and Regional Guidelines for Aggregates Provision in England 2005 to 2020.

Significance criteria (significance category descriptions)

11.4.11 DMRB LA 110 sets out how effects associated with material assets and waste should be assessed through the use of a set of standardised descriptors of effect for each significance category.

11.4.12 Consequently, this simplified significance framework precludes the application of a methodology to derive a measure of the significance of effect based on the more traditional approach of combining the value of a resource (or receptor) and the magnitude of impact (as per the general principles detailed in Chapter 5: Environmental assessment methodology).

11.4.13 The assessment of effects on material assets and waste has adopted the significance category descriptions in Table 11.2. The significance of effects on material assets and waste have been reported in accordance with the significance criteria in Table 11.3. These significance category descriptions and significance criteria are replicated from Tables 3.13 and 3.14 in DMRB LA 110.

Table 11.2: DMRB LA 110 significance category descriptions

Significance category	Description[1]
Very large	Material assets: 1) no criteria: use criteria for large categories. Waste: 1) >1% reduction or alteration in national capacity of landfill, as a result of accommodating waste from a project; or 2) construction of new (permanent) waste infrastructure is required to accommodate waste from a project.
Large	Material assets: 1) project achieves <70% overall material recovery / recycling (by weight) of non-hazardous Construction and Demolition Waste to substitute use of primary materials; and 2) aggregates required to be imported to site comprise <1% re-used / recycled content; and/or[2] 3) project sterilises ≥1 mineral safeguarding site and/or peat resource[3]. Waste: 1) >1% reduction in the regional capacity of landfill as a result of accommodating waste from a project; and 2) >50% of project waste for disposal outside of the region.
Moderate	Material assets: 1) project achieves less than 70% overall material recovery / recycling (by weight) of non-hazardous construction and Demolition Waste to substitute use of primary materials; and 2) aggregates required to be imported to site comprise re-used/recycled content below the relevant regional percentage target[4]. Waste: 1) >1% reduction or alteration in the regional capacity of landfill as a result of accommodating waste from a project; and 2) 1-50% of project waste for disposal outside of the region.

Significance category	Description[1]
Slight	Material assets: 1) project achieves 70-99% overall material recovery / recycling (by weight) of non-hazardous Construction and Demolition Waste to substitute use of primary materials; and 2) aggregates required to be imported to site comprise re-used/recycled content in line with the relevant regional percentage target[4]. Waste: 1) ≤1% reduction or alteration in the regional capacity of landfill; and 2) waste infrastructure has sufficient capacity to accommodate waste from a project, without compromising integrity of the receiving infrastructure (design life or capacity) within the region.
Neutral	Material assets: 1) project achieves >99% overall material recovery / recycling (by weight) of non-hazardous Construction Demolition Waste to substitute use of primary materials; and 2) aggregates required to be imported to site comprise >99% re-used / recycled content. Waste: 1) no reduction or alteration in the capacity of waste infrastructure within the region.

[1] This table, reproduced from DMRB LA 110, uses very precise and deliberate language, specifically "OR", "AND" and "AND/OR" after each descriptor of effect to denote which significance category should be applied. The descriptors for the material assets matter are generally summative (large, moderate, slight and neutral effects), and all descriptors need to be met in full in order to assign a relevant significance category (i.e. with the notable exception of a large effect which can be assigned when a project sterilises ≥1 mineral safeguarding site and/or peat resource). The descriptors of effect for the waste matter are either standalone (very large and neutral effects) or summative (large, moderate and slight effects).

[2] The published version of DMRB LA 110 includes "AND" instead of "AND/OR". This has been changed to correct an editorial error in the standard that was confirmed in an email from Wilson. S (2020) at Highways England.

[3] Sterilisation is defined by DMRB LA 110 to mean "substantially constrain / prevent existing and potential future use and extraction of materials". In the absence of further information, this has been interpreted to mean that the Proposed Scheme would need to substantially sterilise one or more mineral safeguarding sites (in their entirety), placing their future use at risk or rendering them inaccessible for current or future use.

[4] The recycled aggregate target for the north-west region is 30%. This target excludes site-won material and demolition materials. The former is considered a primary material for the purposes of assessment, and the latter is not an imported material.

Table 11.3: DMRB LA 110 significance criteria

Significance	Description
Significant (one or more criteria met)	Material assets 1) category description met for moderate or large effect. Waste 1) category description met for moderate, large or very large effect.
Not significant	Material assets 1) category description met for neutral or slight effect. Waste 1) category description met for neutral or slight effect.

11.5 Assessment assumptions and limitations

11.5.1 Material assets and waste can affect the full range of environmental assessment aspects and matters. Where materials are consumed, and waste is generated, it is acknowledged that, depending on how they are managed, indirect adverse effects may arise (from greenhouse gas emissions, water consumption and pollution, visual impacts, dust, noise, vibration, vehicle emissions, disruption to traffic and other potential causes of nuisance, amongst others). Whilst these impacts would typically be assessed

as part of the EIA, this would not form part of a material assets and waste assessment. Such impacts, effects and mitigation measures are considered as part of the other aspect chapters in this PEIR.

11.5.2 Similarly, the indirect impacts of off-site materials extraction and production and waste disposal are assumed to have already been assessed (and where necessary, mitigated) under the relevant planning and permitting regimes for those sites and thus would not be assessed as part of the material assets and waste assessment for the Proposed Scheme. These stages of the materials and waste lifecycles are also considered to be outside the scope of this assessment due to the range of unknown variables associated with these sites.

11.5.3 Whilst DMRB LA 110 sets out the requirements for assessing and reporting the effects on material assets and waste, this standard is primarily aimed at compliance with the EIA Directive and guiding statutory Environmental Statements, where there is typically much greater certainty around the design of a project. There is limited information available at this stage regarding the precise material requirements and waste quantities associated with constructing the Proposed Scheme; and therefore, there is insufficient information available at this stage regarding the key assessment parameters identified in Section 11.4.

11.5.4 These limitations are not untypical for a preliminary environmental impact assessment, and the information presented in this chapter is considered to represent an appropriate level of detail in line with the current design programme. Those published statistics, benchmarks and key performance indicators identified in Section 11.4 have been used to populate these data gaps at this stage. Any limitations in the qualitative assessment approach will be addressed in the Environmental Statement through the gathering and assessment of quantified design information on material assets consumption and waste generation where available.

11.5.5 Whilst the baseline data sources used in this assessment represent the most recently available stakeholder information, there is a general lag (in years) for materials, waste processing and landfill capacity data in the UK and conditions may change since publication of this data. The annual reporting cycle is also likely to have been impacted to some degree by the COVID-19 pandemic.

11.5.6 Although checks are made by stakeholders for anomalies or errors in their data prior to publication, it cannot be guaranteed that these data sets are error free, or whether any commercial decisions have been taken by site operators that may have affected these data. Site operators are also entitled to withhold certain data for reasons for confidentiality.

11.5.7 Whilst this section provides a generalised list of assumptions and limitations that apply to the assessment of material assets and waste, it should be noted that additional section-specific assumptions and limitations are identified throughout this chapter.

11.6 Study area

11.6.1 The following provides an overview of the study area(s) adopted for the material assets and waste aspect baseline and assessment.

11.6.2 In contrast to other environmental aspects, impacts from the use of material assets and the production and disposal of waste, such as resource depletion and use of landfill capacity, are largely dispersed or generalised, rather than affecting specific geographically-bound receptors.

11.6.3 DMRB LA 110 significance category descriptions also requires that the impacts and effects from this aspect be contextualised within the context of the UK legislative and policy targets for material assets and waste.

11.6.4 In accordance with DMRB LA 110 (paragraphs 3.5 to 3.7), the assessment of material assets and waste has utilised two geographically different study areas to examine the use of material assets and the production and disposal of waste:

- The first study area (Proposed Scheme) – based on the construction footprint or boundary of the proposed works which is defined by the Order Limits (provisional Order Limits denoted on Figure 2.1). Within these areas, material assets would be consumed, and waste would be generated.
- The second study area (north-west region) – based on the likely provenance of material assets required to construct the main elements of the Proposed Scheme, and waste infrastructure that is likely to be suitable to accept waste generated by the Proposed Scheme. These include:
  - The North West Aggregate Working Party area and the North West Crown Estate Dredging area which is likely to be the first source of material assets (primary, secondary and recycled aggregates) used to construct the Proposed Scheme.
  - The former North West Regional Planning area where the waste management infrastructure, likely to be used in managing the majority of waste generated by the Proposed Scheme, is located.

11.6.5 In accordance with DMRB LA 110 (paragraph 3.7.1), professional judgement, with consideration for a balance of the proximity principle and value for money principle, has been applied in establishing the second study area.

11.6.6 Setting the study area at the regional level (north-west England) takes account of the need for the inter-regional movement of materials and waste within England, and echoes the broader approach to minerals and waste planning and management that has traditionally been undertaken on a county and regional-level basis.

11.6.7 This reflects the fact that minerals and waste planning authorities have a statutory duty to plan for an appropriate amount of minerals and waste capacity to be available over a defined period, and takes account of minerals and waste that are transferred across minerals and waste planning authority boundaries.

11.6.8 It would be up to the appointed Contractor to source materials and manage waste during the construction of the Proposed Scheme, and typically they would look to use local (sub-regional) material sources/waste infrastructure wherever practicable to minimise the environmental impact and cost of transport, and support the economic well-being of the local communities.

11.6.9 Procurement rules mean that it is not possible to prescribe specific material suppliers and waste management facilities to be used during construction of the Proposed

Scheme, and these rules prevent setting a precedent that would potentially tie the appointed Contractor to exclusive arrangements with specific material suppliers and waste management facilities.

11.6.10 The ability to use materials suppliers and waste management infrastructure from a wide range of locations would allow existing material assets and waste management capacity to be used effectively and efficiently, without resulting in local overcapacity to the detriment of the local economy.

11.7 Baseline conditions

Baseline sources

11.7.1 A desk-based assessment has been undertaken to describe the current and likely future baseline conditions for material assets and waste during the anticipated construction period (2025 to 2027) in the absence of the Proposed Scheme:

- For the first study area:
  - Types and quantity of material use and waste associated with operation of the existing M60/M62/M66 Simister Island Interchange where available.
  - Information on availability of key construction materials required for the Proposed Scheme.
- For the second study area:
  - Regional (or other relevant geographic scale) presence and capacity of material recovery or recycling facilities to be used by the Proposed Scheme.
  - Regional (or other relevant geographic scale) presence and capacity of landfill facilities to be used by the Proposed Scheme.
  - Location of mineral sites and peat resources in relation to the Proposed Scheme.

11.7.2 Baseline data has been collected at both the regional (north-west), sub-regional (Greater Manchester) and local (provisional Order Limits) level, including availability of primary, secondary and recycled aggregate materials; presence of mineral safeguarding sites and peat resources; as well as information on waste management capacity, including remaining landfill void space and annual throughputs of waste transfer, waste treatment, metal recycling and waste incineration facilities.

11.7.3 The baseline assessment has been prepared with reference to the latest (noting the limitations in Section 11.5) minerals and waste planning information published by the:

- Ministry of Housing, Communities and Local Government[5]
- North West Aggregate Working Party
- Association of Greater Manchester Authorities

[5] Since replaced by the Department for Levelling Up, Housing and Communities.

- British Geological Survey (BGS)
- Crown Estate
- Environment Agency

11.7.4 No account of future climate change has been considered in the baseline conditions, as this is unlikely to affect the material assets or waste matters baseline within the timescales of constructing the Proposed Scheme (2025 to 2027). Please refer to Chapter 15: Climate for potential impacts resulting from climate change during construction and operation of the Proposed Scheme.

Baseline conditions

Material assets

11.7.5 Primary, secondary and recycled aggregates have been chosen to act as a proxy indicator of regional and sub-regional material assets given that large quantities of aggregates are typically required for motorway and all-purpose trunk road projects.

11.7.6 This was also considered appropriate due to the prominence given to aggregates in the DMRB LA 110 environmental assessment standard; and that aggregates represent the construction materials which, by weight, constitute the majority of material assets required to deliver the Proposed Scheme.

11.7.7 This is also supported by the Sustainable Development Strategy and Action Plan (Highways England, 2017) which confirms that its key ambition covering manufactured capital is to:

- Push towards a ‘circular’ approach to the management of its resources
- Minimising its demand for primary resources extracted from the ground
- Maximising the reuse of the resources already in use on the network

Aggregates consumption associated with the existing interchange

11.7.8 The operational maintenance of the existing M60/M62/M66 Simister Island Interchange is likely to consume both unbound aggregates (used as sub-base and drainage applications) and bound aggregates (used in ready mixed concrete, asphalt and pre-cast concrete products).

11.7.9 At the time of writing, there were no figures available regarding the baseline quantities of operational/maintenance aggregates consumption across the first study area. Based on recent experience on other road schemes, this information is unlikely to be available at sufficient granularity to be useful in reporting the baseline conditions associated with the first study area.

11.7.10 Notwithstanding, it is proposed that operational effects be scoped out of the assessment for the reasons outlined in Section 11.8.

Regional primary, secondary and recycled aggregates

11.7.11 The principal materials used in road construction are primary aggregates, including sand, gravel and crushed rock.

11.7.12 Primary aggregates are produced from naturally occurring mineral deposits and used for the first time, as defined by the Mineral Planning Factsheet Construction Aggregates (BGS, 2019). Aggregates are normally defined as being hard, granular materials which are suitable for use on their own or with the addition of cement, lime or bituminous binders. However, a proportion of aggregates sales are for construction fill or other uses where soft and non-granular material may be acceptable or specified.

11.7.13 BGS (2019) confirms that the main use of sand and gravel is for concrete (63% of the total sand and gravel sold in Great Britain). Other uses for sand include mortar, and for gravel include drainage layers or construction fill. The main use for crushed rock is as roadstone in road construction (40% of the total crushed rock sold), where it is either coated with bitumen in asphalt or used uncoated. A further 15% of crushed rock is used in concrete.

11.7.14 The Aggregate Minerals Survey for England and Wales 2019 (Ministry of Housing, Communities and Local Government, 2021a) confirms that crushed rock has a much wider range of uses than sand and gravel, including as a source of both coarse and fine concrete aggregate (14%), other screened and graded aggregates (28%) and for other construction uses, including fill (18%). However, its main use is in road construction (37%), both unbound, primarily for the foundations of roads, and bound with either bitumen or cement in the upper layers.

11.7.15 The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021b) requires mineral planning authorities (MPAs) to maintain a minimum landbank of seven years for sand and gravel and a minimum landbank of 10 years for crushed rock. This is used to determine whether there is a shortage or surplus of supply in a given minerals planning area. The North West Aggregate Working Party is the body charged with data collection to facilitate planning by MPAs, national government agencies and the aggregate industry.

11.7.16 The latest North West Aggregate Working Party Annual Monitoring Report 2021 (Capita, 2022) provides sales and reserves data for the calendar year 01 January to 31 December 2020. This confirms that sand and gravel and crushed rock landbanks for the north-west were 8.05 years and 35.51 years respectively at the end of 2020, and therefore above their respective minimum landbank requirements. Sales of sand and gravel and crushed rock in 2020 in the north-west were 2.13Mt and 6.61Mt respectively, with reserves of 21.11Mt and 247.52Mt.

11.7.17 Capita (2022) confirms that the sand and gravel landbank in Greater Manchester (at 6.22 years) at the end of 2020 is below the seven-year minimum requirement and could be fully depleted during the Minerals Local Plan period (2012 to 2027) unless additional proposals for minerals extraction come forward and planning permissions are granted for the release of additional reserves. Sales of sand and gravel in 2020 were 0.34Mt, above the ten-year average of 0.28Mt and equalling the three-year average of 0.34Mt.

11.7.18 Capita (2022) reports that, whilst reserves of crushed rock are depleting year on year and additional permissions for its extraction will be required in the medium to long term, the landbank in Greater Manchester (at 15.06 years) is currently above the 10 year minimum requirement. Sales of crushed rock in 2020 were 0.74Mt, below both the ten-year average of 0.87Mt and the three-year average of 0.96Mt. Capita (2022) suggests that Greater Manchester is heavily reliant on imported high quality crushed rock as the material extracted within the sub-region is generally of poor quality.

11.7.19 Whilst Capita (2022) reports that sand and gravel reserves in Greater Manchester have tended to fall and are currently below the required seven-year landbank and are likely to remain that way, it suggests that the general fall in sales and reserves of crushed rock may indicate an increased use of secondary and recycled aggregate in the sub-region in place of local primary aggregates. Capita (2022) estimates secondary and recycled aggregate production in the north-west region and Greater Manchester sub-region to have been 7.13Mt and 3.77Mt in 2020, based on a respective handling rate of 8.06Mt and 4.01Mt of C&D materials. This estimate is based on a review of the Environment Agency's Waste Data Interrogator[6].

11.7.20 Capita (2022) also reports that information on the sales of secondary and recycled aggregates was collected through the surveys sent to operators of fixed C&D recycling sites and secondary aggregate producers in the north-west of England. These surveys recorded total sales of secondary / recycled aggregate of 0.99Mt and 0.64Mt respectively in the north-west region and Greater Manchester sub-region in 2020.

11.7.21 In addition to the land-won primary aggregates and secondary and recycled aggregates, the Marine Aggregates Capability and Portfolio Document 2021 (Crown Estates, 2021) reports that there were an additional 9.81Mt of marine aggregate reserves in the north-west as of July 2021, which equates to an additional reserve life of 35.16 years.

Mineral safeguarding sites

11.7.22 DMRB LA 110 (terms and definitions) defines mineral sites as *'Operational sites or sites identified within strategic planning documents for the extraction of minerals.' No definition is provided for mineral safeguarding sites in DMRB LA 110. Mineral sites are therefore assumed to equate to mineral safeguarding sites for the purpose of assessment.*

11.7.23 MPAs are required to define MSAs and adopt appropriate policies in order that known locations of specific mineral resources of local and national importance are not needlessly sterilised by non-mineral surface development. The NNNPS requires that, where a proposed development has an impact on an MSA, there is appropriate mitigation put forward to safeguard mineral resources.

11.7.24 A review of the BRITPITS database (BGS, 2020) has not identified any operational mineral sites within or in close proximity to the first study area. However, a review of the 'Adopted Greater Manchester Joint Minerals Plan' and 'Bury Council Online Proposals Map' suggests that the Proposed Scheme is located within an area designated as MSAs for sand and gravel, and brick clay/surface coal (as shown on Figure 11.1).

11.7.25 This is supported by the Greater Manchester Mineral Resources Map in Support of National, Regional and Local Planning (BGS, 2005) which identifies that the first study area is predominately underlain by mineral resources consisting of superficial

[6] It is important to understand the data limitations associated with the Waste Data Interrogator. The data within the interrogator is collected from the returns from permitted facilities and records only waste received, and waste exported from site. It is not intended as a tool for calculating secondary and recycled aggregates per se.

glaciofluvial sand and gravel deposits; and brick clay and fireclay deposits, coincident with shallow coal bearing strata of the Pennine Coal Measures.

11.7.26 Consultation with the Greater Manchester Minerals and Waste Planning Unit, undertaken for the Proposed Scheme at PCF Stage 2 (option selection), also confirmed the presence of four Areas of Search (AoS) for sand within, or in close proximity to, the study area (as shown on Figure 11.1):

- The first is located within land immediately to the south of the existing northbound to westbound M60 J18 offslip at Parrenthorn Farm and Clarke's Cross;
- The second is located immediately to the south-east of Parrenthorn High School, and is bordered by Bridle Road;
- The third is located immediately to the north-west of Brookvale Care Home, and is currently intersected by Egypt Lane; and
- The fourth is located east of the Hills Lane overbridge, within land occupied by the Hills private property and Pike Fold Golf Club.

11.7.27 AoS are areas where knowledge of mineral resources may be less certain than specific mineral extraction site allocations, but within which planning permissions for particular sites could be granted to meet any shortfall in supply if suitable applications were made. AoS are located within the much larger MSA designations, which are based on the extent of the mineral resource excluding the urban area.

11.7.28 It should be noted that both MSAs and AoS are not considered to meet the definition of mineral sites, as defined in DMRB LA 110, as Government guidance makes it clear that there is no presumption that resources defined in MSA or AoS would be worked/extracted.

Peat resources

11.7.29 DMRB LA 110 (terms and definitions) defines peat resources as "existing or potential peat extraction sites". National planning policy means that MPAs do not identify peat as a mineral resource of local and national importance and specifies that LPAs do not identify new sites or extensions to existing sites for peat extraction.

11.7.30 A review of the Greater Manchester Joint Minerals Plan April 2013 (Association of Greater Manchester Authorities, 2013) confirms that there are sufficient peat workings with planning permission until 2042 to meet existing and future demand and no new planning permissions need be granted for new peat workings in Greater Manchester. In line with the requirements of the NPPF, the Minerals Local Plan does not include an MSA for peat resources.

11.7.31 Peat extraction is focused in the Salford and Wigan areas of Greater Manchester. In the recent past peat has been worked at three sites:

- Little Woolden Moss with a planning permission running to 2042
- Chat Moss where permission expired in 2010
- Astley Moss which finished in 2015

11.7.32 None of these peat workings are located in proximity to the first study area, and there is limited potential for further peat extraction in Greater Manchester as the area has

already been extensively worked. The current policy drive in England is towards carbon sequestration and as a consequence peat harvesting is generally not encouraged.

11.7.33 The Minerals Information Online Tool (BGS, n.d.) confirms the presence of three areas of superficial peat deposits within the first study area (as shown on Figure 11.1):

- The first is located to the north of M60 J18 from approximately 250 m north of M60 J18 southbound to eastbound off-slip to the Pike Fold Golf Club ponds.
- The second is located to the west of M60 J18 underlying the M60 carriageway from approximately 550 m west of M60 J18 to approximately 40 m east of Sandgate Road bridge.
- The third is located to the east of M60 J18, immediately north and east of the Simister allotments and Simister Playground respectively,

11.7.34 Furthermore, occasional reference to organic material or organic clay in historic borehole logs would suggest that localised peat deposits may also be present elsewhere within the study area.

11.7.35 Notwithstanding, these peat deposits are not considered to meet the definition of peat resources provided in DMRB LA 110 as they are neither existing nor potential commercial peat extraction sites.

11.7.36 Information on peat deposits with respect to superficial geology and as a soil resource are covered in Chapter 10: Geology and Soils. This includes the presence of peat in BGS borehole records.

Waste management

11.7.37 Constructing the Proposed Scheme would potentially produce a range of waste types including inert, non-hazardous and small amounts of miscellaneous hazardous wastes.

11.7.38 The majority of wastes assumed to be produced would be C&D type wastes. There would also be a small amount of municipal-type waste associated with construction workers such as food waste, packaging, sewerage etc.

11.7.39 A large proportion of this waste is likely to be suitable for reuse, recycling or other recovery, although a small proportion may also require disposal to landfill.

Waste generation associated with the existing interchange

11.7.40 The operational maintenance of the first study area is likely to generate a range of C&D wastes including, but not limited to asphalt planings, soft-estate vegetative arisings, road sweepings, gully arisings, oil separator waste, animal by-products, litter etc.

11.7.41 At the time of writing, there were no figures available regarding the baseline quantities of operational / maintenance waste generated across the first study area. Based on recent experience on other road schemes, this information is unlikely to be available at sufficient granularity to be useful in reporting the baseline conditions associated with the first study area.

11.7.42 Notwithstanding, it is proposed that operational effects be scoped out of the assessment for the reasons outlined in Section 11.8.

National and regional construction and demolition waste generation

11.7.43 The UK Statistics on Waste (Defra, 2022) reports that the construction sector is the largest contributing sector to the total waste generation in England. This sector generated 119.4Mt of construction, demolition and excavation (CD&E) waste[7] in 2018 (the most recent year available).

11.7.44 Defra (2022) provides an update on the generation and management of UK waste, including the contributions made by various sectors. This confirms that the construction sector in England generated a total of 53.6Mt of non-hazardous C&D waste in 2020 (the most recent year available), 93.2% of which was recovered.

11.7.45 The annual recovery rate for C&D waste in England has remained above 92% since 2010, which is well above the Waste (England and Wales) Regulations 2011 target of 70%. This excludes hazardous waste and excavation and dredging waste which are outside the scope of the target.

11.7.46 The 2021 Waste Data Interrogator (Environment Agency, 2022a) confirms that approximately 8.7Mt of C&D waste was received at waste facilities in the north-west region in 2021, with 3.7Mt of this received at waste facilities in the Greater Manchester sub-region.

11.7.47 Environment Agency (2022a) records that 1.2Mt (28% inert waste, 70% non-hazardous waste and 2% hazardous waste) and 0.2Mt (63% inert waste and 37% non-hazardous waste), of the total waste disposed of to landfill from all sources in the north-west region and Greater Manchester sub-region respectively in 2021, was C&D waste.

Waste transfer, treatment, recycling and recovery baseline

11.7.48 The availability of waste transfer, treatment, recycling and recovery infrastructure able to accept waste generated during construction of the Proposed Scheme has been considered through a review of the 2021 Waste Data Interrogator (Environment Agency, 2022a).

11.7.49 Whilst annual capacity data is published by the Environment Agency for both landfill and incineration facilities at the national, regional and sub-regional level, no annual capacity data is published by the Environment Agency for waste transfer, treatment or recycling sites. Only annual permitted throughput is published for these facilities.

11.7.50 The total annual permitted throughput or capacity reported by the Environment Agency (2022a) for the north-west region and Greater Manchester sub-region is detailed in Table 11.4.

[7] The CD&E figures include excavation waste and dredging spoils that are out of scope for the UK C&D waste statistics shown in paragraph 11.7.44.

Table 11.4: Total permitted throughput or capacity of transfer, treatment, metal recycling and incineration in the north-west and Greater Manchester, 2021

Site type	North-west region (000s tonnes)	Greater Manchester sub-region (000s tonnes)
Transfer (annual throughput)		
Hazardous waste transfer stations	761	359
Household, industrial, commercial waste transfer stations	4,389	1,566
Non-biodegradable waste transfer stations	212	211
Treatment and metal recycling (annual throughput)		
Material recovery	1,851	641
Physical treatment	5,787	1,918
Physico-chemical treatment	1,840	475
Chemical treatment	88	-
Composting	848	223
Biological treatment	9,634	4,690
Metal recycling	3,517	689
Incineration (annual capacity)		
Co-incineration of hazardous waste	175	-
Hazardous waste incineration	100	-
Municipal and/or industrial & commercial incineration	1,227	127
Biomass/waste wood incineration	324	-

11.7.51 The Waste Data Interrogator 2021 (Environment Agency, 2022a) reports that, as of 2021, there were 1,150 permitted transfer, treatment, metal recovery, incineration and use of waste sites in the north-west, with 763 of these having accepted waste in 2021. No equivalent data is provided at the sub-regional level.

11.7.52 Based on these data, it can be assumed that there would be opportunities for waste arisings during the construction of the Proposed Scheme to be transferred, treated, recycled or recovered as appropriate in the second study area, if they cannot be reused, recycled or otherwise recovered on-site (i.e. within the first study area).

Inert, non-hazardous and hazardous landfill capacity baseline

11.7.53 For wastes which cannot be reused, recycled or otherwise recovered, disposal to landfill would be required. The Environment Agency (2022a) details the total remaining landfill capacity in the north-west region and Greater Manchester sub-region in 2021 as presented in Table 11.5.

Table 11.5: Total landfill capacity available in the north-west and Greater Manchester, 2021

Landfill type	North-west region (000s tonnes[1])	Greater Manchester sub-region (000s tonnes[1])
Hazardous merchant landfill	7,140	-
Hazardous restricted landfill	-	-
Non-hazardous landfill with SNRHW cell[2]	6,303	5,295
Non-hazardous landfill	14,764	819

Landfill type	North-west region (000s tonnes[1])	Greater Manchester sub-region (000s tonnes[1])
Non-hazardous restricted landfill	-	-
Inert landfill	6,608	1,727
Total	**34,815**	**7,841**

[1] Converted from cubic metres through adoption of the following conversion factors: inert landfills 1.5 tonnes/m^3, non-hazardous landfills 0.83 tonnes/m^3 and hazardous landfills 1.5 tonnes/m^3.

[2] Some non-hazardous sites can accept some Stable Non-Reactive Hazardous Wastes (SNRHW) into a dedicated cell, but this is usually a small part of the overall capacity of the site.

11.7.54 Remaining Landfill Capacity 2021 data (Environment Agency, 2022b) reports there were 31 permitted operational landfills with remaining capacity in the north-west region at the end of 2021 (comprising 8 inert landfills, 16 non-hazardous landfills, two non-hazardous landfills with SNRHW cell and five hazardous merchant landfills).

11.7.55 Reference to Remaining Landfill Capacity 2021 data (Environment Agency, 2022b) confirms that there were four operational landfills with remaining capacity located in the Greater Manchester sub-region (comprising two inert landfills, one non-hazardous landfill and one non-hazardous landfill with SNRHW cell) at the end of 2021.

11.7.56 Whilst the north-west region has sufficient inert, non-hazardous and hazardous landfill capacity, there is currently no merchant hazardous waste landfill capacity available in the Greater Manchester sub-region. The management of hazardous waste generated in the sub-region region would therefore take place at recycling, recovery or disposal facilities in the region.

11.7.57 No information is publicly available at the sub regional or regional level on when the permitted landfills are scheduled to cease infilling operations. This information is not provided in the Environment Agency's Public Registers or Waste Data Interrogator or Remaining Landfill Capacity datasets. No direct consultation would be undertaken with landfill operators to populate this information.

Future baseline

Future primary, secondary and recycled aggregates baseline

11.7.58 For the purpose of this assessment, it has been assumed that the future material assets baseline (size of the primary aggregate landbanks, marine aggregate reserves and the market for primary, secondary and recycled aggregates) would be largely the same during construction (2025 to 2027) as for the current baseline year.

11.7.59 Whilst it is expected that existing landbanks and marine dredging sites would continue to be depleted, other sites and extensions to existing sites are likely to be granted to offset any potential shortfall in capacity, ensuring that sufficient availability is provided in line with future policy requirements and market demands.

Future minerals safeguarding sites and peat resources baseline

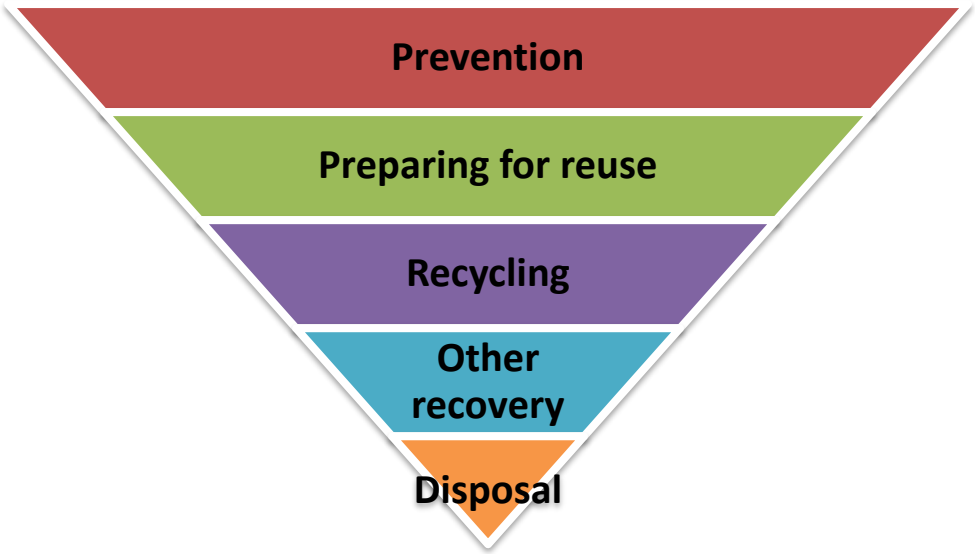
11.7.60 It has been assumed that the size and location of mineral safeguarding sites would remain unchanged from the current baseline year. The locations of MSAs are considered to be relatively constant given that they are largely defined on the basis of geological mapping. Future allocated mineral sites would typically be located within

MSAs. It has also been assumed that the size and location of peat deposits would remain unchanged from the current baseline year.

Future waste treatment, recycling and recovery capacity baseline

11.7.61 Waste treatment, recycling and recovery infrastructure facilities are considered to be a beneficiary of incoming materials through driving the management of the waste hierarchy, and by creating conditions that facilitate a circular approach to the management of materials (see Plate 11.1).

Plate 11.1: Waste hierarchy



11.7.62 These facilities are therefore not considered to be sensitive receptors for the purpose of assessment in the same way as landfill sites are, given that they are part of a recovery system that has the potential to reduce the environmental effects associated with waste generation, management and disposal. These facilities are also different to landfills, in that landfills are a finite resource.

11.7.63 Waste treatment, recycling and recovery facilities are typically characterised by large annual throughputs; consequently, large step changes in capacity (as single facilities are commissioned) have an exaggerated impact on the historical trend. Waste treatment, recycling and recovery infrastructure capacity cannot therefore be realistically projected forward to the construction phase of the Proposed Scheme.

11.7.64 Professional experience has shown that waste markets are flexible and adapt to changing markets within a region; and that historical trends show that waste treatment, recycling and recovery is added or removed, not least to cope with changes in waste generation. It is expected that, whilst the actual waste facilities available may change over the course of constructing the Proposed Scheme, the overall capacity is likely to remain similar as the market responds.

11.7.65 The future waste treatment and recovery infrastructure capacity for use in the assessment would, therefore, be based on the most recent available Environment Agency annual capacity/input data for 2021. This suggests that there is likely to be adequate opportunity for wastes arising during the construction of the Proposed

Scheme to be treated, recycled or otherwise recovered via appropriate means within the second study area.

Future inert, non-hazardous and hazardous landfill capacity baseline

11.7.66 Projected future inert, non-hazardous and hazardous landfill void capacity has been forecast, using statistical trend analysis, and is shown in Table 11.16 and illustrated in Plate 11.2 and Plate 11.3 for the north-west region and Greater Manchester sub-region respectively during the anticipated construction phase (2025 to 2027).

11.7.67 This is based on the average annual percentage change in remaining landfill capacity for the years for which consistent data is available from the Environment Agency (i.e. 2005 to 2021). The predicted changes in inert, non-hazardous and hazardous landfill capacity are derived from the existing Environment Agency (2022a) time-based data (i.e. remaining landfill capacity at the end of each calendar year).

11.7.68 These data have been projected forward to 2027, using the calculated average annual capacity change in landfill capacity from 2005 to 2021[8], in order to provide an estimate of the remaining landfill capacity that may be available during the construction of the Proposed Scheme (expected between 2025 to 2027).

11.7.69 The estimates, provided in Table 11.6, assume continuation of a similar trend, in the subtraction and addition of landfill capacity, as that reported by the Environment Agency for 2005 to 2021.

Table 11.6: Forecast future baseline landfill capacity in the north-west and Greater Manchester, 2022-27

Timeline	North-west forecast future landfill capacity (000s tonnes)			Greater Manchester forecast future landfill capacity (000s tonnes)		
	Inert	Non-hazardous	Hazardous	Inert	Non-hazardous	Hazardous
2005	18,449	62,423	8,884	4,019	14,774	N/A
2006	31,159	58,899	8,820	10,036	13,383	N/A
2007	20,822	52,269	8,817	4,095	12,425	N/A
2008	20,217	46,196	8,553	3,052	12,246	N/A
2009	28,238	44,994	8,219	3,588	12,092	N/A
2010	21,043	44,245	7,994	3,755	11,480	N/A
2011	20,827	43,531	7,866	4,158	9,815	N/A
2012	20,821	38,328	7,641	4,417	9,326	N/A
2013	22,019	35,929	7,506	3,917	8,357	N/A
2014	12,414	35,144	7,359	5,612	8,069	N/A
2015	9,438	32,964	7,248	2,971	7,775	N/A
2016	10,021	32,648	9,947	2,561	6,281	N/A

[8] North-west region: inert landfill (-2.84%), non-hazardous landfill (-6.21%) and hazardous landfill (-0.77%); Greater Manchester sub-region: inert landfill (+2.38%), non-hazardous landfill (-4.15%) and hazardous landfill (n/a).

Timeline	North-west forecast future landfill capacity (000s tonnes)			Greater Manchester forecast future landfill capacity (000s tonnes)		
	Inert	Non-hazardous	Hazardous	Inert	Non-hazardous	Hazardous
2017	8,741	25,965	9,839	2,293	6,448	N/A
2018	7,035	25,975	9,692	2,245	7,709	N/A
2019	8,247	20,464	9,225	2,088	4,796	N/A
2020	7,806	23,229	9,408	1,787	6,515	N/A
2021	6,608	21,067	7,140	1,727	6,115	N/A
2022	6,420	19,758	7,085	1,768	5,861	N/A
2023	6,238	18,531	7,030	1,810	5,618	N/A
2024	6,061	17,379	6,976	1,853	5,385	N/A
2025	5,888	16,300	6,922	1,897	5,162	N/A
2026	5,721	15,287	6,868	1,942	4,947	N/A
2027	5,558	14,337	6,815	1,988	4,742	N/A
Average (000s tpa) during construction (2025 to 2027)	**5,723**	**15,308**	**6,868**	**1,943**	**4,950**	**N/A**

Plate 11.2: Forecast future landfill capacity in the north-west (2022-27) (000s tonnes)

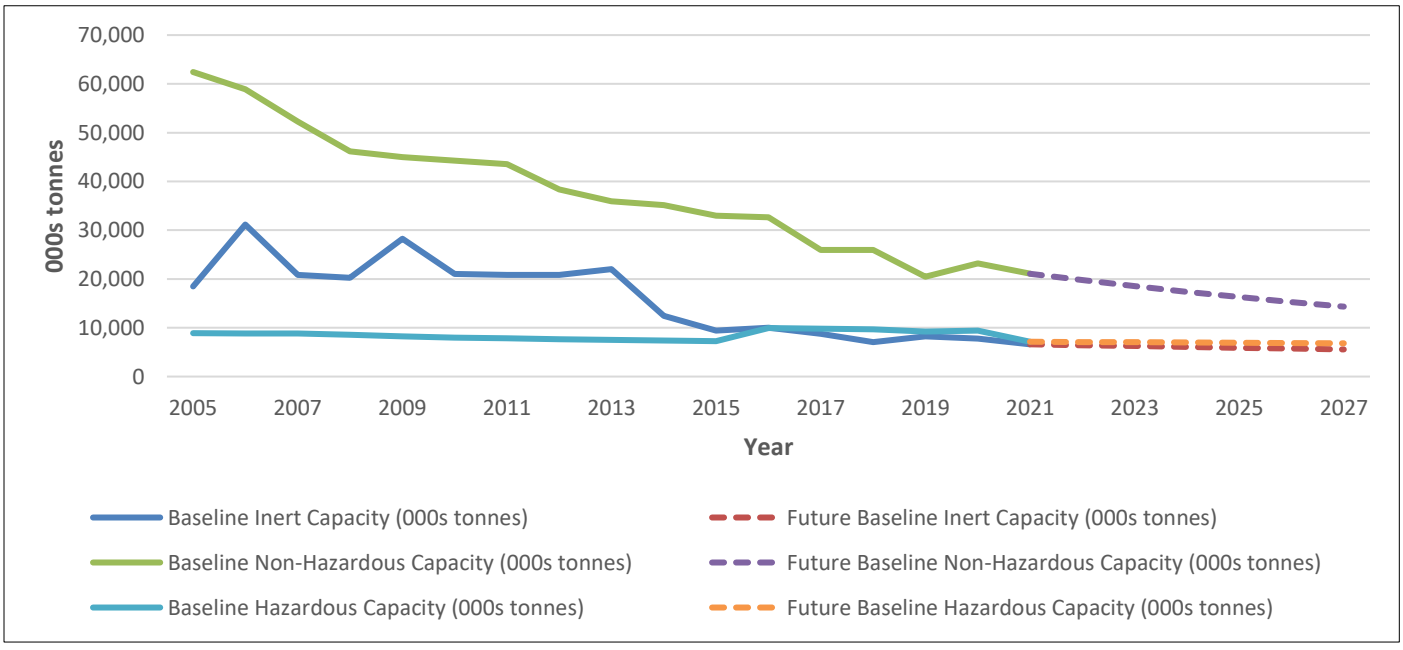
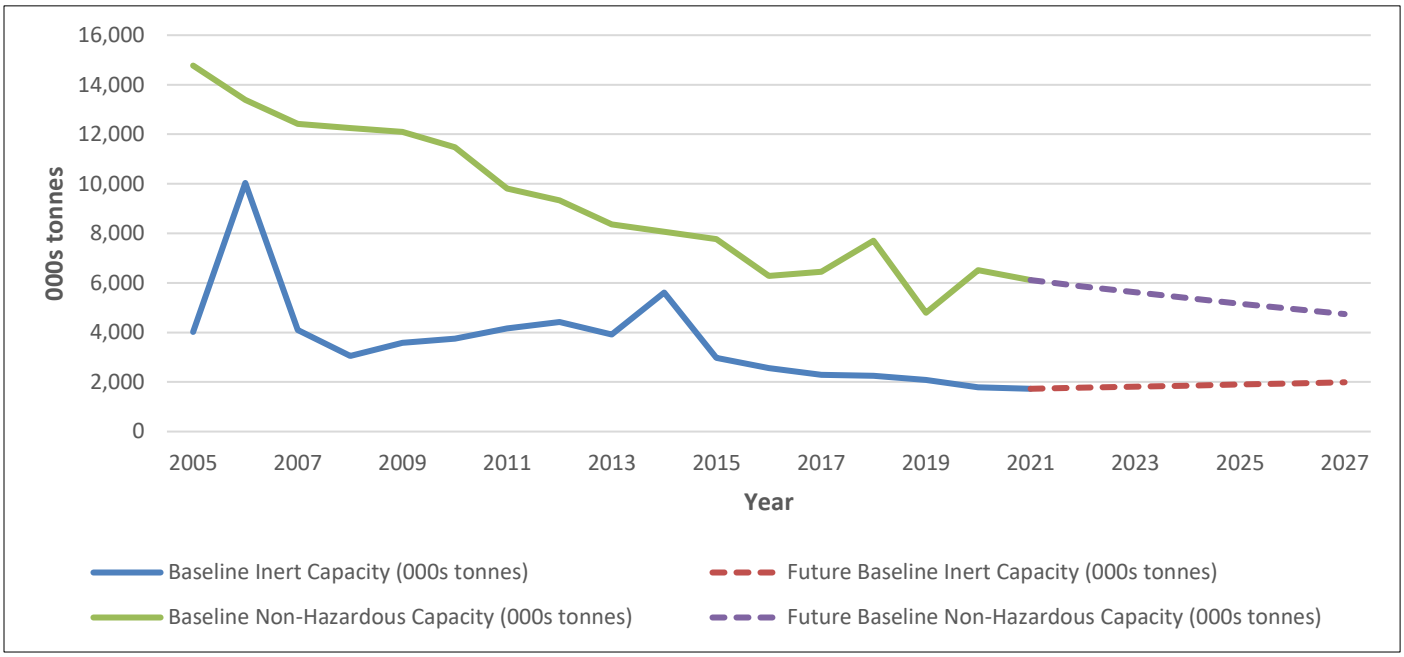


Plate 11.3: Forecast future landfill capacity in Greater Manchester (2022-27) (000s tonnes)



11.7.70 Although there is generally a reducing trend for landfill disposal in England, the forecast future baseline landfill capacity suggests that there is likely to be available inert, non-hazardous and hazardous landfill in the north-west region to support the construction of the Proposed Scheme between 2025 and 2027. However, there is likely to be limited capacity at the sub-regional level unless additional capacity is provided in the intervening period by the Grater Manchester Authorities.

11.7.71 This means that any inert, non-hazardous, SNRHW and hazardous waste that is destined for landfill would most likely find available regional capacity in the study area. Waste Planning Authorities have a statutory responsibility to make provision for sufficient landfill capacity; future local plans should include provision for landfill sites and/or to identify other suitable placement locations to enable continued capacity to be available as landfill void space is occupied.

11.7.72 Even where wastes are accepted at landfill, some may, subject to their properties, be used within landfill cover or other engineering uses rather than subject to and accounted as disposal. Any landfills that have ceased infilling, at the time of construction, and are no longer accepting waste may also still require inert and non-hazardous materials for capping and restoration purposes, and therefore may be amenable to accepting any suitable surplus materials arising from construction.

11.7.73 For example, reference to Environment Agency (2022a) confirms that 926,000 tonnes and 96,000 tonnes were deposited in landfill for the purposes of waste recovery in the north-west region and Greater Manchester sub-region respectively in 2021. This activity covers the deposit of waste in land for benefit and recovery purposes. Whereas landfilling is the deposit in land for the purposes of final disposal.

11.7.74 Notwithstanding, it is envisaged that the vast majority of waste arising from construction of the Proposed Scheme would be re-used, recycled or otherwise recovered within the first or second study area in accordance with legislative and policy requirements. This assumption is validated by the available English statistics, with Defra (2022) confirming that 93.2% of non-hazardous C&D waste is currently being diverted from landfill. This

would also be required in order to demonstrate the Proposed Scheme's contribution to achieving the following targets in DMRB LA 110:

- At least 70% (by weight) of non-hazardous C&D waste "shall" be subjected to material recovery/diverted from landfill (constitutes a requirement of Highways England) (paragraph 3.17 of DMRB LA 110).
- At least 90% (by weight) of non-hazardous C&D waste "should" be subjected to material recovery/diverted from landfill (constitutes advice expressed as a recommendation by Highways England) (paragraph E/2.1.1 of DMRB LA 110).

Summary of baseline conditions

11.7.75 The baseline environment is comprised of receptors which have been defined geographically based on the likely impacts and effects associated with the use and consumption of material assets and the production and disposal of waste, as set out in DMRB LA 110 (paragraph 3.9 and 3.10 of DMRB LA 110).

11.7.76 Whilst these receptors and a summary of their baseline conditions are provided in Table 11.7, it should be noted that the DMRB LA 110 significance category descriptions preclude the need to assign a sensitivity rating to the identified receptors for the purposes of assessment (see Section 11.4).

11.7.77 The sensitivity of all receptors within the baseline are intrinsically considered within the significance category descriptions provided in DMRB LA 110, and as such the methodology for this aspect is not based on the method of combining the sensitivity of the receptor and the magnitude of impact to determine the significance of effect as detailed in Chapter 5: Environmental assessment methodology.

Table 11.7: Summary of the baseline conditions for material assets and waste

Sensitivity	Description	Summary of baseline conditions
N/A – not required for assessment	Primary, secondary and recycled aggregates	Primary aggregates are, in their own right, considered as sensitive receptors. Notwithstanding, there is likely to be a good supply of both primary, secondary and recycled aggregates within the second study area to support the construction of the Proposed Scheme.
N/A – not required for assessment	Mineral safeguarding sites and peat resources	A proportion of the first study area intersects with MSAs for sand and gravel and surface coal/brick clay, and three AoS for sand. Three areas of superficial peat deposits are also recorded within the first study area. These MSAs, AoS and peat deposits are not considered to meet the definition of mineral safeguarding sites and peat resources provided in DMRB LA 110.
N/A – not required for assessment	Inert, non-hazardous and hazardous landfill capacity	There is likely to be available landfill capacity within the second study area to accommodate the majority of wastes arising from the construction of the Proposed Scheme, and there are unlikely to be any specific constraints with regards to disposing of inert, non-hazardous, stable non-reactive hazardous or hazardous waste streams. However, very limited landfill capacity is forecast to be available within the Greater Manchester sub-region to support the construction of the Proposed Scheme between 2025-27.

11.7.78 DMRB LA 110 (paragraph 3.12.2) recommends that sensitive receptors (designated sites identified in other environmental topics) should also be considered in order to minimise the effects from material assets and waste. In addition to the generalised

receptors identified in Table 11.7 for material assets and waste, additional environmental receptors and designated sites are considered as part of the other aspect chapters in this PEIR and are not reproduced in this chapter.

11.8 Potential impacts

Construction

Consumption of material assets

11.8.1 Constructing the Proposed Scheme would unavoidably require the use of large quantities of material assets which impacts upon their immediate, and in the case of primary aggregates (new materials rather than secondary or recycled), long-term availability, resulting in temporary or permanent adverse impacts on the environment through the depletion of natural resources.

11.8.2 Material assets include both primary materials, such as mineral aggregates, and manufactured construction products such as asphalt and concrete. Some of these materials would originate off-site, purchased as primary construction products, but it is likely that some would arise on-site, particularly from excavated soils, crushed concrete or recycled asphalt planings, or secondary / recycled materials brought in from off-site, possibly from other projects or industries.

11.8.3 Whilst the precise quantities are currently unknown at this stage, the Proposed Scheme is anticipated to require a large quantity of both primary materials and manufactured construction products during earthworks, demolition and main construction activities. These materials are likely to include, but are not limited to:

- Topsoil, general fill and landscaping fill
- Aggregates for capping, sub-base, site compound hardstanding, drainage filter media and concrete
- Asphalt base, binder and surface courses, including aggregates and bitumen
- Concrete for use in structures, retaining walls, culverts, headwalls, piles, foundations, fenceposts, kerbs, chambers, catch pits, etc
- Iron and steel for use in structures, reinforcement, safety barriers, fencing, manhole covers, cabinets, etc
- Plastics for use in drainage pipes, chambers, gully pots and interceptors, traffic signs, cables, ducting and road markings, etc
- Timber for use in fencing and for structural formwork and falsework

11.8.4 The largest quantity of materials to be used in construction of the Proposed Scheme would likely be earthworks materials, aggregates for road foundation materials, asphalt aggregates and drainage and duct aggregates. It is assumed at this stage that all these materials, except for site-won earthwork's materials, would be imported to site.

11.8.5 Large amounts of imported fill material would be required particularly for the new Northern Loop link. This may be reduced by reusing or recycling material generated at site. However, there is still expected to be a significant shortfall of material, estimated at approximately 180,000m^3. This volume excludes attenuation ponds which are expected

to generate up to 200,000m^3 of arisings (this volume will be confirmed once the size of the attenuation ponds are confirmed).

11.8.6 The primary aim will be to utilise this arising cut material to construct the permanent earthworks and satisfy the fill deficit. However, this is subject to the arising material being suitable for reuse as an earthworks engineering fill which will be confirmed following site investigations. Should the material be unsuitable, various options will be explored to obtain this material from local sources, including other nearby construction projects which have a surplus of suitable fill, as well as local quarries. No borrow pits will be created specifically for the Proposed Scheme.

Sterilisation of mineral safeguarding sites and peat resources

11.8.7 The Proposed Scheme would also require structural works (including earthworks and concrete and steel structures) as well as imported aggregates and asphalt for road construction. Constructing the Proposed Scheme would require land to be acquired and used outwith the existing highway boundary for both temporary (e.g. construction compounds, laydown areas, haul roads etc.) and permanent (for new highways, access roads, structures, embankments, drainage, attenuation ponds and land for environmental mitigation etc.) construction purposes.

11.8.8 Any land to be permanently acquired and used inside MSAs and AoS may therefore result in potential partial sterilisation impacts to mineral resources. Sterilisation may occur through constructing the Proposed Scheme directly overlying these MSAs and AoS which may restrict their future workability through immediate land take, or through construction on or close to the boundary of these areas which can indirectly sterilise the mineral resource. Indirect sterilisation can occur through closing off the access to a resource in circumstances where access to the resource is limited.

11.8.9 The potential exists for partial sterilisation impacts to occur to the MSA for sand and gravel and brick clay/surface coal within the first study area, and more specifically to the:

- AoS for sand and gravel located at Parrenthorn Farm and Clarke's Cross, where the proposed M60 northbound to M60 westbound free flow link would be constructed.
- AoS for sand and gravel located immediately to the south-east of Parrenthorn High School, where land for environmental mitigation is proposed.

11.8.10 Whilst additional land take would be required for construction site compounds, working areas, storage and haul roads within the MSAs and AoS present in the study area, these works are of a temporary nature and would be completed with these areas restored to a condition that would not inhibit the future extraction of mineral resources.

11.8.11 It is also assumed that the proposed land for environmental mitigation, that is to be permanently acquired within MSAs / AoS, would not inhibit the future extraction of mineral resources. This land would not form part of the hard engineered part of the highway (i.e. to be constructed with concrete, steel, bituminous materials, etc.), and therefore sterilisation is unlikely to occur as it is assumed that this land could be restored to its previous use (as land for environmental mitigation) should these minerals ever need to be extracted.

11.8.12 Due to its compressible nature, any peat that is encountered within the footprint of the Proposed Scheme may need to be excavated and managed as waste if deemed

unsuitable for conventional construction methods. Peat resources hold large stocks of poorly protected carbon, and any excavation of peat is likely to result in carbon losses from the excavated peat and also any areas affected by drainage. Any impacts on climate from the potential release of sequestered carbon would be considered as part of the Chapter 15: Climate assessment for the Proposed Scheme.

11.8.13 Notwithstanding this, it is proposed that both mineral safeguarding sites and peat resources be scoped out of the assessment on the basis that no likely significant effects would be realised for the Proposed Scheme. This determination is supported by the following consultation responses, from the Greater Manchester Minerals and Waste Planning Unit and Coal Authority, that were received for the Proposed Scheme at PCF Stage 2 (option selection):

- The Greater Manchester Minerals and Waste Planning Unit (Williams. C, 2018/19) has confirmed that the extent of the Proposed Scheme is unlikely to impact on the potential future extraction of sand and gravel within the study area, as such it is content that the resource would not be sterilised and no minerals resource assessment is therefore necessary. No sterilisation of the brick clay resource is also likely to occur given that the Williams. C (2018/19) confirmed that they would not expect the clay associated with the coal to be exploited as the Coal Authority has confirmed that the coal would not need to be extracted.
- The Greater Manchester Minerals and Waste Planning Unit (Williams. C, 2018/19) has confirmed that no sterilisation (by definition) of peat resources is likely to occur given that the current policy drive is towards carbon sequestration, and subsequently planning authorities do not identify new sites or extensions to existing sites for peat extraction. Whilst the approach of the Greater Manchester Minerals Plan is not to extract peat, should peat extraction be necessary the local environmental impacts of the loss of this resource should be dealt with through any scheme proposals put forward but would not be a minerals planning issue.
- The Coal Authority (MacArthur, 2019) has confirmed that the sterilisation of the surface coal resource is unlikely to occur given that there are no known coal seams/outcrops near the surface. Consequently, in considering the limited extent of the area where the development is proposed, the fact that the shallowest coal seam is in excess of 30m below ground level, together with both the suggested regional benefits and the impracticalities of extracting any surface coal so close to an operating highway, the Coal Authority considers that the removal of the coal would be unreasonable and that a sustainable objection could not be justified. This is further reinforced when considering the key developments in the UK energy system and the ways in which energy is expected to be produced in the longer term.

Generation and disposal of waste to landfill

11.8.14 Constructing the Proposed Scheme would generate large quantities of surplus materials and waste, leading to potential impacts on the available waste management infrastructure through permanently occupying landfill capacity.

11.8.15 Landfill is a finite resource and, through the ongoing disposal of waste, there is a continued need to expand existing and develop new landfill facilities. This loss of resources to landfill requires the extraction or production of new material assets which, in turn, accelerates the depletion of natural resources.

11.8.16 The utilisation of sub-regional landfill capacity also has potential to displace (or push out) waste that would otherwise be landfilled in the Greater Manchester area, thus impacting upon the waste planning authority's (WPA) proximity and net self-sufficiency principles which are viewed as a key performance indicator and driver for waste planning at the sub-regional level.

11.8.17 A range of waste types, including inert, non-hazardous and small volumes of hazardous wastes, would be generated during the construction of the Proposed Scheme. The majority of wastes produced would be C&D waste, a large proportion of which could be suitable for re-use, recycling or recovery on or off-site, although a proportion could require disposal to landfill. Smaller quantities of municipal waste (household like waste) would also be generated by construction workers and site welfare activities.

11.8.18 Whilst the precise quantities are currently unknown at this stage, the Proposed Scheme is anticipated to result in large quantities of surplus materials and wastes during earthworks, demolition and main construction activities. These waste streams are likely to include, but are not limited to:

- Vegetation, trees, scrub and invasive plants (non-hazardous)
- Surplus topsoil and unacceptable earthworks materials including peat (inert, non-hazardous or hazardous)
- Asphalt road planings (non-hazardous or hazardous (if containing road tar))
- Concrete and other masonry waste (inert)
- Signage, signal posts, lighting columns, steel safety barriers and other street furniture (non-hazardous)
- Ferrous and non-ferrous metal waste (non-hazardous)
- Treated and untreated wood waste (non-hazardous or hazardous)
- Plastic waste (non-hazardous)
- Mixed construction and demolition waste (non-hazardous or hazardous)
- Mixed packaging (non-hazardous)
- Canteen, office, ad hoc waste (non-hazardous)
- Asbestos-containing materials (hazardous)
- Hydraulic oils (hazardous)
- Waste electrical and electronic equipment (WEEE), lamps, bulbs, etc. (hazardous or non-hazardous)
- Miscellaneous hazardous waste associated with the maintenance of plant and machinery or chemicals required as part of the construction processes

11.8.19 The largest quantities of surplus materials and waste are anticipated to be unsuitable earthworks materials, excavated materials from constructing the attenuation ponds, demolition materials and asphalt planings from removal of existing pavement. It is assumed at this stage that the surplus earthworks materials would be reused within the construction of the Proposed Scheme, where geotechnically and geochemically suitable for use. Aggregate crushing and grading would be used to recycle or recover demolition and pavement arisings into the main construction works where practicable.

Operation

11.8.20 DMRB LA 110 (paragraph 3.21) specifies that the assessment shall report on the first year of operational activities (opening year). It has been assumed that no large-scale maintenance activities would occur during the first year of operational activities (2027), and thus no notable materials consumption or waste generation is likely to be realised. It has also been assumed that any sterilisation impacts to mineral safeguarding sites would have been mitigated as far as practicable during construction.

11.8.21 Operational impacts have therefore been scoped out of the assessment on the basis that no likely significant effects would be realised. Although the opening year is a time period not necessarily confined to operational effects, any construction phase effects overlapping within this period will be captured within the construction phase assessment. This was agreed with the Planning Inspectorate by way of its Scoping Opinion (Planning Inspectorate, 2021).

11.8.22 Notwithstanding this, the design process would inherently seek to reduce the consumption of material assets, unnecessary sterilisation of mineral and waste sites, and the generation of waste throughout the lifecycle of the Proposed Scheme. Design choices and the choice of materials would make a significant contribution to reducing the environmental impacts associated with material assets and waste during operation, by influencing the required method and frequency of maintenance, and facilitating opportunities to recover and regenerate materials and products at the end of first life to support a circular economy (as defined in Section 11.9).

11.8.23 It is also assumed that the assessment of any environmental impacts and effects associated with material assets and waste during any large scale future maintenance, renewal, or improvement works beyond the opening year, would be undertaken by National Highways North West Asset Delivery Contractor(s) (or equivalent) in accordance with the requirements of DMRB LA 110 (or any future environmental assessment standards specified by National Highways).

11.9 Design, mitigation and enhancement measures

11.9.1 Design, mitigation and enhancement measures will be implemented to avoid or minimise the potential environmental effects associated with the consumption of material assets, sterilisation of mineral safeguarding sites and the management of waste during the construction of the Proposed Scheme.

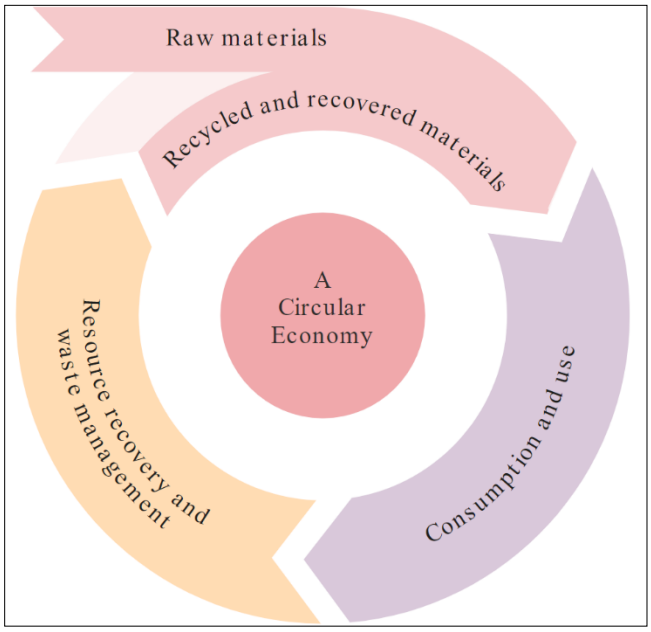
11.9.2 This section identifies established and reliable design, mitigation and enhancement measures, as per the definitions provided in Chapter 5: Environmental assessment methodology, considering relevant legislation, policy and good practice for this aspect. These measures would be implemented during the design and construction of the Proposed Scheme. Embedded mitigation would be developed as the design progresses.

11.9.3 Measures would be implemented to reduce the potential impacts associated with both the consumption of material assets and the production and disposal of waste during the construction of the Proposed Scheme. There is significant synergy between material assets and waste, thus there is overlap between the mitigation measures.

11.9.4 Minimising the use of new/virgin materials and maximising the use of reused, recycled and responsibly sourced materials in the build, and diverting materials from landfill would reduce the attendant indirect environmental impacts and effects associated with materials production (as discussed in Section 11.5), thereby supporting a circular economy.

11.9.5 A circular economy is an alternative to a traditional linear economy (of make, use, dispose) in which resources are kept in use for as long as possible; maximum value is extracted from these resources while in use; products and materials are recovered and regenerated at end of life; and products, components and materials are kept at their highest utility and value at all times (see Plate 11.4).

Plate 11.4: A Circular Economy (reproduced from Defra, 2018



11.9.6 Where practicable, the design of the Proposed Scheme should work towards the ambition of zero avoidable waste in construction. This means preventing waste being generated at every stage of the project's lifecycle, from the manufacture of materials and products, the design, specification, procurement and assembly of infrastructure through to deconstruction.

11.9.7 The primary objective for zero avoidable waste should be at the top of the waste hierarchy (see Plate 11.1) on prevention, i.e. measures taken before a substance, material or product has become waste, that use less material in design or reduce:

- The quantity of waste, including through the re-use of products or the extension of the life span of products; or
- The adverse impacts of the generated waste on the environment and human health; or
- The content of harmful substances in materials and products.

11.9.8 As such the aim is not to focus on lower value recycling and other recovery, and in any case the majority of C&D construction and demolition waste is already being 'recovered' in some form (93.2% in England). If waste cannot be prevented then the secondary

objective is for waste to be kept at its highest level within the waste hierarchy, in line with the Government's Resources and Waste Strategy and EU Waste Framework Directive, which in descending order of preference, is:

- Preparing for reuse (for example repair or remanufacture)
- Closed-loop recycling (where waste is used as a feedstock in the same process)
- Open-loop recycling (where waste is used as a feedstock for a different purpose)

11.9.9 If waste can be managed in this way, then it is 'avoidable' as it has a further use and is not being disposed of to landfill or as energy recovery. However, it is recognised that some waste produced may be unavoidable and is considered unsuitable for further use (e.g. asbestos, asbestos contaminated materials, or material treated with persistent organic pollutants). All other waste is avoidable waste, in that it can either be prevented, reused or recycled.

Embedded (design) mitigation

11.9.10 The CJP environment team is working in close collaboration with the CJP infrastructure design team to avoid or prevent environmental impacts through the scheme design. Chapter 3: Assessment of alternatives details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

11.9.11 Those design changes that are relevant to this aspect include consideration of the following, amongst others:

- Optimising the cut-fill balance to reduce material requirements and waste
- The location and extent of carriageway widening
- The alignment of the new offline carriageway

11.9.12 The main changes, from the PCF Stage 2 Preferred Route Announcement (PRA) design made at the start of PCF Stage 3, that are relevant to material assets and waste are as follows:

- Northern Loop – M60 westbound to M60 southbound – changed vertical alignment so that M66 southbound diverge link goes over (rather than under) the Northern Loop link. This results in a significant reduction of earthworks volumes compared to PRA design and also removes a retaining wall adjacent to the M66 southbound merge.
- M60 northbound to M60 westbound merge and link – removed offline link that was shown in the PRA design to maintain use of existing M60 northbound to M60 westbound link with a corresponding reduction in materials use and waste generation.

11.9.13 Embedded mitigation would also be integrated into the design and construction of the Proposed Scheme for the purpose of avoiding environmental effects from this aspect. The following measures would be implemented based on established and reliable standard construction measures considering relevant legislation, policy and good practice:

- Implementing Design for Resource Efficient (DfRE) construction principles in a systematic manner to suit the scale of the Proposed Scheme, to identify, prioritise

and select appropriate opportunities to improve project resource efficiency and design out waste:

- Designing for reuse and recovery: identifying, securing and using materials that already exist on site, or can be sourced from other projects.
- Designing for materials optimisation: simplifying layout and form to reduce material use, using standard design parameters, balancing cut and fill, maximising the use of renewable materials and materials with recycled content; and using engineering plan configurations and layouts that show how the most effective use of materials and arisings can be achieved.
- Designing for off-site construction: maximising the use of pre-fabricated structure and components, encouraging a process of assembly rather than construction.
- Designing for the future (deconstruction and flexibility): identify how materials can be designed to be more easily adapted over an asset's lifetime and how deconstructability and demountability can be increased at end of first life.
- Designing for waste efficient procurement: identifying and specifying materials that can be acquired responsibility, in accordance with recognised industry standards.

Evidence of material resource efficiencies and waste reductions would be demonstrated in a number of ways, for example value engineering registers, design meeting records, designing out waste workshops, site waste management plans, specifications, drawings or site photographs.

- Developing and implementing a Sustainable Procurement Plan (SPP). The SPP would set out a clear framework to increase the procurement and use of sustainably and responsible sourced construction materials and products with proven sustainability credentials that reduce adverse impacts on people and the environment during the construction of the Proposed Scheme. The plan would specify the:
  - Use of key material elements (asphalt, concrete, aggregate, steel, aluminium and plastics) responsibly sourced from suppliers with industry recognised responsible sourcing certification for that material (e.g. BRE (2014) BES 6001, or membership of a sector specific scheme that complies to BSI BS 8902:2009).
  - Use of timber and wood-derived products that are sustainably sourced from independently verifiable legal and sustainable sources or from a licensed Forest Law Enforcement Governance and Trade partner.
  - Use of alternatives to primary materials, where available and permitted by the Specification for Highway Works. This could include materials that already exist on site or can be sourced from other projects/suppliers.
  - Ensuring that any imported aggregates comprise re-used, secondary or recycled content at levels at least in line with the Ministry of Housing, Communities & Local Government (2009) 'North-west regional guideline for aggregates provision 2005-2020' target of 30% where available.
  - Minimal use of hazardous materials that have the potential to harm human health or the environment; and that might cause problems for future reuse, recycling and recovery.

The SPP would also set out the policies that would be employed by the appointed Principal Contractor and its subcontractors to evaluate and specify the responsible sourcing of construction materials and products, and the procedures that are to be put in place to check and verify that the SPP is being implemented and adhered to during construction. This would include setting out any measurement criteria, methodology and performance indicators to assess progress and demonstrate success; and how the chain of custody of materials would be audited and evidenced during procurement.

- Reducing any permanent land taken within or close to the boundary of MSAs and AoS to reduce any unnecessary sterilisation of minerals resources where practicable during the construction of the Proposed Scheme:
  - Any sand and gravel arisings (a safeguarded mineral resource) that are incidentally extracted during site preparations and construction would be processed and used on site where practicable, and/or exported to nearby minerals operators for processing so as to supply aggregates to other development projects for high value applications.
- Ensuring that any peat deposits encountered during construction of the Proposed Scheme are managed in accordance with the following hierarchy where practicable:
  - Prevention: avoiding generating excess peat during construction (e.g. by avoiding areas of peat or by using construction methods that do not require excavation, such as floating roads etc).
  - Re-use: use peat produced on site in designated areas in an environmentally beneficial and suitable way, in the restoration of temporary works areas or as part of landscaping strategy.
  - Recycling/recovery/treatment: modification of peat produced on site for use as a fuel, or as a compost/soil conditioner, or dewater peat to improve its mechanical properties in support of re-use.
  - Storage: temporarily store peat on-site (for example, during short periods in the construction period) and then re-use.
- Undertaking a pre-demolition assessment of all highway structures and assets to be removed or demolished as part of the Proposed Scheme. This assessment would be used to determine the quantities of demolition assets, elements, components, products and materials; and to make recommendations for their re-use (on and off-site), recycling, other recovery or final disposal. This assessment would also support the production of the Site Waste Management Plan (SWMP) and SPP by identifying the types and quantities of each waste to be produced during demolition and any opportunities to use these site-won materials to offset the use of primary materials.
- Implementing a SWMP, in a manner to suit the requirements of the Proposed Scheme, to plan, implement, monitor and review waste minimisation and management throughout the construction phase of the Proposed Scheme. The SWMP is a live document, updated on a regular basis during the design and construction phase. It would be used to forecast waste arisings and enable practical decisions to be taken at the detailed design and construction stage regarding waste prevention and the segregation of materials onsite for reuse, recycling, recovery or disposal, as well as for the layout of site waste management storage and treatment facilities. The SWMP would:

  - Be prepared using either the good practice resources developed by WRAP or the appointed Principal Contractor's own SWMP tools and resources.
  - Include targets or key performance indicators for waste recovery in line with prevailing Government and National Highways targets.
  - Document the methods to be used to measure and record the quantity of waste generated during construction.
  - Be accompanied by appropriate communication between the Client, Designer and Principal Contractor as well as subcontractors and other members of the supply chain.
- Complying with waste 'Duty of Care' requirements and taking all reasonable steps to ensure that waste is managed safely without endangering human health or harming the environment.
  - Engaging early with contractors during design to identify possible mitigation and enhancement measures, and to identify opportunities to reduce waste.
  - Obtaining all necessary waste carrier registrations; environmental permits, mobile plant deployments and/or waste exemptions in relation to the storage, sorting, treatment, use, disposal and transportation of waste.
  - Preparing any documentation required of statutory and industry regulated codes of practice or end of waste quality protocols (e.g. CL:AIRE Code of Practice and Environment Agency Quality Protocol for the Production of Aggregates from Inert Waste).
  - Ensuring waste arisings generated are handled, stored, managed and re-used or recycled as close as practicable to the point of origin, with consideration of the proximity principle and value for money principle.
  - Identifying areas for stockpiling and storing arisings that would reduce degradation, damage and loss, and ensuring that site compounds and on-site storage, stockpiling and processing areas are located/designed to reduce impacts to those designated environmental sites and sensitive environmental receptors identified by other aspects in this PEIR.

11.9.14 The Proposed Scheme preliminary design is ongoing and will continue to be influenced, as the preliminary design is progressed to detailed design and construction, by environmental factors to avoid or prevent effects where practicable. This process, as described in Chapter 3: Assessment of alternatives, will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

Essential mitigation

11.9.15 No likely significant adverse environmental effects have been identified for this aspect of the Proposed Scheme, and therefore no essential mitigation measures would be required to reduce or offset these effects.

Enhancement

11.9.16 No enhancement measures have been identified at this stage with regards to this aspect. Enhancement measures would be explored throughout the design and

construction of the Proposed Scheme, and as an intrinsic part of developing the SPP and SWMP.

11.9.17 Example enhancement opportunities for this aspect could include, but not be limited to, the following:

- Recycling suitable material for construction of enhancement measures, identified by other aspects, where the need for enhancement has been identified. For example, using felled vegetation and dead wood to create habitat piles and hibernacula within retained habitat and designated landscaping and mitigation areas.
- Using surplus recycled or recovered materials in community projects, for example utilising recycled mulch from tree felling on adjacent community facilities.

11.10 Assessment of likely significant effects

11.10.1 The likely significance of each residual effect is assessed in Table 11.8 after consideration of the proposed embedded mitigation measures in Section 11.9, in line with the methodology described in Section 11.4. All effects have been qualitatively assessed as being non-significant based on the application of professional judgement to the DMRB LA 110 significance category descriptions.

11.10.2 Where effects have been identified, these would be reduced where practicable by implementing the embedded mitigation measures outlined in Section 11.9 and by ensuring that the construction of the Proposed Scheme responds to the national regulatory or policy standards and local policy requirements relevant to this aspect. The residual effects detailed in Table 11.8 assume the implementation of this embedded mitigation.

11.10.3 As reported in Section 11.4, there is limited information available at this stage regarding the precise material requirements and waste quantities associated with constructing the Proposed Scheme. Any limitations in the current qualitative assessment approach will be addressed in the Environmental Statement through the gathering and assessment of quantified design information on material assets consumption and waste generation. Given the nature of the DMRB LA 110 significance category descriptions, the resulting significance of effect is unlikely to change between the PEIR and the Environmental Statement.

11.10.4 Whilst the application of embedded mitigation measures has the potential to reduce the impacts from the consumption of material assets and the production and disposal of waste to a certain but unspecified degree, it is unlikely that the construction of the Proposed Scheme would be able to deliver increased material resource efficiency at levels necessary to meet the significance category descriptors for a neutral effect for the material assets and waste matters of this aspect.

Table 11.8: Summary of likely effects after mitigation

Matter	Significance threshold	Description of potential effects from the Proposed Scheme	Resulting significance of effect category
Material assets	(1) Project achieves less than 70% overall material recovery or recycling (by weight) of non-hazardous C&D waste to substitute use of primary materials within the first or second study areas.	Whilst it is currently unknown what percentage of materials would be recovered / recycled to substitute the use of primary materials on or off-site, the nature of the Proposed Scheme means that it would inevitably require primary materials to be imported to site for the purposes of construction. Nevertheless, it is assumed that the Proposed Scheme would achieve an overall material recovery / recycling rate of ≥70% through using site-won materials, importing materials with recovered / recycled content and recovering / recycling materials off-site. Government statistics confirm that the construction industry in England is currently achieving a recovery rate of 93% for non-hazardous C&D waste. This rate has remained at similar levels since 2010 and has at all times been well above the Waste (England and Wales) Regulations 2011 target of 70%. Furthermore, it has been assumed that the Proposed Scheme would adopt the DMRB LA 110 target of ensuring that at least 90% (by weight) of non-hazardous C&D waste be recovered or diverted from landfill. Materials would either be recovered within the provisional Order Limits boundary or within the wider north-west region to offset the use of primary construction materials and support a circular economy.	Proposed Scheme is likely to achieve 70-99% overall material recovery or recycling (by weight) to substitute use of primary materials in the first or second study areas. • Significance: Slight adverse • Significant: Not significant
	(2) Aggregates imported to site comprise re-used or recycled content below percentage target of 30%.	Some degree of re-used or recycled content is anticipated given that this is standard practice in construction, and Construction Procurement Guidance (WRAP, 2009) suggests that infrastructure projects typically exceed 10% even without explicitly trying to increase recycled content. WRAP (2009) reports that the recycled content as a percentage of the total material cost for an infrastructure project was found to be in the region of 8 - 36% using standard practice products, rising to 25 - 49% when applying cost-neutral good practice. Reference to WRAP (2013) Resource Efficiency Benchmarks for Construction Projects reports that the proportion of recycled content by total aggregates weight, for the completed infrastructure projects within its dataset, was 27% recycled content/tonne at the 50th percentile (median) level. Further reference to the Mineral Products Association (2020) Profile of the UK Mineral Products Industry 2020 Edition confirms that in 2018 the share of recycled aggregate materials as a proportion of total Great Britain aggregates sales was approximately 30%. These data support the assumption that re-used or recycled aggregate content use on the Proposed Scheme is likely to be in line with the relevant regional percentage target of 30%.	Aggregates imported to site for use in constructing the Proposed Scheme would likely comprise re-used or recycled content in line with the relevant regional percentage target of 30% where available. • Significance: Slight adverse • Significant: Not significant
Waste	(1) Project leads to a greater than 1% reduction or	The precise quantities of C&D waste generated by the Proposed Scheme is currently unknown. Nevertheless, a greater than 1% reduction or alteration in regional landfill capacity is considered unlikely to occur given that the Proposed Scheme would need to	Proposed scheme leads to a less than 1% reduction or alteration in regional landfill capacity.

Matter	Significance threshold	Description of potential effects from the Proposed Scheme	Resulting significance of effect category
	alteration in regional landfill capacity.	dispose of greater than 57,225 tonnes of inert waste, 153,080 tonnes of non-hazardous waste or 68,682 tonnes of hazardous C&D waste to landfill during the construction period for this to be realised. This is based on estimated forecast levels of inert landfill capacity (5,722,549 tonnes), non-hazardous landfill capacity (15,308,014 tonnes) and hazardous landfill capacity (6,868,177 tonnes) in the north-west between 2025 and 2027. Professional judgement, applied to similar construction projects[9], and the available Government waste management statistics would suggest that this is unlikely to be realised. This is also based on the assumption that the construction of the Proposed Scheme would adopt the DMRB LA 110 target of ensuring that at least 90% (by weight) of non-hazardous C&D waste be recovered / diverted from landfill.	• Significance: Slight adverse • Significant: Not significant
	(2) Greater than 1% of project waste requiring disposal outside of the region.	The precise quantities of C&D waste generated by the Proposed Scheme are currently unknown. Nevertheless, it is anticipated that the north-west region has sufficient capacity to accommodate (treat, recycle or recover) the majority of the inert, non-hazardous and hazardous waste from the Proposed Scheme, without compromising integrity of the receiving infrastructure (design life or capacity) within the region. The north-west region is also likely to have available inert, non-hazardous and hazardous landfill capacity to support the construction of the Proposed Scheme. It is considered unlikely that the Proposed Scheme would need to dispose of >1% of project waste to landfills outside of the north-west region.	Proposed scheme disposes of <1% of scheme waste outside of the region. • Significance: Slight adverse • Significant: Not significant

[9] Waste records from the A19/A184 Testos Junction Improvement Scheme, which is similar in nature to the Proposed Scheme (a junction upgrade, one major flyover structure, similar footprint and comparable total scheme value), would indicate that a scheme of this magnitude has the potential to generate in the region of 92,857 tonnes of inert waste, 150,303 tonnes of non-hazardous C&D waste and 504 tonnes of hazardous C&D waste. These records also confirm that 0 tonnes of inert waste, less than 40 tonnes of non-hazardous waste and less than 200 tonnes of hazardous waste was subsequently disposed of to landfill. This represents a total waste recover rate of approximately 99.9%.

12. Noise and Vibration

12.1 Topic introduction

12.1.1 Noise and vibration can have an effect on the environment and on the quality of life enjoyed by individuals and communities. It may in certain circumstances lead to effects on human, ecological and infrastructure (e.g. buildings) receptors.

12.1.2 This chapter describes the findings of the noise and vibration assessment undertaken for the Preliminary Environmental Information Report (PEIR) and the likely environmental effects of the Proposed Scheme, during both construction and operation.

12.1.3 This chapter is supported by the following figures and appendices:

- Figure 12.1: Noise Study Areas, Noise Important Areas, Existing Noise Barriers and Noise Monitoring Locations
- Figure 12.2: Noise Sensitive Receptors
- Figure 12.3: Construction Noise and Vibration Impacts
- Figure 12.4: Road Traffic Noise Changes in the Do-Minimum v Do-Something 2027 Opening Year
- Appendix 12.1: Baseline Noise Survey Results
- Appendix 12.2: Construction Noise and Vibration

12.1.4 This chapter uses some technical acoustic terminology. These terms are described in a glossary at the end of this PEIR.

12.2 Stakeholder engagement

12.2.1 Stakeholder engagement has been undertaken with Bury Metropolitan Borough Council in May 2021 and focused on agreeing the assessment methodology and noise measurement locations, with Environmental Officers in the local authority who are responsible for noise and vibration. As a result of this consultation there were no changes to the proposed assessment methodology that was outlined in the Environmental Scoping Report (Highways England, 2021).

12.2.2 Table 12.1 summarises key requirements and responses relating to noise and vibration from the Planning Inspectorate's Scoping Opinion (2021), along with comments received from other stakeholders on this aspect.

Table 12.1: Key stakeholder feedback for noise and vibration aspect

Stakeholder	Comment	Response
Planning Inspectorate	ID 4.7.2 Figure 12.1 and section 12.2 refers to "three study areas" that are "generally sufficient for most projects". It is also stated that the assessment "will not be limited to these distances if it is considered there is a risk of likely significant effects beyond 100m for construction vibration, 300m for construction noise, or 600m for operational noise". The ES should provide a clear definition of the individual study areas and set out where potential for likely significant effects has been assessed beyond the "generally sufficient" study areas and the locationally specific circumstances under which additional receptors are considered beyond those areas.	The Environmental Statement will fully describe and justify the study areas used in the assessments presented within the Environmental Statement.
Planning Inspectorate	ID 4.7.3 Reference is made to the presence of existing noise mitigation along some sections of the M60 and M66, but that further details of Scoping Opinion for M60/M62/M66 Simister Island Interchange 31 ID Ref Other points Inspectorate's comments location, length and height of these barriers are needed to inform the assessment. The ES should be clear about any assumptions made within the assessment and how they are taken into account at part of any modelling (e.g. assumptions around efficacy and condition of these features). The ES should be particularly clear about whether or not existing noise mitigation: • Will be removed / altered as part of the Proposed Development (and if not, how its retention will be safeguarded as part of the design) • Fits in as part of any wider mitigation package of new / extended noise barriers to be installed.	Existing noise barriers have been identified and are listed in paragraph 12.5.3 and shown on Figure 12.1 of this PEIR.
Planning Inspectorate	ID 4.7.4	Future developments that include noise sensitive receptors have been identified and are listed in Table 12.3 of this PEIR. These locations will be assessed in the Environmental Statement, and mitigation will be identified where needed.

Stakeholder	Comment	Response
	Paragraphs 12.3.12 and 12.3.14 state that cumulative impacts are both implicit in the future "Do-Minimum" and "Do-Something" scenarios traffic modelling but also would need to be considered in terms of the introduction of any new noise sensitive receptors from future development. With reference to the transport assessment(s), the noise chapter of the ES should clearly present these distinct strands of the cumulative assessment and clearly identify representative "worst case" receptor locations for modelling of any future noise sensitive receptors, identify any mitigation needs for these future receptors and set out how they would be secured and delivered as part of the DCO.	
Public Health England (now known as UK Health Security Agency (UKHSA)	Project should meet the aims of the Noise Policy Statement for England (NPSE).	Consideration of the Proposed Scheme with respect to national policy on noise will be undertaken. The Environmental Statement will report against the three aims within the NPSE in the context of sustainable development and describe the actions taken to support delivery of each aim.
Public Health England	Project should explore opportunities to improve the health and quality of life.	The Proposed Scheme will explore opportunities to improve health and quality of life in order to meet the third aim of the NPSE.
Public Health England	Need to ensure approach is consulted on and agreed.	The Proposed Scheme has an ongoing process of consultation with various stakeholders. Specific to noise, the local authority was consulted in May 2021. The approach agreed is to follow the guidance within the Design Manual for Roads and Bridges (DMRB) LA 111 Noise and Vibration (Highways England, Revision 2, 2020a; hereafter referred to as DMRB LA 111), as stated in the Environmental Scoping Report.
Public Health England	Values for significant observed adverse effect level (SOAEL) and Lowest observed adverse effect level (LOAEL).	The setting of values for SOAEL and LOAEL is an area where DMRB LA 111 provides example values but allows for modification to fit local circumstances. The suggested values for LOAEL and SOAEL within DMRB LA 111 are based on values that have been used for consented road schemes over the past six years. The proposed scheme is similar to many of these schemes, both in terms of the type of scheme and the surrounding environment. For these reasons it is the intention to use the example values of LOAEL and SOAEL provided in DMRB LA 111.

Stakeholder	Comment	Response
Public Health England	Construction assessment and mitigation.	The Proposed Scheme already has a contractor appointed and a construction methodology is being developed to inform the Environmental Statement. This information will be used to inform calculations and subsequent assessment undertaken for the Environmental Statement. This assessment will follow the methodology within DMRB LA 111. Due to the nature of the Proposed Scheme there will be requirement for some night working. The implications of this and actions to control the noise will be described within the Environmental Statement.
Public Health England	Noise insulation should not be used as a mitigation measure.	It is agreed that the application of noise insulation for dwellings would not result in the removal of a significant adverse effect. Noise insulation is mentioned within the Environmental Scoping Report only to assist describing the hierarchy approach to mitigation that will be used for the scheme, and to indicate that mitigation at the receiver is the last resort when other mitigation means are insufficient or not cost effective.
Public Health England	Use of L_{den} (in noise assessment chapter).	The noise assessment will focus on established indices for noise impact assessment in the UK, such as L_{Aeq} and L_{A10}. The values of LOAEL and SOAEL within the Environmental Statement will be described in terms of the assessment metrics of L_{Aeq} and L_{A10}, with equivalent L_{den} provided for information in order to assist other environmental topics.
Public Health England	Use of health metric (e.g. disability-adjusted life year (DALY)) for the noise assessment.	Paragraph 3.28 of the guidance which has informed the population and human health assessment, DMRB LA 112 (Highways England, Revision 1, 2020b), states that a qualitative assessment of human health shall be undertaken, with evidence to support the conclusions. The population and human health assessment has been scoped on this basis. The decision on the preferred option has already been made and so the calculation of noise-related health outcomes in terms of DALYs and monetisation is considered to be of limited value to decision-makers. The current position is therefore not to provide a quantification of health outcomes from noise for the Environmental Statement. A qualitative commentary will be provided within the population and human health assessment on the health outcomes associated with traffic noise at different levels.

Stakeholder	Comment	Response
Public Health England	Steps taken to arrive at significance.	As is described in paragraph 12.7.24 of the Environmental Scoping Report, the determination of significance will not be simply undertaken by considering the decibel change. Other factors are considered, such as the absolute noise level and the location of the noise source and whether it will change. The steps taken to arrive at significance will be reported in the Environmental Statement as required by DMRB LA 111.
Public Health England	Receptor types to consider during the assessment.	Different types of sensitive receptors will be examined as described in paragraph 12.3.5 of the Environmental Scoping Report. These will include, but not be limited to, dwellings, schools, places of worship and community facilities.
Public Health England	Consider measures for enhancement.	Measures for enhancement will be investigated, as is noted in the Environmental Scoping Report (paragraph 12.5.11). This process has already started with environmental aspects feeding into the preliminary design of the route.
Public Health England	Qualitative characterisation of the area.	Site visits and noise surveys have been undertaken by experienced consultants. Observations have been made of the noise climate, as reported in Section 12.7 and Appendix 12.1.
Public Health England	Length of noise surveys.	It is the intention for the noise surveys to be undertaken at each location over a period of one week. For the Proposed Scheme the noise climate in the immediate vicinity of the M60 and M62 would not be expected to change by much due to the constant road traffic using these motorways. A week-long survey is therefore considered sufficient length to characterise the noise climate. The surveys will cover a weekend period as there may be weekend working for the proposed scheme.
Public Health England	Use of different metrics (e.g. events) for the assessment.	The assessments of both construction and operational noise follow established practice and guidance, and the metrics outlined within the stated methodologies will be used for assessment. Given the proposed scheme has a very dominant and near continuous noise source, it is considered very unlikely that examining further metrics would provide any assistance in the determination of a significant effect.
Public Health England	Use the mitigation hierarchy when considering mitigation.	Priority will be given to reducing noise at source, as is described in the Environmental Scoping Report (paragraph 12.5.5). When the need for mitigation is identified, or enhancement is considered, reducing the noise at source will be considered first.

Stakeholder	Comment	Response
Public Health England	Undertaking of post opening monitoring.	Noise is one of the environmental aspects that is assessed within Highways England's Post Opening Project Evaluation (POPE) process, which examines how a scheme is performing against the predicted impacts after one and five years. In accordance with DMRB LA 111 (paragraph 4.2), there is no intention to undertake post opening noise monitoring, unless required during the POPE or DCO process.
Public Health England	Production of an Environmental Management Plan (EMP).	A first iteration of the EMP will be produced for the Environmental Statement. A second iteration of the EMP will be produced for the construction period at detailed design stage in conjunction with the contractor.
Public Health England	Proposed scheme should consider the development of green spaces.	The Proposed Scheme has little opportunity to develop large areas of green space. Private amenity areas will not be physically changed, although the noise climate in some may change and this will be considered when determining significance.
Public Health England	Consider the step change in noise during the assessment.	The change in noise on opening of the proposed scheme will form the initial indication of likely significance of effect. Within DMRB LA 111 there is a move away from examining the long-term effects and this is noted within paragraph 12.7.23 of the Environmental Scoping Report. The potential for a perceived worsening of the noise climate on scheme opening needs to be managed. This can occur for online widening schemes, such as parts of the Proposed Scheme, where local residents have become used to the noise from the road when there is a reduced speed limit during construction. Then once open, and the speed limit returns to what it was before, there is a perceived increase in noise despite the assessment indicating it may have been reduced. This is not possible to quantify and so needs to be managed by stakeholder communications.
Public Health England	Requirement for stakeholder communications to use available technology.	The Proposed Scheme has a dedicated stakeholder team, and communications with key stakeholders have been ongoing. The stakeholder team will be taking full advantage of current technology. With a lot of the Proposed Scheme being online widening, the local residents will already be aware of the noise generated by a busy road. Therefore, the use of audio recording, while useful for some projects, is not considered to be a valuable addition to the proposed scheme. With respect to the visual impact, it is standard practice by Highways England on large schemes such as this, for a scheme fly-through to be created.

12.3 Legislative and policy framework

12.3.1 The National Policy Statement for National Networks (NPS NN) (Department for Transport (DfT), 2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIPs) on the national road and rail networks in England. The Secretary of State (SoS) uses the NPS NN as the primary basis for making decisions on DCO applications.

12.3.2 Key policies from the NPS NN relevant to this aspect is set out below:

- Paragraph 5.190 states that 'the potential noise impact elsewhere directly associated with the development, such as changes in road traffic movements elsewhere on the road network should be considered as appropriate.'
- Paragraph 5.191 states that 'operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance. The prediction of road traffic noise should be based on the method described in Calculation of Road Traffic Noise. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies.'
- Paragraph 5.193 states that 'developments must be undertaken in accordance with statutory requirements for noise. Due regard must have been given to the relevant sections of the Noise Policy Statement for England, National Planning Policy Framework and the Government's associated planning guidance on noise.'
- Paragraph 5.194 states that 'the project should demonstrate good design through optimisation of scheme layout to minimise noise emissions and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission. The project should also consider the need for the mitigation of impacts elsewhere on the road and rail networks that have been identified as arising from the development, according to Government policy.'
- Paragraph 5.195 states that 'the Secretary of State should not grant development consent unless satisfied that the proposals will meet the following aims, within the context of Government policy on sustainable development:
  - *avoid significant adverse impacts on health and quality of life from noise as a result of the new development*
  - *mitigate and minimise other adverse impacts on health and quality of life from noise from the new development*
  - *contribute to improvements to health and quality of life through the effective management and control of noise, where possible'*
- Paragraph 5.199 refers to the Noise Insulation Regulations, and the requirement for these to be considered with an indication of the likely eligibility for compensation under the regulations to be provided in the assessment.
- Paragraph 5.200 states that 'applicants should consider opportunities to address the noise issues associated with the Noise Important Areas as identified through the noise action planning process.'

12.3.3 In addition to the national policy set out in the NPS NN, the Proposed Scheme must also have regard to relevant legislation and local plans and policy. A summary of legislation and policy is provided in Appendix 1.1. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

12.4 Assessment methodology

12.4.1 The assessment of impacts from noise and vibration has been undertaken following the requirements and advice within DMRB LA 111 Noise and Vibration (Highways England, Revision 2, 2020a; hereafter referred to as DMRB LA 111). The Proposed Scheme can therefore be measured against the NPS NN policy.

12.4.2 The assessment of noise from construction has been undertaken quantitatively based on the requirements within DMRB LA 111, which in turn references the guidance and calculation methodology within BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise (British Standards Institution, 2014a).

12.4.3 Noise predictions from construction are undertaken using known noise levels from various items of plant that would be used during the different activities associated with the construction of the Proposed Scheme. The information required to inform these predictions has been based on experience of similar schemes and in collaboration with the principal contractor who has provided indicative plant lists that may be used for the construction of the Proposed Scheme.

12.4.4 The noise levels from construction have been predicted for receptors within the construction noise study area. Calculations of construction noise have been undertaken using spreadsheets to predict noise from construction activities, and a three-dimensional (3D) GIS process to calculate propagation from noise source locations to receptors, including consideration of screening. Detailed information on assumed plant and equipment is provided in Appendix 12.2 for information.

12.4.5 The assessment of vibration from construction has been undertaken quantitatively based on the requirements and advice within DMRB LA 111, which in turn references the guidance and calculation methodology within BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration (British Standards Institution, 2014b.

12.4.6 For some activities of construction (e.g. piling and compaction) equations are available within BS 5228-2:2009+A1:2014 to calculate the level of vibration at a distance from the construction activity. Certain input parameters are required for these calculations and, until the exact plant to be used is confirmed, some of the information required has been based on professional judgement.

12.4.7 The impact from construction traffic on the motorways and the local road network has been examined to determine whether this could impact upon sensitive receptors. This has been undertaken for the construction years of 2025, 2026 and 2027. The noise from the use of haul routes has not been included within the construction calculations since it is considered to have negligible impact, with one exception. The haul routes are located north and south of the M60, and close to Junction 18, where the road traffic noise level is already high. Haul routes will be re-confirmed and considered during the assessment that will be presented in the Environmental Statement. During certain

construction activities (e.g. piling of retaining walls and gantries and bridge span installation) it will be necessary to implement temporary closures of some existing roads, the location and duration of these closures are considered.

12.4.8 For the consideration of noise from the operation of the Proposed Scheme, the approach has been based on the requirements and advice within DMRB LA 111. The approach within DMRB LA 111 is to compare the predicted noise level with and without the Proposed Scheme at individual or groups of sensitive receptors. Noise levels have been calculated using the methodology contained within the Calculation of Road Traffic Noise (CRTN) (Department of Transport and Welsh Office, 1988) using proprietary noise modelling software. The assessment presented in this PEIR has been based on a scheme design and traffic model that is now superseded, however, all changes will be taken into account in the assessment that will be reported in the Environmental Statement. The changes relate mainly to the design outside of the traffic running lanes and so the operational road traffic noise assessment presented is considered to be a good representation of potential impacts.

12.4.9 Appendix 5.2 of this PEIR sets out the criteria which has been used to assess significance for this aspect.

12.5 Assessment assumptions and limitations

12.5.1 The assessment of construction noise and vibration is based on the construction program that was developed for an earlier design of the Proposed Scheme that has now been superseded. Although there may be some changes to this program for the design that will be fixed at Environmental Statement stage, it is considered that the assessment based on this previous information gives a reasonable description of potential impacts. The Environmental Statement will be updated with any changes to the construction programme once finalised. The construction of the updated scheme may need more night-time working, but the conclusions for the construction phase in terms of the location of adverse impacts are likely to be similar.

12.5.2 The operational noise and vibration assessment in this chapter has been based on a traffic model and design of the Proposed Scheme that have both been superseded. Traffic forecasts and scheme design will both be updated for the Environmental Statement and DCO application. The assessment of effects presented in this PEIR have therefore been kept to a high level and should be considered as preliminary and will be subject to change in the Environmental Assessment when mitigation measured will also be considered in detail.

12.5.3 Existing noise mitigation along some sections of the M60 and M66 is in the form of noise barriers. There are existing noise barriers in nine locations adjacent to the existing route of the Proposed Scheme which have been identified from existing data sources, and are:

- 143m of timber noise barrier alongside the M60 J17 eastbound off-slip road, close to dwellings on Philips Park Road, Stanley Drive, Park Close and Sycamore Place. This is assumed to be 1.5m high and would remain in place with the Proposed Scheme
- 78m of timber noise barrier alongside the M60 J17 westbound on-slip road. This is assumed to be 1.5m high and will remain in place with the Proposed Scheme

- 186m of brick wall north of the M60 eastbound mainline carriageway, between Besses o' th' Barn and Balmoral Avenue, assumed to be 2.5m high. Adjoining the east end of this barrier there is a 331m long timber noise barrier running along Glendevon Place, assumed to be between 1.5 and 2.5m high. Both remain in place with the Proposed Scheme
- 734m of timber noise barrier alongside the M60 westbound mainline carriageway, between Bury Old Road (A665) and Warwick Avenue, assumed to be between 1m and 2.5m high. This noise barrier will remain in place with the Proposed Scheme
- 470m of timber noise barrier alongside the M60 eastbound mainline carriageway, between Sandgate Road and Brathay Close, assumed to be 1.5m high. This noise barrier will remain in place with the Proposed Scheme
- 435m of timber noise barrier alongside the M60 westbound mainline carriageway, between Sandgate Road and Parrenthorn Road, assumed to be 1.5m high. This noise barrier will remain in place with the Proposed Scheme
- 142m of timber noise barrier alongside the M60 J18 eastbound off-slip road and assumed to be 1m high. This noise barrier would be removed to allow for the construction of the new M60 J18 eastbound off-slip road leading to the new Northern Loop, and it will be replaced by a similar length and height noise barrier at a similar location alongside the new slip road
- 335m of timber noise barrier alongside the M60 eastbound mainline carriageway, in the vicinity of Egypt Lane. This is assumed to be 3m high and will remain in place with the Proposed Scheme
- 346m of timber noise barrier running above the concrete wall bounding alongside the dedicated left turn from the westbound M62 to the M60 at Simister. This is assumed to be 1.5m high and will remain in place with the Proposed Scheme

12.5.4 The location, length and height of these existing barriers will be confirmed with National Highways prior to the detailed noise modelling at the Environmental Statement stage, and assessment made of the condition of the barriers and their assumed effectiveness.

12.6 Study area

12.6.1 Advice on how to set the study area for an assessment of noise and vibration is provided within DMRB LA 111. The distances used for the study areas have been chosen based on professional judgement and correspond to the distance where it is considered that receptors could potentially be affected by noise or vibration.

12.6.2 For construction noise receptors up to 300m from construction activity have been considered for potential effects. For construction vibration, any receptors within 100m of an activity likely to generate a noticeable level of vibration have been considered.

12.6.3 The Study Area for operational road traffic noise has been chosen as the area within 600m of new road links or road links physically changed or bypassed by the project, as shown in Figure 12.1. There are no other road links with potential to experience a short-term change of 1.0dB or more as a result of the project outside of this area, and ss the study area has not been extended or reduced.

12.6.4 For diversion routes a study area of 25m width from the edge of the road is used, where the diversion route requires full carriageway closures during the night to enable construction works to take place.

12.7 Baseline conditions

Baseline sources

12.7.1 The following sources have been used to inform the baseline:

- Department for Environment, Food and Rural Affairs (Defra) Noise Action Plan: Roads (Defra, 2019)
- Ordnance Survey Mastermap digital mapping
- Baseline noise surveys undertaken between October and December 2021

Baseline conditions

12.7.2 The existing noise climate near the Proposed Scheme is dominated by road traffic noise, predominantly from the M60, M62 and M66, as well as traffic using local roads. There is also a combined railway line and Metrolink tramline that passes over the M60 at the western end of the Proposed Scheme, about 240m east of M60 J17. Railway noise would therefore contribute to the local noise climate in some locations.

12.7.3 There are six Noise Important Areas (NIA) within 600m of the Proposed Scheme. Two of them are directly adjacent to the Proposed Scheme, and the remaining four located adjacent to the local road network. They are listed in Table 12.2 and shown on Figure 12.1.

Table 12.2: Defra Noise Important Areas (NIAs) for road traffic within the study area

NIA ID	Description	Location	Asset owner	Number of dwellings within NIA
1671	On M60 extending from west of J17 to west of J18	Adjacent to the Proposed Scheme and road network	Highways England (National Highways) and Bury Metropolitan Borough Council	821
8188	On M60 J18	Adjacent to the Proposed Scheme and road network	Highways England (National Highways)	170
10718	On M62 north-east of M60 J18	Adjacent road network	Highways England (National Highways)	2
1670	On A56 Bury New Road to the north-west of the Proposed Scheme	Adjacent road network	Bury Council	171
10719	On A665 Higher Lane to the west of the Proposed Scheme	Adjacent road network	Bury Council	38
1406	On M66 extending from Griffe Lane to Haweswater Crescent	Adjacent road network	Highways England (National Highways)	63

12.7.4 The wider area around the Proposed Scheme is mostly urban, with the exception of the area to the north-east of M60 J18, which is more rural. The settlement of Simister is

located to the south-east of M60 J18, with more open space immediately adjacent to the other three quadrants. As shown in Figure 12.2, sensitive receptors for humans also include multiple residential properties located either side of the M60 in Prestwich to the south and Besses o'th' Barn to the north. The settlement areas also contain other noise sensitive receptors, including 16 educational premises and six healthcare facilities (such as dental practices, medical centres and Prestwich Hospital) within the study area. The closest residential property is approximately 12m from the south-eastern part of the roundabout in Simister, and the closest school is St Margaret's Church of England Primary School at approximately 125m south of the M60 near J18. There are also isolated semi-rural properties in the area of the Proposed Scheme. Examples of other sensitive receptors include places of worship, community services and leisure facilities.

12.7.5 Figure 12.2 shows the sensitive receptors within the noise study area. These also include outdoor noise sensitive areas such as Heaton Park (Registered Park and Garden), Poppythorn (Conservation Area), Prestwich Country Park and Hollins Vale (Local Natural Reserve). There are no designated biodiversity areas or quiet areas designated by Bury Metropolitan Borough Council within the study area for the noise assessment.

12.7.6 A series of noise surveys was undertaken between October and December 2021. Five locations were utilised that are representative of individual or groups of sensitive receptors. The full details of the noise measurement surveys is provided in Appendix 12.1, and the locations indicated in Figure 12.2. Table 12.3 summarises the locations and baseline measurement results giving averages for each location over the week-long survey periods.

Table 12.3: Baseline noise survey results, free-field

Noise Survey ID	Location description	Survey Dates	Average weekday measured $L_{A10,18h\ (06:00-00:00)}$ dB	Average measured daytime* $L_{Aeq,t}$ dB	Average measured night-time $L_{Aeq,t\ (23:00-07:00)}$ dB	Average measured other period* $L_{Aeq,t}$ dB
N1	Droughts Lane, Simister, south-east quadrant of M60 J18	05/10/21 to 12/10/21	60.8	61.2	56.1	59.1
N2	Eastview, Corday Lane, south-west quadrant of M60 J18	05/10/21 to 12/10/21	63.2	63.8	59.9	62.6
N3	Conisborough Place, adjacent to eastbound carriageway of M60 between J17 and J18	05/10/21 to 12/10/21	66.0	65.4	61.3	64.3
N4	Marston Close, north-east quadrant of M60 J18	05/10/21 to 12/10/21	59.4	58.3	54.6	55.8
N5	Cowlgate Farm, isolated property west of M66 northbound	30/11/21 to 07/12/21	72.8	72.6	66.5	70.0

Noise Survey ID	Location description	Survey Dates	Average weekday measured $L_{A10,18h\ (06:00-00:00)}$ dB	Average measured daytime* $L_{Aeq,t}$ dB	Average measured night-time $L_{Aeq,t\ (23:00-07:00)}$ dB	Average measured other period* $L_{Aeq,t}$ dB
* Daytime period includes Monday to Friday 07:00-19:00 and Saturday 07:00-13:00 Other period includes Monday to Friday 19:00-13:00, Saturday 13:00-23:00 and Sunday 07:00-23:00						

12.7.7 It is National Highways policy to deploy Low Noise Surfacing (LNS) on all new and resurfaced roads, assumed to provide a -3.0 dB(A) reduction compared to a standard Hot Rolled Asphalt where speeds are above 75 kph[10]. The latest National Highways Pavement Management System Construction Records indicates that a LNS is currently laid on the following sections of the M60, M62 and M66 carriageways and associated slip roads within the Proposed Scheme corridor, with all other roads within the Study Area considered to be surfaced with hot rolled asphalt:

- LNS on both M60 mainline carriageways between J17 and J18 eastbound and between J18 and J19 westbound
- LNS on M60 eastbound and westbound carriageways between J18 and J19
- LNS on M60 westbound and Hot Rolled Asphalt on M60 eastbound between J16 and J17
- LNS on the M62 eastbound and westbound mainline carriageways between J18 and J19
- LNS on the M66 northbound and southbound mainline carriageways between J3 and J4

12.7.8 No baseline vibration surveys have been undertaken as the advice within DMRB LA 111 state *'the construction vibration baseline shall be assumed to be zero due to the absence of construction work prior to project commencement'.*

Future baseline

12.7.9 The Do-Minimum traffic scenario is representative of the predicted growth in traffic, accounting for local and regional development. Cumulative impacts are implicit in the future (i.e. 15 years after opening) Do-Minimum and Do-Something scenarios because committed developments are included in the traffic model.

12.7.10 Traffic growth aside, the future noise baseline around the Proposed Scheme is likely to be similar to the existing baseline.

12.7.11 There are areas of proposed housing development alongside the M60, M62 and M66 as well as within the surrounding area, either currently being constructed or with planning approval to be constructed. Those developments within 600m of the Proposed Scheme, listed in Table 12.4, are included within the noise assessment presented in

[10] **Based on Paragraphs 5 and 6 of Appendix A2 in DMRB LA 111 (Highways England, 2020a).**

this PEIR chapter as sensitive receptors, and will be updated during the assessment for the Environmental Statement.

Table 12.4: Proposed developments included within the noise assessment

Planning application reference	Location	Proposed number of dwellings	Overlap in temporal scope? Construction M60: 2025-2027 Operation M60: 2027-2042
63003 – Residential / Employment	85 Bury Old Road, Whitefield, M45 7AY	11	No. Construction has not yet been started, but construction could be complete prior to construction of the Proposed Scheme. Development will be considered as a receptor as appropriate as it could be in place before construction of Proposed Scheme.
65379 – Residential	92 Mersey Drive, Whitefield, Manchester, M45 8LF	27	No. The demolition of the existing building has been completed. Construction of the proposed development is currently underway (as of September 2022) and it is therefore likely to have been completed prior to construction of the Proposed Scheme. Development will be considered as a receptor as appropriate as it will be in place before construction of Proposed Scheme.

12.7.12 Developments have been selected where it is considered that receptors may experience significant effects (adverse or beneficial) or are located in areas where noise mitigation or enhancement may be considered. This selection process is based on professional judgement, identifying receptor types that would be considered as noise sensitive based on the list of noise sensitive receptors given in DMRB LA 111. For the Environmental Statement a review will be undertaken to determine whether any additional noise sensitive developments have been granted planning permission.

12.7.13 The potential impact at any large areas of land that have been allocated by Bury Metropolitan Borough Council for housing developments but where no planning application has yet been put forward or permission been granted, will not be included within the assessment or considered for mitigation or enhancements in the Environmental Statement.

12.7.14 Future climate change has the potential to alter the noise climate, as rainfall, temperature and wind are factors that can influence the generation or propagation of noise. While the NPS NN stated calculation methodology for the prediction of road traffic noise (i.e. CRTN) is based on moderately adverse wind directions and velocities as well as on dry road conditions, temperature is not explicitly considered in CRTN. In addition, weather conditions are not considered within the assessment methodology contained within DMRB LA 111.

Value / sensitivity of receptors

12.7.15 DMRB LA 111 does not provide a scale of value or sensitivity for receptors. A receptor is either sensitive or not sensitive to noise and/or vibration. DMRB LA 111 defines a noise sensitive receptor as *'dwellings, hospitals, healthcare facilities, education facilities, community facilities, international and national designated sites, public rights of way and cultural heritage assets'*.

12.7.16 With no scale of value, it is therefore not possible for the noise and vibration assessment to use the matrix-based approach to determine potentially significant effects.

12.8 Potential impacts

12.8.1 In this section the potential impacts from noise and vibration on the sensitive receptors during both construction and operation are described. For construction this considers only adverse impacts since it is not possible for a construction activity to reduce the ambient noise level at a receptor.

12.8.2 The main construction phase is expected to start in 2025 and finish in 2027. For construction impacts, the main activities taking place that are likely to generate noise and/or vibration are described below.

12.8.3 For the potential impacts from the operation of the new road (i.e. when it is open for traffic), only noise is considered.

Construction

12.8.4 Impacts from construction can be defined as those that occur between the start of enabling works and the end of the Proposed Scheme construction period. Although temporary, construction-related impacts may nevertheless require mitigation. Typical construction impacts might include a localised increase in noise and/or vibration or a loss of amenity due to the presence of construction traffic.

12.8.5 At various locations along the Proposed Scheme route there are sensitive receptors sufficiently close that construction activities could increase the existing noise or vibration level and cause adverse impacts. The areas where construction disruption occurs tends to be localised to the areas where construction activity is occurring at a particular time in the programme. The disturbance arising from construction reduces with increased distance from works.

12.8.6 An assessment of noise and vibration during construction considers the impact of the following factors:

- Phases of construction
- Plant and equipment to be used and their noise emissions
- Distances from nearest noise sensitive receptors

12.8.7 The main construction phases that are expected to increase noise and vibration during construction that have been considered are:

- Mobilisation and enabling works, e.g. site clearance, earthworks, access roads and accommodation units
- Online works, e.g. roadworks, central reserve barrier, gantries, retaining walls, paving, compaction
- Offline works, e.g. new road sections, structures, piling
- Construction of ponds. E.g. earthworks, drainage, landscaping
- Construction traffic and traffic diversions

12.8.8 A detailed list of the construction phasing and the plant and equipment assumed for the various construction activities is presented in Appendix 12.2.

Operation

12.8.9 There is potential for the Proposed Scheme to result in road traffic noise increases at nearby noise sensitive receptors as a result of new sections of road being built, localised online widening of the M60 bringing traffic closer to receptors, or changes in traffic flows, composition or speed as a result of the Proposed Scheme.

12.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

12.9.1 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the Proposed Scheme design. Chapter 3 details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

12.9.2 Embedded mitigation relevant to this aspect includes:

- The provision of a standard low-noise surfacing as standard for the Proposed Scheme
- The like-for-like replacement of any noise barriers that need to be removed temporarily during construction and to accommodate the design.

12.9.3 The Proposed Scheme design is ongoing and will continue to be influenced by environmental factors to avoid impacts where feasible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

Essential mitigation

12.9.4 Essential mitigation would occur as a matter of course due to legislative requirements or standard sector practices. Examples of essential mitigation for this aspect during the construction phase includes the following:

- The use of Best Practicable Means (BPM) during construction. This is standard sector practice in accordance with British Standard 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise (British Standards Institution, 2014a); and British Standard 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (British Standards Institution, 2014b). Examples of these BPM are as follows:
  - Appropriate selection of plant and construction methods: only plant conforming with or better than relevant national or international standards, directives or recommendations on noise or vibration emissions will be used. Construction plant will be maintained in good condition with regard to minimising noise and vibration output.
  - Construction plant will be operated and maintained appropriately, following manufacturer's written recommendations or using other appropriate operation and maintenance programmes that reduce noise and vibration emissions.

- Use of audible reversing warning systems on mobile plant and vehicles will be of a type which, whilst ensuring that they give proper warning, have a minimum noise impact.
- Choice of routes and timings for the transport of construction materials, waste materials and personnel to reduce the risk of increased noise and vibration impacts due to the construction of the Proposed Scheme.
- Haul roads will be well maintained and avoid, where feasible, the use of steep gradients.
- All site employees will be reminded of their obligation to minimise noise on site.
- Community liaison will keep residents updated about works via letter, email or a virtual information hub.

- During the noisiest phases of night-time works the contractor will review the temporal scope to aim to reduce adverse impacts to be within 10 or more nights in any consecutive 15 nights, or a total of more than 40 nights in any consecutive 6-month period for noise levels above SOAEL at receptors

12.9.5 Essential mitigation, including the measures listed above, will be included in a 1st Iteration of the EMP which will be prepared for the Environmental Statement and DCO submission (refer to Chapter 5). At the detailed design stage mitigation measures would be developed further in collaboration with the contractor who will be able to contribute more project specific detail.

12.9.6 During preparation of areas for compounds and the attenuation water storage system there is often a layer of topsoil that needs to be stripped off before the location can be used. It may be practicable to stockpile this material so it can act as noise screening for nearby receptors. The extent of any material is currently unknown for all compound and attenuation water storage system locations and so any potential noise screening cannot be determined at this stage. For the Environmental Statement, further information will be available that may allow any the effect from any noise screening to be considered within the assessment.

12.9.7 For the mitigation of any likely significant adverse operational effects, the potential use of a road surface with better noise reducing properties than a conventional low noise surface will be considered on the M60 between J17 and J18 in both directions. The provision of additional or extended noise barriers will also be examined within the Environmental Statement where appropriate, based on the predicted impacts to determine if they provide a sustainable value-for-money ratio.[11]

12.9.8 As it is required by DMRB LA 111, the suitability of each potential road traffic noise mitigation measure for use shall be determined based on the following criteria:

[11] The monetised benefit, or value-for-money, is calculated by comparing the cost of the noise barrier against the monetised benefit in terms of health as calculated by the appraisal method contained within the Government's Transport Appraisal Guidance (Department for Transport, 2021). If the ratio of cost to benefit is greater than 1 then the barrier is considered to be within the context of sustainable development.

- The likely perceived benefit of the measure at any noise-sensitive receptors
- The benefit of a measure in terms of elimination of likely significant effects
- For residential noise receptors only, a comparison of the monetised noise benefit of a mitigation measure against the cost of the measure over the anticipated design life of the project
- Practicality of the measure, for example, in terms of safety considerations and engineering constraints
- The impact of the measure across other environmental factors, for example the visual impact of a noise barrier
- Any relevant mitigation requested during consultation.

Enhancement

12.9.9 To meet the aims of the Noise Policy Statement for England (NPSE), opportunities for enhancement should be explored. Enhancement is not where a reduction in noise is required to mitigate an adverse effect, but where it would reduce the level of noise and provide betterment. Enhancement measures are assessed against the same criteria as measures being considered to provide mitigation.

12.9.10 The possible enhancement that can be achieved from resurfacing and/or provision of noise barriers will be considered within the Environmental Statement.

12.10 Assessment of likely significant effects

Construction noise

12.10.1 The assessment of construction noise considers predicted noise levels against effect levels that are derived from measurements of baseline noise levels. Appendix 5.2 describes how effect levels are derived, with Table 12.5 presenting the LOAEL and SOAEL for receptors within the study area. The approach to defining the LOAEL and SOAEL is explained in more detail in Appendix 12.2.

Table 12.5: Construction noise effect levels

Representative Areas	Daytime		Night-time	
	LOAEL	SOAEL	LOAEL	SOAEL
Receptors within 100m of motorway roads	64	70	60	63
Receptors greater than 100m from motorway roads	58	65	55	55

12.10.2 A significant effect is considered to occur where a Moderate or Major impact is predicted. A Moderate magnitude impact is where the predicted construction noise level is above or equal to SOAEL and below SOAEL +5dB, a Major magnitude impact arises where the SOAEL +5dB is predicted to be equalled or exceeded.

12.10.3 Calculations of noise from the main construction phases have been made for a series of distances from works areas. The calculations assume that all plant items working in each phase are located at the closest point to each receptor, providing a potential worst

case assessment. In practice plant will be spread out over a wider area of work, and construction noise levels at receptors are likely to be lower.

12.10.4 Table 12.6 indicates potential construction noise levels during mobilisation and enabling works. The closest sensitive receptors to the compound nearest to M60 J17 are approximately 15m from the compound boundary on Ross Avenue. The compound in the north-west quadrant at M60 J18 is within approximately 20m of Cowlgate Farm and 95m of residential receptors on Mode Hill Lane.

Table 12.6: Predicted construction noise levels during mobilisation and enabling works, $L_{Aeq,t}$ dB

Activity	10m	20m	50m	100m	200m	300m
Establish temporary working compounds	78	72	64	58	52	49
Traffic management for enabling works	78	72	64	58	52	49
Site clearance	78	72	64	58	52	49
Earthworks	83	77	69	63	57	53
Access road paving	84	78	70	64	58	54
Accommodation units	82	75	68	62	55	52

12.10.5 Construction noise levels will be at levels that will exceed SOAEL by more than 5dB at the closest receptors on Ross Avenue and at Cowlgate Farm. This level of construction noise indicates potential Major magnitude adverse impacts, which is a potential significant effect. Mitigation measures for the construction phase of mobilisation and enabling works should therefore be considered.

12.10.6 Table 12.7 indicates potential construction noise levels during online works that will take place on the existing motorways. The closest sensitive receptors to works on the M60 mainline between J17 and 18 are located both north and south of the M60 within 10-15m on roads such as Balmoral Avenue and Warwick Close. The closest sensitive receptors to works on the M66 are at Cowlgate Farm approximately 30m from the M66 and dwellings on Castle Hey Close approximately 60m west of the M66. There are residential dwellings within approximately 15m of the roundabout at M60 J18 in the south-east quadrant at Simister.

Table 12.7: Predicted construction noise levels during online works, $L_{Aeq,t}$ dB

Activity	10m	20m	50m	100m	200m	300m
Traffic management	78	72	64	58	52	49
Site clearance	82	76	68	62	56	52
Earthworks	79	73	65	59	53	49
Drainage works	80	74	66	60	54	51
Roadworks	79	73	65	59	53	49
Vehicle restraint system	83	77	69	63	57	53
Central reserve barrier	80	74	66	60	54	51
Pavement and white lining	88	82	74	68	62	59
Gantry works	81	75	67	61	55	51
Retaining wall	82	76	68	62	56	52
Sheet piling for piers	86	80	72	66	60	56

12.10.7 Construction noise levels will be at levels that will exceed SOAEL by more than 5dB at the closest receptors to the online works. This level of construction noise indicates potential Major magnitude adverse impacts, which is a potential significant effect. Mitigation measures for the online construction phases should therefore be considered.

12.10.8 Table 12.8 indicates potential construction noise levels during offline works constructing the Pike Fold Bridge and Pike Fold Viaduct structures. The closest noise sensitive receptor to both structures is Cowlgate Farm west of the M66 and approximately 145m south-west of Pike Fold Bridge and 130m north-east of Pike Fold Viaduct.

Table 12.8: Predicted construction noise levels during offline works, $L_{Aeq,t}$ dB

Activity	10m	50m	100m	150m	200m	300m
Earthworks	84	70	64	60	58	54
Drainage	82	68	62	58	56	52
Piling	81	67	61	57	55	51
Fiber Reinforced Concrete (FRC) to abutment pile caps and walls	83	69	63	59	57	53
Beam installation	84	70	64	60	58	54
Diaphragm walls	79	65	59	56	53	49
Bridge deck construction	84	70	64	60	58	54

12.10.9 At the closest receptor to the structures works, predicted noise levels would be below SOAEL, and be of a Minor magnitude of impact for some receptors. This indicates no significant effect during these works.

12.10.10 Table 12.9 indicates potential construction noise levels during works constructing new ponds. There are six ponds proposed, with the closest noise sensitive receptors to any

pond construction works at ponds 4, 6 and 7 at distances exceeding 50m and exceeding 100m at ponds 1, 2 and 5.

Table 12.9: Predicted construction noise levels during ponds construction, $L_{Aeq,t}$ dB

Activity	10m	50m	100m	150m	200m	300m
Site establishment	82	68	62	58	56	52
Earthworks	81	67	61	58	55	52
Drainage	81	67	61	58	55	52
Landscaping	82	68	62	58	56	52

12.10.11 At the closest receptors to the construction of the ponds 4, 6 and 7 predicted noise levels would be above SOAEL, by a margin of more than 5dB above SOAEL for some receptors. This level of construction noise indicates potential Major magnitude adverse impacts, which is a potential significant effect. Mitigation measures should therefore be considered for the construction phases of these ponds.

12.10.12 During the construction of the ponds 1, 2 and 5 there is unlikely to be any exceedance of SOAEL due to the increased distance to receptors, indicating a Minor magnitude if impact. This indicates no significant effect during the works at ponds 1, 2 and 5.

12.10.13 Locations where the daytime SOAEL is predicted to be equalled or exceeded are possible significant effects. Table 12.10 summarises the total numbers of receptors in the study area where a Moderate or Major magnitude of impact is predicted during any of the construction phases, and includes those below SOAEL and within the study area where Minor and Negligible magnitudes of impacts are predicted.

Table 12.10: Potential construction noise impacts

Magnitude	Number of sensitive receptors	
	Daytime	Night-time
Negligible	1,103	256
Minor	1,232	17
Moderate	533	1,037
Major	352	1,882

12.10.14 There are Moderate and Major magnitude of impacts predicted at multiple sensitive receptors, which are potential significant effects.

12.10.15 In accordance with DMRB LA 111, construction noise shall constitute a significant effect where it is determined that a Moderate or Major magnitude of impact would occur for a duration exceeding either of the following:

- 10 or more days or nights in any 15 consecutive days or nights
- A total number of days exceeding 40 in any six consecutive months

12.10.16 There are some activities, such as site clearance and de-vegetation, fencing, road surfacing (pavement works) and white lining, that move along their working areas from one end to the other, so that the noisiest period of activity is limited to the duration of

the activity at the closest point to a given receptor. Although the significant effect for some of the noisiest activities (such as de-vegetation) would be shorter than the temporal scope outlined above, a significant effect at receptors cannot be ruled out overall due to the continuous 3-year program of works, where different construction phases follow on from one to another.

12.10.17 There are 533 and 1,037 noise sensitive receptors predicted to result in day and night-time Moderate magnitudes of impact respectively (Table 12.9), where the SOAEL is predicted to be met or exceeded by up to +5dB. With the implementation of the essential mitigation discussed in Section 12.10 a reduction in construction noise levels of at least 5dB can be expected, reducing construction noise levels to below SOAEL for receptors. The magnitude of impact would therefore be reduced to Minor and the effect would be considered to be **not significant**.

12.10.18 For those receptors where a Major magnitude of impact is predicted, the SOAEL is predicted to be exceeded by +5dB or more. The essential mitigation discussed in Section 12.9 could achieve reductions in construction noise of between 5 to 20dB for different activities, but exceedance of SOAEL cannot be ruled out, resulting in potential **significant effects**.

12.10.19 Allowing for a minimum 5dB reduction from calculated levels as a result of essential mitigation, there are therefore potential significant effects in the following working areas:

- During mobilisation, the activities of site clearance, earthworks, paving and accommodation units works
- During demobilisation, the activity of reinstatement
- During M60 online works the activities of site clearance, earthworks, drainage, roadworks, vehicle restraint system, central reserve barrier, paving and white lining, gantry works, retaining wall and piling for piers
- During M66 online works the activities of paving and white lining, and piling for piers
- During M60 J18 roundabout online works the activities of site clearance and traffic signals works
- Construction of ponds 4, 6 and 7

Construction vibration

12.10.20 For human response to vibration the SOAEL is 1.0 mm/s. A significant effect is considered to occur where a Moderate or Major impact is predicted. A Moderate magnitude impact is where the SOAEL is predicted to be equalled or exceeded up to a value of 10 mm/s and a Major magnitude impact arises where the vibration is predicted to exceed 10 mm/s.

12.10.21 Contained with BS 5228-2:2009+A1:2014 (British Standards Institution, 2014b) are equations to predict the expected level of vibration from various activities. These have been used to predict the expected impact from vibration from piling and compaction activities. It has been assumed that vibratory piling will be the main type of piling that is utilised and piling calculations have been based on this method. A large 2.1m wide BOMAG roller has been assumed to be used during paving works. Table 12.11 shows the number of sensitive receptors expected to be experience the different magnitudes of vibration from these activities. The calculations only consider those receptors within

100m of the activity and is based on a steady-state operation with a 50% probability of the predicted value being exceeded.

Table 12.11: Potential construction vibration impacts, human response

Magnitude	Number of sensitive receptors	
	Piling	Compaction
Negligible	110	469
Minor	24	178
Moderate	0	18
Major	0	0

12.10.22 A construction vibration impact magnitude of Moderate or Major is a likely significant effect. There are no predicted Moderate or Major magnitudes of effect during piling, and so there is no potential significant impact from piling works.

12.10.23 There are 18 receptors where vibration during compaction is predicted to be above the SOAEL of 1.0 mm/s for human response, which is a Moderate magnitude of effect indicating a potential significant impact.

12.10.24 All of these 18 receptors are within 17m of the pavement works; Outside of this distance vibration reduces to below the SOAEL, changing the magnitude of effect to Minor or Negligible. The maximum level of vibration is calculated to be 1.9 mm/s PPV at Droughts Lane, approximately 10m north of M60 pavement works.

12.10.25 The highest predicted level of 1.9 mm/s is just above the SOAEL of 1.0 mm/s, where Table 1.5 of Appendix 5.2 advises the following effect;

"It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents."

12.10.26 There are 18 receptors where vibration during compaction of the road surface is predicted to exceed SOAEL, where the magnitude of impact is of Moderate. The duration of the activity is also considered, and a significant effect is deemed to occur when the duration of the activity exceeds:

- 10 or more days or nights in any 15 consecutive days or nights
- A total number of days exceeding 40 in any six consecutive months

12.10.27 The duration of compaction during paving is expected to be less than the above at any given location as it is a transient activity that will pass the closest sensitive receptors in a period of time shorter than that indicated above. **No significant effects** are therefore predicted from vibration during construction.

Construction traffic and diversion routes

12.10.28 The impact from construction traffic on the motorways and the local road network has been examined to determine whether this could impact upon sensitive receptors. This has been undertaken for the construction years of 2025, 2026 and 2027. The amount of construction traffic compared to the existing traffic on the majority of the roads is low, and any increases in noise would be negligible and of less than 1 dB(A) on all roads.

12.10.29 There is one possible construction haul route that is located away from the motorway roads. This would be the use of Ross Avenue and Oak Avenue to transport earthworks material away from pond 6 if the alternative route is not available. As a worst case there could be 3,000 HGV movements using this route over a 3-6 month period. These are residential streets, and this number of HGVs is a potential significant impact, which will be considered in more detail at the Environmental Statement stage.

12.10.30 During certain construction activities (e.g. piling of retaining walls and gantries and bridge span installation) it will be necessary to implement temporary closures of some existing roads. Table 12.12 presents a summary of the proposed carriageway closures that would result in traffic diversions onto the local road network that would normally experience lower traffic levels at night.

Table 12.12: Summary of carriageway closures and traffic diversion routes

Road closure	Diversion route description	No. dwellings within 25m
M60 J17-18 eastbound and westbound full closure	From M60 J17 south along A56 Bury New Road to A6044 Scholes Lane turning east to A576 Middleton Road then north-east to M60 J19, then north to M60 J18. This route would be the same for both directions of travel.	258
Eastbound	As above, one direction only from M60 J17.	258
M60 J19 to J18 westbound	As above in counter direction, leaving M60 at J19 west onto A576 Middleton Road to A6044 Scholes Lane, then north onto A56 Bury New Road re-joining M60 at J17.	258
M66 northbound and southbound closure J3 to J4	Leave M66 at J3 turning west onto Pilsworth Road and continue onto Croft Lane until it joins the A56 then follow this south to M60 J17. Join the M60 at J17 heading east until reaching M60 J18. This route would be the same for both directions of travel.	377

12.10.31 The use of any diversion route should be considered as a Major magnitude of impact at night (23:00 to 07:00 hours), and would be a significant effect if these occur for 10 or more nights in any consecutive 15 nights, or a total of more than 40 nights in any consecutive 6-month period. The periods when these diversions may be used are not finalised at this stage, therefore a potential significant impact cannot be ruled out.

Operation

12.10.32 The assessment of potential changes in road traffic noise has been carried out based on a scheme design and traffic model that have subsequently been superseded. The design assessed reflects the proposed new structures and alignment of the Proposed Scheme, and impacts are likely to be similar with the new design once fixed. The assessment presented therefore provides an indication of the potential magnitude of change in road traffic noise.

12.10.33 The predicted changes in road traffic noise upon Scheme opening in 2027 are presented in Table 12.12 which indicates the potential change in road traffic noise between Do Minimum and Do Something (in 2027), including embedded (design) mitigation, including the alignment and standard road surfacing assumptions, but not considering any essential mitigation that may such as enhanced surfacing or noise barriers.

Table 12.13: Operational road traffic noise potential short-term change summary

		Daytime		Night-time	
		Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
Increase in noise level dB $L_{A10,18h}$ / L_{night}	<1.0	3,740	15	3,827	1
	1.0-2.9	302		183	
	3-4.9	3		2	
	>5				
No Change	0	1,192	11	1,264	
Decrease in noise level dB $L_{A10,18h}$ / L_{night}	<1.0	1,390	22	1,376	1
	1.0-2.9	73	1	48	
	3-4.9		1		
	>5				

12.10.34 There are more predicted increases in road traffic noise than predicted decreases. Those receptors where a road traffic noise increase of greater than 1dB is predicted are located either side of the M60 between J17 and J18. The three receptors where a road traffic noise increase exceeding 3 dB are predicted are located at the western end of Balmoral Avenue, within approximately 25 m of the eastbound M60. This increase is mostly due to the higher predicted traffic speeds in the opening year, with a smaller contribution from the edge of the closest lane of traffic moving closer to receptors at this location.

12.10.35 Many of the predicted increases of 1 dB or more are in areas where the existing noise level is above the SOAEL, which indicates a potential significant effect. Additional mitigation for operational road traffic noise will therefore be considered at the Environmental Statement stage when noise modelling will be updated to reflect the final design and traffic assessment.

12.10.36 There are predicted negligible noise changes in the area of Simister, south-east of J18, and also either side of the M66.

12.10.37 There are no roads outside of the area physically changed or bypassed by the Proposed Scheme that are predicted to experience a short-term noise level change of more than 1.0 dB(A) as a result of the Proposed Scheme.

12.10.38 Most of the road traffic noise changes for dwellings and other sensitive receptors would be of a negligible magnitude and below 1.0 dB, which are not considered to be significant.

12.10.39 There are 14 residential dwellings located on Balmoral Avenue where a long-term change of 1dB or more is predicted, and where the future year road traffic noise level is 68 dB or higher. This indicates potential qualification for dwellings for noise insulation under the Noise Insulation Regulations. This will be reassessed and confirmed for the

assessment for the Environmental Statement, once noise mitigation has been considered.

12.10.40 No significant beneficial effects are predicted.

12.10.41 The predicted unmitigated change in noise at each NIA within the Study Area is presented in Table 12.14. This table also lists what potential noise mitigation measures the Proposed Scheme would consider for each NIA. The environmental effects at these NIAs will be revised accordingly at the Environmental Statement stage based on the updated modelled noise levels.

Table 12.14: Potential noise mitigation at each Noise Important Area within the study area

NIA number	Road	Change in noise[1]	Potential noise mitigation and justification
1671	M60	Increase and Decrease	An Increase in height of noise barriers along the M60 between J17 and J18 between Balmoral Avenue and Glendevon Place and Kenilworth Avenue and Warwick Avenue. The use of a road surface with better noise reducing properties than a standard low noise surface on the M60 between J17 and J18.
8188	M60 J18	No change	None
10718	On M62 north-east of M60 J18	No change	None
1670	On A56 Bury New Road to the north-west of the Proposed Scheme	No change	None
10719	On A665 Higher Lane to the west of the Proposed Scheme	No change	None
1406	On M66 extending from Griffe Lane to Haweswater Crescent	No change	None

[1] The change reported is in terms of 'no change' (including negligible changes), 'increase' or 'decrease' to avoid confusion with environmental effects.

12.10.42 The preliminary information presented within this PEIR is in line with the policies set out in the NPS NN, as described in Section 12.3. Areas where there would be potential impacts from the Proposed Scheme have been identified, and the relevant standards and guidance to be used at the Environmental Statement stage have been identified.

13. Population and human health

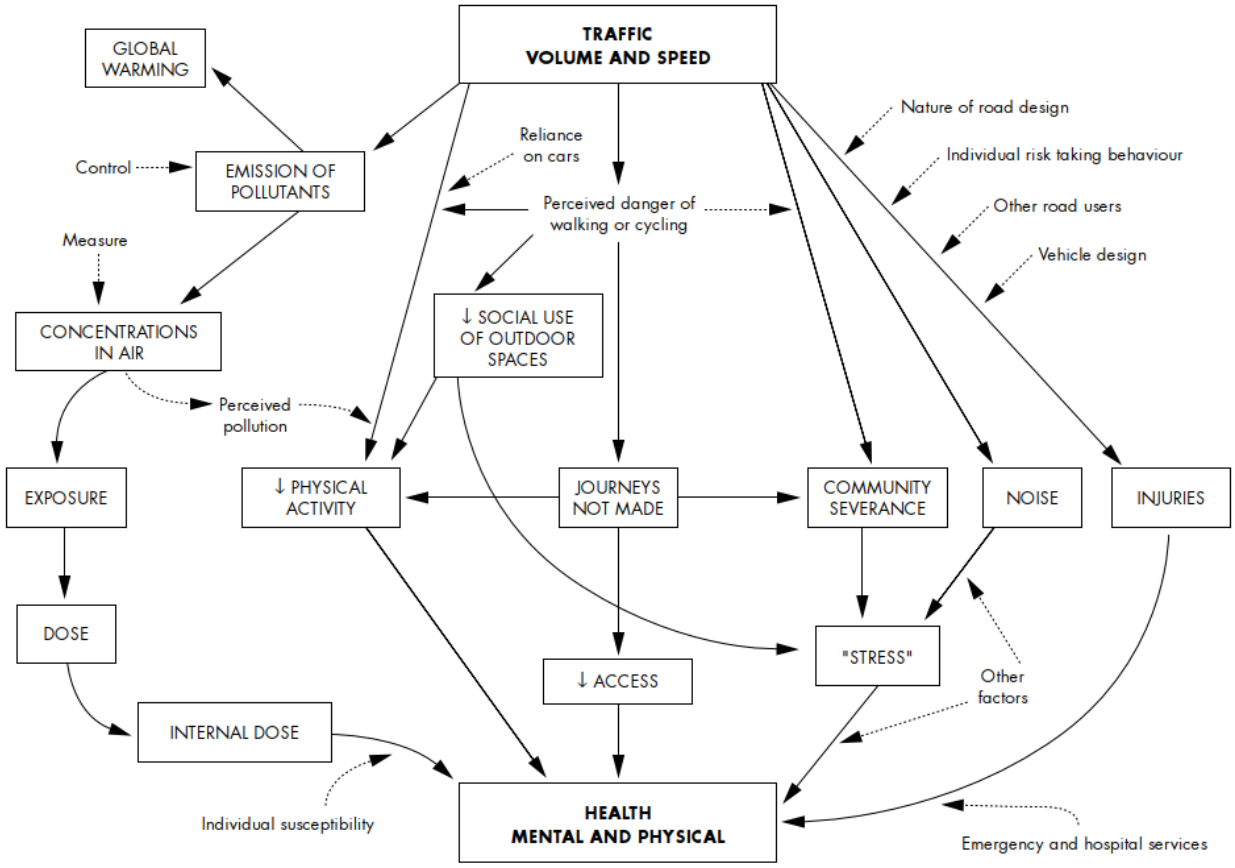
13.1 Topic introduction

13.1.1 This chapter provides a preliminary assessment of the interrelated aspects of population and human health. In accordance with the DMRB LA 112 Population and Human Health, the population assessment relates to impacts on land use and accessibility. The assessment addresses potential impacts on land use change (i.e. impacts on residential, employment, community and agricultural land use) as well as impacts on access for walkers, cyclists and horse riders.

13.1.2 The World Health Organization (WHO) constitution defines health as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (WHO, 1948).

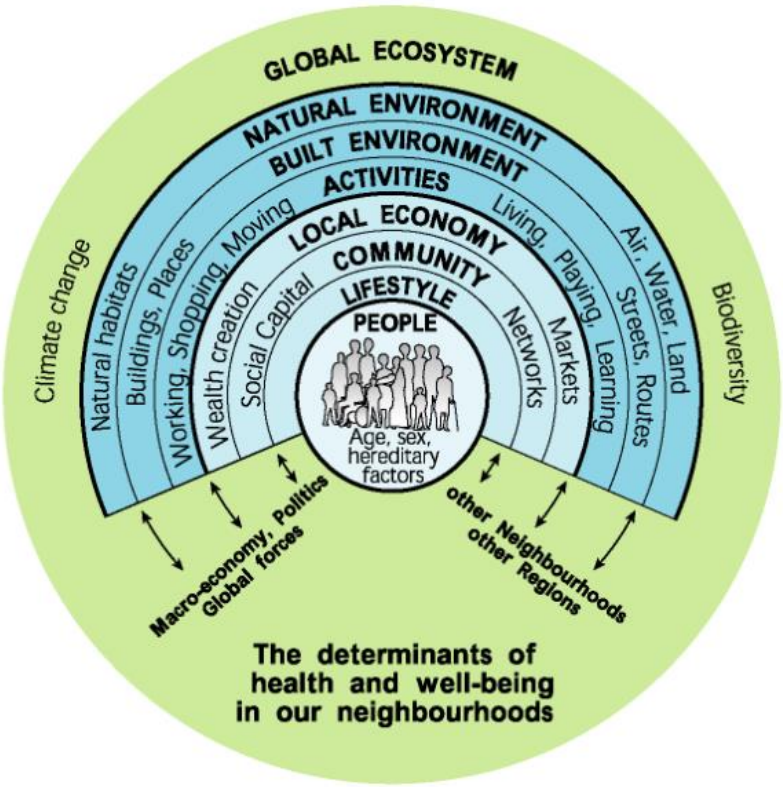
13.1.3 Highway projects can affect human health in a variety of direct and indirect ways. Plate 13.1 provides an illustration of some of the pathways through which highways, road use and traffic movements can affect physical and mental health.

Plate 13.1: Links between traffic volume and speed on health (Source: Joffe and Mindell, 2002)



13.1.4 Health is determined by a complex interaction between individual characteristics, lifestyle and the physical, social and economic environment. Most public health experts agree that these 'wider determinants of health' have a greater influence than formal healthcare for ensuring a healthy population. Plate 13.2 provides a conceptual illustration of wider determinants of health in our natural and built environment.

Plate 13.2: Determinants of health and wellbeing in our neighbourhoods (Source: Barton and Grant, 2006)



13.1.5 A related issue, of key importance to public health, is the issue of health inequalities. The Marmot Review into health inequalities (Marmot, 2010) looked at differences in health and wellbeing between social groups and described how the social gradient on health inequalities is reflected in the social gradient on educational attainment, employment, income, quality of neighbourhood and other issues. Understanding the wider determinants of health is seen as an important means of tackling health inequalities and improving population health as a whole.

13.1.6 This assessment takes account of the findings from other aspects within this Preliminary Environmental Information Report (PEIR) to understand how the Proposed Scheme is likely to affect environmental determinants of health. It also addresses effects on wider determinants relating to the themes of access; traffic and transport; socio-economic conditions; and land use (see Section 13.4 for further detail on the scope of matters covered within this assessment).

13.1.7 This chapter is supported by the following figures:

- Figure 13.1: Population and Human Health Context Study Area
- Figure 13.2: Land Use and Accessibility Baseline
- Figure 13.3: Agricultural Landholdings
- Figure 13.4: Key Population and Human Health Impacts

13.2 Stakeholder engagement

13.2.1 Table 13.1 summarises the key requirements from the Planning Inspectorate's Scoping Opinion (2021) as relevant to the scope of the population and human health assessment, and identifies any matters scoped out of the assessment as agreed with the Planning Inspectorate and other stakeholders. This table also explains any changes to the assessment methodology as a result of this engagement.

Table 13.1: Key stakeholder feedback for population and human health aspect

Stakeholder	Comment	Response
Planning Inspectorate	Connections to employment, services, facilities and leisure and community severance during construction should be scoped in.	These determinants have been scoped into assessment and are considered within this report.
	Agree that employment opportunities during operation, access to / by public transport and other wider determinants of health listed in Table 13.7 should be scoped out of assessment.	Noted. Assessment provided in this document reflects the scope provided in Table 13.7 of the Environmental Scoping Report (Highways England, 2021).
	Explanation required as to how health values identified as significantly worse than the national average have been determined, and how this influences assessment of significance of effect.	Further explanation provided in Table 13.7 of this report.
	Assessment of human health impacts needs to state the significance of identified effects and be supported by methodology for doing so.	The assessment of human health impacts has been undertaken in accordance with DMRB LA 112 Population and Human Health (Highways England, Revision 1, 2020a; hereafter referred to as DMRB LA 112). The approach to significance is currently being addressed by National Highways and the Environmental Statement will reflect any agreed changes to the approach.
Public Health England (PHE) (now known as the Office of Health Improvement and Disparities (OHID) and the UK Health Security Agency (UKHSA))	Potential for impacts on human health from sources of water contamination and electric and magnetic fields should be clarified.	Confirm that no impacts on human health associated with water contamination or electric and magnetic fields are anticipated.
	• Support for design development reduces public exposure to air quality pollutants, addresses inequalities of exposure and maximises opportunities for physical activity. • Identification of wider determinants of health that the assessment should address, and of vulnerable groups that should be considered. • Suggested guidance to follow for assessment of health impacts associated with noise, which involves quantification approaches.	• Opportunities to contribute towards improved health outcomes will continue to be explored as the design development progresses. • The assessment provided in this report identifies the determinants of health scoped into assessment and additional consultation with the Director of Public Health will be undertaken to inform an understanding of vulnerable groups which will be reported within the forthcoming Environmental Statement. • At this stage of assessment, no quantification of health outcomes associated with noise has been undertaken. This opportunity will be considered further in the Environmental Statement.

13.3 Legislative and policy framework

13.3.1 The National Policy Statement for National Networks (NPS NN) (Department for Transport (DfT), 2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NPS NN as the primary basis for making decisions on DCO applications.

13.3.2 Key policy from the NPS NN relevant to this aspect is set out below:

- Paragraph 3.22 states that severance can be a problem in some locations. Where appropriate applicants should seek to deliver improvements that reduce community severance and improve accessibility.
- Paragraph 5.205 states that applicants should consider reasonable opportunities to support other transport modes in developing infrastructure, and that the applicant should provide evidence that they have used reasonable endeavours to address any existing severance issues that act as a barrier to non-motorised users.
- Paragraph 4.82 states that the applicant should identify measures to avoid, reduce or compensate for adverse health impacts as appropriate. These impacts may affect people simultaneously, so the applicant, and the SoS (in determining an application for development consent) should consider the cumulative impact on health.
- Paragraph 5.166 states that existing open space, sports and recreational buildings and land should not be developed unless the land is surplus to requirements or the loss would be replaced by equivalent or better provision in terms of quantity and quality in a suitable location. Applicants considering proposals which would involve developing such land should have regard to any local authority's assessment of need for such types of land and buildings.
- Paragraph 5.184 states that public rights of way, National Trails and other rights of access to land (e.g. open access land) are important recreational facilities for walkers, cyclists and equestrians. Applicants are expected to take appropriate mitigation measures to address adverse effects on coastal access, National Trails, other public rights of way and open access land and, where appropriate, to consider what opportunities there may be to improve access. In considering revisions to an existing right of way consideration needs to be given to the use, character, attractiveness and convenience of the right of way.
- Paragraph 5.206 states that for road and rail developments, if a development is subject to EIA and is likely to have significant environmental impacts arising from impacts on transport networks, the applicant's environmental statement should describe those impacts and mitigating commitments.

13.3.3 In addition to the national policy set out in the NPS NN, the Proposed Scheme must also have regard to relevant legislation and local plans and policy. Legislation and local planning policy will be complied with. Full details of legislation and local planning policy relevant to this aspect is detailed in Appendix 1.1 of this PEIR and will also be provided in the Environmental Statement.

13.4 Assessment methodology

13.4.1 The assessment of effects on land use and accessibility and human health has been undertaken in line with DMRB LA 112, which provides the National Highways standard on what should be included within the topic of Population and Human Health. In addition, the following guidance documents have informed the approach to the assessment of effects on human health:

- Health in Environmental Impact Assessment: A Primer for a Proportionate Approach (Cave et al., 2017)
- Human Health: Ensuring a high level of protection (International Association for Impact Assessment (IAIA) and European Public Health Association (EUPHA), 2020)

- Health Impact Assessment in spatial planning guide for local authority public health and planning teams (PHE, 2020)

Land use and accessibility

13.4.2 Matters scoped into assessment for land use and accessibility are set out in Table 13.2.

13.4.3 The judgement of likely significant effects on land use and accessibility uses the value/sensitivity and magnitude criteria from DMRB LA 112 (Revision 1) and the significance matrix from LA 104 (Revision 1) which can be found in Appendix 5.2 of this PEIR.

13.4.4 The assessment of significance considers how the community would be affected by the identified impacts, taking into account the wider context of resources (i.e. whether alternative resources would be available and unaffected) and the proportion of the community affected. This is in line with LA 104 which states that the assessment of the significance of effects shall cover factors such as the receptors/resources to be affected and geographic importance.

Human health

13.4.5 Matters scoped into assessment for human health are set out in Table 13.2. Further detail regarding the scoping of wider health determinants is provided in the Environmental Scoping Report (Highways England, 2021).

13.4.6 A source-pathway-receptor approach has been undertaken to inform whether there are plausible links between impacts on health determinants and potential health outcomes. This has involved the following broad process:

- Identifying how the Proposed Scheme would potentially impact on a health determinant,
- Understanding the pathways between potential impacts and physical, mental and social health outcomes, and
- Considering the likelihood that communities (potential receptors) would be exposed to those pathways, taking into account the effectiveness of essential mitigation.

13.4.7 The understanding of pathways between potential impacts and health outcomes has been informed by scientific literature including systematic reviews with meta-analyses where available. Systematic reviews provide a summary of all the literature available on a particular topic which meets pre-defined eligibility criteria. These are more helpful as an evidence base as they synthesise the available research and help to reduce the overall level of bias which may influence an individual research paper.

13.4.8 The sensitivity of communities is described as either ‘high’, ‘medium’ or ‘low’ as required by DMRB LA 112 (para 3.3.1, p21). The judgement of the level of sensitivity has applied the IAIA/EUPHA (2020) guidelines. The guidelines suggest the judgement of sensitivity should consider issues such as overall population health status, age profile, levels of deprivation, health inequalities and capacity to adapt.

13.4.9 Health outcomes are reported as positive, neutral, negative or uncertain as required by DMRB LA 112 (Table 3.32, p21). DMRB LA 112 does not currently provide significance criteria. However, the Scoping Opinion (Planning Inspectorate, August 2021) stated that the Environmental Statement should *‘describe the methodology for determining the significance of effects and report the significance of effects on human health’*.

13.4.10 In the absence of adopted significance criteria in DMRB LA 112, the human health assessment reported in this PEIR adopts a narrative approach setting out the judgement of significance.

13.4.11 In its scoping consultation response, PHE (now OHID and UKHSA) recommended that significance should be judged in consideration of the following factors: sensitivity, magnitude, cumulative effects, importance, acceptability and opportunity for mitigation.

13.4.12 The approach to determining significance has taken on board the scoping advice as well as the IAIA/EUPHA (2020) and PHE (2020) guidance identified above. The assessment of human health effects provides a conclusion as to whether the identified health impact is considered 'significant' or 'not significant'. For each judgement of significance made, a narrative has been provided to explain which factors have been considered when making the judgement of significance. The following considerations have been made, where relevant, to inform the judgement of significance by the assessor:

- Whether there would be a high level of exposure or widespread impacts
- Whether there would be a cumulation of impacts which may interact or give rise to synergistic effects on health
- Whether the population exposed to an impact is particularly sensitive due to pre-existing vulnerabilities or inequalities
- The duration of effects and whether they would be reversible
- The level of acceptability, including whether statutory thresholds for pollutants would be exceeded and/or whether the issue is a public health priority
- The severity of the related health outcomes (i.e. whether it is related to a change in mortality or morbidity)
- The strength of evidence for an association between a change in a determinant and health outcomes
- Whether a large proportion of the population would likely be affected
- Whether the impact is likely to increase or tackle health inequalities at a population level

13.4.13 During the finalisation of this preliminary assessment, new guidance on determining significance for human health in EIA (Pyper, R et al., 2022) was published by the Institute of Environmental Management and Assessment (IEMA). The IEMA guidance provides an indicative framework for determining sensitivity, magnitude and significance. However, at this point the DMRB LA 112 has not altered its reporting framework for health outcomes. Therefore the approach taken in this PEIR is to report health outcomes using the four outcome categories and approach to significance as outlined above. The significance considerations outlined above are broadly aligned with the new IEMA guidance, which also advocates a narrative approach.

Table 13.2: Summary of population and human health scope

Matter	Scoped in – construction	Scoped in – operation
Land use and accessibility		
Private property and housing	✓	✓
Community land and assets	✓	✓
Development land and business	✓	✓
Agricultural landholdings	✓	✓
Walkers, cyclists and horse riders	✓	✓
Human health		
Access to the natural environment and outdoor recreation – this includes the ability of communities to access green/open space.	✓	✓
Accessibility for walking and cycling – this includes potential impacts on active travel.	✓	✓
Connections to employment, services, facilities and leisure – this includes changes in the outline spatial characteristics of the transport network, including the surrounding road network, public transport routes and changes in access by car and public transport.	✓	✓
Community severance – this includes the degree of severance or separation between communities and facilities.	✓	✓
Employment opportunities including training opportunities[1] – this includes opportunities to address this social determinant of health and potentially address health inequalities.	✓	×
Quality of urban and natural environments – this addresses changes in environmental conditions relevant to human health including air quality, noise, sources of pollution and landscape amenity.	✓	✓

[1] Not assessed within PEIR as limited construction information is available. This determinant will be assessed within the Environmental Statement for the Proposed Scheme.

13.5 Assessment assumptions and limitations

13.5.1 Data from the Office for National Statistics (ONS) have been used to form the baseline conditions. However, in some cases datasets are reliant on estimates (e.g. for population) or has not been updated since the 2011 Census. This PEIR has been prepared before the release of the relevant 2021 Census data. The Environmental Statement will use the latest available census data.

13.5.2 The assessment considers health effects and data relating to population level data, rather than health data and effects relating to individuals. The aggregated data and statistics used to support the assessment cannot be used to make inferences about the health of individuals within the communities assessed.

13.5.3 Health data collected in 2020 for certain health indicators used in the human health baseline is limited as it does not cover the full year.

13.5.4 The EIA process assesses changes in concentrations of air pollutants, as well as changes in outdoor noise at specific receptor sites. These measurements do not equate to levels of exposure experienced by people at these receptor sites. Several factors, such as amount of time people spend in the locations, quality of buildings or ventilation,

will affect the level of potential exposure that people may have, which cannot be reliably quantified in the EIA with the data available.

13.5.5 Although the assessment has referred to research that reports evidence of associations between changes in health determinants and effects on health, the research has limitations and may not be generalisable to the population context of the Proposed Scheme. Professional judgement has been used in the interpretation of the evidence and its relevance to the Proposed Scheme. Furthermore, evidence of association does not necessarily mean causation. Conclusions on cause and effect relationships for human health cannot be drawn from aggregated population level data.

13.5.6 The assessment does not draw conclusions on the viability of any individual businesses, including farm businesses, that may be affected by changes in land or access from the Proposed Scheme. Such matters would relate to the relevant margins that support the businesses and any impacts on business viability would depend on direct negotiation between the interested parties and their representatives. Instead, the assessment presents effects in relation to whether the existing land use can feasibly continue in light of likely physical impacts on land-take or access.

13.5.7 There is potential for discrepancies in reported landownership boundaries due to historic boundaries shown on spatial datasets or other mapping errors.

13.5.8 All measurements are approximate.

13.5.9 The use of the Strava Global Heatmap application (app) to inform cycling activity in the area has the limitation that it is likely to be a selective group of cyclists and runners who use the app. The app is likely used more by very keen and more competitive cyclists and runners and may not reflect the activities of occasional cyclists and runners, family rides with younger children or short regular commutes. Nevertheless, the app is widely used and provides an indication of routes regularly used and routes which tend to be avoided.

13.6 Study area

13.6.1 The study areas for the assessment of effects on population and human health are set out below and shown in Figure 13.1.

Land use and accessibility

13.6.2 The study area for land use and accessibility topics is the provisional Order Limits plus a buffer of 500m, as set out in DMRB LA 112. It is noted that direct physical impacts on land use and accessibility assets, such as land take, would be restricted to the physical footprint of the Proposed Scheme, including land and access required temporarily for construction. However, 500m is deemed appropriate to capture any land use assets outside of the provisional Order Limits which could potentially be indirectly affected by impacts on their main points of access should these fall within the footprint of the Proposed Scheme.

Human health

13.6.3 The study area for human health will consist of the wards that coincide with the study area for land use and accessibility, as set out in Figure 13.1.

13.6.4 In line with DRMB LA 112, the area defined above will capture potential direct effects on human health associated with changes in air and noise pollution, temporary and permanent changes in land use and access, and also indirect effects associated with

changes in traffic volumes, speed or composition which could indirectly affect active travel or recreational journeys undertaken by pedestrians, cyclists and horse-riders.

13.7 Baseline conditions

Baseline sources

13.7.1 The Population and Human Health baseline has been informed by the following information sources:

- Ordnance Survey (OS) mapping
- Aerial photography
- OHID Fingertips and Local Health webtools (OHID, 2022)
- Land registry data
- Bury Council website (including documents to support the emerging Local Plan)
- ONS datasets (ONS, 2018; ONS, 2020)

Baseline conditions – land use and accessibility

Private property and housing

13.7.2 The 'Private property and housing' element in DMRB LA 112 is defined as *'land, buildings and infrastructure for the purpose of residential use.'*

13.7.3 The key communities within 500m of the Proposed Scheme are Simister (Simister Lane, Droughts Lane and Simister Green located to the south-east of M60 J18), Whitefield (which lies north of the M60 between J17 and J18), Unsworth (bordering the M66, north of M60 J18) and Prestwich (south of M60 J17) (Figure 13.2). There are also residential properties which border the M60 both to the north and south, between M60 J17 and J18, which includes the community of Kirkhams. The populations of these communities are set out in Table 13.3.

Table 13.3: Communities and usual resident population within the study area

Local authority	Wards	Population of Ward (mid-2019 estimate)	Community (i.e. name of area/neighborhood)
Bury	Holyrood	11,156	Simister, Kirkhams, Heaton Park
	Unsworth	9,462	Whitefield, Unsworth
	Besses	10,916	Whitefield, Unsworth
	Pilkington Park	9,695	Whitefield
	St Mary's	10,428	Prestwich

13.7.4 Several streets and houses in the study area are immediately adjacent to the provisional Order Limits. These include:

- Philips Park Road East, Whitefield, Pilkington Park ward
- Ross Avenue, Whitefield, Pilkington Park ward
- Oak Avenue, Whitefield, Pilkington Park ward
- Chestnut Avenue, Whitefield, Pilkington Park ward

- Balmoral Avenue, Whitefield, Besses ward
- Kensington Street, Whitefield, Besses ward
- Kenilworth Avenue, Whitefield, Holyrood ward
- Warwick Close, Whitefield, Holyrood ward
- Warwick Avenue, Whitefield, Holyrood ward
- Barnard Avenue, Whitefield, Holyrood ward
- Glendevon Place, Whitefield, Besses ward
- Conisborough Place, Whitefield, Besses ward
- Derwent Close, Whitefield, Besses ward
- Duddon Close, Whitefield, Besses ward
- Derwent Avenue, Whitefield, Besses ward
- Brathay Close, Whitefield, Besses ward
- Rothay Close, Whitefield, Besses ward
- Marston Close, Whitefield, Besses ward

13.7.5 Table 13.4 presents the housing allocations and applications which have been identified within the study area.

13.7.6 The Greater Manchester Spatial Framework (GMSF) was produced by the Greater Manchester Combined Authority (GMCA). The GMSF: Publication Plan was published for consultation between 1 December 2020 and 26 January 2021. However, on the 3 December 2020, Stockport Council voted against adoption of the plan. The remaining nine councils (Bolton, Bury, Manchester City, Oldham, Rochdale, Salford, Tameside, Trafford and Wigan) agreed to form a joint committee to develop a new planning strategy based on the GMSF, titled, 'Places for Everyone', covering the long-term plans for jobs, new homes and sustainable growth across their respective boroughs. A consultation version of Places for Everyone was presented to the Committee, and pending revision, was issued for formal public consultation in August 2021.

13.7.7 Reference to the Proposed Scheme was made in the Places for Everyone plan submitted to the Secretary of State for examination on 14 February 2022, stating, *'Works to improve the capacity of Simister Island (the junction of the M62, M60 and M66 motorways) are already planned, but additional investment in the motorway network will be required to support the scale of development proposed within the North-East Growth Corridor'* (GMCA, 2022 p.61). The programme is that this plan is adopted by the end of 2023. Relevant allocations are set out in Table 13.4.

13.7.8 Bury and Manchester are anticipated to see an 11.0% and 11.4% increase in the number of households respectively between 2019 and 2041 based on ONS projections (ONS, 2018).

Table 13.4: Housing and employment allocations and applications within the land use and accessibility study area

Allocation/Application	Number of units	Notes
Simister and Bowlee (Northern Gateway) (JPA1.2) (in Places for Everyone Submission Plan (August 2021))	1,550 homes	Housing allocation in Places for Everyone Submission Plan (GMCA, August 2021)
Heywood / Pilsworth Northern Gateway (JPA1.1)	1,200,000 sqm employment, 1,200 homes	Mixed use allocation in Places for Everyone Submission Plan (GMCA, August 2021)
Hodder Way	14 homes	Housing allocations in UDP, Bury Metropolitan Borough Council
Albert Road and Hazel Road	55 homes	
Land South of Albert Road	129 homes	
Land at Hollins Mount Farm	140 homes	
Prestwich Hospital	120 homes	
Cedar Avenue	20 homes	
Land adjacent to 15 Prestfield Road, Whitefield, Manchester, M45 6BD (ref 58918)	33 apartments	Planning application to Bury Metropolitan Borough Council abuts Proposed Scheme provisional Order Limits
85 Bury Old Road, Whitefield, Manchester, M45 7AY (ref 63003)	11 apartments, 562 sqm employment (25 full time employees)	Planning application for housing and office space to Bury Metropolitan Borough Council 50m from provisional Order Limits
Lord Clive Pub, 92 Mersey Drive, Whitefield, Manchester, M45 8LF (ref 65379)	27 units	Planning application to Bury Metropolitan Borough Council 400m from provisional Order Limits
34-36 Fountain Place & Aldi Foodstore Ltd, Higher Lane, Whitefield, Manchester, M45 7EA (ref 62751)	445 sqm employment	Extension of existing car park.

Community land and assets

13.7.9 Community land and assets includes land, buildings and infrastructure which provide a service or resource to a community, for example open spaces, village greens, village halls, healthcare and education facilities. Given the urban nature of the study area there are such community facilities located in the settlements throughout the study area.

13.7.10 Areas of community land identified within or immediately adjacent to provisional Order Limits for the Proposed Scheme are set out in Table 13.5 (see Figure 13.2).

Table 13.5: Community land and assets potentially affected by the Proposed Scheme

Community asset	Location	Description / baseline issues
Land south of Whitefield Golf Course	Within the provisional Order Limits on the western edge of the Proposed Scheme, north of M60.	This area of greenspace is part of Philips Park (the majority of which is located south of the M60 - see below). It comprises woodland, scrub and some amenity grass areas. A footbridge over the motorway connects to the rest of Philips Park to the south. Approximately 5ha of land south of Whitefield Golf Course is within the provisional Order Limits. It is an area used for outdoor recreation such as dog walking, walking and potentially mountain biking. None of the fairways or greens associated with Whitefield Golf Course are within the provisional Order Limits.
Prestwich Forest Park and Philips Park (public park)	Within the provisional Order Limits on the western edge of the Proposed Scheme.	Prestwich Forest Park encompasses Philips Park and comprises woodland, scrub and some amenity grass areas. An important area for outdoor recreation, including mountain biking. It has an estimated 654,045 visits per year (Day, B. H., and G. Smith (2018)). Approximately 0.8ha is within the provisional Order Limits (coinciding with Philips Park).
Greater Manchester Mental Health NHS Foundation Trust Prestwich Site	Grounds of the hospital are within 60m of the provisional Order Limits, south-west of M60 J17.	Greater Manchester Mental Health (GMMH) NHS Foundation Trust Prestwich Site provides specialist mental health facilities. It is accessed from Bury New Road.
Cloughside College	Within 58m of the provisional Order Limits, south-west of M60 J17.	A community special school (non-boarding) catering for children aged 11–19 with hearing impairment, speech, language and communication issues and social, emotional and mental health issues. It currently has 11 pupils (with capacity for 40) (Gov.uk, 2022). Although not immediately close to the provisional Order Limits, children at this school are potentially more sensitive to impacts from the Proposed Scheme (see Human Health assessment).
Our Lady of Grace Roman Catholic Primary School	School grounds are within 25m of the provisional Order Limits, south-east of M60 J17.	Primary school is somewhat shielded from the Proposed Scheme by housing along Highfield Road and Cross Avenue. Its main access is from Highfield Road with a further pedestrian access from Willow Road. The school has 348 pupils aged 3–11 years (with capacity for 445) (Gov.uk, 2022).
The Frigate public house	Beer garden abuts the provisional Order Limits on north side of M60 in Whitefield.	Public house may serve as a community social meeting point for local residents. Beer garden to rear of the public house abuts the provisional Order Limits.
Eden Gardens Allotment	Abuts provisional Order Limits on north side of M60 in Whitefield.	Accessed from Derwent Avenue, Whitefield. It has an estimated 1,620 visits per year (Day, B. H., and G. Smith (2018)).
Plot of land south of Marston Close	Provisional Order Limits bisect this plot of land on north side of M60 in Whitefield.	A path to the rear of properties on Marston Close bounds the north-west edge of this plot of land. The land is privately owned but aerial imagery indicates it may be used informally by local residents, possibly as a place of informal play for children, and by dogwalkers.
Prestwich Heys Football Club	Located south of the M60 (immediately adjacent to the Provisional Order Limits)	Accessed via Sandgate Road. The football club has an estimated 110,360 visits per year (Day, B. H., and G. Smith (2018)).

Community asset	Location	Description / baseline issues
Parrenthorn High School	School grounds abut the provisional Order Limits to the south-west of M60 J18.	Accessed via Heywood Road/Simister Lane which crosses the M66 via a bridge. The school has 897 pupils aged 11–16 years (and has capacity for 1050) (Gov.uk, 2022).
St Margaret's Church of England Primary School	School grounds within 10m of the provisional Order Limits to the south-west of M60 J18.	Accessed via Heywood Road/Simister Lane which crosses the M66 via a bridge. The school has 238 pupils aged 4–11 years (and has capacity for 247) (Gov.uk, 2022).
Unsworth Cricket and Tennis Club	Located between Pole Lane, Unsworth and the M66. The cricket grounds abut the provisional Order Limits.	Access from Pole Lane. Likely to be used by the community for venue hire as well as by members of the cricket and tennis club. No data on usage has been identified at this preliminary stage.
Unsworth Academy	Main school campus is immediately adjacent to M66 within 40m of provisional Order Limits (but with playing fields within the provisional Order Limits – see below).	Accessed via Parr Lane, Unsworth. The school has 910 pupils aged 11–16 years (and has capacity for 935) (Gov.uk, 2022).
Unsworth Academy school playing fields	Located east of M66 and south of Griffe Lane. Within the provisional Order Limits.	These playing fields are accessed from the school via an underpass under the M66. Part of the playing fields is within the provisional Order Limits, with the remainder of the playing field area surrounded by the provisional Order Limits.
Pike Fold Golf Club	Located east of the M66. Within the provisional Order Limits.	The western, southern and part of south-eastern edges of the golf course are within the provisional Order Limits. No data on usage has been identified at this preliminary stage.
Heaton Park	Abuts the south-east edge of the provisional Order Limit, to the south-west of the M60.	Public park covering over 240ha. It has an estimated 2,433,340 visits per year (Day, B. H., and G. Smith (2018)).

Development land and business

13.7.11 LA 112 defines development land as 'land identified in national or local plans, polices or strategies for development… and land subject to planning permission'. Business land is defined as 'land and buildings for the purpose of commercial/industrial enterprise'.

13.7.12 There are some employment allocations and applications within the study area. These are identified above in Table 13.4.

13.7.13 Given the urban nature of the study area there are several businesses present including various shops, services, leisure and hospitality venues. Table 13.6 provides a summary of those present within the land use and accessibility study area.

Table 13.6: Commercial and industrial properties within the land use and accessibility study area

Community	Commercial and industrial properties within the land use and accessibility study area
Simister	The Farmer's Arms public house is located on Simister Lane.
Unsworth	On Parr Lane there are convenience stores, shops, salons and fast food outlets. The Queen Anne Inn is located on Hollins Lane. Unsworth South Social Club is located on Derwent Avenue. To the very north of the main study area there is a plant and machinery hire business.

Community	Commercial and industrial properties within the land use and accessibility study area
Whitefield / Besses	There are several shops, fast food outlets, public houses and businesses located along the A56 'Bury New Road' and the A665 'Bury Old Road', as well as a veterinary hospital. There is an Aldi superstore located at the junction of the A56 and the A665. The Frigate Public House is located on Thatch Leach Lane and there are several convenience stores.
Prestwich / Kirkhams	There is a retail park located to the south of the M60 at J17 off the A56 'Bury New Road'. This has a Tesco superstore and a number of restaurants and a Premier Inn. There is a Shell garage just off of M60 J17. There are also some commercial buildings located on Tottington Lane. On the A665 'Bury Old Road' there is an Esso garage and a number of shops and fast food outlets.

Agricultural landholdings

13.7.14 LA 112 defines agricultural landholdings as 'land and associated infrastructure for the purpose of agricultural production, for example arable farming and dairy farming'.

13.7.15 Agricultural land use is located in the study area around M60 J18. Preliminary information about the land use of fields which coincide with the provisional Order Limits has been obtained from National Highways' land agents for the Proposed Scheme. Further information will be sought, where appropriate, to inform the Environmental Statement. Table 13.7 sets out the agricultural landholdings identified which appear to interface with the Proposed Scheme. These are indicated on Figure 13.3.

Table 13.7: Agricultural landholdings potentially affected by the Proposed Scheme

Agricultural landholding reference	Location and description
SW1 (Land title MAN157263, GM693423)	South-west of M60 J18. Five large fields north and south of Simister Lane. It is understood they are associated with Mellowdew Farm, Simister and therefore access to these fields is likely to be via the Simister Lane bridge over the M60. These are used for mixed farming (pasture and arable). Approximately 15.9ha, involving parts of three fields and two entire fields, is within the provisional Order Limits. It is judged this land is of high sensitivity for agricultural land use.
SW2 (Land title GM661930)	South-west of M60 J18. Field to rear of 10 Simister Lane. Small field abuts M60 highway boundary. Currently used for grazing horses. The land parcel is 1.04ha in total with 0.2ha of this located within the provisional Order Limits. It is assumed this land is not used for commercial agricultural production and therefore judged to be low sensitivity for agricultural land use.
NW1 (Land title LA99619)	North-west of M60 J18 (south-west of Cowlgate Farm). Land is assumed to be used for grazing horses (under short-term tenancies). Entire field (11.9ha) is within provisional Order Limits. This land is partially dependent on proximity to stables and therefore judged to be of medium sensitivity.
NW2 (land title GM58567)	Land owned by National Highways. It is understood to be used for grazing horses under no formal agreement. Entire field (3.2ha) is within provisional Order Limits. It is assumed this land is not used for commercial agricultural production and since there is no formal arrangement it is judged to be negligible sensitivity for agricultural land use.
NW3 (land titles GM319431 and GM22155)	Land at Cowlgate Farm, north-west of M60 J18. Cowlgate Farm and its associated field to the north (2.1ha) is outside of (but surrounded by) the provisional Order Limits, however its access route (Pole Lane and Mode Hill Lane) is within the provisional Order Limits. The land is used for grazing horses. It is assumed this land is occasionally used for commercial agricultural production, is partially dependent on spatial relationship to property and therefore judged to be medium sensitivity.

Agricultural landholding reference	Location and description
NE1 (Land title GM337146)	Land north-east of M60 J18, north of Egypt Lane. A small plot (1.6ha) of land currently not used and overgrown. The entire plot is within the provisional Order Limits. This land is allocated for mixed use (housing and employment) under the Places for Everyone plan (Heywood and Pilsworth) (see Table 13.4 above). This land is not used for commercial agricultural production and is judged to be negligible sensitivity for agricultural land use.
NE2 (Land title 706922)	Land north-east of M60 J18, north and south of Egypt Lane. Agricultural fields belonging to Unsworth Moss Farm, Simon Lane. The land is used for mixed agriculture (cattle grazing and arable). Some 16ha (three fields) are within the provisional Order Limits. This land was allocated for mixed use (housing and employment) under the Places for Everyone plan (Heywood and Pilsworth) (see Table 13.4 above). It is judged this land is of high sensitivity for agricultural land use.
NE3 (Land title MAN135862)	North-east of M60 J18. There are five fields at Egypt Farm to the north of M62 which appear to be used for pasture/grazing sheep. While these fields are outside of the provisional Order Limits, their access (Egypt Lane) is within the provisional Order Limits. This land was allocated for mixed use (housing and employment) under the Places for Everyone plan (Heywood and Pilsworth) (see Table 13.4 above). It is judged this land is of high sensitivity for agricultural land use.
NE4 (Land title GM782300)	North-east quadrant of M60 J18, to the east of Unsworth Academy school playing fields and west of Castle Brook. Field (5.2ha) is on the south side of Griffe Lane. Field is used for cattle grazing and pasture. Approximately 4.1ha of the field is within provisional Order Limits. This land was allocated for mixed use (housing and employment) under the Places for Everyone plan (Heywood and Pilsworth) (see Table 13.4 above). It is judged this land is of high sensitivity for agricultural land use.

Walkers, cyclists and horse riders

13.7.16 Walkers and cyclists can be considered as two types – those who walk or cycle as part of an active travel journey (e.g. as part of a regular commute or to access services); and those who are walking or cycling for recreational purposes. The first type will typically be more interested in an efficient, convenient route, while the second type would be more interested in the recreational amenity of the route. Equestrian activity is dominated by recreational horse-riding and therefore horse riders are assumed to be recreational unless there is clear evidence otherwise.

13.7.17 Pedestrians, cyclists and horse riders are prohibited from using the motorways themselves, including the M60, M62 and M66. These motorways act as a barrier for these groups in many locations.

13.7.18 There are 25 routes which intersect or are in very close proximity to the provisional Order Limits which are used by walkers, cyclist and in some instances, horse riders. These include 18 routes which are PRoWs, a permissive path, a local cycle track and pedestrian routes on the local highway network. These are described in Table 13.8 (Figure 13.2).

Table 13.8: Public rights of way and other routes in close proximity to the Proposed Scheme

PRoW / route	Location	Description / baseline issues
Footpaths 34 WHI, 34b WHI, 31 WHI, 32 WHI,	Within Whitefield Golf Course, north of the M60 and north of Philips Park, south of the M60.	PRoW network that connects to further routes north of the provisional Order Limits within Whitefield Golf Course and also footpath 33 WHI. Likely used by walkers and cyclists for recreation and access for users between Stand and Besses O' Th' Barn as well as Philips Park.

PRoW / route	Location	Description / baseline issues
Subway at J17	Subway that crosses underneath J17 island.	Subway that runs underneath the M60 (within the provisional Order Limits). Pedestrian access from Besses O' Th' Barn in the north to Prestwich to the south.
Philips Park Road cycle path	Cycle path north of the M60 and south of Whitefield Golf Course.	A Transport for Greater Manchester's (TfGM) Cycle Network route (within the provisional Order Limits) used by cyclists and walkers that joins two parts of Philips Park Road for access for users between Stand and Besses O' Th' Barn.
Footpath 33WHI	Footpath that crosses the M60 at the northern end of Prestwich Forest Park	Public footpath that crosses the M60 (within the provisional Order Limits) at the northern end of Prestwich Forest Park via a footbridge. This connects to routes to the north (including public footpaths 31WHI, 32WHI, 34aWHI and 34bWHI) as well as residential areas; and footpaths to south (including public footpaths 24PRE and 25PRE), which gives access to Prestwich Forest Park and Philips Park as well as to the nearby urban areas and Bury New Road. The footpaths surrounding the crossing are well used and are likely used mostly by recreational walkers.
Bury New Road	Crosses the Proposed Scheme at the J17	Bury New Road (A56) runs north to south across the Proposed Scheme between Besses o' th' Barn and Prestwich. The road and junction are largely a dual carriageway with pavement on either side. Bury New Road crosses the M60 via J17. This is likely used as a crossing point between communities north and south of the M60 for walkers and cyclists, but is not a convenient route for them. They either need to negotiate an indirect route via a subway system and Prestwich Footbridge, or in the case of cyclists, negotiate intimidating traffic conditions (slip-roads and multiple lanes of traffic) on the gyratory itself.
Bury Old Road	Crosses the Proposed Scheme to the north-east of J17	Bury Old Road (A665) runs north-west to south-east across the Proposed Scheme between Besses o' th' Barn and Prestwich. It crosses over the M60 and under the tram line, with pavements on both sides for pedestrians. It offers a more direct crossing point for walkers and cyclists than J17.
Sandgate Road / Footpath 18WHI	Crosses over the M60 on Sandgate Road, between Besses o' th' Barn and Kirkhams.	Public footpath that crosses over the M60 on Sandgate Road. Sandgate Road has pavements on either side of the road. Generally, this connects the residential areas either side of the M60 and is therefore an important community route. It may also be used as a school route for children living north of the M60 who go to Parrenthorn High school. There is also a number of recreational routes and footpaths that can be accessed via this crossing. North of the crossing, it connects to Footpath 12WHI which, if followed, leads to Unsworth as well as crossing the M66 at Hills Lane. This joins to Footpath 9WHI which runs in a south-easterly direction within the provisional Order Limits. These routes feed into longer recreational routes to the north, east and south of the Proposed Scheme. To the south of the Sandgate Road crossing, this connects to routes to Heaton Park and Heaton Park Reservoir.

PRoW / route	Location	Description / baseline issues
Permissive path connecting Heybrook Close to Parrenthorn Rd via Haweswater Underpass	Heybrook Close to Parrenthorn Rd	Permissive path that connects Derwent Avenue and Heybrook Close to Parrenthorn Road via an underpass under the M60. This is likely to be used by pedestrians to connect the communities in the north to the facilities in the south, including schools and leisure and sporting facilities. The route appears well used and offers a more direct route for schoolchildren than Sandgate Road, but can get very muddy, has no lighting provision and has evidence of attracting anti-social behaviour.
Footpath 29bPRE	North of the M60 and south-east of Simister	Footpath that connects to Simister Lane both at the north and southern extents of Simister, looping to the south of the village and adjacent to the M60. This route is likely used for informal recreation by dog walkers and appears likely to have been severed by construction of the M60 (although access south of the M60 is facilitated through connection to Nutt Lane/Old Hall Lane and via Old Hall Lane footbridge).
Footpaths 28aPRE and 29aPRE	South of the M60 and east of Prestwich	Footpaths that form a loop to the north of bridleway 27aPRe and do not provide any meaningful recreational or active travel use. These routes were likely once connected to footpath 29bPRE, with the connection severed by construction of the M60.
Simister Lane	Simister, south of the M60 J18	Simister Lane runs south-west to north-east across the M60, south of the M60 J18. This could be used by residents in Simister and Kirkhams to cross between communities, as well as to access recreational routes within the local area.
Footpath 46WHI	Crosses the M62 to the north-east of the Proposed Scheme	Footpath Public footpath starting at Simister Lane, that runs north to cross the M62 on an overbridge. This connects to a large number of routes to the north, east and south. Directly it connects to Footpath 50PRE and Footpath 9WHI. Likely to be used for recreational journeys.
Footpath 9WHI	North-east of the M60 J18	This PRoW runs along Egypt Lane before heading north parallel to the M66 and south of Pike Fold Golf Course to join Hills Lane, Unsworth. Likely to be used for recreational journeys.
Footpath 8WHI	Crosses the M66 at Unsworth Academy	Public footpath that crosses under the M66 at Unsworth Academy, which also allows access for school pupils to the school playing fields.
Castle Road / Restricted byway 85BUR	Crosses the M66 at Castle Road	Restricted byway that crosses over the M66 on Castle Road, which has pavements for some of its route. This connects directly to Footpaths 89BUR and 87BUR as well as bridleway 79BUR. Generally, this crossing connects residential areas in Unsworth to recreational routes to the north and east of the Proposed Scheme. A TfGM Cycle Network route also follows Castle Road which loops northwards to Aviation Road which could be followed by all types of cyclists.
Footpath 12WHI	North-west of Simister Island, along Mode Hill Lane.	Public footpath that follows one lane track down Mode Hill Lane. Connects to Unsworth Pole via Pole Lane Mode Hill Lane and Oak Lane to Oak Bank Estate. Footpath is metalled and used by the public and by farm traffic.
Footpath 89BUR	Immediately adjacent to scheme (east of M66)	Connects 85BUR to 6WHI. Path No.85 to county borough Boundary Path starts from path No.85 by the motorway and continues along Griffe Lane to cross Castle Brook near the county borough boundary approximately 319m to the west of Brick House.

PRoW / route	Location	Description / baseline issues
Restricted byway 84BUR	Immediately adjacent to scheme (west of M66)	79BUR to Hollins Lane. Path starts from 79BUR and runs southwards alongside the motorway. The path then turns south westwards along the eastern boundary of woodland to emerge on Hollins Lane between No.124 Hollins Lane and Unsworth North Methodist Church.
Footpath 50PRE	Crosses the M62	Unnamed road that crosses the M62. It provides access from Simister Lane to Lower Droughts Farm.
Restricted byway 101BUR	Crosses underneath the M66.	Access from Castlebrook High School and Unsworth Academy to playing fields (located on the east of the M66).

13.7.19 Within the study area there are numerous more PRoW which serve as access to greenspaces and recreational walking, as well as providing routes within some of the more built-up areas of the surrounding area.

13.7.20 National Cycle Network (NCN) Route 6 is outside of the study area of the Proposed Scheme. However, it is likely to be a destination for cyclists crossing the study area. The NCN passes through Prestwich Forest Park and passes over the M60 via a foot/cycle bridge to the west of the Proposed Scheme. There are further TfGM Cycle Network links on Bury New Road, between Thatch Beach Lane and Albert Road near Whitefield Community Primary School and Ribble Road near two further primary schools in Whitefield, as well as along Heywood Road, Prestwich linking St Margaret's C of E Primary School and Parrenthorn High School with Simister and Castle Road and Aviation Road in Unsworth (see Figure 13.2). There are also a variety of mountain bike trails within Prestwich Forest Park and along the River Irwell. These routes also provide access to open space to the north (Figure 13.2).

13.7.21 There are four stables within 2km of the Proposed Scheme:

- Castlebrook Stables (less than 100m from the Proposed Scheme on Castle Road)
- The Stables at Whittle Fold Farm
- Stables at Sandfield Farm
- Stables at Brookvale Farm.

13.7.22 There is therefore potential for horse riders to be using the lanes and bridleways in the study area.

Baseline conditions – human health

13.7.23 The health baseline considers indicators for wider determinants of health and certain health conditions in the area, before considering the specific resources and receptors within the study area.

Baseline health profiles of communities within the study area

13.7.24 Health data have been obtained from the OHID. Data have been obtained for the wards which coincide with the study area to provide an indication of local health issues. This is based on aggregated population level data. It should be noted that the health of individuals within the study area will vary considerably and cannot be inferred from these data. Although the Manchester ward boundary of Higher Blackley abuts the provisional Order Limits, there are no residential areas close to the Proposed Scheme as the land use is Heaton Park. The main settlements of Higher Blackley ward are over

1km away and therefore health data for this ward has been excluded from the baseline as it is considered not relevant.

13.7.25 Table 13.9 sets out data for each ward for certain health indicators which are relevant to transport. Cells in Table 13.9 which are shaded indicate health values which are significantly worse than the average for England. As can be seen from Table 13.9, some of the communities within Besses and St Mary's score significantly worse than England for indicators of chronic obstructive pulmonary disease (COPD) emergency admissions, long-term illness, deaths from coronary heart disease, life expectancy and income deprivation. These communities also score worse than average across a number of the other health indicators, including premature deaths. This indicates that these communities may, on average, be more sensitive to pollution and problems of traffic than other communities and have less capacity to adapt to change. There may also be a greater dependency on public transport, taxis, walking and cycling among people in income deprived communities to access services and employment.

Table 13.9: Health profile of local communities (ward level data)

Health indicator[1]	Wards in study area					England average
	Holyrood	Unsworth	Besses	Pilkington Park	St Mary's	
Percentage of total resident population age 0-15 years of age (2020)[2]	18.1	18.0	21.3	17.5	18.2	19.1
Percentage of total resident population who are 65 and over (2020)[3]	18.0	22.8	14.8	24.0	18.5	18.0
Emergency hospital admissions for COPD (2016/17 – 2020/21) (SAR)	64.3	86.1	**146.1**	45.8	86.0	100
Percentage of people who reported long-term illness or disability (2011)	17.6	**19.1**	**20.3**	18.0	**21.5**	17.6
Deaths from respiratory diseases, all ages, (2016-2020) (SMR)	111.2	81.1	**131.4**	97.8	101.9	100
Deaths from coronary heart disease, all ages, (2016-2020) (SMR)	118.0	104.9	**171.5**	88.4	**146.7**	100
Income deprivation (English Indices of Deprivation 2019) (%)	12.6	12.1	**20.2**	9.1	**15.0**	12.9
Life expectancy at birth (male) (2016-2020) (years)	79.6	80.2	**76.4**	81.7	**76.6**	79.5
Life expectancy at birth (female) (2016-2020) (years)	84.3	82.7	**81.3**	82.1	**81.7**	83.2

Health indicator[1]	Wards in study area					England average
	Holyrood	Unsworth	Besses	Pilkington Park	St Mary's	
General health: Percentage people reporting 'Very good health' (2011)	47.1	46.6	45.5	49.1	45.6	47.2
General health: Percentage people reporting 'good health' (2011)	34.4	32.9	33.4	32.3	32	34.2
General health: Percentage people reporting 'fair health' (2011)	13.1	14.2	14.5	13.5	15.8	13.1
General health: Percentage people reporting 'bad health' (2011)	4.3	4.9	5.0	4.0	5.2	4.2
General health: Percentage people reporting 'very bad health' (2011)	1.1	1.3	1.6	1.1	1.4	1.2

Legend: Better 95% | Similar | Worse 95%

Quintiles: Low | | | | High

[1] Health indicator values that are significantly worse (within the 95% upper or lower confidence interval as appropriate) than the national average are indicated in red. Those which are significantly better (within the 95% upper or lower confidence interval as appropriate) are indicated in green. Further detail regarding methodology used for individual health indicators can be found at the following weblink: https://fingertips.phe.org.uk/profile/guidance.

[2 & 3] Data collected in 2020 for this health indicator is limited as it does not cover the full year.

13.7.26 Certain health data are not available at ward level and yet are relevant in helping to inform a broad understanding of health which can be influenced by transport schemes. Table 13.10 sets out some district level health indicators. The data show that the rate of people killed or seriously injured is lower than the England average across both Bury and Manchester districts. The data also show that the percentage of physically active adults in both Bury and Manchester is slightly lower than average for England. Improvements to active travel infrastructure can provide opportunities to improve levels of physical activity as well as reduce risks of being killed or seriously injured on roads.

13.7.27 Active forms of travel, such as walking and cycling, are associated with a range of health benefits. These include improved mental health, reduced risk of premature death and prevention of chronic diseases such as coronary heart disease, stroke, type 2 diabetes, osteoporosis, depression, dementia and cancer (British Medical Association, 2012). Research also suggests that countries with highest levels of active travel generally have amongst the lowest obesity rates (Bassett et al., 2008).

Table 13.10: Physical activity and rates of killed and seriously injured (district level data)

Health indicator	Local authority area (districts)		England average
	Manchester	Bury	
Percentage adults physically active (%)	66.1	65.6	67.2
Rate killed or seriously injured on roads (2016-2018) (rate per 100,000)	32.1	21.8	42.6

Baseline scenario health determinants

Location and type of community, recreational and education facilities and severance/separation of communities from such facilities

13.7.28 The location and type of community, recreational and education facilities are described in the land use and accessibility assessment above under 'Community land and assets' and shown on Figure 13.2. These include sports and leisure facilities, retail facilities, schools and churches. The M60 motorway causes a barrier between communities north and south of it as there are relatively few places where the motorway can be crossed (namely the footbridge to Philips Park, Bury New Road and the subways at J17, Bury Old Road, Sandgate Road and Haweswater Underpass – see Table 13.5). Generally it is likely that residents south of the M60 would tend to use facilities in Whitfield and Kirkhams south of the M60, while residents to the north would use facilities located in Whitefield, Prestwich and Unsworth on the north side. However the Parrenthorn High School catchment area crosses the M60, meaning schoolchildren north of the M60 would have to use Sandgate Road (over 2km for children who live east of Derwent Avenue) or the permissive path via Haweswater Underpass to get to the school, which can be muddy and appears to attract antisocial behaviour. For children in Simister, the route to Parrenthorn High School is relatively direct via the Simister Lane road bridge.

13.7.29 Bury New Road (the A56) is a relatively broad transport corridor (approximately 20m wide) which includes a dual carriageway. It is likely the road width and limited number of pedestrian crossing points would contribute to physical separation east and west of the road, while the traffic flows and noise may increase perceived severance for residents.

Location of green/open space and severance/separation of communities from such facilities

13.7.30 The locations of areas green space likely to be used by the local communities which coincide with or abut the provisional Order Limits are described in the land use and accessibility assessment above under 'Community land and assets' in Table 13.5 and shown on Figure 13.2. Broadly speaking the larger areas of green space are in the west of the study area (Whitefield Golf Course, land south of Whitefield Golf Course, Prestwich Forest Park and Philips Park), in the east of the study area (agricultural fields and Pike Fold Golf Course) and in the south-east of the study area (Heaton Park). The M60 and M66 cause a degree of separation between residents one side of the motorways and green space to the other due to the relatively limited number of places where the motorways can be crossed. There are further areas of green space accessible to the communities within the study area such as Fusiliers Meadow between Thatch Leach Lane and Albert Road, north of the M60 and Boz Park in Unsworth, west of the M66.

13.7.31 Tree planting on the soft estate along the M60, M66 and M62 corridors provides a visual screen, while in addition to green space used by communities, most residential properties in the study area have private gardens which provide green space for individual households.

Location of healthcare facilities and severance/separation of communities from such facilities

13.7.32 There are several healthcare facilities within the study area (Figure 13.2) which include dentists, GP surgeries, and care homes. These services are provided north and south of the M60 so it is unlikely that there is significant separation from communities and these facilities as it is expected they would choose the facilities most convenient to them.

Outline spatial characteristics of the transport network and usage in the area

13.7.33 Baseline information on routes used by walkers and cyclists is presented in the land use and accessibility under 'Walkers, cyclists and horse riders' with key routes described in Table 13.8.

13.7.34 There are several bus services that are run within the study area. These bus routes serve shorter routes in the local community but also for longer journeys out of the study area towards Bury to the north and Manchester city centre to the south. Two routes which use the M60 J18 are the X41 service connecting Manchester city centre with Accrington, and the X43 service which connects Manchester city centre with Burnley. A number of the services run along Bury New Road and Bury Old Road. There are no bus/coach stations within the study area.

13.7.35 The Manchester Metrolink tram network bisects the study area and Proposed Scheme north to south at the point where Bury Old Road also crosses the Proposed Scheme. Within the study area there are four tram stops on this line, Heaton Park, Prestwich, Besses o' th' Barn and Whitefield. Services running northbound go to Bury, and southbound to Manchester Piccadilly or to Altrincham. This service could provide links for shorter journeys within the local area or longer journeys using links at Bury and Manchester.

Air quality management areas (AQMA) and ambient air quality

13.7.36 Chapter 6 of this PEIR describes the baseline air quality conditions. As can be seen from Figure 6.2 the Greater Manchester AQMA follows the motorway corridors, Bury New Road and Bury Old Road, within the study area. The AQMA was declared for exceedances of the nitrogen dioxide (NO_2) local air quality objective (AQO). Residents most likely to be exposed to these exceedances are those whose homes abut the highway corridors. Further information on ambient air quality and the identification of human health receptors is presented in section 6.7 of Chapter 6, Air Quality.

Areas sensitive to noise

13.7.37 Chapter 12 of this PEIR describes the baseline noise environment. The six Noise Important Areas (NIAs) within 600m of the Proposed Scheme are indicated on Figure 12.1 while noise sensitive receptors are indicated on Figure 12.2.

Sources and pathways of potential pollution

13.7.38 The main pollution sources and pathways in the study area of relevance to human health are traffic emissions (air pollution and noise) from traffic using the highway

network as outlined above. Chapter 10, Geology and Soils, identifies potential sources of land contamination such as current and former industrial uses, a fuel station, areas of made ground can coal tar associated with the original carriageway construction, pre-dating the mid-1980s. Light pollution is also present and is outlined below in relation to landscape amenity.

Landscape amenity

13.7.39 Chapter 8, Landscape and Visual, describes the baseline landscape and visual baseline. Transport corridors are dominant within the area while the density of urban areas also has a substantial influence on views. The night-time landscape is heavily influenced by lighting from of the existing M60 J18 and mainline M60, M62 and M66 lighting. Heaton Park is a high value landscape, along with the Bury Special Landscape Area. Away from Heaton Park, the landscape character areas in the study area are valued as medium sensitivity, while the townscapes are valued low (see Chapter 8, Landscape and Visual for further detail).

Safety information associated with the existing affected road network

13.7.40 A preliminary review of collision data indicates seven fatal collisions on the highway network within the study area for the five-year period 2017-2021 inclusive. Four fatal collisions were on the motorway network, while three were on the surrounding roads (one on Bury New Road north of J17 (Besses ward), one on Bury Old Road south of M60 mainline and one on St Margaret's Road near Heaton Park Reservoir (Holyrood ward). Further analysis of the baseline collision data will be reported in the Environmental Statement.

Future baseline

13.7.41 The future baseline will likely be characterised by continued population growth within and around the study area as more of the residential development allocations get built out. As indicated by allocations in the Places for Everyone Joint Local Plan there is clear intent for housing growth in the area, which would likely impact on existing agricultural land use in the future.

13.7.42 The COVID-19 pandemic that has affected the UK since 2020 may continue to influence future trends. For example, there has been an increase in people working from home and hybrid working (ONS, 2022). Some people switched from the use of public transport to walking, cycling or using their own cars due to concern about communicable diseases. There may be continued increase in cycling levels, which have been increasing in England since 1993 (Cycling UK, 2019). In addition, people may have an increased preference for outdoor recreation where social distancing is easier than in indoor leisure and recreation venues. The level to which these types of behaviour change continue will depend on the trajectory of the pandemic and individual responses to their experience of 2020/2021 (e.g. heightened anxiety or concern) which is at this time uncertain.

Value / sensitivity of receptors

13.7.43 All land use and accessibility receptors within the baseline have been assigned a value based on criteria in DMRB LA 112 and using professional judgement in interpreting those criteria. Table 13.11 summarises the value of key land use and accessibility receptors identified within or adjacent to the provisional Order Limits. These are the receptors considered to have most potential to be affected by the proposals. It is not

considered proportionate to report on all land use and accessibility receptors within the study area as they are not likely to be significantly affected.

13.7.44 In terms of human health receptors, the wards of Besses and St Mary's are considered to have high sensitivity as they score significantly worse than England across several health indicators with known links to transport. All other wards within the study area are deemed to have medium sensitivity.

13.7.45 Further work to identify vulnerable groups within the study area will be undertaken to inform the ongoing health assessment to be reported within the Environmental Statement. For example there are likely to be vulnerable groups who regularly attend Cloughside College and the Prestwich Hospital complex as mental health services are provided in that location.

Table 13.11: Value/sensitivity of receptors

Receptor	Sensitivity/value	Reason
Residential		
Simister, Kirkhams (Manchester), Heaton Park (Manchester), Whitefield, Unsworth, Prestwich	Very high	This is a major residential area which exceeds the 5ha/150 houses threshold in LA 112.
Housing allocations within Bury and Manchester	Very high	Extensive housing allocations exceeding the 150 house threshold in LA 112.
Community land and assets		
Land south of Whitefield Golf Course	High	Likely used by people in local neighbourhood for informal outdoor recreation on a frequent basis
Philips Park/Prestwich Forest Park (public park)	Very high	Extensive public recreational asset judged to attract daily use by high number of visitors for a variety of recreational pursuits
Greater Manchester Mental Health NHS Foundation Trust Prestwich Site	Very high	Specialist health services offered where there are unlikely to be many alternatives in district
Cloughside College	Very high	Specialist educational services provided where there are unlikely to be many alternatives in district
Our Lady of Grace Roman Catholic Primary School	Very high	School serving majority of primary school children in catchment
Whitefield Golf Course	Low	Golf club serving members, likely to serve a sizeable minority of residents in study area. Other golf courses are in the area.
The Frigate public house	Low	Several other public houses in area can offer social meeting points. Likely to serve a sizeable minority of residents in study area
Eden Gardens Allotment	Medium	Some other allotments available in the local area but waiting lists for allotment has been closed indicating high demand.
Plot of land south of Marston Close	Negligible	Land is privately owned and other areas of similar quality greenspace are available in the neighbourhood.

Receptor	Sensitivity/value	Reason
Prestwich Heys Football Club	High	Likely to serve a sizeable portion of the local football community on a frequent (weekly) basis. Limited alternative facilities nearby.
Parrenthorn High School	Very high	School serving majority of secondary school children in catchment
St Margaret's Church of England Primary School	Very high	School serving majority of primary school children in catchment
Unsworth Cricket and Tennis Club	High	Likely to serve a sizeable portion of the local cricket and tennis community on a frequent (weekly) basis. Limited alternative facilities nearby.
Unsworth Academy	Very high	School serving majority of secondary school children in catchment
Unsworth Academy school playing fields	Very high	School serving majority of secondary school children in catchment
Pike Fold Golf Club	Low	Golf club serving members, likely to serve a sizeable minority of residents in study area. Other golf courses are in the area.
Heaton Park	Very high	Extensive public recreational asset judged to attract daily use by high number of visitors for a variety of recreational pursuits
Development land and business		
Various businesses as identified in Table 13.6	Medium	The businesses identified in the study area offer employment sites of <1ha (excluding car parks for the supermarket sites) and therefore are judged to be medium value.
Agricultural landholdings		
SW1	High	In regular agricultural production
SW2	Low	It is assumed this land is not used for regular commercial agricultural production.
NW1	Low	It is assumed this land is not used for regular commercial agricultural production.
NW2	Negligible	No formal agricultural tenancy agreement and not used for commercial agricultural production.
NW3	Medium	It is assumed this land is used for occasional commercial agricultural production.
NE1	Negligible	Land overgrown and unused for agriculture.
NE2	High	In regular agricultural production.
NE3	High	In regular agricultural production.
NE4	High	In regular agricultural production.

Receptor	Sensitivity/value	Reason
WCH routes		
Permissive path linking Heybrook Road to Parrenthorn Road via Haweswater Underpass	High	Although this route is likely to be used regularly by schoolchildren it is in poor condition and many schoolchildren are likely to avoid this route due to concerns over antisocial behaviour and mud. It is therefore valued as 'high' rather than 'very high'.
Bury New Road (M60 J17)	Very high	Main urban route likely to be used by high numbers of pedestrians and cyclists daily.
Footpath 8WHI / Restricted byway 101BUR	Very high	Provides direct access for schoolchildren between school and playing field.
Footpath 33 WHI, Simister Lane, Sandgate Road / Footpath 18WHI	High	Routes likely to be in regular use for commuting or recreation by a sizeable minority of the local community
Beech Avenue, Oak Avenue and Ross Avenue, Whitefield	Medium	Routes likely used by residents on these streets to get to/from properties in neighbourhood in first/last part of an overall journey on foot or by bicycle. Since there are pavements on each side of these streets and alternative streets around the neighbourhood and to Bury New Road (i.e. via Chestnut Avenue or Sycamore Place) these have been valued as 'medium' sensitivity as in each case they serve a small number of local residents rather than offer routes for wider community access.
Bridleway 27aPRE, Footpath 46 WHI/ Footpath 50PRE, Footpath 9WHI, Footpath 29bPRE, Footpath 6WHI, Aviation Road / Bridleway 79 BUR, Castle Road / Restricted Byway 85 BUR, Restricted byway 84BUR, Restricted byway 89 BUR, Footpath 12WHI, Footpath 32WHI / Footpath 31WHI / Footpath 34WHI and Footpath 34bWHI	Medium	Public rights of way likely to be frequently used for recreation and local journeys by walkers, cyclists and in some cases, horse riders.
Footpaths 28aPRE and 29aPRE.	Low	These routes appear to have fallen into disuse as they no longer offer a meaningful rote and people tend to use bridleway 27aPRE.
Human health receptors		
General population in Holyrood ward	Medium	Population generally scores average across key health indicators.
General population in Unsworth ward	Medium	Population generally scores average across key health indicators.
General population in Besses ward	High	Population scores worse than average on a number of health indicators and reports higher than average bad or very bad health.
General population in Pilkington Park ward	Medium	Population generally scores average across key health indicators.

Receptor	Sensitivity/value	Reason
General population in St Mary's ward	High	Population scores worse than average on a number of health indicators and reports higher than average bad or very bad health.

13.8 Potential impacts

Construction

Land use and accessibility

Private property and housing

13.8.1 There is potential for some temporary and permanent land take to facilitate construction. Properties most at risk are those which abut or coincide with the provisional Order Limits.

13.8.2 There would also be potential impacts on boundaries and disruption to access for residential properties located in close proximity to the Proposed Scheme and its proposed haul routes, such as Ross Avenue, Oak Avenue and Balmoral Avenue. There would also be a likely loss of amenity during construction from factors such as dust, noise and visual intrusion (see potential health impacts).

Development land and business

13.8.3 Temporary and permanent loss of land from land allocated for employment purposes or for which planning permissions supporting employment purposes have been sought or obtained would occur. No impact on existing business land is anticipated (impacts on golf courses are considered under 'Community land and assets').

Community land and assets

13.8.4 Temporary and permanent loss of areas of community land would potentially occur, including from a golf course, facilities used by Prestwich Football Club, land south of Whitefield Golf Course, Philips Park/Prestwich Forest Park and Unsworth Academy. In addition, construction of the Proposed Scheme could cause temporary or permanent disruption of access to community facilities. There would also be a likely loss of amenity during construction from factors such as dust, noise and visual intrusion (see potential health impacts).

Agricultural landholdings

13.8.5 There would be permanent and temporary loss of agricultural land from the construction footprint of the Proposed Scheme. There is also potential for disruption to access for some farms. Details of potentially affected landholdings are being gathered and will be presented where appropriate in the Environmental Statement.

Walkers, cyclists and horse riders

13.8.6 Construction of the Proposed Scheme would require the diversion and temporary closures of PRoW throughout the study area, with associated impacts on local outdoor recreation and access. There would also be a likely loss of amenity during construction from factors such as dust, noise and visual intrusion (see potential health impacts).

Human health

Access to the natural environment and outdoor recreation

13.8.7 Access to the natural environment and outdoor recreation could potentially be reduced by the following impacts:

- Diversions and temporary closures of PRoW causing physical loss of access
- Land-take from community assets such as parks, golf courses and playing fields
- Loss of other greenspace including vegetation clearance and land take from agricultural land (with consequent loss of visual access to greenspace)

13.8.8 Since there is a growing body of evidence suggesting positive associations between exposure to greenspace and positive mental and physical health outcomes, the loss of access to greenspace is a plausible pathway to adverse mental and physical health outcomes.

Accessibility for walking and cycling

13.8.9 During construction there is potential to physically prevent accessibility for walking and cycling through temporary closures of PRoW and other routes. There is also potential to discourage walking and cycling through impacts on the amenity of routes from noise, dust and general disruption such as diversion routes and impacts on road surface condition. The presence of construction vehicles may also dissuade some people from walking and cycling, for example parents may be reluctant to let their children walk to school due to safety concerns if streets are used as haul routes, such as along Oak Avenue. This has potential to reduce the amount of physical activity undertaken with consequent associations with weight gain, loss of cardiovascular fitness and loss of wellbeing. There are other potential impacts such as loss of social interaction within neighbourhoods, with further potential associations with reduced social capital and mental wellbeing.

Connections to employment, services, facilities and leisure

13.8.10 Traffic management and disruption to walking and cycling routes could delay access to services for some people, although it is not anticipated that access to any key community facilities (such as doctor's surgeries and shops selling essential goods) or leisure facilities would be prevented due to the relatively limited footprint of the provisional Order Limits.

Community severance

13.8.11 Changes in traffic patterns within the local area due to highway closures or as a result of construction vehicles accessing site have potential to cause or worsen existing community severance on a temporary basis. This could lead to potential negative impacts on mental health associated with reduced community cohesion, and on physical and health if the change in traffic patterns is sufficient to discourage the use of routes used by walkers and cyclists for the reasons described in paragraph 13.8.9.

Employment opportunities including training opportunities

13.8.12 There is potential for the contractor engaged in the construction of the Proposed Scheme to offer employment and training opportunities, which may be taken up by local residents. This may help to reduce health inequalities by tackling unemployment in the local area.

Quality of urban and natural environments (including biophysical determinants such as air pollution and noise)

13.8.13 Construction noise and dust and views of construction works could adversely affect the quality of the natural environment for people who live, work or undertake recreational activities in close proximity to the provisional Order Limits, with potential for negative impacts on both physical and mental health. There is potential for sleep disturbance due to noise and task lighting from night-time working and also due to noise from diverted traffic during night-time closures of the motorway.

Operation

Land use and accessibility

Private property and housing

13.8.14 No additional impacts over and above those described in paragraph 13.8.1 are anticipated.

Development land and business

13.8.15 No additional impacts over and above those described in paragraph 13.8.2 are anticipated.

Community land and assets

13.8.16 There could be changes in the access or amenity of community assets where permanent PRoW diversions are required or where PRoW would be closed. For example, attenuation ponds (Pond 6) are proposed on land south of Whitefield Golf Course which would reduce the amount of greenspace accessible to the public.

Agricultural landholdings

13.8.17 No additional impacts over and above those described in paragraph 13.8.4 are anticipated.

Walkers, cyclists and horse riders

13.8.18 There would be beneficial impacts on access for walkers, cyclists and horse riders where the Proposed Scheme addresses poor accessibility and inadequate cycleway and footway provision.

13.8.19 PRoW temporarily severed by the Proposed Scheme would be reinstated and so no new operational severance would occur. However, diversions and closures of existing PRoW with new routes being provided to access existing or proposed new crossing points would be required. There would also be permanent closure of some PRoW at land south of Whitefield Golf Course where attenuation ponds (Pond 6) are proposed.

Human health

Access to the natural environment and outdoor recreation

13.8.20 The new junction arrangement at M60 J18 would involve permanent loss of some greenspace, however this is not in an area where many people would be exposed to the loss. Although attenuation ponds are proposed at land south of Whitefield Golf Course, this would not present a loss of natural environment, rather a change from greenspace to ‘blue’ space. Much of the land to be permanently acquired is to be used

for landscaping purposes and so would not present a loss of greenspace. PRoW diversions may change the access arrangements to the natural environment but it is not anticipated there would be any notable permanent loss.

Accessibility for walking and cycling

13.8.21 Access for walking and cycling would be reinstated following construction so no negative impact is anticipated. Since the Proposed Scheme is a motorway project, it would not directly affect walking and cycling in operation.

Connections to employment, services, facilities and leisure

13.8.22 The Proposed Scheme would improve safety and reliability of journeys via the motorway network within the study area, which would be positive for connections to employment, services, facilities and leisure undertaken by these routes (which includes some bus services).

Community severance

13.8.23 There is potential to affect community severance should the Proposed Scheme result in changes to traffic speed and patterns on the surrounding road network. However, this is a low likelihood since the main works are to the motorway network.

Quality of urban and natural environments (including biophysical determinants such as air pollution and noise)

13.8.24 There is potential to impact on this determinant of health if air quality and noise modelling (see Chapter 6: Air Quality and Chapter 12: Noise and Vibration) indicate that increases in noise and pollution levels would occur as a result of changing traffic patterns in the local area.

13.8.25 There is also potential for landscaping proposals as set out in the Preliminary Environmental Design (Figure 2.2) to improve the quality of environment in the medium to long term, once planting becomes established.

13.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

13.9.1 The design of the Proposed Scheme, including construction activities, seeks to limit land-take from current and proposed residential and employment land uses, community land and assets and agricultural landholdings as far as practicable.

13.9.2 The type and quality of new surfacing, crossing and access points for PRoW and other routes used by walkers, cyclists and horse riders would be suitable for the intended use and context (i.e. whether rural or urban, or whether there is likely cyclist, wheelchair or horse rider use). Key design considerations include DMRB GG 142 Walking, Cycling and Horse-Riding Assessment and Review (WCHAR) standard (Highways England, 2019), LTN 1/20 Cycle Infrastructure Design (Department for Transport, 2020), the Equality Act 2010, and relevant county council and district and borough council plans and strategies.

13.9.3 Further changes may be made to the scheme design and provisional Order Limits to:

- Refine the provisional Order Limits and design to avoid some marginal encroachment on private land, for example along Kenilworth Avenue and close to Simister Lane

- Realign PRoW within the footprint of the permanent works, including:
  - Any affected PRoW within Whitefield Golf Course, with routing designed to retain attractiveness and journey length
  - Footpaths 28aPRE and 29aPRE, with routing designed to retain attractiveness and journey length
  - Footpath 9WHI to the north of the new highway boundary, ensuring connectivity to Hill's Lane is maintained and route attractiveness retained or improved
- Provide replacement land of equivalent or better provision in terms of quantity and quality in a suitable location in the event that any existing open space, sports and recreational buildings and land is lost, unless that land is surplus to requirements. This will be identified if applicable in the Environmental Statement.

13.9.4 Embedded landscape design mitigation measures are set out in Section 8.9 of Chapter 8: Landscape and Visual.

13.9.5 Embedded mitigation as identified in Chapter 12: Noise and Vibration includes low noise surfacing and reinstallation existing noise barriers.

Essential mitigation

13.9.6 Essential mitigation relevant to this aspect is listed below, and will be included in the 1st Iteration of the Environmental Management Plan (EMP) which will accompany the Environmental Statement for the Proposed Scheme:

- Clear, regular and sensitive communication between the developer's land agents and affected parties shall be maintained to reduce uncertainty and anxiety among the residential, business and agricultural communities
- Clear communication over construction activities and phasing to allow individuals to make necessary plans and better cope with any potential disruption and create opportunities for individual residents and for other sensitive receptors such as schools to discuss their specific needs
- Where temporary occupation of access routes to agricultural landholdings is required, access for the landowners and tenants would be maintained throughout construction
- The construction activities would be planned to limit requirements for temporary PRoW, footway and cycleway closures or diversions, and banksmen used to facilitate safe access in preference to closing routes where practicable. Temporary diversion routes would be well-signed and would be suitable for all potential users of the existing provision (for example, where closure of a bridleway is required, the diversion route provided would be suitable for WCH)
- Clear signage for temporary and permanent diversions of PRoW and other routes used by walkers and cyclists
- Access and egress for construction plant and vehicles at the point of access from Sandgate Road would be managed by banksmen
- All land acquired on a temporary basis would be fully reinstated
- Use of Best Practicable Means to minimise noise and vibration emission during construction in accordance with British Standard 5228-1:2009+A1:2014 and British

Standard 5228-2:2009+A1:2014 (see Section 12.9 of Chapter 12: Noise and Vibration)

- Best practice measures to control fugitive dust emissions (as described in Section 6.9 of Chapter 6: Air Quality)
- Liaison with Greater Manchester Combined Authority (GMCA) and/or developers as appropriate to minimise impact on site development process for GMSF allocations GM1.1 and 1.3 (if taken forward)
- Liaison with landowners/operators of Whitefield Golf Course and Pike Fold Golf Course to minimise impacts associated with land take during construction
- Permissive path connecting Derwent Avenue to Parrenthorn Road via Haweswater Underpass would remain open for pedestrians and cyclists at all times, with particular consideration for busy periods around school opening and closing times
- Stockpiling of stripped material to provide noise screening for nearby receptors (as described in Section 12.9 of Chapter 12: Noise and Vibration)
- Installation of temporary controlled crossing points for walkers and cyclists on Oak Avenue and Ross Avenue
- Cessation of HGV access along Oak Avenue and Ross Avenue at key times such as school opening and closing and peak commuting, to be determined through consultation with local residents

Enhancement

13.9.7 Opportunities to improve existing facilities used by WCH are currently being explored and have not yet been confirmed. They could potentially include improvements to the TfGM cycleways which run between Philips Park Road East and Philips Park Road West, and via the permissive route which runs through Haweswater Underpass, in line with the TfGM's 'Beelines' initiative. Such improvements would improve their amenity and accessibility of these routes for cyclists, people with mobility impairments and wheelchair users in particular.

13.9.8 A further opportunity being explored is amenity improvements to the underpass used by Unsworth Academy to access their playing fields. If taken forward, these measures would improve the quality of local walking and cycling routes, leaving a beneficial legacy for the scheme.

13.9.9 There is also potential for sympathetic landscaping proposals to enhance the recreational value of land at Philips Park north of the M60, for example to create a circular route around the attenuation ponds. This is subject to design and consultation.

13.10 Assessment of likely significant effects

Construction

Land use and accessibility

Private property and housing

13.10.1 The value of the private property and housing resource in the study area is 'very high'. The impacts identified in Table 13.12 would affect a very small proportion of the overall housing stock in the study area. Furthermore, no residential land use would be compromised to the extent that it cannot function as housing. It is judged that there is

potential for a discernible change but that the impacts would not compromise overall residential viability of residential land use.

Table 13.12: Construction impacts on private property and housing

Asset	Description of impacts	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect
Existing housing (value: very high)	• Philips Park Road East, Oak Avenue and Ross Avenue, Whitefield, Pilkington ward - No direct impacts on residential properties. These streets could potentially be used as a haul route during construction. It is currently uncertain regarding the number of vehicles and duration of activities that may require this route to be used. It is assumed there may be disruption to access for >50 residential properties during the construction phase. This would not compromise the use of the land for residential purposes. • Kensington Street, Whitefield, Besses ward. Temporary land take from a parking area for five cars to the west of Prestwich Court and parts of rear edge of garden area from behind Prestwich Court to allow construction access. This would not compromise the use of the land for residential purposes. • Balmoral Avenue, Whitefield, Besses ward. Part of Balmoral Avenue would be within provisional Order Limits. Likely occasional, intermittent disruption to access for 16 residential properties during the construction phase. This would not compromise the use of the land for residential purposes. • Kenilworth Avenue and Warwick Close, Whitefield, Holyrood ward. No direct impacts on residential properties. Kenilworth Avenue and Warwick Close would be within provisional Order Limits. Likely occasional, intermittent disruption to access for approximately 40 residential properties during the construction phase. This would not compromise the use of the land for residential purposes. • Warwick Avenue and Barnard Avenue, Whitefield, Holyrood ward. Temporary land take from driveway from one property and potential temporary land take from edge of rear gardens	• Liaison with affected residents regarding phasing and timing of construction works. • Access to properties maintained throughout construction where practicable	Negligible adverse – there would be discernible changes to features of some properties but only on a temporary and reversible basis and residential function would be retained	Slight adverse

Asset	Description of impacts	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect
	from up to three further properties. This would not compromise the use of the land for residential purposes. • Corday Lane, Prestwich, Holyrood ward. No direct impacts on residential properties. Corday Lane would be within provisional Order Limits. Likely occasional, intermittent disruption to access for residential property during construction. This would not compromise the use of the land for residential purposes. • Egypt Farm, Egypt Lane, Unsworth ward. No direct impacts on residential property. Egypt Lane would be within provisional Order Limits. Likely occasional, intermittent disruption to access for residential property during construction. This would not compromise the use of the land for residential purposes.			
Land allocated for housing	• Heywood / Pilsworth Northern Gateway (JPA1.1). Acquisition of a very small (less than 2%) proportion of the site, mostly required on a permanent basis. • Simister and Bowlee (Northern Gateway) (JPA1.2). Permanent acquisition of a very small proportion of the site (approximately 1%) adjacent to the M60. This is not likely to compromise use of the site for development.	• None identified	Negligible adverse	Slight adverse

Development land and business

13.10.2 No impacts on business land use have been identified in the preliminary assessment, with the exception of the sports facilities addressed under 'Community land and assets'.

13.10.3 The emerging Places for Everyone: Policy JP Allocation 1.1 Heywood / Pilsworth (Northern Gateway) is a mixed-use allocation and includes an employment allocation also relevant to the 'Development land and business' assessment (see Table 13.4). The draft masterplan details that the land in the southern most corner, adjacent to M60 J18, is likely to come forward in the final phase (Phase 5) of the Northern Gateway and beyond the current plan period (2021-2037). The draft master-planning work also identifies this area as potential future employment development (post-plan period).

13.10.4 Although the allocation has the capacity to deliver a total of around 1,200,000sqm of new employment floorspace (in addition to the 135,000sqm that has an extant planning permission at South Heywood), it is anticipated that around 700,000sqm of this will be delivered within the plan period.

13.10.5 Given the scale of the development, it is anticipated that the remaining 365,000sqm of the total employment floorspace will be delivered beyond the plan period. This will be in the southern-most part of the allocation, adjacent to the M62. However, land in this area has been safeguarded for highway improvements so the Proposed Scheme is unlikely to affect the output of this emerging allocation. The assessment of impacts is Negligible adverse magnitude and **Slight adverse** significance.

Community land and assets

13.10.6 The majority of community land and assets identified adjacent to the Proposed Scheme would not be directly impacted. None of the impacts on community land and assets identified in Table 13.13 are expected to compromise the long-term viability of recreational or community use of the assets. The most affected community land is land south of Whitefield Golf Course and Unsworth Academy playing fields (Figure 13.4), although effects on the playing fields are expected to be limited in duration with full restoration of access and use post-construction.

Table 13.13: Construction impacts on community land and assets

Asset	Sensitivity	Description of impact	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect
Philips Park/Prestwich Forest Park, Prestwich	Very high	Small amount of land take (approximately 0.7 ha, <0.5% of Prestwich Forest Park) to facilitate construction activities and maintenance access. Approximately 0.35ha of this would be permanent land-take with the remainder having a permanent right of access. Since this is close to the M60 mainline it is unlikely to be a noticeable impact to most users of the community land and is not likely to notably affect the recreational function of the space.	• None identified at this stage.	Negligible adverse	Slight adverse
Land south of Whitefield Golf Club	High	Small-medium degree of temporary land take (maximum circa 5ha or just under 11% of total area of facility) required to facilitate construction of drainage proposals. Small degree of permanent land take (extents currently unknown) to accommodate potential detention pond and access track. It is likely that the land take would avoid impacts on the fairways and greens of the golf course, and so the function of golf course is expected to remain. Temporary disruption in access via PRoW as described in Table 13.15.	• Footpath diversions suitable for use by all relevant user types, and well signed. • Full reinstatement of land occupied on a temporary basis.	Minor adverse	Moderate adverse
Prestwich Heys FC grounds	High	Temporary access included off Sandgate Road through the Football Club's grounds to access the mainline M60 works area. No physical works are proposed here; it is included as a temporary access only.	• Access to football club to be maintained throughout construction where practicable • Where practicable, cease construction activities and ensure unimpeded access during times of peak use, informed through liaison with Prestwich Heys FC and Bury Council.	Negligible adverse	Slight adverse

Asset	Sensitivity	Description of impact	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect
St Margaret's Church of England Primary School	Very high	No physical impact is anticipated on the school grounds. However, construction activities would be close to the playing field so there is potential for noise, dust and other activities to disrupt sports use.	• Works to be carried out outside of school hours and hours of use of the sports pitches wherever practicable	Negligible adverse	Slight adverse
Unsworth Academy playing fields	Very high	Approximately 2ha strip between sports pitches would be within provisional Order Limits to facilitate some drainage activities. There is potential to disrupt sports use of the pitches, depending on the timing of the works and health and safety constraints.	• Works to be carried out outside of school hours and hours of use of the sports pitches wherever practicable • Works to be fenced off to ensure safety of schoolchildren and other users of the facilities	Minor adverse	Moderate adverse
Pike Fold Golf Club, Bury	Low	Land take (circa 1.4ha or 2.5% of the total area of the facility). Land take restricted to boundaries of golf course and is not likely to affect functional use of facility.	• Access to golf course to be maintained throughout construction where practicable	Negligible adverse	Slight adverse

Agricultural landholdings

13.10.7 Table 13.14 sets out construction impacts on four agricultural landholdings. The two agricultural landholdings most affected by land take (SW1 and NE2) are arable holdings. For SW1, the degree of land take required as a proportion of the total area farmed is very substantial, but the Proposed Scheme does not compromise access to plots or areas of plots where no land take is required or to infrastructure considered critical to the function of the land. For NE2, consideration also needs to be taken that the future baseline for land use in the area is uncertain due to the Places for Everyone land allocation (JPA1.1) which suggests a degree of land use change from agriculture to new urban development is expected.

Table 13.14: Construction impacts on agricultural landholdings

Agricultural landholding	Baseline summary	Sensitivity	Description of impact	Essential mitigation identified	Magnitude of impact on individual asset/s (with essential mitigation)	Significance of effect
SW1	22.7ha Mixed use (pasture and arable)	High	Approximately 14ha within provisional Order Limits, some of which to be used as a site compound and an area of soil storage. Permanent land take would be used to accommodate attenuation pond and ecological mitigation as set out in the Preliminary Environmental Design (Figure 2.2). Remaining area of farmland likely to be accessible and available for agricultural use during construction period.	• Restoration of approximately 2ha land.	Moderate adverse	Moderate adverse
SW2	1.04ha Grazing horses	Low	Strip of land, approximately 0.2ha, permanently acquired to provide access to land parcels to the south. It is uncertain how access to land will be maintained therefore assessed as worst case (loss of access).	• To be confirmed (it is likely a right of access could be negotiated but this is not confirmed)	Major adverse	Moderate adverse
NW1	11.9ha Grazing horses	Medium	Majority of land (11.6ha) within provisional Order Limits to be used for construction of embankments for the Northern Loop, soil storage and construction compound.	• Restoration of approximately 6.4ha land.	Moderate adverse	Moderate adverse
NW2	3.2ha Informal grazing of horses	Negligible	Entire field to be used for construction of embankments for the Northern Loop and soil storage as well as for an attenuation pond and ecological mitigation.	• None	Major adverse	Slight adverse
NW3	2.1ha Grazing horses	Medium	Strip of land, approximately 0.2ha, permanently acquired from east side of fields (adjacent to existing M66 boundary). Pole Lane also within provisional Order Limits, meaning there is potential for intermittent disruption for farm vehicles using lane due to presence of construction vehicles.	• Measures to reduce traffic impacts set out in construction traffic management plan	Minor adverse	Slight adverse

Agricultural landholding	Baseline summary	Sensitivity	Description of impact	Essential mitigation identified	Magnitude of impact on individual asset/s (with essential mitigation)	Significance of effect
NE1	1.6ha Unused/ overgrown	Negligible	Permanent acquisition of entire plot (1.6ha) for construction of Northern Loop and motorway widening.	• None	Major adverse	Slight adverse
NE2	>30ha Mixed use (cattle grazing and arable)	High	Approximately 16ha within provisional Order Limits to be used for construction of Northern Loop, soil storage and ecological mitigation proposals.	• Restoration of approximately 5ha (eastern portion of two fields accessible from Egypt Lane).	Moderate adverse	Moderate adverse
NE3	10.6ha Pasture/grazing sheep	High	No direct impact on land anticipated. Egypt Lane also within provisional Order Limits, meaning there is potential for intermittent disruption for farm vehicles using lane due to presence of construction vehicles.	• Measures to reduce traffic impacts set out in construction traffic management plan	Negligible adverse	Slight adverse
NE4	5.2ha Pasture/cattle grazing	High	Approximately 4.6ha to be acquired. It is uncertain how this land will be used in the Proposed Scheme although part of it would be used for an attenuation pond, therefore assumed as lost from agriculture as a worst case.	• None	Moderate adverse	Moderate adverse

Walkers, cyclists and horse riders

13.10.8 Table 13.15 sets out the likely effects on walkers, cyclists and horse riders.

13.10.9 Other minor roads which fall outside the provisional Order Limits, and PRoW routed along these roads, may also be affected by plant access during the enabling works phase. At present there is insufficient information on likely routing to assess these impacts but given the short duration of the enabling works phase (three to four months) and low numbers of vehicles requiring access, it is not anticipated that effects would be significant.

Table 13.15: Construction impacts on walkers, cyclists and horse riders

Receptor (sensitivity)	Distance from provisional Order Limits	Sensitivity	Nature of impact	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect
Network of PRoW within Whitefield Golf Course (footpath 34WHI, 34bWHI, 31WHI, 32WHI)	Crosses/within provisional Order Limits	Medium	Temporary disruption to access during construction, and closure of parts of 32WHI and 31WHI where they would fall within footprint of drainage proposals.	• Construction activities planned to limit requirements for footpath diversions • Footpath diversions suitable for use by all relevant user types, and well signed	Moderate adverse	Moderate adverse
Footpath 33WHI and Philips Park Road	Crosses/within provisional Order Limits	High	Potential closure to access during construction whilst haul route within Philips Park/Prestwich Forest Park is in place. The amount of construction vehicle traffic and duration of use is currently uncertain. Closure for a period during construction is assumed as a worst case which would require a substantial diversion (>500m) (though it may be possible the route is kept open).	• Use of banksmen to facilitate safe access for walkers • Footpath and cycleway diversions suitable for use by all relevant user types, and well signed	Major adverse (note: this is a worst case assessment as it is hoped arrangements can be made to keep the route open throughout construction)	Large adverse

Receptor (sensitivity)	Distance from provisional Order Limits	Sensitivity	Nature of impact	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect
Beech Avenue, Oak Avenue and Ross Avenue, Whitefield	Crosses/within provisional Order Limits	Medium	These streets would potentially be used as an alternative exit for HGVs in the event an egress onto the mainline (M60) or Philips Park Road cannot be established. As a worst case assumption approximately 3,000 HGV movements (one-way) may need to use this route over a 3 – 6 month period. It may not be a continuous use of the route during this period. This impact may inconvenience walkers and cyclists for a short part of their overall journey.	• Installation of temporary controlled crossing points for walkers and cyclists • Cessation of HGV access at key times such as school opening and closing and peak commuting, to be determined through consultation with local residents	Minor averse	Slight adverse
Bury New Road	Crosses/within provisional Order Limits	Very high	Temporary disruption of footways and highway surface to accommodate drainage works may be required. These would be temporary and likely short term (less than a few weeks in duration).	• Construction activities planned to limit requirements for diversions • Diversions suitable for use by all relevant user types, and well signed	Negligible adverse	Slight adverse

Receptor (sensitivity)	Distance from provisional Order Limits	Sensitivity	Nature of impact	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect
Permissive path connecting Heybrook Close to Parrenthorn Road via Haweswater Underpass	Crosses/within provisional Order Limits	High	Works are proposed to widen the Proposed Scheme at Haweswater Aqueduct. Short-term disruption to access, likely including periods of closure, whilst highway widening works to M60 are completed. Alternative access via Sandgate Road is some 1.7 km longer which adds considerable distance for some schoolchildren north of the M60 who are in the catchment for Parrenthorn High School.	• Seek to ensure route remains open for pedestrians, with particular consideration for busy periods around school opening and closing times, as far as practicable.	Major adverse	Large adverse
Footpaths 28aPRE or 29aPRE	Crosses/within provisional Order Limits	Low	Closure during construction due to permanent acquisition of land and soil storage area.	• Proposals currently uncertain (assumes permanent closure as worst case)	Major adverse	Slight adverse
Bridleway 27aPRE and local cycle route which follows Bridle Road between M60 J19 and Heywood Road	<10m from provisional Order Limits	Medium	Bridleway follows boundary of the provisional Order Limits where there are proposals for soil storage areas and ecological mitigation proposals. Potential for loss of amenity for the affected stretch however access is assumed to be retained.	• Works to be fenced off to protect users of the PRoW	Negligible adverse	Slight adverse

Receptor (sensitivity)	Distance from provisional Order Limits	Sensitivity	Nature of impact	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect
Footpath 29bPRE	<10m from provisional Order Limits	Medium	Footpath follows boundary of provisional Order Limits where some earthworks and widening to the M60 southbound carriageway would be required. Potential for loss of amenity for the affected stretch however access is assumed to be retained.	• Works to be fenced off to protect users of the PRoW	Negligible adverse	Slight adverse
Footpaths 50PRE, 9WHI and 46WHI, which follow Egypt Lane.	Crosses/within provisional Order Limits	Medium	Egypt Lane would be used for construction plant access during the enabling works phase, and therefore there may be occasional disruption in access or reduction in amenity of these routes during the construction period. It is assumed access would be retained.	• Use of banksmen to facilitate safe access for walkers, cyclists and horse riders	Minor adverse	Slight adverse
Footpath 9WHI	Crosses/within provisional Order Limits	Medium	The section of this route which falls within the provisional Order Limits west of Egypt Lane would be closed during construction resulting in a loss of connectivity for recreational routes between Egypt Lane and Hills Lane.	• None identified	Major adverse	Moderate adverse
Footpath 12WHI (Pole Lane and Mode Hill Lane)	Crosses/within provisional Order Limits	Medium	Pole Lane would be used for construction plant access during the enabling works phase, and therefore there may be occasional disruption in access or reduction in amenity of these routes during the construction period. It is assumed access would be retained.	• Use of banksmen to facilitate safe access for walkers	Minor adverse	Slight adverse

Receptor (sensitivity)	Distance from provisional Order Limits	Sensitivity	Nature of impact	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect
Footpath 8WHI	Crosses/within provisional Order Limits	Very high	Potential occasional disruption in access during construction for safety reasons should work be undertaken overhead of underpass and potential requirement for a diversion where drainage work may be required.	• Ensure access through underpass is maintained during school hours for access to playing fields • Diversion route to be provided around drainage proposals • Use of banksmen to facilitate safe access for walkers	Minor adverse	Moderate adverse
Footpath 89BUR (Griffe Lane)	Crosses/within provisional Order Limits	Medium	Griffe Lane would be used for construction plant access during the enabling works phase, and therefore there may be occasional disruption in access or reduction in amenity of these routes during the construction period. It is assumed access would be retained.	• Use of banksmen to facilitate safe access for walkers	Minor adverse	Slight adverse
Castle Road / Restricted byway 85BUR	Crosses/within provisional Order Limits	High	Potential for occasional, intermittent disruption to access during construction for safety reasons should work be undertaken overhead of underpass or where construction vehicles are present at the junction with Griffe Lane. It is assumed access for the public would generally be maintained.	• Use of banksmen to facilitate safe access for walkers, cyclists and horse riders	Negligible adverse	Slight adverse

Receptor (sensitivity)	Distance from provisional Order Limits	Sensitivity	Nature of impact	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect
Footpath 84BUR	<10m from provisional Order Limits	Medium	Footpath follows boundary of provisional Order Limits at the M66 northbound carriageway. Potential for loss of amenity for the affected stretch however access is assumed to be retained.	• Works to be fenced off to protect users of the PRoW	Negligible adverse	Slight adverse

Human health

13.10.10 Key effects on human health during construction are illustrated on Figure 13.4.

Access to the natural environment and outdoor recreation

13.10.11 With essential mitigation in place, the temporary, medium-term disruption in access for Prestwich Heys FC grounds would not impede use of the pitches on this site. It is also anticipated that the access to and function of playing fields at Unsworth Academy would be maintained. While there may be a loss of amenity at Whitefield Golf Course and Pike Fold Golf Club, both facilities are expected to remain functional and accessible during construction. Therefore, no significant effects on these formal outdoor recreational facilities are expected.

13.10.12 Footpath 9WHI would be closed during construction and Footpath 8WHI may be temporarily closed, reducing the choice and convenience of routes which provide recreational access from Unsworth to areas of countryside to the east of the M66. Other PRoW near Unsworth affected by construction works either offer little recreational value due to existing severance or would remain open during construction with localised diversions or access managed by banksmen. HGV traffic movements along Ross Avenue and Philips Park Road, Whitefield would potentially disrupt access to Philips Park and greenspace south of Whitefield Golf Course. There would be closure of PRoWs in this area due to a requirement to construct attenuation ponds. This would affect some residents in Whitefield, although access to Philips Park, Prestwich to the south of the M60 via Philips Park Road and Footpath WHI33 via the overbridge is expected to be generally maintained.

13.10.13 There is relatively limited greenspace within walking distance of residents in the study area so any reduction in access is potentially important at community level. While access is expected to be maintained, it is uncertain what effect construction activities, including noise, dust and traffic, would have on people in terms of whether they could be dissuaded from accessing the greenspace. In particular, vulnerable groups such as children and elderly may be less likely to use the areas (or in the case of children, discouraged to do so by their parents due to safety concerns).

13.10.14 Given the temporary, medium term nature of disruption during construction, the health impacts are more likely to be temporary, negative wellbeing impacts (i.e. frustration at inconvenience or loss of amenity), rather than any long term change in serious health outcomes. This is expected to affect a low proportion of the population in the study area. On this basis the health impact is assessed as **negative (not significant)** in the absence of the essential mitigation identified in Table 13.12 and Table 13.14, and **negative (not significant)** with essential mitigation in place.

Accessibility for walking and cycling

13.10.15 There would be a substantial number of HGV movements (worst case assumption up to 30,000 HGV movements over a period of up to six months) along Oak Avenue, Ross Avenue and Beech Avenue within the residential estate located west of Bury New Road and south of Higher Lane in Whitefield. However, away from these streets in the neighbourhood accessibility would remain unchanged. Philips Park Road would also be used by construction vehicles which may require a substantial diversion route if access to the public cannot be maintained on safety grounds. Construction vehicles would also use Bridle Road, Prestwich (along which 27aPRE and a local cycle route are routed), Griffe Lane (along which footpath 89BUR is routed) and Egypt Lane and the farm

access road which connects Egypt Lane to Simister Lane, Simister (along which footpaths 46WHI and 50 PRE are routed) to access working areas for a period of three to four months whilst the initial enabling works are completed only. Whilst these additional three routes utilised during the enabling works phase are all used by walkers, and in some cases cyclists, the daily number of vehicle movements required during the enabling works would be low and the duration over which access could potentially be disrupted is short. Essential mitigation identified to mitigate potential impacts on accessibility for walkers and cyclists includes the use of temporary controlled crossing points on Oak Road and Ross Avenue in Whitefield and the use of banksmen for access and egress along footpaths 33 WCHI, 27aPRE, 46WHI, 50PRE and 8WCHI.

13.10.16 While it is plausible that some people may be dissuaded from walking or cycling these routes, they are very localised impacts and so only a very low proportion of the community is likely to be affected. Furthermore these impacts would be confined to the construction stage and therefore it is unlikely to result in a change in the baseline health status of the population in the study area. On this basis the health effect is assessed as **negative (not significant)** both with and without essential mitigation.

Community severance

13.10.17 Following completion of the initial enabling works, construction traffic and worker vehicles would predominantly access the construction working areas directly from the M60, M66 and M62. The additional traffic flows on these motorways generated by construction traffic and worker vehicles would be negligible in comparison to baseline flows. The number of vehicle movements required through Simister and Prestwich during the enabling phase is anticipated to be too low to noticeably affect actual or perceived levels of severance.

13.10.18 There could be a substantial number of HGV movements (worst case assumption up to 30,000 HGV movements over a period of up to six months) along Oak Avenue and Ross Avenue, Whitefield for a period of up to six months during construction, however with essential mitigation in place (temporary controlled crossing points) no physical severance would occur. Nevertheless, the impact may result in reduced social interaction among residents and reduced independent mobility for children within the affected housing estate (if parents have road safety concerns due to increased HGV traffic).

13.10.19 Traffic diversions may be required when night-time and weekend highway closures are implemented during the main construction works. Diversion routes are not yet confirmed but given their temporary nature (likely to be days to a few weeks in duration maximum), the resulting changes in traffic patterns and flows would not have a likely significant effect on community severance.

13.10.20 Health outcomes may include reduced social interaction within the affected neighbourhood if people are dissuaded from spending time outside due to the temporary increases in traffic. However, these impacts are not likely to affect a change in health status in the community, as the impacts would be restricted to the construction stage and only impact on a low proportion of population in the study area. Therefore the effect on community severance is assessed as **negative (not significant)** both with and without essential mitigation in place**.**

Connections to employment, services, facilities and leisure

13.10.21 No physical obstruction of access to employment, services, facilities and leisure is anticipated during construction outside of the changes in access to outdoor recreation

reported above. There is potential for traffic management to impact on the reliability of bus journey times, however this impact is anticipated to be intermittent and short-term.

13.10.22 The impact on connections to employment, services, facilities and leisure is therefore expected to be **negligible (not significant)** both without and with essential mitigation.

Quality of urban and natural environments (including air pollution and noise)

13.10.23 Construction compounds would be located immediately north-west and south-west of M60 J18 and a small compound would be located west of Ross Avenue, which is close to the residential neighbourhood. Section 12.8 of Chapter 12: Noise and Vibration describes where noise from construction works is likely to be heard and sets out the expected duration of exposure. A limited number of sensitive receptors, including residents of Cowlgate Farm on Pole Lane, residents of Rothay Close, Marston Close, Westlands and Corday Lane and St Margaret's Church of England Primary School, Parrenthorn High School and some residents on Ross Avenue, are expected to experience some notable noise disturbance during construction. No particularly noisy works (such as earthworks) are currently planned to take place during night closures when sleep disturbance would most likely be incurred, although it is acknowledged that for some shift workers some occasional sleep disturbance could still take place. There would however be concurrent night working in several parts of the Proposed Scheme particularly along the M60 Mainline J17-18 and M60 J18 eastbound off-slip (see Chapter 2: The Scheme) which means there is potential for sleep disturbance from construction noise and task lighting.

13.10.24 There would also be some night-time closures of the motorway requiring traffic to be diverted. Diverted traffic may increase night-time noise levels in some neighbourhoods outside of the existing study area, however at this time the proposed diversion routes have not been confirmed. Therefore, this potential impact will be assessed further in the Environmental Statement.

13.10.25 A construction dust assessment has been undertaken which identifies potential measures to control the risk of nuisance emissions (see Chapter 6: Air Quality). A quantitative assessment of noise and air quality impacts associated with construction vehicle movements will also be undertaken, although construction traffic numbers are anticipated to be too low for any impact on human health associated with oxides of nitrogen (NO_x) and particulate matter (PM_{10}) emissions (see Section 6.8 of Chapter 6: Air Quality for further detail).

13.10.26 No likely pathways from other environmental impacts such as potential water pollution or ground contamination to the local community are expected from the Proposed Scheme.

13.10.27 In conclusion, based on currently available information, noise, lighting and dust emissions may cause temporary annoyance and disturbance for people in a relatively low number of residential properties in the study area and two schools located in close proximity to works areas. Temporary annoyance and occasional sleep disturbance are transient effects and unlikely to have an impact on quality of life beyond the short-term. It is assessed that the effect on population health from these impacts will be **negative (not significant)**.

Operation

Land use and accessibility

Private property and housing

13.10.28 No operational impacts on private properties and housing have been identified. Effects relating to permanent land acquisition are assessed as a construction related impact and detailed in Table 13.12.

Development land and business

13.10.29 No operational impacts on development land and business have been identified.

Community land and assets

13.10.30 Proposals at land south of Whitefield Golf Course have the potential to improve the amenity of the area by creating a circular path around attenuation ponds. See Table 13.16 for the assessment of impacts.

Table 13.16: Operation impacts on community land and assets

Receptor	Nature of impact	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect (with essential mitigation)
Land south of Whitefield Golf Course	The proposed attenuation ponds would become a permanent feature in this area of greenspace. However, some of the PRoW would be permanently closed potentially reducing accessible greenspace.	• Proposals under development to provide a new, circular path around the ponds to restore recreational amenity.	Minor beneficial	Slight beneficial
Prestwich Forest Park and Philips Park (public park)	Site of proposed culvert works would be replanted, restoring the visual amenity of the area of greenspace impacted on by construction.	• Appropriate landscaping and restoration	No change	Neutral

Agricultural landholdings

13.10.31 No operational impacts on agricultural landholdings are anticipated. Effects relating to permanent land acquisition are assessed as a construction related impact and detailed in Table 13.14 as the land would be lost from agriculture during the construction stage. It should be noted that some of the permanent land take proposed would accommodate ecological mitigation and drainage proposals.

Walkers, cyclists and horse riders

13.10.32 Permanent realignment of footpaths within Whitefield Golf Course and north-east of M60 J18 would be required as set out in Table 13.15, however these routes are used by recreational users who are likely less sensitive to changes in journey length. Furthermore, realignment would also present opportunities for slight improvements to the amenity of footpath 9WHI. The significance of effect on the network of PRoW within Whitefield Golf Course, footpaths 28aPRE and 29aPRE and on footpath 9WHI is assessed as **neutral** (see Table 13.17).

Table 13.17: Operation impacts on walkers, cyclists and horse riders

Receptor	Nature of impact	Essential mitigation identified	Magnitude of impact (with essential mitigation)	Significance of effect (with essential mitigation)
Network of PRoW within Whitefield Golf Course (footpath 32WHI)	A likely permanent realignment of the public footpath where it falls within the footprint of the permanent works for the Proposed Scheme	Diversion routes would be well signed.	No change (the existing network would be reconfigured in the design to be a circular route. Since these are footpaths used recreationally, no noticeable change in distance or journey times is anticipated for walkers)	Neutral
Footpaths 28aPRE and 29aPRE	Approximately 150m of footpath 28aPRE and approximately 50m of footpath 29aPRE would be stopped up. A proposed new footpath alignment would connect the remaining footpath sections south of the electricity pylon.	Diversion routes would be well signed	Minor beneficial. The proposed new alignment would be approximately 115m shorter.	Neutral
Footpath 9WHI	Approximately 300m of this footpath would be stopped up to allow construction of the Northern Loop. A proposed new footpath would be realigned around the edge of the highway to maintain connectivity.	Diversion routes would be well signed	Negligible beneficial (no discernible change in distance is anticipated for walkers between Egypt Lane and Hills Lane).	Neutral
Footpath 8WHI	Marginal realignment of the public footpath may be required depending upon final location and design of the attenuation pond to the east of Unsworth Academy playing fields.	Diversion routes would be well signed	No change (it is anticipated that the proposed attenuation pond would be sited to avoid the public right of way)	Neutral

Human health

13.10.33 Key impacts on human health during operation are illustrated on Figure 13.4.

Access to the natural environment and outdoor recreation

13.10.34 The realignment of PRoW within Whitefield Golf Course and of footpaths 28aPRE, 29aPRE and 9WCH would have negligible impact on opportunities for access to the natural environment, with a **neutral** effect on health assessed during operation in the absence of essential mitigation and with essential mitigation as described in Table 13.16 in place.

Accessibility for walking and cycling

13.10.35 Replacement routes would be provided for the existing Public Rights of Way affected by the scheme, including any Public Footpaths where they are affected by new drainage ponds, wetlands or swales. The Proposed Scheme proposals relate to the motorway itself and therefore do not accommodate improvements to facilities for walkers and cyclists so no impact on post-construction accessibility for walking and cycling is anticipated. Therefore no impact population health outcomes associated with regular exercise is predicted. Therefore, the effect is assessed as **neutral**.

Community severance

13.10.36 The only section of highway within the study area which is used by walkers and cyclists and has direct connectivity onto the M60 or M66 within the provisional Order Limits is Bury New Road at M60 J17. Walking and cycling crossing facilities through the Whitefield Interchange (M60 J17) are grade separated, albeit indirect and inconvenient. In terms of community severance, the M60 and M66 already forms a significant barrier, both physical and perceived, between the communities of Whitefield and Prestwich, and the Proposed Scheme would not notably alter the baseline in this respect. For these reasons, the effect on community severance is assessed as **neutral**.

Connections to employment, services, facilities and leisure

13.10.37 No changes to the availability or accessibility of routes used by pedestrians and cyclists providing access to employment, services, facilities and leisure is anticipated as a result of the Proposed Scheme. A proportion of the community would benefit from reduced congestion on the M60, M62 and M66 as a result of the Proposed Scheme, which would also be beneficial to some bus services that use the motorway network. No significant change in health status for the community is anticipated, although some individuals may have positive wellbeing outcomes due to more reliable journeys. The effect is assessed as negligible **positive (not significant).**

Quality of urban and natural environments (including air pollution and noise)

13.10.38 Chapter 6: Air Quality reports the air quality assessment based on 519 modelled ‘worst case’ receptors. In this context ‘worst case’ means the receptors where the greatest level of change in air quality is expected (either improvement or worsening). Exceedances of the annual mean NO_2 air quality objective (AQO) is modelled at 15 receptors all located immediately north of M60 J17, many of which are in Besses Ward which is considered to have high sensitivity to air pollution based on the health indicators. However, as reported in Chapter 6, the level of change in NO_2

concentrations for these receptors would be imperceptible. As such it is unlikely to result in a noticeable change in population health outcomes for this community.

13.10.39 Overall, 336 of the 519 human health receptors are modelled to experience an increase in annual mean NO_2 concentrations. The largest increases are expected at modelled receptor locations representative of the housing allocation JPA1.1 (Heywood/Pilsworth allocation north-east of J18), due to the influence of the Northern Loop. However, all these would all be below the annual mean NO_2 AQO. There is no safe level of air pollution and therefore any increase is considered negative to health. However, it should be noted that the epidemiological evidence is based on relatively small risk levels and therefore it is not considered likely that significant impacts on population health would occur unless there is an exceedance of the AQOs and where there is a substantial change in concentrations of pollutants compared to the baseline. The increases from the Proposed Scheme are considered unlikely to result in a noticeable change in population health outcomes.

13.10.40 The Proposed Scheme is also modelled to result in a reduction in NO_2 concentrations at 171 human health receptors, seven of which are modelled to experience a reduction of more than o.4µg/m^3 and to exceed the NO_2 AQO in either the do-minimum or do-something scenarios. This would be positive but given the relatively small proportion of receptors affected it is unlikely that there would be widespread exposure in the local community to this improvement in air quality, and therefore it is considered unlikely to result in a noticeable change in population health outcomes for this community.

13.10.41 Annual mean PM_{10} concentrations were modelled to be well within the relevant AQO and all of the receptors modelled would experience either an 'imperceptible' or 'small' change in concentration as a result of the Proposed Scheme. Therefore, there are no predicted exceedances of either the PM_{10} or $PM_{2.5}$ AQOs.

13.10.42 In conclusion, the assessment of health effects due to air quality associated with the Proposed Scheme is considered to be a combination of **positive (not significant)** and **negative (not significant)**.

13.10.43 The noise assessment reports that most of the road traffic noise changes for dwellings and other sensitive receptors would be of a negligible magnitude and below 1.0 dB, which is not considered to be significant.

13.10.44 There are 300 dwellings and two other sensitive receptors where the predicted change in road traffic noise is of a Minor magnitude of between 1-2.9 dB. As most of these are located in areas where existing road traffic noise levels are above the Significant Observed Adverse Effect Level (SOAEL), this is a potentially significant effect and essential mitigation for road traffic noise will therefore be considered within the Environmental Statement. There are three dwellings where a Moderate magnitude road traffic noise increase exceeding 3dB is predicted and where road traffic noise levels are above SOAEL, and all three are located at the western end of Balmoral Avenue, within approximately 25m of the eastbound M60 (see Chapter 12: Noise and Vibration for further detail).

13.10.45 In terms of population health, there is a large population in the baseline exposed to relatively high levels of noise from the M60, M66 and M62 as indicated by the presence of Noise Important Areas (NIA) (see Chapter 12: Noise and Vibration for more details). Key health issues associated with noise are 'annoyance' (defined as '*a feeling of displeasure, nuisance, disturbance or irritation caused by a specific sound'* (WHO, 2018)), sleep disturbance and ischaemic heart disease (IHD) (WHO, 2018). It should be noted that relative risk from long term exposure to high levels of noise (40 – 80 dB L_{den})

is very low compared to other risk factors and not likely to be a significant factor at the scale of population within the study area that could be exposed to changes in the noise environment from the Proposed Scheme. The more likely health impacts would be annoyance and sleep disturbance. On the basis that only three dwellings are modelled to experience a perceptible change in noise, the population health effect is assessed as **negative (not significant)**.

13.10.46 Further potential impacts from changes to the quality of the urban and natural environment will be assessed in the Environmental Statement when detailed information about the Proposed Scheme design and landscaping proposals are available. This will include consideration of the potential interaction of impacts on different health determinants on physical health and mental wellbeing.

14. Road drainage and the water environment

14.1 Topic introduction

14.1.1 This chapter presents the results of a preliminary assessment of likely significant effects of the construction and operation of the Proposed Scheme on road drainage and the water environment (RDWE). This follows the methodology set out in the Design Manual for Roads and Bridges (DMRB) LA 113 Road Drainage and the Water Environment, Revision 1 (Highways England, 2020a; hereafter referred to as DMRB LA 113). The spatial scope varies according to the water environment receptor and potential extent of impacts; full details on the study area are presented in Section 14.6.

14.1.2 In accordance with DMRB LA 113, three principal types of impact are considered in this assessment which include:

- Impacts on surface water quality (including routine runoff and spillage)[12] and hydromorphology
- Impacts on groundwater quality, groundwater levels and flows and Groundwater Dependent Terrestrial Ecosystems (GWDTE)[13]
- Flood risk and surface water drainage

14.1.3 This chapter is supported by the following figures:

- Figure 14.1: Surface Water Receptors in the study area
- Figure 14.2: Proposed Outfall Locations
- Figure 14.3: Aquifer Designations
- Figure 14.4: Groundwater Receptors in the study area
- Figure 14.5: Groundwater Dependent Terrestrial Ecosystem (GWDTE) locations and Initial Groundwater Dependency Classification
- Figure 14.6: Flood Zones
- Figure 14.7: Areas at Risk from Surface Water Extents
- Figure 14.8: Areas Susceptible to Groundwater Flooding
- Figure 14.9: Areas at Risk of Flooding from Reservoirs

14.1.4 This chapter is supported by the following appendices:

- Appendix 14.1: Water Framework Directive (WFD) Regulations Assessment
- Appendix 14.2: Preliminary Water Quality Assessment Report (PWQAR)
- Appendix 14.3: GWDTE Assessment

[12] Potential effects to surface water habitats and species have been considered in Chapter 9 of this PEIR.

[13] An assessment of impacts to other potential groundwater receptors, such as groundwater abstractions, springs, sinks, sources, etc. identified from datasets and information that was received post submission of the Environmental Scoping Report (Highways England, 2021a) has also been included in the PEIR.

- Appendix 14.4: Preliminary Flood Risk Assessment (FRA) (hereafter referred to as the Preliminary FRA)

14.1.5 Appendix 14.1 provides a stage 2 assessment associated with the Proposed Scheme's compliance with the Water Environment (Water Framework Directive) Regulations (England and Wales) 2017 (hereafter referred to as WFD Regulations). A stage 3 (detailed) WFD Regulations assessment will be undertaken for the Environmental Statement.

14.1.6 A PWQAR has been prepared for the Proposed Scheme to document the assessment process that has been undertaken. The assessment related to water quality for routine runoff and spillage risk during operation within this chapter draws upon the assessment and conclusions in the PWQAR. The Highways England Water Risk Assessment Tool (HEWRAT) has been used to assess the water quality impacts from the Proposed Scheme. The PWQAR will be updated for the Environmental Statement.

14.1.7 The initial assessment related to GWDTE is provided in Appendix 14.3: GWDTE Assessment. This report is an update to the initial GWDTE assessment provided within the Environmental Scoping Report (Highways England, 2021a). The updated assessment draws upon additional groundwater baseline information, such as the 1:10,000 scale geological mapping and a detailed review of springs, seepages, etc. This has enabled the development of individual Conceptual Site Models (CSMs) for each potential GWDTE within the initial 250m screening buffer at this PEIR stage.

14.1.8 A Preliminary FRA has been prepared for the Proposed Scheme in accordance with the requirements of the National Policy Statement for National Networks (NPS NN) (Department for Transport, 2014). The assessment related to flood risk within this chapter draws upon the studies and conclusions made within the Preliminary FRA. The Preliminary FRA will be updated for the Environmental Statement to a Flood Risk Assessment (FRA) for planning.

14.2 Stakeholder engagement

14.2.1 Table 14.1 summarises the key requirements from the Planning Inspectorate's Scoping Opinion (Planning Inspectorate, 2021) as relevant to the scope of the RDWE assessment, and identifies any matters scoped out of the assessment as agreed with the Planning Inspectorate and other stakeholders. This table also explains any changes to the assessment methodology as a result of this engagement.

14.2.2 A number of the Scoping Opinion responses included matters that are indirectly relevant to the RDWE aspect (e.g. biodiversity, geology and soils etc). These comments have not been included in Table 14.1 as they are not directly related to the aspect scope and methodology and are being assessed by other environmental aspects.

Table 14.1: Key stakeholder feedback for RDWE aspect

Stakeholder	Comment	Response
Planning Inspectorate	ID 4.9.1 Tidal flood risk is proposed to be scoped out as none of the watercourses in the study area are tidal rivers and the Irwell Catchment Flood Management Plan does not identify tidal flooding as a source of flood risk in the catchment. Based on this, the Inspectorate is content to scope this matter out.	Noted and agreed.
Planning Inspectorate	ID 4.9.2 The Inspectorate agrees that reservoir flood risk can be scoped out, on the basis that the risk of failure is considered to be very low (due to their monitoring and inspection regime) and taking into account the prevailing baseline and future baseline environment in and around the Proposed Development.	Noted and agreed. The Preliminary FRA assessed baseline flood risk from reservoirs to be very low.
Planning Inspectorate	ID 4.9.3 As no canals are identified in the study area, the Inspectorate is content to scope out impacts from canal flooding.	Noted and agreed.
Planning Inspectorate	ID 4.9.4 The Inspectorate does not agree to scope out impacts to ponds based on the current information, as there remains potential for the Proposed Development to impact high value receptors. The Environmental Statement should provide an explanation where it diverges from DMRB LA 113 standard (for e.g., in relation to the presence of 'protected species' as criteria for surface water receptors of high importance), and specify which ponds are proposed to be scoped out and why.	Noted. As outlined at scoping, the environmental assessment will reconfirm the importance of ponds during the assessment process. Ponds considered likely to be affected by the Proposed Scheme were identified at scoping and will be individually identified and assessed within the RDWE chapter at Environmental Statement stage. DMRB LA113 Table 3.69 will be used to assess the attributes and indicators of quality to determine impacts to ponds.
Planning Inspectorate	ID 4.9.5 The inspectorate cannot agree to scope out impacts relating to changes in recharge rates associated with construction areas. Evidence should be provided in the Environmental Statement, including results of any site investigation. This should ascertain whether sand bands within superficial drift soils have the potential to provide a source of water, the value of such a resource and the extent to which there may or may not be impact pathways from the Proposed Development as the design evolves.	Noted. Ground investigation (GI) data will be reviewed to identify the more permeable sand and gravel horizons, their value as a groundwater resource, and the potential impacts associated with changing recharge rates. This will be reviewed in conjunction with the evolving design for the Proposed Scheme and will be reported in the Environmental Statement.

Stakeholder	Comment	Response
Planning Inspectorate	ID 4.9.6 There are multiple references to construction activities potentially taking place in floodplains. Based on this information, the Inspectorate considers that there is potential for impacts to floodplains and insufficient evidence has been provided to suggest they will not be impacted. Therefore, the Inspectorate does not agree to scope this matter out.	The impact of the Proposed Scheme to watercourses and floodplains has been scoped in.
Planning Inspectorate	ID 4.4.5 The Environmental Statement should identify the existing presence and extent of peat deposits within the study area and describe where/how the peat would be removed. The Environmental Statement should also assess significant effects from disturbance(s) to peat (where they are likely to occur), on hydrology, groundwater, and flood risk.	A review of the extent and thickness of peat deposits will be carried out using available GI data, along with any proposals for peat removal. The subsequent impacts for RDWE will also be reported within the Environmental Statement.
Environment Agency	Flood Risk: The scoping report states that a flood risk assessment will be undertaken to support the proposals. The proposed option would not appear to directly impact on designated "main river" watercourses but also recognises that control of surface water runoff will be an issue to address in design. The Lead Local Flood Authority should be consulted.	A preliminary flood risk assessment has been undertaken and is presented in the PEIR. A flood risk assessment will also be updated and included in the Environmental Statement. The Lead Local Flood Authority has been consulted on the initial drainage design and will continue to be consulted as the drainage design develops.
Environment Agency	Water Quality: As noted in this section, there is a requirement under the National Policy Statement to demonstrate compliance with the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. In particular there should be no deterioration of any waterbody and measures to meet the overall objective of ‘good’ ecological status/potential should be addressed where possible. As such a specific compliance assessment against the Water Framework Directive is welcome. The scoping report identifies that mitigation will be required for existing outfalls (Para 14.3.24) and the potential for Sustainable Urban Drainage System (SUDs) is noted. We support the opportunities to incorporate environmental best practice in the form of multifunctional and above ground SUDs where feasible.	A compliance assessment has been produced in support of this PEIR. A detailed compliance assessment will be undertaken and report in the Environmental Statement.
	Surface water from the motorway network flows into a number of tributaries in the surrounding area from current motorway outfalls. These ultimately flow into the River Roch and River Irk watercourses which	The surface water from the motorway also flows into a tributary of the River Irwell which is monitored for compliance against the Water Framework Directive Regulations.

Stakeholder	Comment	Response
	monitored by the Environment Agency for compliance against the EU Water Framework Directive Regulations, namely: - River Irk (Wince - Irwell) (Ref: GB112069061131), Moderate Status - Whittle Bk (Irwell) (Ref: GB112069061250), Moderate Status - River Roch (Spodden -Irwell) (GB112069064600), Moderate Status	
	The scoping report identifies that mitigation will be required for existing outfalls (Para 14.3.24) and the potential for Sustainable Urban Drainage System (SUDs) is noted. We support the opportunities to incorporate environmental best practice in the form of multifunctional and above ground SUDs where feasible.	Noted. SuDS have been incorporated at this stage where appropriate. This will be further investigated, in terms of feasibility and updated SuDS design produced. This is discussed in further detail in the Water Quality Assessment report which supports this PEIR.
Environment Agency	Water Quality: If any infiltration to ground is proposed, included unlined storage lagoons we would require a thorough risk assessment to identify risks from road drainage particularly with regards to hydrocarbons and micro plastics. We would expect at the planning stages this detailed drainage design be completed in line with current guidance including SUDS guidance the LA113 standards and the Environment Agency's approach to groundwater protection available from gov.uk	Noted. At present infiltration to ground is not proposed and attenuation ponds proposed are to be lined. The design may be updated on receipt of GI data and this will be informed by a groundwater risk assessment which will be presented in the Environmental Statement.
Environment Agency	Environmental Permitting: The nearest main river watercourses to the junction are Castle Brook to the north east of the junction and Whitefield Brook between Derwent Ave and the eastbound approach carriageway. Any works that would impact on these watercourses may require a flood risk activity permit which is separate to and in addition to any planning permission granted.	Noted. Requirement for FRAP will be identified in the Environmental Management Plan and presented in the Environmental Statement.
Environment Agency	Environmental Permitting: Any dewatering activities on-site could have an impact upon local wells, water supplies and/or nearby watercourses and environmental interests. This activity was previously exempt from requiring an abstraction licence. Since 1 January 2018, most cases of new planned dewatering operations above 20 cubic metres a day will require a water abstraction licence from us prior to the commencement of dewatering activities at the site.	Noted. Requirement for abstraction licences will be identified in the Environmental Management Plan and presented in the Environmental Statement.

14.3 Legislative and policy framework

14.3.1 The National Policy Statement for National Networks (NPS NN) (Department for Transport, 2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NPS NN as the primary basis for making decisions on Development Consent Order (DCO) applications.

14.3.2 Key policy from the NPS NN relevant to this aspect is set out below:

- Paragraphs 5.91 to 5.97 state that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk although essential transport infrastructure is permissible in areas of high flood risk subject to the requirements of the Exception Test. But where development is necessary, it should be made safe without increasing flood risk elsewhere. The Environmental Statement will need to be accompanied by a FRA, which will identify and assess the risks of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account.
- Paragraph 5.93 states that the assessment of impact should take climate change into account.
- Paragraph 5.99 states that when determining an application, the SoS should be satisfied that flood risk would not be increased elsewhere, that the most vulnerable development is located in the areas of lowest risk, and that it is appropriately flood resilient and resistant.
- Paragraph 5.109 states that the scheme should be designed and constructed to remain operational and safe for users in times of flood.
- Paragraphs 5.219 and 5.220 state that the scheme should prevent both new and existing development from contributing to, or being put at unacceptable risk from, or being adversely affected by, water pollution.
- Paragraphs 5.221 to 5.223 require that the applicant carries out an assessment of the impacts of the proposed project on water quality, water resources and the physical characteristics of the water environment, as part of an Environmental Statement. It also states for those projects that are improvements to the existing infrastructure, such as road widening, opportunities should be taken to improve upon the quality of existing discharges where these are identified and shown to contribute towards WFD commitments. The NPS NN also states that the overall aim of projects should be no deterioration of ecological status in watercourses.
- Paragraph 5.226 states that in terms of Water Environment Regulation compliance, the overall aim of projects should be no deterioration of overall status in watercourses.
- Paragraph 5.230 states that projects are required to adhere to National Standards for Sustainable Drainage Systems (SuDS), which promotes the most sustainable approach but recognises feasibility, and use of conventional drainage systems as part of a sustainable solution for any given site given its constraints. For example, Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems (Defra, 2015).

14.3.3 In addition to the national policy set out in the NPS NN, the Proposed Scheme will also have regard to relevant legislation, and local plans and policy. A summary of legislation and policy is provided in Appendix 1.1. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

14.4 Assessment methodology

14.4.1 The Environmental Scoping Report (Highways England, 2021a) sets out the criteria which was used to assess significance for RDWE. The criteria used are also presented in Appendix 5.2 of the PEIR.

14.4.2 The assessment of the Proposed Scheme's impact on RDWE follows that set out in DMRB LA 113. The assessment criteria for assessing the value of water environment receptors and the magnitude of impacts are included in Appendix 5.2. The significance of effects is assessed in line with DMRB LA 104 Table 3.70 (Highways England, 2020b). Where there is no defined assessment methodology, such as for Hydromorphology, the assessment methodology has been determined based on prior experience of, and methodologies used on comparable projects undertaken for National Highways. It should also be noted that as presented in the Environmental Scoping Report (Highways England, 2021a) and Appendix 5.2 of this PEIR, the value definitions for GWDTE differ from those proposed in DMRB LA 113 (see paragraph 14.4.18).

14.4.3 The assessment methodology adopts the source-pathway-receptor principle to determine impacts, i.e., an impact is considered only where there is a pathway that could convey an impact to a receptor. This approach has been used for construction impacts in the absence of a prescribed methodology in DMRB LA 113.

Surface water quality

14.4.4 A Water Quality Study Report (WQSR) (Highways England, 2020d) was produced following the Project Control Framework (PCF) Stage 2 assessment to consider the existing water quality impacts from the highway and the Proposed Scheme at PCF Stage 2.

14.4.5 Assessments of routine runoff were also undertaken for the design options considered at PCF Stage 2 and reported in detail in the WQSR (Highways England, 2020e). These assessments showed that the use of SuDS is highly likely to be required to mitigate for failures.

14.4.6 Both simple and detailed level assessments have been undertaken as part of the PEIR to assess the surface water outfalls based on changes to drainage catchments sizes and updated traffic data. The following tools and standards have been used for the assessment for routine runoff and accidental spillage risk:

- DMRB LA 113 (Highways England, 2020a)
- Highways England Water Risk Assessment Tool (HEWRAT) v2.0.4
- HEWRAT Help Guide v2.0 (Highways England, 2015)
- Metal Bioavailability Assessment Tool (M-BAT) (Water Framework Directive – United Kingdom Technical Advisory Group (WFD-UKTAG), July 2014)

14.4.7 Data used in the assessments and the methodology used are detailed in Appendix 14.2.

14.4.8 Where low flows (i.e. less than 0.001m^3/s) occur in a receiving watercourse there is potential that routine runoff could infiltrate to ground and present a risk to groundwater quality depending upon the underlying geology. At present no locations have been identified where infiltration due to low flows may occur. Therefore groundwater assessments have not been carried out. Depending on the results of the Ground Investigation, groundwater assessments based upon the methodology described in Appendix C of DMRB LA 113 using HEWRAT will be undertaken to determine the requirements for lining of attenuation features. Any groundwater assessment required will be presented in the Environmental Statement.

14.4.9 A simple level surface water quality assessment has initially been undertaken for routine runoff. For those outfalls that record HEWRAT Environmental Quality Standard (EQS) failures, based upon the data and design currently available and the embedded mitigation, further detailed assessment has been carried out using the Metal Bioavailability Assessment Tool (M-BAT) in accordance with DMRB LA 113 and UKTAG (2014). The M-BAT assessment has used data collected on-site for the PCF Stage 2 Water Quality Study and supported by Environment Agency data where appropriate. The M-BAT assessment and results are described in Appendix 14.2: Preliminary Water Quality Assessment Report (PWQAR).

14.4.10 Changes to the design or traffic modelling during future stages of the Proposed Scheme design may result in reassessment using HEWRAT being required. Where this occurs, the results will be reported in the Environmental Statement as appropriate.

Hydromorphology

14.4.11 Additional guidance used in the assessment of potential hydromorphology impacts includes:

- C786 Culvert Design and Operation Guide (CIRIA, 2019)
- Scottish Environment Protection Agency (SEPA) Good Practice Guide: Outfall and Intake (Scottish Environmental Protection Agency (SEPA), 2019)
- SEPA Good practice guide: River crossings (SEPA, 2010)

14.4.12 A hydromorphology assessment has been carried out, which largely involved a simple desk-based study using the sources outlined in Section 14.7. In addition, field surveys were carried out in September 2021 and January 2022 where general hydromorphological observations were made on the following watercourses:

- Bradley Brook
- Tributary of Bradley Brook
- Parr Brook
- Blackfish
- Castle Brook
- Castle Brook Tributary
- Tributary of Castle Brook Tributary
- Tributary of River Irk 1.

14.4.13 Accessibility issues prevented surveys from taking place along Hollins Brook, Whittle Brook, Brightley Brook, Tributary of Parr Brook 2, Unnamed Watercourse 1 and the Western tributary of Parr Brook.

14.4.14 The hydromorphology assessment identified natural river processes which could be affected by the Proposed Scheme. Features identified in Appendix E of LA113 included:

- Flow processes
- Sediment movement
- Boundary conditions (channel bed and banks)
- Riparian zones
- Floodplains
- Downstream and catchment channel connectivity
- General channel form and function
- Watercourse setting within the wider catchment

14.4.15 The above baseline elements are subsequently compared against assessment criteria, including receptor importance (Table 14.20) and magnitude of impacts, which are discussed in Appendix 5.2.

Groundwater

14.4.16 The assessment to determine the significance of effects for the groundwater environment in this PEIR is based on known groundwater receptors and construction/operational phase activities associated with the Proposed Scheme, following the principles outlined in DMRB LA 113. For the Environmental Statement, quantitative assessments for certain aspects will be undertaken, utilising GI data, including dewatering impact assessments and for discharges to groundwater. This includes establishing a basic CSM as outlined in Appendix A of DMRB LA 113 to include details of:

- Groundwater flow directions
- Depth to groundwater
- Aquifer layering and hydraulic characteristics
- Groundwater quality
- Groundwater interaction with surface water, GWDTE, licensed/unlicensed groundwater abstractions, springs, sinks, sources etc

14.4.17 A high-level, conceptual review of hydrogeological processes has been undertaken for the PEIR. This is based on available baseline data received at the time of writing to determine how the construction and operation of the Proposed Scheme could impact on identified groundwater receptors. For the Environmental Statement, this high-level understanding will be developed into a detailed CSM, using GI data and quantitative assessments (where required), to refine the current understanding and further assess how these impacts could vary over time with the different phases of construction and operation.

14.4.18 Within the Environmental Statement, potential GWDTE (including existing identified sites, as well as additional potential GWDTE identified through ecology surveys) will be further assessed to establish if there is a potential linkage between the Proposed Scheme and the groundwater supporting the feature. The initial screening buffer of 250m (see paragraph 14.6.7) will be increased (where appropriate) if potential impacts on groundwater flows, levels, or quality are expected to extend beyond this distance, due to, for example, new design elements. Assessment of GWDTE, and in particular, the value criteria for each site, will be based on those set out in guidance for setting out assessment under the Water Framework Directive; and align with UK Technical Advisory Group (UKTAG) guidance (UKTAG, 2005). The UKTAG guidance brings together the degree of groundwater dependency (low, moderate, and high), and the level of ecological designation / protection of a site, to determine the overall importance of each potential GWDTE. This, alongside the GWDTE value criteria presented in the Environmental Scoping Report (Highways England, 2021a), deviates from the value (importance) definitions proposed in LA 113 Table 3.70.

14.4.19 In addition, to support this PEIR, a preliminary dewatering impact assessment has been carried out to gain an initial understanding of the potential maximum dewatering radius of influence for the proposed cuttings. The methodology, assumptions, and results for which are outlined in Section 14.8.

Flood risk

14.4.20 In line with DMRB Table 3.2 a simple level assessment has been undertaken to assess flood risk. There is a readily available collection of data and information which has been used to understand the likely environmental effects of the project. A Preliminary FRA has been produced in accordance with the technical guidance related to NPPF and compliance with the requirements of the NPS NN.

14.4.21 The NPS NN sets out the need for, and the Government's policies to deliver, development of Nationally Significant Infrastructure Projects (NSIPs). Paragraph 5.92 outlines that applications in the following locations should be accompanied by an FRA:

- Flood Zones 2 and 3 - medium and high probability of river and sea flooding
- Flood Zone 1 - (low probability of river and sea flooding) for projects of 1 hectare or greater, projects which may be subject to other sources of flooding (local watercourses, surface water, groundwater or reservoirs), or where the Environment Agency has notified the local planning authority that there are critical drainage problems.

14.4.22 The Proposed Scheme is larger than 1 hectare (ha) and located wholly within Flood Zone 1, therefore an FRA is required to demonstrate compliance with the NPS NN. For the purposes of the assessment of flood risk impacts, the Proposed Scheme has been classified as 'Essential Infrastructure' in accordance with the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG), 2021).

14.4.23 The Preliminary FRA has been produced in accordance with the Planning Practice Guidance (PPG) to the NPPF (MHCLG, 2021) with the aim of demonstrating compliance with the requirements of the NPS NN, specifically that the Proposed Scheme will:

- Remain operational and safe for users in times of flood

- Not increase flood risk elsewhere

14.4.24 The Preliminary FRA demonstrates the Proposed Scheme's compliance with the NPS NN by including:

- An assessment of flood risk to the Proposed Scheme from all sources including appropriate consideration of climate change
- An assessment of change in flood risk from all sources as a result of the Proposed Scheme including consideration of potential mitigation measures.

14.4.25 The Proposed Scheme is entirely within Flood Zone 1 indicating a low risk of flooding from main rivers. The risk of flooding from ordinary watercourses has been inferred through the use of the Environment Agency's Risk of Flooding from Surface Water (RoFSW) mapping.

14.4.26 Flood Risk is conceptualised using the source-pathway-receptor model, where risk is dependent on all elements being present.

14.4.27 Due to the generally low likelihood of flooding, the assessment of Flood Risk has been determined using readily available national Flood Risk datasets, supplemented with hydrological and hydrogeological assessment, to develop a conceptual understanding of baseline Flood Risk and changes in flood mechanisms driven by potential impacts of the Proposed Scheme.

14.4.28 Flood risk is a function of:

- The probability (likelihood) of flooding from the flood source
- The consequences of flooding which is determined largely by the vulnerability of the receptor to flooding.

14.4.29 The baseline value of flood risk features has been assigned based on the data relating to the predicted flood extents and the land uses at risk from this source. Where there was uncertainty regarding whether a land use would be at risk, a precautionary approach has been taken.

14.4.30 The magnitude of change has been determined based on the data available for the flood sources and a conceptual assessment based on an understanding of the mechanism of the change using organisational judgement and experience of similar schemes.

14.5 Assessment assumptions and limitations

14.5.1 The assessment is based on the Proposed Scheme design as described in Chapter 2 The Scheme. Scheme and construction activities design is ongoing (including highways structures, drainage design and outfalls that are of particular relevance to RDWE) and may change depending on design evolution.

14.5.2 The PEIR has been based on readily available web-based data sources and organisational experience on comparable projects (both in type and scale of development) for National Highways. If appropriate, field surveys may be undertaken for the Environmental Statement.

14.5.3 The PEIR has been based on only outline details of the construction activities. Further information on construction activities, including site compound locations and activities, have not yet been confirmed. Where available these will be considered in the Environmental Statement.

14.5.4 No GI data were considered for the PEIR stage. The GI data will be considered in the Environmental Statement.

14.5.5 The following are assumed based on current knowledge of the design:

- The Proposed Scheme would mainly use the existing drainage network and outfalls, which would discharge routine runoff at a rate attenuated to existing discharge rates. When the discharge is to a new outfall then discharge is to be limited to greenfield run off rates or 2 l/s/ha, whichever is higher.
- Where temporary haul roads cross watercourses, the assessment has assumed that temporary culvert crossings would be constructed.
- Construction drainage is assumed to join the main drainage network of the Proposed Scheme using surface water channels, slot drains and kerbs and gullies.

14.5.6 Some aspects pertaining to the outline design of the Proposed Scheme are currently unknown at this stage including, but not limited to: formation/invert levels for cuttings, subsurface earthworks and structures, a ground improvement schedule, detailed temporary works information, and a detailed Drainage Strategy.

Surface water quality

14.5.7 It is possible that further changes to the drainage design will be implemented as the drainage design process evolves. Assessments will be updated to reflect any changes and reported in the Environmental Statement. The identification of potential mitigation options in this PEIR has not taken into account constraints or the presence of statutory undertakers' apparatus, land take, access and maintenance requirements.

14.5.8 The assumptions and limitations related to the HEWRAT assessment undertaken at PCF Stage 2 are detailed in the Simister Island Water Quality Study Report (Highways England, 2020e). The assumptions and limitations relating to the HEWRAT and M-BAT assessments are presented in Appendix 14.2.

Hydromorphology

14.5.9 Some of the waterbodies have yet to be surveyed to inform the hydromorphological baseline. At this stage, where field surveys have not taken place, it is highlighted that the assessment was carried out via desk study.

14.5.10 The Environmental Statement will be informed of potential Biodiversity Net Gain (BNG) through condition assessments that give habitats preliminary and post scheme scores. For hydromorphology, BNG will be evaluated through River Condition Assessments. This will involve a desk study and Modular River Physical (MoRPH) river condition field survey, and findings recorded in a River Condition Assessment baseline report, which will be summarised in the Biodiversity chapter of the Environmental Statement.

Groundwater

14.5.11 Several data sets still need to be obtained to inform the groundwater baseline within the Environmental Statement, which include:

- Environment Agency groundwater level/quality monitoring data and groundwater flood incident records (where available)
- Unlicensed groundwater abstractions and groundwater flooding records (obtained from the local authority)
- Mining and groundwater information from the Coal Authority (including mine abandonment plans, current/historic abstractions, monitoring data etc.), in relation to the potential coal mining areas located in the west of the groundwater study area
- UK Habitat Classification (UKHab) survey[14], and National Vegetation Classification (NVC) survey data within a buffer of 250m (see paragraphs 14.4.16 and 14.6.7) around the Proposed Scheme, as well as results from hydrogeological walkover surveys (where appropriate) to determine the groundwater dependency of potential GWDTEs and to establish the presence of surface water features and surface water dependent habitats such as ponds and wetlands

14.5.12 For the purposes of the PEIR, it has been assumed that the groundwater receptors listed in paragraph 14.5.11 (unlicensed groundwater abstractions, additional GWDTE etc.) will be present, and they will be included in the assessment of impacts.

14.5.13 This PEIR has been produced without consideration of the available GI information. This will be considered in the Environmental Statement. Assessment of the data will aim to determine the impact on the groundwater regime and associated groundwater receptors.

14.5.14 The outline design for the Proposed Scheme indicates that there is no requirement for borrow pits. As such, no borrow pit dewatering impact assessment has been undertaken, and these features are not discussed further in this PEIR. Other aspects of the outline design (of relevance to the groundwater assessment and that are currently unknown at this stage), are listed in paragraph 14.5.6.

14.5.15 It has been assumed for this PEIR stage, that soil stripping would be required throughout the full extent of the provisional Order Limits, but that it would be less than one metre deep and would therefore not require dewatering. This conservative assumption has been made to provide a worst-case scenario for potential direct (and hence significant) impacts to sensitive groundwater receptors.

14.5.16 At the time of writing, the outline/draft drainage strategy for the Proposed Scheme assumes that all proposed attenuation ponds would be lined. In addition, filter drains are expected to be lined with an impermeable membrane. There are no swales

[14] Jacobs UK Ltd. has carried out an extended UKHab survey within 500m of the Proposed Scheme. The results from this survey have not been included in the initial identification of potential GWDTE. This is due to their absence of ecological designation and the corresponding lower receptor value. The PEIR therefore focusses on those GWDTE with a statutory or non-statutory ecological designation. The results of the UKHab survey will, however, be taken into account for the Environmental Statement, which will potentially add additional GWDTE needing to be assessed.

proposed as part of the outline drainage design at this PEIR stage, and as such, for the purposes of the PEIR, it is assumed that there are no proposed discharges to ground or groundwater. The final (detailed) design for all drainage assets would, however, need to be based on the GI data received at the Environmental Statement stage and subsequent geotechnical feasibility assessments. This would include, for example, using the GI data to inform groundwater assessments (based upon the methodology described in Appendix C of DMRB LA 113 using HEWRAT) to determine the requirements for lining all attenuation features (where necessary). The results of which will be presented in the Environmental Statement. However, as described above, and in paragraph 14.4.8, at present no locations have been identified where infiltration at low flows may occur. This is described further in Appendix 14.2 and thus a groundwater assessment has not been deemed necessary at this PEIR stage.

Flood risk

14.5.17 Information regarding baseline flood risk has been obtained from desk-based sources.

14.5.18 An assessment of groundwater flood risk has been undertaken using BGS groundwater flooding susceptibility data, to identify the potential for shallow groundwater emergence. A high-level review has also been undertaken of groundwater levels reported in BGS borehole records, bedrock and superficial aquifer properties, and potential indicators of shallow groundwater emergence (such as springs) to determine areas of high, medium and low groundwater flood risk within the provisional Order Limits. The assessment of groundwater flood risk will be revised taking into consideration available GI data and included in the updated FRA to support the Environmental Statement.

14.5.19 In order to assess flood risk from the majority of Ordinary Watercourses, the Environment Agency RoFSW mapping is considered to sufficiently represent the risk associated with Ordinary Watercourses (see Appendix 14.4). The RoFSW mapping does not take climate change into account for the 1% (1 in 100) Annual Exceedance Probability (AEP) flood event. The 0.1% (1 in 1,000) AEP RoFSW mapping has therefore been adopted as a proxy for an assumed 1% (1 in 100) AEP plus climate change flood event extent.

14.5.20 The assessment assumes that all SuDS and highways and surface water drainage networks would be fully maintained and managed as per National Highways operating standards.

14.6 Study area

14.6.1 Based upon the information obtained to date, the study area comprises surface water features (rivers, lakes and ponds) and groundwater features (designated aquifers, potential mine workings, springs, GWDTEs).

14.6.2 As stated in Section 14.2 of the Environmental Scoping Report (Highways England, 2021a) the study area for the each of the RDWE attributes is a distance measured from the provisional Order Limits for the Proposed Scheme of:

- 500m for hydromorphology
- 1km for surface water and flood risk
- Up to 2km for groundwater, limited to 250m for GWDTE (see paragraph 14.6.7)

14.6.3 The study areas mentioned above have been extended in locations where there is potential for further-reaching impacts.

Surface water

14.6.4 For surface water, a 1km study area has been chosen in line with the HEWRAT help guide. This states that outfalls to a given watercourse that discharge within 1km of each other to the same reach of a watercourse should be assessed for cumulative impacts. The DMRB standard also considers 1km as 'close proximity' in relation to protected areas for consideration within assessments.

Flood risk

14.6.5 The study area for the assessment of flood risk has been defined by the extent by which flood risk may be influenced by the Proposed Scheme and the extent of any relevant flood zones. This is driven by the need to consider the impact of the Proposed Scheme to people and property elsewhere, regardless of their location, although for a scheme such as this it is typical to consider risks up to a distance of 1km from the Proposed Scheme. If the assessment undertaken during the PEIR stage identifies the potential for impacts at a distance further than 1km from the Proposed Scheme, the study area would be extended accordingly for the Environmental Statement stage. This would be based on a conceptual assessment of the flood source and impacts on existing flood mechanisms.

Groundwater

14.6.6 For the groundwater study area, a 2km buffer in all directions around the provisional Order Limits is considered appropriate. This is based on organisational experience regarding the maximum potential extent of effects likely on groundwater receptors in the type of aquifers present, and the uncertainties associated with the degree of heterogeneity of these aquifers. These include, for example, the extent of existing and historical mining shafts and adits, and their influence on the existing groundwater regimes present.

14.6.7 For GWDTE, an initial screening buffer of 250m has been applied based on SEPA guidance (SEPA, 2017). The initial screening assessment has been undertaken from desk-based data such as maps (Defra, 2022b), citations (Tameside MBC, 2022), and brief online descriptions of the site from local authority websites. This will be followed up for the Environmental Statement stage with field surveys, if needed, and consultation with the Lancashire Wildlife Trust.

14.7 Baseline conditions

Baseline sources

14.7.1 The baseline conditions have been established based on the following sources:

- British Geological Survey Susceptibility to Groundwater Flooding mapping (BGS, 2020)
- British Geological Survey mapping (BGS, 2022) at 1:10,000 scale and 1:50,000 scale

- British Geological Survey historical borehole records, and permeability index/aquifer properties datasets (where required)
- British Geological Survey baseline groundwater quality information for the Permo-Triassic Sandstones of Manchester and East Cheshire (Technical Report: NC/99/74/8) (Griffiths et al., 2003)
- British Geological Survey baseline groundwater quality information for the Pennine Coal Measures Group (Technical Report: OR/07/039) (Cheney, 2007)
- Bury Council Preliminary Flood Risk Assessment (JBA Consulting, 2011)
- Bury, Rochdale and Oldham Strategic Flood Risk Assessment, Volume II – Level 1 SFRA (JBA Consulting, 2009)
- Department for Environment, Food and Rural Affairs (Defra) (2022a). ENV15 - Water abstraction tables for England
- Designation data and mapping from DEFRA's MAGIC map application (Defra, 2022b), including:
  - Environment Agency bedrock and superficial aquifer designations
  - Environment Agency groundwater Source Protection Zones (SPZs)
  - Environment Agency Nitrate Vulnerable Zones and Groundwater Vulnerability Map
- Flood Estimation Report: Bradley Brook at M60 Culvert (Jacobs, 2021a)
- Statutory and non-statutory designated ecological sites, and Habitats of Priority Importance (HPI) register
- Environment Agency Long Term Flood Risk Information Mapping (Environment Agency, 2019)
- Environment Agency Catchment Data Explorer for Water Framework Directive surface water and groundwater bodies (Environment Agency, 2022)
- Environment Agency Ecology and Fish Data Explorer (Environment Agency, 2021b)
- Environment Agency Flood Map for Planning (Environment Agency, 2021c)
- Environment Agency Risk of Flooding from Reservoirs (Environment Agency, 2021d)
- Environment Agency Risk of Flooding from Surface Water (RoFSW) Extent: 0.1, 1 and 3.3 percent annual chance datasets (Environment Agency, 2021e)
- Environment Agency Historic Flood Map (Environment Agency, 2022a)
- Environment Agency Statutory Main River Map dataset (Environment Agency, 2022b).
- Environment Agency Water Quality dataset (Environment Agency, 2022c)
- Environment Agency present and historical land uses, and contaminated land (part 2A) datasets (Environment Agency, 2022d)
- Environment Agency Licensed Surface Water and Groundwater Abstraction data sets (Environment Agency, 2022e)
- Greater Manchester Surface Water Management Plan (JBA Consulting, 2012)

- Highways Agency Drainage Data Management System (Highways England, 2022b)
- Irwell Catchment Flood Management Plan (Environment Agency, 2009)
- M60 J18 Simister Island Water Quality Study Final Report (Highways England, 2020e)
- M60/M62/M66 Simister Island Interchange Drainage Strategy Report (National Highways, 2022)
- North West River Basin Management Plan (Environment Agency, 2018)
- Ordnance Survey (OS) mapping for identifying the locations of springs, sinks, sources, spreads, collects, issues, wells (Ordnance Survey, 2022).
- Sites of Biological Importance (SBI) register (Tameside MBC, 2020)
- The Coal Authority Interactive Map Viewer (Coal Authority, 2020), including:
  - Mine Entry points
  - Abandoned Mines Catalogue
  - Development High Risk Areas
  - Past Shallow Coal Mine Workings
  - Probable Shallow Coal Mine Workings
  - Coal Outcrops

Surface water features

14.7.2 There are numerous Main Rivers, surface watercourses and other water bodies within the 1km study area, as summarised in Table 14.2. All watercourses are within the River Irwell catchment.

Table 14.2: Features of the surface water environment within the study area (1km)

Watercourse	Description
Hollins Brook (Main River)	The source (SD826080) of Hollins Brook is the confluence of Whittle Brook and Castle Brook, approximately 440m east of the M66 southbound carriageway. It continues in a north-westerly direction for approximately 600m before entering a culvert conveying it beneath the M66. The brook continues in a general westerly direction for approximately 1.5km before joining the River Roch.
Brightly Brook (Main River)	The source (SD840092) of Brightly Brook is south of Pilsworth Road flowing westwards beneath Moss Hall Road and south of Pilsworth South Landfill before merging with Hollins Brook.
Castle Brook (Main River)	The source (SD828066) of Castle Brook is on the north side of the M62 and east of the M66 near Unsworth Moss and Moss Side. From its source it flows westwards through Pike Fold Golf Course and then northwards to discharge into Whittle Brook. This watercourse receives runoff from the M66 highways network (via Outfall 2 described in Table 14.6).
Tributary 1 of Castle Brook (Egypt Farm Drain) (Ordinary Watercourse - Bury Metropolitan Borough Council)	This watercourse rises (SD832068) by Egypt Farm, north of the M66 and approximately 500m east of M60 J18. It flows in a northerly direction for approximately 500m before reaching the southern boundary of Pike Fold Golf Course and its confluence with Tributary 2 of Castle Brook.

Watercourse	Description
Tributary 2 of Castle Brook (Golf Course Drain) (Ordinary Watercourse - Bury Metropolitan Borough Council)	This watercourse rises (SD826064) along the southern boundary of Pike Fold Golf Course. It flows through the golf course and continues northwards for approximately 1.4km before merging with Castle Brook. This tributary receives runoff from the M66, M62 and M60 highways networks (via Outfall 1 described in Table 14.6).
Parr Brook (Main River)	The source (SD815062) of Parr Brook is north of Ribble Drive in Sunny Bank, approximately 1.3km north-west of M60 J18. It flows north through Sunny Bank Wood, approximately 800m west of the M66 and Bury Golf Club, approximately 600m west of the M66, before flowing west into Lamb Lodge Reservoir 1.3km west of the M66.
Tributary of Parr Brook (Ordinary Watercourse - Bury Metropolitan Borough Council)	The tributary rises (SD822058) approximately 550m west of M60 J18 by Hodder Way, Whitefield. From here the watercourse is culverted beneath the residential housing, flowing south towards the M62 by Derwent Avenue before flowing northwards, still culverted, to Cambeck Close where it merges with Parr Brook.
Whittle Brook (Main River)	The source (SD848085) of Whittle Brook is near Heywood to the north-west of Junction 19. Whittle Brook passes through a culvert under the M62 twice, at its closest to the Proposed Scheme it crosses approximately 1.8km east of M60 J18.Castle Brook joins on the west bank near Thurston Fold and then it is joined by Brightley Brook from the east after which it is called Hollins Brook. The watercourse then passes under the M66, approximately 700m south of Junction 3. From here it flows west for approximately 1.2km before discharging into the River Roch.
Tributary 1 of Whittle Brook (Ordinary Watercourse - Bury Metropolitan Borough Council)	The tributary rises (SD835066) on the north side of the M62 flowing eastwards then in a northeasterly direction through the field adjacent to the M62 and Simon Lane (farm access track). The tributary appears to be culverted beneath Simon Lane before continuing north-east past Unsworth Moss Farm and merging with Whittle Brook approximately 1.5km east of M60 J18.
Bradley Brook (Ordinary Watercourse - Bury Metropolitan Borough Council)	Bradley Brook rises (SD8000048) approximately 550m north of the M60 to the east of Philips Drive, from which it flows southwards through Whitefield Golf Course. It crosses under the M60, approximately 650m west of M60 J17 and after approximately 200m is joined by Tributary 1 of Bradley Brook. Bradley Brook receives runoff from the M60 highways network (via Outfall 6 described in Table 14.6). The brook flows through Philips Park, generally south-westwards for approximately 1.6km before its confluence with the River Irwell. The brook has three tributaries, two of which are in the study area.
Tributary 1 of Bradley Brook (Ordinary Watercourse - Bury Metropolitan Borough Council)	Tributary 1 of Bradley Brook rises (SD808045) on the south side of the M60 approximately 400m south-west of Junction 17.
Tributary 2 of Bradley Brook (Ordinary Watercourse - Bury Metropolitan Borough Council)	This tributary was scoped out in the Environmental Scoping Report (Highways England, 2021a).
Blackfish	A small watercourse originating at the northern end of Heaton Park Golf Course. The watercourse flows south-eastwards to the River Irk. This watercourse does not receive highways runoff from the motorway.

Watercourse	Description
Heaton Park Reservoir (Bury Metropolitan Borough Council and Manchester City Council)	Owned and operated by United Utilities, the reservoir lies approximately 750m directly south of M60 J18 and covers an area of some 33 hectares (ha). The reservoir is fed by Haweswater Aqueduct which carries up to 450,000m^3 of water per day from Haweswater in the Lake District to provide public drinking water to the Manchester region. The reservoir is not hydrologically connected to the watercourses within the study area (SD826049).
Other unnamed watercourses and drains	There are several unnamed drains and watercourses within the study area, some of which are small field drains. These watercourses do not receive road runoff and their alignment would not be impacted by the Proposed Scheme. Therefore, these watercourses are not considered further in the assessment.
Ponds, lakes and additional reservoirs	There are three ponds within 500m of the centre of M60 J18 associated with Egypt Farm, located to the north-east of the junction; at their nearest, these ponds are approximately 75m from the eastbound carriageway. There are also several ponds within Pike Fold Golf Club. Some of these ponds may be man-made and not considered as natural features. Other ponds and lakes within the 1km study area have not been identified at this stage but are likely to not be directly affected by the Proposed Scheme and thus would not be considered further unless they are identified at the Environmental Statement stage as being affected by the works.

14.7.3 As described in Section 14.6 the study area can be extended if impacts could potentially occur beyond the 1km study area for surface waters. In the absence of a drainage survey and confirmation of all outfalls within the Proposed Scheme extent, selective downstream receptors have been included at this time beyond the 1km study area that are hydrologically connected to those within the study area. These have been included in the assessment as potential downstream receptors. These are:

- River Roch (Spodden to Irwell) – Hollins Brook which flows within the study area joins the River Roch approximately 1.5km west of the M66. The River Roch then flows west through Lomax Woods, beneath Heap Bridge on the A58 Bury New Road. It meanders south-west of the M66 J2 then flows underneath the M60, Waterfold and the East Lancashire Railway before flowing south merging with the River Irwell approximately 2km west of the Proposed Scheme.
- River Irwell (Main River) – The River Roch merges into the River Irwell by Radcliffe Ees approximately 2km west of the Proposed Scheme. It flows in a southerly direction west of the Proposed Scheme. This watercourse is also approximately 1.6km downstream of the source of Bradley Brook (which receives road runoff from areas within the Proposed Scheme).
- River Irk – The River Irk is located approximately 1.5km south of the Proposed Scheme and receives road runoff (via Outfall 5) from areas of the highway within the Proposed Scheme and thus is included in the assessment. The River Irk flows in a westerly direction passing under the M60 approximately 100m south of the centre of M60 J19. It continues flowing south before merging with the River Irwell in Manchester city centre approximately 6km south of the Proposed Scheme.

Surface water quality

14.7.4 The North West River Basin Management Plan (RBMP) classifies WFD Regulations waterbodies according to their ecological and chemical status and whether they have been heavily modified or not. Waterbodies are required to achieve 'good' ecological and chemical status (or potential, if designated as heavily modified or artificial) by 2021 or 2027. Table 14.3 summarises the current overall, ecological, physico-chemical status of WFD designated waterbodies within the study area and their downstream waterbody and are described further below. The Catchment Data Explorer website identifies the source and diffuse pollution pressures for the water body catchments not achieving good status, also presented in Table 14.3.

14.7.5 As presented in Table 14.3 all of the waterbodies 'Fail' for chemical status. The failures, based upon 2019 published data (Environment Agency, 2022), are mostly due to priority hazardous substances, notably: polybrominated diphenyl ethers (PBDE) and mercury and its compounds which all waterbodies fail and perfluorooctane sulphonate (PFOS) for which the River Roch and River Irk fail.

14.7.6 Vehicles and road runoff are not typically considered as significant sources of these pollutants. Several of these pollutants are banned in the UK with pollution levels now due to historical use.

14.7.7 All the watercourses have a 'moderate' classification for phosphate except the River Roch and River Irwell which are classified as 'poor'. Roads may contribute to phosphate levels through seasonal degradation of plant matter, soil and atmospheric deposition however wastewater treatment works and agriculture are likely to be the most significant sources of this pollutant, rather than highway runoff. The Catchment Data Explorer website identifies the pollution pressures for the catchments as presented in Table 14.3.

14.7.8 As shown in Table 14.2, there are other waterbodies and watercourse crossings in the study area, including several brooks, unnamed tributaries and unnamed drains (see Figure 14.1). These waterbodies are not monitored by the Environment Agency for WFD Regulations reporting purposes and therefore their water quality status is unknown. Existing water quality in these smaller watercourses is likely to be influenced by surrounding land uses (which are predominantly residential and agricultural), surface water runoff, road drainage, sewerage misconnections, nutrient inputs from agriculture and golf courses, accidental spillages and unlicensed discharges. There is likely to be a significant network of surface water sewers which discharge into the watercourses listed above.

Table 14.3: Current WFD Regulations status (2022), (Cycle 3) for surface water bodies, data derived from Environment Agency's Catchment Data Explorer (Environment Agency, 2022)

Water body name	Whittle Brook (Irwell)	Roch (Spodden to Irwell)	Irwell (Roch to Croal)	Irk (Wince to Irwell)
Water body ID	GB112069061250	GB112069064600	GB112069060840	GB112069061131
Water body type	River	River	River	River
Upstream water body	-	Whittle Brook (Irwell)	Roch (Spodden to Irwell)	Irk (Source to Wince Brook)
Downstream water body	Roch (Spodden to Irwell)	Irwell (Roch to Croal)	Irwell (Croal to Irk)	Irwell/Manchester Ship Canal
Hydromorphological designation	Not designated	Heavily modified	Heavily modified	Heavily modified
Overall water body classification	Moderate	Moderate	Moderate	Moderate
Overall ecological status	Moderate	Moderate	Moderate	Moderate
Hydromorphological supporting elements				
Hydrological regime	Supports Good	-	Supports Good	-
Morphology	Supports Good	-	-	-
Physico-chemical elements				
Acid-neutralising capacity	-	High	High	High
Ammonia	Good	Moderate	Moderate	Good
Biological oxygen demand	-	-	-	High
Dissolved oxygen	High	High	High	High
pH	High	High	High	High
Phosphate	Moderate	Poor	Poor	Moderate
Temperature	High	High	High	High
Specific (selected) pollutants				
Copper (Cu)	-	-	-	High

Water body name	Whittle Brook (Irwell)	Roch (Spodden to Irwell)	Irwell (Roch to Croal)	Irk (Wince to Irwell)
Zinc (Zn)	-	-	-	High
Iron (Fe)	-	High	High	High
Priority hazardous substances (selected)				
Lead (Pb) (and its compounds)	-		-	Good
Cadmium (Cd) (and its compounds)	-	Good	-	Good
Overall chemical status	Fail	Fail	Fail	Fail
Pollution Pressures (i.e., issues for not achieving good status)	Agriculture and rural land management Urban and transport	Urban and transport Water Industry	Agriculture and rural land management Urban and Transport Water Industry	Agriculture and rural land management Urban and Transport Water Industry Domestic General Public Local and Central Government

14.7.9 Water sampling data provided by the Environment Agency (2022c) have been presented for selected pollutants relevant to road drainage in Table 14.4a. The data shown are an average of the last 10 sample records for each variable for pH, temperature, dissolved oxygen and alkalinity. Table 14.4b also includes water quality data for copper and zinc for sampling points within the study area for watercourses downstream of the Proposed Scheme. The ranges of copper and zinc are presented based upon sampling data from the past ten years. It should be noted that this data is very limited and will have been subject to watercourse conditions at the time of sampling. Any assumptions and limitations associated with the use of this data have been outlined in Appendix 14.2.

Table 14.4a: Water Quality data for features of the surface water environment within the study area (1km) (source: Environment Agency Water Quality Data Archive (averaged), 2022c)

Watercourse	Sample location (up or downstream of Proposed Scheme)		Sample date (of those samples used to obtain average)	pH	Temp (ºC)	Oxygen dissolved % saturation	Alkalinity to pH 4.5 as $CaCO_3$ (mg/l)
Hollins Brook	E: 381206, N: 408432 (Prior to confluence River Roch/Whittle Brook Irwell Downstream)	Approx. 3km upstream (u/s)	March 2013 – April 2017	7.895	9.74	95.81	128.5
River Roch	E: 380680, N: 407734 (Blackford Bridge)	Approx. 3km u/s	June 2019 – March 2020	7.691	10.3	93.83	63.8
River Irwell	E: 380136, N: 407399 (above confluence with River Roch)	Approx. 3km u/s	January – July 2016 *(only 4 samples taken)*	7.618	8.2	93.53	65.75
Wince Brook	E:386939, N: 405562 (above confluence with River Irk)	Approx. 4km downstream (d/s)	Aug 2017 – Feb 2020	7.561	13.17	86.12	82.4
River Irwell	(at Footbridge u/s Forest Bank)	Approx. 4.5km d/s	Aug 2019 – May 2021	7.642	9	95.7	70.2

Table 14.4b: Environment Agency Water Quality Data Archive for dissolved copper and zinc for watercourses downstream of the Proposed Scheme (Environment Agency, 2022c)

Site Name	Sampling ID	Date Range of sample data	Dissolved Copper Range (µg/l)	Dissolved Zinc Range (µg/l)
River Roch at Blackford Bridge	NW-88002241	November 2011 – December 2013	2.33 – 4.42	6.32 – 72.4
River Irk at Red Bank above Scotland Weir	NW-88002380	January 2013 – August 2014	1.91 – 4.95	11.40 – 53.10
River Irk at Hendham Vale	NW-88002375	February 2012 – December 2013	1.84 – 4.03	14.10 - 178
Hollins (Whittle) Brook Ptc River Roch	NW-88002239	October 2012 – December 2013	2.37 – 7.96	6.25 – 174

14.7.10 Table 14.5 summarises the chemical analysis of water samples taken on site for each existing outfall in September 2019 as part of the PCF Stage 2 Water Quality Study Report. Although the total dissolved copper concentrations measured on site are all higher in value than the standard bioavailable EQS limit of 1µg/l in HEWRAT, ranging from 1.6µg/l to 4.9µg/l, these are likely to be below the limit when bioavailability is considered. For zinc, the concentrations measured on-site vary from 4.6µg/l to 24µg/l. Likewise Zinc concentrations exceed the value of 10.9µg/l bioavailable EQS in HEWRAT at two locations, however when bioavailability is taken into consideration these are likely to be within the limits. The water hardness band used in HEWRAT was medium based upon the laboratory analysis of the site samples, as described in the PCF Stage 2 Water Quality Study (Highways England, 2020d). One sample from Bradley Brook (outfall six), was marginally above the medium threshold of 200mg/l at 202mg/l in HEWRAT. A precautionary approach was taken and the medium band selected as the toxicity of zinc decreases with increasing water hardness.

Table 14.5: Summary of chemical analysis of on-site sampling (September 2019)

Outfall (watercourse)	Cu, Dissolved (µg/)l	Zn, Dissolved (µg/l)	pH	Dissolved Organic Carbon (mg/l)
Outfall 1 (tributary of Castle Brook)	4.9	10	7.3	6.8
Outfall 4 (Tributary of Parr Brook)	2.7	4.6	7.4	10
Outfall 5 (River Irk)	4.0	24	7.9	5.7
Outfall 6 (Bradley Brook)	1.6	15	7.8	3.8

Surface water flows

14.7.11 On the National River Flow Archive (NRFA) website (UKCEH, 2022) data are available from several gauging stations along watercourses within, upstream, or downstream of the study area. The Q_{95} is the flow that is exceeded 95% of the time and is representative of low flows and can be used to determine the value of receptors in accordance with DMRB LA113. Q_{95} was calculated in the PCF Stage 2 Simister Island

Water Quality Study Report (Highways England, 2020d) for some proposed outfalls based upon the Institute of Hydrology methodology which is described further in Appendix 14.2. Flow data have also been obtained from Wallingford HydroSolutions Ltd. for some locations. The Q95 data and the relevant sources of the data are presented in Table 14.6. Outfall locations are shown on Figure 14.2. Data on the Baseflow Index (BFI) have also been included in Table 14.6; this gives an indication as to how much groundwater contributes to the flow in a watercourse.

14.7.12 The outfalls referred to in Table 14.6 are described in further detail in the 'Existing Drainage' section, paragraphs 14.7.14 to 14.7.24.

Table 14.6: Q_{95} flows for receiving watercourses and for watercourses upstream and downstream of the study area

Watercourse name	Gauging station ID number	Q_{95} (m^3/s)	BFI
Values from NRFA website (UKCEH, 2022)			
River Roch (at Blackford Bridge) (upstream of Proposed Scheme) NGR: SD806077	69023	1.49	0.53
River Irk (Collyhurst Weir) (downstream of the Proposed Scheme) NGR: SJ848996	69043	0.91	0.6
River Irwell (at Adelphi) NGR: SJ824987	69002	5.01	0.49
Values from the M60 J18 Simister Island Water Quality Study (Highways England, 2020d) based upon IoH methodology			
Un-named tributary of Castle Brook (Outfall 1A) NGR: SD828065	-	0.00081	0.799
Un-named tributary of Castle Brook (Outfall 1B) NGR: SD828065	-	0.00081	0.799
River Irk (Outfall 5) NGR: SD836053	-	0.24	0.597
Bradley Brook (Outfall 6) NGR: SD802044	-	0.00429	0.721
Values from Wallingford HydroSolutions Ltd.			
Castle Brook – downstream of confluence with tributary (Outfall 1 assessment location) NGR: SD 82836 06724	-	0.010	0.80
Castle Brook (Outfall 2) NGR: SD 82628 07391	-	0.012	0.75
Parr Brook – downstream where watercourse first emerges into open channel (Outfalls 4 & 7) NGR: SD 81549 06347	-	0.014	0.78

14.7.13 The majority of the outfalls discharge to watercourses with Q_{95} values that are sufficient for the HEWRAT assessments to be undertaken as surface water assessments. Where

the outfalls discharge directly into a piped section of watercourse or the existing highway drainage network (i.e. Outfalls 4 and 7) the minimum Q_{95} value of 0.0011m^3/s before the watercourse is considered to act as a soakaway has been used. The approach taken for each outfall has been described further in Appendix 14.2. It should be noted that for outfall 1A and 1B to the tributary of Castle Brook based upon a proportional area calculation using the Q_{95} from downstream of the confluence with Castle Brook, the Q_{95} is greater than the minimum for surface water assessments in HEWRAT. This is described further in Appendix 14.2.

Existing drainage

14.7.14 The National Highways Priority Drainage Assets Programme was developed to identify nationally those outfalls and soakaways that represent a potential risk to receiving water quality and culverts that represent a potential risk of flooding. The results of this programme are recorded on National Highways Drainage Data Management System (DDMS). Under this programme, outfalls can be classified as any of six categories which describe the level of risk of pollution to a receiving watercourse. Categories include A (very high), B (high), C (moderate), D (low) or X (risk addressed) or 'Not Determined' for those where a baseline assessment has not been undertaken to determine the pollution risk. Outfall category is determined upon evidence submitted to DDMS, either through a site survey or desk-based study (i.e. through HEWRAT). Categories of risk are defined in the HADDMS Priority Registers Priority Outfalls Verification User Guide (Highways Agency, 2010).

14.7.15 According to DDMS information, there are no Category A or Category B outfalls, seven Category C, one Category D, and no Category X or 'Not determined' outfalls within the study area for those outfalls currently recorded on DDMS and these are presented in Table 14.7 and shown on Figure 14.2. Some of the Outfall IDs represent more than one outfall. It should be noted that the risk status of the outfalls is yet to be verified through site specific assessments and this will be done as part of the assessment stage to be reported in the Environmental Statement for the Proposed Scheme design.

Table 14.7: Outfalls within the study area recorded on National Highways DDMS (taken from Water Quality Study, Highways England, (2020d))

Outfall ID	Risk	Location
SD8208_0858j SD8208_0858k SD8208_0858l	Category C (moderate risk)	Situated approx. 290m south of the first slip road to the M66 J3 on the western side of the M66. Discharges indirectly into Hollins Brook via drains.
SD8208_1556o SD8208_1556p SD8208_1556q	Category C (moderate risk)	Situated approx. 290m south of the first slip road to the M66 J3 on the eastern side of the M66. Discharges indirectly into Hollins Brook via drains.
SD8208_2232h	Category C (moderate risk)	Discharges directly into Hollins Brook on the eastern side of the M66.
SD8306_4225b	Category D (low risk)	Located on one of the un-named tributaries of Castle Brook. Outfall located on the south side of M62 on the northern edge of Simister.

14.7.16 During earlier PCF stages of the project, six outfalls were identified using as-built drawings from DDMS. The PCF Stage 2 Water Quality Study Report (Highways England, 2020d) outlines that outfall data on HADDMS are incorrect compared to as-

built drawings, which do not correspond to the outfall locations reported at previous stages. Therefore, at PCF Stage 2 a site visit was undertaken to confirm the location of the outfalls and to collect data to be used in water quality assessment using the HEWRAT.

14.7.17 Of the six identified outfalls presented in Figure 14.2, two could not be located and were not assessed at PCF Stage 2. Outfall number 3 was initially verified during the site visit and assessed, however, is now not affected by the Proposed Scheme at this PCF Stage 3 and so has been omitted from this PEIR. As such, Outfalls 1, 5 and 6 were taken forward for assessment.

14.7.18 For the remainder (Outfalls 1, 5 and 6) an assessment of routine runoff impacts was undertaken at PCF Stage 2 for the existing situation and for the design options considered at PCF Stage 2. The results of this were presented in the Water Quality Study Report (Highways England, 2020d) and are also presented in Appendix 14.2.

14.7.19 Overall, there were three relevant outfalls verified during site visits for the Water Quality Study Report (Highways England, 2020d) undertaken at the end of PCF Stage 2, these are detailed below:

- For the M66 through M60 J18, the roundabout circulatory, the M66 slip roads, M62 east slip roads and M60 eastbound exit slip road at J18, the drainage flows to the north-east of M60 J18, before heading north under Egypt Lane and outfalls into a ditch on the boundary of Pike Fold golf course (Outfall 1). This ditch connects into Castle Brook.
- For the M60 from J18 to just east of J19, including the J18 south slip roads, the drainage outfalls into the River Irk (Outfall 5).
- For the M60 from the centre of J18 to just west of M60 J17 the drainage outfalls just south of Whitefield Golf Course to Bradley Brook (Outfall 6).

Surface water resources

14.7.20 Based on Environment Agency data, there are two surface water abstraction locations within the 1km study area, both for industrial, commercial and public services (Environment Agency, 2022e). It is possible further small-scale surface water abstractions could be present within the study area but not recorded within the data. It is also possible additional licences have been granted since 2017 and therefore updated data will be requested for the next stage of assessment and reported in the Environmental Statement.

14.7.21 Based on Defra data provided in July 2021, there are 12 consents to discharge within the study area. These are detailed below in Table 14.8. It is possible that there are unlicensed discharges not recorded within the data.

Table 14.8: Discharge consents within the study area (Defra, 2022a)

Date Effective	Long Name	NGR	Discharge Type
10/06/1997	Castle Brook Farm Septic Tank	SD8260007650	Domestic property (single) (incl farmhouse)

Date Effective	Long Name	NGR	Discharge Type
23/12/1985	Egypt Farm	SD8330006400	Domestic property (single) (incl farmhouse)
01/04/1991	Park Lane D/S of S.W.	SD7998004962	Storm Tank/CSO on Sewerage Network (water company)
14/07/1983	The Bungalow	SD8260007680	WwTW (not water co) (not STP at a private premises)
27/01/1999	STP Pike Fold Golf Club STP	SD8261007410	WwTW (not water co) (not STP at a private premises)
09/12/2005	Heaton Park Open Reservoir	SD8286004670	WTW/Water Collection/Treatment/Supply
19/03/1999	Castle brook Business Park PS	SD8180008600	Pumping Station on unadopted sewerage network (not water co)
01/04/2018	Maple Avenue CSO	SD8072004880	Storm Tank/CSO on Sewerage Network (water company)
01/04/2018	Farm Hill CSO 091KO	SD8053003980	Storm Tank/CSO on Sewerage Network (water company)
09/06/2018	Clifton Rd Leach St CSO	SD8056003980	Storm Tank/CSO on Sewerage Network (water company)
10/06/2016	Simister Lane WW Ntwk PS	SD8337006210	Pumping Station on Sewerage Network (water company)
01/04/2018	Parr Brook CSO	SD8157007270	Storm Tank/CSO on Sewerage Network (water company)
01/10/1996	241 Heywood Old Road	SD8450005400	Domestic property (single) (incl. farmhouse)
01/05/1970	302-308 Heywood Old Rd	SD8440306430	Domestic property (multiple) (incl. farmhouses)
05/05/1972	276 Heywood Old Rd	SD8442006330	Domestic property (single) (incl. farmhouse)
17/10/1972	395, 397 & 399 Heywood Old Rd	SD8437006520	Domestic property (multiple) (incl. farmhouses)
31/01/1973	296, 298 & 300 Heywood Old Rd	SD8440006490	Domestic property (multiple) (incl. farmhouses)

14.7.22 The discharge types include:

- Domestic property (single)
- Storm tank/combined sewer overflow (CSO) on sewerage network
- Wastewater Treatment works (WwTW) (not water company)
- WwTW/water collection/treatment/supply
- Pumping station on unadopted sewerage network
- Pumping station on sewerage network

14.7.23 According to MAGIC map there are no Drinking Water Safeguard Zones (Surface Water) located within the study area (Defra, 2022b).

14.7.24 The study area falls within two surface water nitrate vulnerable zones (NVZ) (Defra, 2022b). NVZs are areas designated as being at risk from agricultural nitrate pollution. Nitrate pollution is typically associated with agricultural land use rather than highways. The two NVZs in the study area are:

- Irwell/Manchester Ship Canal (Kearsley to Irlam Locks)
- River Irk (Moston Brook to River Irwell)

14.7.25 A small section of the southern end of the Proposed Scheme along the M60 lies within the River Irk NVZ.

Water-dependent designated sites

14.7.26 Within the study area there are several Sites of Biological Importance (SBI) and Local Nature Reserves (LNR) (see Chapter 9: Biodiversity and Figure 9.1 for further details):

- Hollins Vale (LNR, SBI) – ponds and small lodges[15]
- Pilsworth (SBI) – large standing water and small lodges
- Hazlitt Wood (SBI) – reedbed, swamp and fen, ponds and small lodges, aquatic invertebrates
- Philips Park and North Wood (LNR, SBI) – ponds and lodges

14.7.27 The nature conservation sites with an element of dependency upon the surface water environment, and the extent to which these sites will potentially be impacted by changes in water quality or flows, will be identified during the Environmental Statement stage. Protected species dependent upon water are discussed in the Biodiversity chapter.

Recreation

14.7.28 Within the study area, those watercourses close to Public Rights of Way (PRoW), parks (i.e. Philips Park) and within golf courses have the potential to be utilised for recreational purposes and provide amenity value.

Hydromorphology

14.7.29 Figures 14.1 and Table 14.9 present the location of all hydromorphology receptors within the study area of the Proposed Scheme. There are 14 watercourses, numerous ponds and one reservoir within the study area. Of these, any that are assessed as not having an impact from the Proposed Scheme, will not be considered further in this assessment.

14.7.30 Baselines for WFD Regulations water bodies have been included in Appendix 14.1.

[15] Lodges are man-made waterbodies created to hold water for industrial processes in Greater Manchester for the textile industry.

Table 14.9: Hydromorphology baseline and values (provisional for those watercourses/waterbodies not yet visited)

Watercourse	Description	Value
Parr Brook	The source of Parr Brook is unclear, but it is identified adjacent to Parrenthorn High School (NGR: SD 8260 0539). From its source, Parr Brook flows north towards the River Roch in Whitefield (NGR: SD 8221 0585). The watercourse is largely culverted and, where surveyable, exhibits a straightened channel comprising of a silt bed substrate and lined by grazed grasses. Banks are heavily poached, and there is some vegetation on bed of the watercourse leading to some flow variation.	Medium
Brightley Brook	Watercourse not visited due to access issues, therefore baseline conditions assessed via desk study. Straightened channel which has its source at coal pits farm (NGR: SD 84020 09230), north-east of the M60. No morphological features visible. Watercourse is culverted beneath a road. Three online reservoirs and a bypass channel.	Medium
Hollins Brook	Watercourse not visited due to access issues, therefore baseline conditions assessed via desk study. Originating from coal pits farm (NGR: SD 84020 09230), where it flowed as Brightley Brook. Flows as Hollins Brook following the confluence with Castle Brook, north of the M60. Largely straight channel with some gentle sinuosity. Evidence of bedforms and other morphological features present. Several weirs and culverts.	Medium
Whittle Brook	Watercourse not visited due to access issues, therefore baseline conditions assessed via desk study. Sinuous channel originating north of Middleton (NGR: SD 84370 08860) and flows west to confluence with Hollins Brook. Evidence of localised erosion and morphological features present. No modifications found along the watercourse.	Medium
Castle Brook	A largely straightened watercourse, with some evidence of lateral adjustment, originating from Unsworth Moss Farm (NGR: SD 83380 06910) from where it flows north towards Whittle Brook at Thurston Fold Farm (NGR: SD 8260 0800). Where surveyed, dredging and modification to channel form has disconnected Castle Brook from its flood plain, whilst a largely silted bed, on account of adjacent land use (golf course and agriculture) facilitates the colonisation of vegetation along much of the channel. Additionally, several footbridges and culverts cross the watercourse.	Medium
Bradley Brook	A largely straight channel originating at Park Lane (NGR: SD 79970 04960), north of the M60, from where it flows south towards a culvert which allows the watercourse to flow beneath the M60. From the outlet, Bradley Brook exhibits a sinuous planform and continues to flow south-west towards a confluence with the River Irwell in Prestwich along a confined valley where it is fed by the Tributary of Bradley Brook 1. The channel exhibits little evidence of morphological features upstream of the M60. Downstream, erosion and morphological features including pool-riffles and step-pool sequences are evident. Further downstream of the Tributary of Bradley Brook 1, sand bars are present enabling further sinuosity as the channel confinement reduces.	Medium
Blackfish	Small and (largely) naturally straight watercourse originating north of Heaton Park (NGR: SD 8325 0536) and flows south-east toward confluence with River Irk at Higher Blackley. North of Heaton Park, Blackfish comprises a heavily silted channel with no evidence of significant river processes, whilst in Heaton Park an active channel lined by silt and small gravels influencing some variation in flow. No significant erosion or depositional features observed.	Medium
Tributary of Bradley Brook 1	A straight drainage channel originating in south of the M60 in Prestwich (NGR: SD 80590 04520), from where it flows south-west towards its confluence with Bradley Brook. Where visible on the field survey, this watercourse exhibited little in natural processes and morphological features. A culvert crossing was observed which caused flows to pond upstream where siltation was present.	Low

Watercourse	Description	Value
Castle Brook Tributary	Straight drainage channel originating from Pike Fold golf club (NGR: SD 82690 06410), east of the M66, and flows typically north-east towards a confluence with Castle Brook. No morphological features likely as watercourse was largely dry with pockets of imperceptible flows observed. No modifications present.	Low
Tributary of Castle Brook Tributary	Straight drainage channel originating from Lower Droughts Farm (NGR: SD 83440 06290) and flows north-west towards Castle Brook. Watercourse is culverted beneath the M62 and an access track further north. No morphological features observed, as the channel was comprised of imperceptible flows.	Low
Western Tributary of Parr Brook	A straightened watercourse originating at Tamar Close, Whitefield (NGR: SD 8143 0565) and flows north-east toward Parr Brook at a culverted confluence (NGR: SD 8151 0620). The watercourse is largely culverted but, where observed, it displays a channel devoid of river processes and depositional features. The open channel is heavily influenced by surrounding land use which is open green space within a residential area.	Medium
Tributary of Parr Brook 2	A culverted watercourse originating in Whitefield (NGR: SD 8222 0581) and flows south-west to a culverted confluence with Parr Brook (NGR: SD 8222 0562). As the watercourse is entirely culverted, this was not visited during surveys, however with it being culverted, it is unlikely to comprise any significant river processes or depositional features.	Low
Tributary of the River Irk 1	A straightened watercourse where some lateral adjustment has been observed during surveys. The tributary of the River Irk has its source in Parkwood Cottages (NGR: SD 8364 0555), from where it flows north-east towards a bend and then south-east towards a confluence with the River Irk (NGR: SD 8404 4473). Watercourse situated in a steep valley where benches, berms and riffles occur within a gently sinuous reach immediately downstream of a culvert. Elsewhere, no significant river processes or depositional features observed.	Medium
Unnamed Watercourse 1	Watercourse not visited due to access issues, therefore baseline conditions assessed via desk study. Straight drainage channel originating at Heywood Farm and typically flowing south-east towards the River Irk in Rhodes (NGR: SD 83640 05550). No morphological features likely. Culverted beneath residential estate in Rhodes.	Low
Heaton Park Reservoir	Waterbody not visited, therefore baseline conditions assessed via desk study. Artificial water body, in which no natural features and processes are likely.	Low
Ponds and lakes	There are several ponds within the study area, most appearing to be man-made and either used for treatment or ornamental purposes. No natural processes observed in the ponds.	Low

Groundwater

Geology and aquifers

14.7.31 Chapter 10: Geology and Soils provides the baseline information for the geology beneath the Proposed Scheme. The groundwater study area covers a larger extent, i.e. up to 2km from the provisional Order Limits, compared to the 250m buffer used for Chapter 10. Whilst the groundwater study area differs in size, the bedrock and superficial geology are expected to be broadly similar to that described in Chapter 10. Therefore, most of the formations and deposits described within 250m of the Proposed Scheme are also expected to be present within 2km. However, where differences exist for superficial geology and bedrock geology these are identified in Table 14.10 and Table 14.11 respectively.

14.7.32 The mapped superficial deposits within the groundwater study area are classified mainly as secondary A and secondary undifferentiated aquifers (Defra, 2022), with pockets of unproductive strata and a high degree of variation in permeability (Table 14.10) (BGS, 2020). However, a detailed review of lithological information provided in borehole records shown on the BGS GeoIndex website (BGS, 2020), indicates that made ground deposits are extensive throughout the provisional Order Limits, which is to be expected given the presence of the existing motorway and motorway junctions. Made ground was shown to comprise predominantly sand and gravel (sometimes with clay) to a maximum depth of 12.8m along the western edge of M60 J18. As described in Chapter 10, a large area of infilled ground also borders the M66 to the east and is a registered landfill site (Pilsworth South Landfill).

14.7.33 The bedrock and superficial aquifer designations[16] are included in Figure 14.3.

Table 14.10: Superficial aquifer information for the groundwater study area

Geological unit	Description	Aquifer designation	Permeability index	Hydrogeology
Glacial till (diamicton)	Variable lithology, typically sandy, silty clay, with pebbles, but can contain gravel-rich, or laminated sand layers.	Secondary Undifferentiated	Mixed flow, high to low permeability	Typically acts as an aquitard or aquiclude but can locally comprise productive sand and gravel horizons, which may yield limited amounts of groundwater, although groundwater abstraction is unlikely.
Peat	An accumulation of wet, dark brown, partially decomposed vegetation, or an organic rich clay.	Unproductive strata	Mixed flow, low to very low permeability	Typically comprises 90% water and acts as an aquitard, limiting groundwater discharge. Permeability varies with the degree of decomposition and soil compression and often reduces with depth.
Glacio-lacustrine deposits	Devensian clay and silt.	Unproductive strata	Intergranular flow, very high to high permeability	Clay constituent typically causes this unit to act as an aquitard or aquiclude. Despite containing occasional productive silt/sand horizons, the limited extent and thickness of these deposits makes groundwater abstraction unlikely.
Glacio-fluvial/ glaciofluvial ice contact deposits	Sand and gravel, locally with lenses of silt, clay or organic material.	Secondary A	Intergranular flow, very high to high permeability	Sand and gravel constituents may locally yield significant groundwater volumes where deposits are of sufficient thickness. The aquifer may contain perched water tables above discontinuous clay lenses. Local groundwater abstraction possible.

[16] There may be minor discrepancies between the bedrock and superficial aquifer designations shown on Figure 14.3 compared to what is currently shown on the BGS GeoIndex website. This may be due to updated datasets received by the Environment Agency, or an error within the shapefile classification. This will be reviewed for the Environmental Statement.

Geological unit	Description	Aquifer designation	Permeability index	Hydrogeology
Hummocky (moundy) glacial deposits	Lithologically diverse deposits, composed of rock debris, clayey till and poorly-to well-stratified sand and gravel.	Secondary Undifferentiated	Intergranular flow, very high to high permeability	Sand and gravel layers are the productive horizons, but the dominance of clay likely causes this unit to act locally as an aquitard. Groundwater abstraction is unlikely.
Alluvium	Typically soft to firm, consolidated compressible silty clay, that can contain layers of silt, sand, peat, basal gravel, and a desiccated surface zone.	Secondary A	Intergranular flow, high to very low permeability	Where sand/gravel layers are thick and continuous, groundwater yields will be high, making local groundwater abstraction possible, although the dominance of clay in this unit may limit its potential as an aquifer.
Head	Comprises sand and gravel, locally with lenses of silt, clay or peat and organic material.	Secondary Undifferentiated	Mixed flow, high to very low permeability	The extent and thickness of these deposits limits the available groundwater yield contained within the more productive sand and gravel horizons and groundwater abstraction is therefore unlikely. The unit may contain multiple perched water tables above discontinuous clay/peat lenses.
River terrace deposits*	Sand and gravel, locally with lenses of silt, clay and peat.	Secondary A	Intergranular flow, very high to high permeability	Sand and gravel deposits will typically comprise high porosity and high permeability and can locally yield significant groundwater volumes if clay lenses are infrequent and sand/gravel deposits are of sufficient thickness. Local groundwater abstraction possible.
**River terrace deposits lie outside of the 250m buffer used for Chapter 10: Geology and Soils but are shown to be present within the groundwater study area, located 365m east of the provisional Order Limits at their closest point.*				

14.7.34 Bedrock formations within the groundwater study area are listed in Table 14.11, and typically comprise several individual members and beds. The aquifer designations are therefore discussed at the formation level only.

14.7.35 The Pennine Coal Measures Group (hereafter referred to as Coal Measures) and the Rossendale Formation are Carboniferous in age, and designated as Secondary A bedrock aquifers, the former of which underlies a large part of the Proposed Scheme. The younger Permo-Triassic Chester and Collyhurst sandstone formations, present at depth beneath the southern and western parts of the groundwater study area, comprise Principal bedrock aquifers. Units of mudstone (belonging to the Permian age Manchester Marls Formation), are shown to have been thrust between the sandstone bearing strata of the Chester Formation, by extensive faulting in the area, and are classified as Secondary B aquifers. The permeability index as defined by the BGS (BGS, 2020), and descriptions of the likely hydrogeological characteristics of the strata, are also provided in Table 14.11.

Table 14.11: Bedrock aquifer information for the groundwater study area

Geological unit	Description	Aquifer designation	Permeability index	Hydrogeology
Pennine Lower Coal Measures Formation	Carboniferous mudstone, siltstone and sandstone	Secondary A	Fracture flow, high to low permeability	Complex multi-layered aquifer. Argillaceous strata dominate, acting as aquitards or aquicludes, isolating the occasional sandstone horizons which act as separate aquifers and constitute up to a third of the succession in the Manchester area. This is where most of the groundwater storage / movement occurs as both intergranular and fracture flow. Faulting has split the once continuous sandstone horizons into discrete blocks, to which no direct recharge can occur. The mining of numerous coal seams has been extensive and has largely disrupted the natural hydrogeological conditions, by the creation of open shafts which have for example connected layers which were previously isolated
Pennine Middle Coal Measures Formation		Secondary A	Fracture flow, moderate to low permeability	
Pennine Upper Coal Measures Formation		Secondary A	Fracture flow, moderate to low permeability	
Chester Formation	Permo-Triassic coarse to fine-grained sandstone	Principal	Mixed flow, high to moderate permeability	Part of the Sherwood Sandstone Group and is in hydraulic continuity with the other four formations in this group. Stratification due to layers of siltstones and mudstones can isolate sandstone layers, creating perched water tables throughout the formation. Mudstone beds are laterally discontinuous and unlikely to constitute regional hydraulic barriers
Collyhurst Sandstone Formation*	Permian soft red sandstone with a millet seed texture (aeolian origin)	Principal	Intergranular flow, high permeability	Poorly cemented sandstone with a high hydraulic conductivity. Its increased thickness and intense faulting in the Manchester area permits a free interflow at many points with the Sherwood Sandstone Group above
Manchester Marls Formation	Permian fine-grained marl (mudstone), with beds of coarser material and thin, carbonate-rich deposits including evaporites	Secondary B	Fracture flow, low permeability	Consists mainly of mudstones of low hydraulic conductivity which inhibit vertical hydraulic continuity in the Manchester area. Predominantly an aquitard in this area
Rossendale Formation* (Rough Rock Formation)	Carboniferous fine to very coarse-grained and pebbly sandstone, interbedded with siltstone, mudstone, marine shales, thin coals and seatearths	Secondary A	Fracture flow, low permeability	Constitutes an important aquifer horizon in the Lower Coal Measures

Geological unit	Description	Aquifer designation	Permeability index	Hydrogeology
*The Collyhurst Sandstone Formation and Rossendale Formation lie outside of the 250m buffer used for Chapter 10: Geology and Soils but are shown to be present within the groundwater study area, located 420m west and 1.3km north-east of the provisional Order Limits at their closest points, respectively.				

Groundwater levels

14.7.36 BGS data show that there are three main areas within the provisional Order Limits for the Proposed Scheme with potential for groundwater flooding to occur at surface level or to property or infrastructure situated below ground level (BGS, 2022a). These three areas are shown on Figure 14.8 and generally include:

- Most of the area in and around M60 J18, extending north to Unsworth along the M66
- Between M60 J17 and J18 around Oak Bank and north of Parrenthorn Road
- In the far west, to the west of M60 J17

14.7.37 The remainder of the area within the provisional Order Limits is considered to have limited potential for groundwater flooding to occur.

14.7.38 A high-level assessment of groundwater levels reported in the BGS borehole records has also been undertaken. A total of 132 boreholes are located within the provisional Order Limits, as shown on the BGS GeoIndex website (BGS, 2020). Out of these, 56 borehole logs recorded groundwater level information, either as a groundwater strike, seepage, or noted the fact that the borehole was dry during drilling. Where recorded, groundwater strikes, and seepages were generally less than 3m below ground level (mbgl) (see Table 14.12). In most instances, groundwater was encountered within the made ground deposits, with some groundwater strikes recorded in the underlying superficial strata (where made ground was less than 1.2m deep). Given that only four out of the 132 BGS borehole records reached bedrock, and none of the four borehole logs recorded any groundwater level information, it is not possible at this stage to assess the hydrogeology of the bedrock aquifers within the groundwater study area, nor their interactions with overlying unconsolidated deposits.

14.7.39 The groundwater strike data shown in Table 14.12 indicate that groundwater is typically encountered in the sand and gravel deposits associated with the made ground or glaciofluvial deposits but can also be encountered in clay (belonging to the made ground or glacial till). The mapped locations of the four historic borehole records listed in Table 14.12 (with groundwater levels of less than 1mbgl), broadly correlate with the three areas of highest susceptibility to groundwater flooding listed in paragraph 14.7.36.

Table 14.12: Depth of groundwater strikes in BGS borehole records and the geological strata in which the strikes were recorded

Groundwater strike depth (mbgl)	No. of boreholes/trial pits
0 to 1	4
1 to 2	10
2 to 3	4

Groundwater strike depth (mbgl)	No. of boreholes/trial pits
Deeper than 3	2
Strata for groundwater strike	**No. of boreholes/trial pits**
Made ground (gravel and cobbles)	6
Made ground (sand)	4
Made ground (clay)	5
Superficials (sand)	2
Superficials (clay)	3

14.7.40 No formal groundwater monitoring has been completed to validate groundwater levels as part of the Proposed Scheme to date, notably during the winter period when groundwater levels are expected to be at their highest. Groundwater monitoring is planned to be undertaken in several boreholes across the Proposed Scheme to gain an understanding of baseline groundwater levels, fluctuations, and quality in the area. The groundwater monitoring data (where available as part of the GI) will be used to inform the groundwater assessment for the Environmental Statement.

Connection to hydrological features

14.7.41 The local groundwater may be connected (either directly or indirectly) to watercourses (as baseflow, sinks, sources, spreads, collects, issues etc.), and spring discharges. Changes to groundwater quality and levels beneath the Proposed Scheme may therefore influence water quality and / or flows in these watercourses/hydrological features. Table 14.13 provides details of the springs, sinks, spreads and collects identified from Ordnance Survey maps/historical maps within the groundwater study area. Of particular note are the four springs located along St George's Road (adjacent to the M66), within Unsworth Cricket Club, Whitefield Golf Club and to the north of Parrenthorn Road; all of which lie within 100m of the provisional Order Limits and could therefore experience the most significant impacts.

14.7.42 "Issues" marked on Ordnance Survey/historical maps have not been listed in Table 14.13, on the basis that they typically relate to drainage infrastructure (such as culvert outfalls), rather than being indicative of shallow groundwater emergence. However, as the marked "issues" shown on Figure 14.4 have not yet been surveyed, it is not possible to validate their presence or type. As a result, for the purposes of the PEIR, they have been conservatively treated as high value receptors (spring discharges in this instance) with hydrogeology site walkovers planned for the Environmental Statement stage to refine this understanding, and to identify which (if any) "issues" require reclassification and further detailed assessment. At Environmental Statement stage, ground truthing will only be conducted for those "issues" which fall within the radius of likely impacts from groundwater dewatering, of which there are currently none for any the proposed cuttings. It should be noted, however, that there are two "issues" that lie within the east of the provisional Order Limits. One is located immediately north of the Northern Loop, and the second lies 140m south of the Proposed Scheme, to the south of M60 J18 (see Figure 14.4).

Table 14.13: Hydrological features in the groundwater study area

Location	NGR	No. of discharge points/features	Distance from provisional Order Limits
Springs			
North of Simister Lane	SD8359706127	1	110m east
Clifton Junction	SD7928402870	2	1.86km south-east
Nuttall Wood North	SD7830405018	1	1.92km west
Hurst Farm North	SD7841705197	1	1.82km west
A56/Hollins Brow	SD8080207703	2	1.36km west
Blackley Crematorium	SD8409103812	1	1.7km south-east
Schoolside Lane	SD8485805563	1	1.27km east
Heaton Park Golf Course East	SD8407704789	1	800m southeast
Hazlitt Wood South	SD8331604730	1	570m south
Woodgate Drive	SD8217804814	1	495m south
Heaton Park Northwest	SD8278604564	1	630m south
Butt Hill Road	SD8162803108	1	1.73km south
M60 Eastbound	SD7990604469	1	210m west
Philip's Park South	SD7993203894	1	715m south-west
Philip's Park Southwest	SD7948403771	1	985m south-west
Clifton Junction North	SD7928902925	1	1.79km south-west
Unsworth Cricket Club	SD8225606866	1	85m west
St George's Road	SD8216807617	1	15m west
Hollins Brow North	SD8094507994	1	1.2km west
Hollins Vale South	SD8189208221	1	270m north-west
Parr Fold	SD8169706692	1	680m west
Blackley Close	SD8144206698	1	920m west
Whitefield Golf Club South	SD8043204861	1	40m north
Parrenthorn Road North	SD8224505532	1	0m (within southern edge)
Sinks			
Clifton Junction	SD7928902925	2	1.8km south-west
Drinkwater Park South	SD8052102447	2	2km south
Drinkwater Park	SD8039502707	1	1.7km south
Philip's Park South	SD7990703849	2	600m south-west
Ringley Woods East	SD7870004141	1	1.5km west
Pike Fold Golf Course East	SD8348206914	1	140m east
Boothroyden	SD8479204609	2	1.45km south-east
Heaton Park	SD8278104210	1	810m south
Heaton Park South	SD8308203903	1	1.26km south

Location	NGR	No. of discharge points/features	Distance from provisional Order Limits
Heaton Park Golf Course East	SD8391405114	1	485m south-east
Old Hall Lane	SD8418004818	1	780m south-east
Baguley Crescent	SD8441305121	1	910m south-east
Water Farm House North-east	SD8194510049	1	1.9km north
Moss Hall Road	SD8273009992	1	1.9km north-east
Spreads			
Blackley Crematorium West	SD8409103812	2	1.55km south-east
Rhodes Northwest	SD8458605474	1	1.0km east
Thurston Fold North	SD8287507930	1	510m north-east
Water Farm House West	SD8148209727	1	1.8km north
Roach Bank Road North	SD8163309444	1	1.36km north
Pilsworth Road North	SD8198109208	1	1.2km north
Collects			
Blackley Crematorium West	SD8409103812	3	1.5km south-east
Rhodes Northwest	SD8458605474	1	1.1km east
Thurston Fold North	SD8287507930	1	590m north-east
Heaton Park South	SD8308203903	1	1.3km south
Snape Hill Wood Northeast	SD7920205049	1	1.1km west
**NB. There are no "sources" shown on Ordnance Survey maps within the groundwater study area*			

Groundwater as a resource

14.7.43 There are no SPZs within the groundwater study area or its vicinity (Defra, 2022). This indicates that there are no licensed groundwater abstractions used for public water supply.

14.7.44 Seven licensed groundwater abstractions have been identified within the groundwater study area for the Proposed Scheme (Defra, 2022a) (see Figure 14.4). As shown in Table 14.14, all of these abstractions are associated with industrial/commercial uses, primarily for spray irrigation (for golf courses), or food and drink processing water. Licensed groundwater abstraction information for Pilsworth Landfill/Quarry, located 800m north of the provisional Order Limits, suggests that active dewatering is taking place at this site, which will be confirmed at the Environmental Statement stage.

Table 14.14: Licensed groundwater abstractions in the groundwater study area (Defra, 2022a)

License no.	Name (and no. of abstraction points)	Distance from provisional Order Limits	Maximum annual quantity (m^3/yr)	Aquifer	NGR	Primary use of abstraction
2569002273/R01	Borehole at Hills Lane (1)	265m east	8,000	Coal Measures	SD8264706975	Industrial, commercial, and public services
NW/069/0002/013	Sump 'A' at Pilsworth Landfill Site (1)	780m north	-	Carboniferous Limestone Series	SD8231408875	Industrial, commercial, and public services
2569002264R02	Borehole at Bury Golf Club (1)	1.23km west	7,000	Coal Measures	SD8096307673	Industrial, commercial, and public services
2569004042	Borehole at Premises (Stanley Road) (1)	1.22km north-west	7,000	Permo-Triassic Sandstone	SD809063	Industrial, commercial, and public services
2569004052	Borehole at Whitefield Golf Club (1)	380m north	8,000	Coal Measures	SD80420538	Industrial, commercial, and public services
2569004053	Borehole at Stand Golf Club (1)	1.19km north-west	9,000	Superficial Deposits	SD7975405858	Industrial, commercial, and public services
2569004002	Boreholes at Clifton Junction (4)	1.59km to 1.87km south-east	945,568	Permo-Triassic Sandstone	SD7968402769	Industrial, commercial, and public services

14.7.45 Groundwater abstractions of less than 20m^3/day do not require a licence. The location of unlicensed groundwater abstractions, or private water supplies (PWSs), may be recorded by the local authority, and this information will be obtained for the Environmental Statement. It should be noted however, that for most PWSs there is an onus on the abstraction owner to provide details to the local authority. As such, there may be other PWSs which the local authority is not aware of. If, following receipt of PWS information from the local authority, potential data gaps are thought to remain, a targeted approach will be undertaken for confirming the presence of PWSs for the Environmental Statement. This may include for example, questionnaires being sent to local residents (that lie within a predetermined buffer), and PWS surveys to ground truth the presence of these assets (if/where required).

14.7.46 As shown in Table 14.15, there are six wells shown on OS maps within the groundwater study area, and a further 65 wells shown on historical maps (see Figure 14.4). The closest well, according to present-day Ordnance Survey mapping, lies 160m east of the

provisional Order Limits; located just east of Croft Avenue. However, these wells may not necessarily indicate the presence of PWSs (i.e. they may be redundant wells; particularly those identified from historical sources).

Table 14.15: Wells marked on Ordnance Survey maps in the groundwater study area

Location	NGR	Distance from provisional Order Limits
Hazlitt Wood West	SD8326805056	220m south
Woodland View	SD8061204094	470m south
Hill Crest	SD7912104174	1.2km west
Hollins Vale North	SD8163508390	580m north-west
Simon Lane	SD8434806825	1km east
Croft Avenue	SD8366405938	160m east

14.7.47 As groundwater users may be particularly vulnerable to any disruptions to groundwater flow, provision and quality, potential effects to all licensed and unlicensed groundwater abstractions will be considered further in the Environmental Statement.

14.7.48 Discharges of liquids to ground or groundwater may be occurring within the groundwater study area. As shown on Figure 14.4, three licensed groundwater discharges have been identified (Defra, 2022a), the closest of which lies 110m south of the provisional Order Limits at St George's Church (see Table 14.16). The types of discharges are currently unknown, as are the licensed maximum discharge rates. These additional data will be confirmed at the Environmental Statement stage (if/where required).

Table 14.16: Licenced groundwater discharges in the groundwater study area (Defra, 2022a)

License no.	Name	Distance from provisional Order Limits
S/151/S	St George's Church	110m south
S/280/S	Mount Pleasant Farm	510m east
S/314-03/S	Mellowdew Cottage	280m south

GWDTE

14.7.49 Three locally designated ecological sites (see Chapter 9: Biodiversity) have been identified within the initial 250m screening buffer, from the provisional Order Limits (see Figure 14.5). A summary of their ecological designation and initial groundwater dependency classification is provided in Table 14.17. A detailed assessment of the baseline conditions at each GWDTE site is provided in Appendix 14.3: GWDTE Assessment, along with a description of the GWDTE assessment methodology adopted for the PEIR stage. A full assessment of GWDTE will be undertaken for the Environmental Statement, which will include an assessment of potential GWDTE that do not have an ecological designation. The assessment would comprise of field surveys, if appropriate, use of ecology survey data to identify additional potential GWDTE sites, and consultation with the Lancashire Wildlife Trust (where appropriate).

Table 14.17: Potential GWDTE and an initial assessment of their groundwater dependency

Ecologically designated site name	Initial assessment of potential groundwater dependency
Hazlitt Wood SBI	Low to high
Hollins Vale LNR, SBI, and Hollins Plantation SBI	Low to high
Philips Park and North Wood LNR and SBI	Moderate to high

Groundwater quality

14.7.50 Groundwater quality information for the two main bedrock aquifers underlying the groundwater study area is provided in two Environment Agency reports (Griffiths *et al.*, 2003; Cheney, 2007). The key points of pertinence to this assessment are summarised below. Note that no published groundwater quality information is available for the superficial aquifers within the groundwater study area.

14.7.51 The Permo-Triassic Sandstone aquifer comprises a predominantly calcium bicarbonate type groundwater, the baseline chemistry of which is thought to be primarily influenced by the dissolution of carbonate and dolomite cements (Griffiths *et al.*, 2003). As a result, it is likely that shallower parts of the aquifer have been decalcified, i.e. the original calcite has been dissolved, reflected by low alkalinity and pH values. The presence of thick, relatively impermeable superficial deposits over much of the aquifer may also permit reducing conditions to exist, even at shallow depths, resulting in high iron and manganese concentrations, but low nitrate concentrations (due to denitrification). Saline groundwater has occurred in parts of Greater Manchester, most notably in the Trafford Park area and near Chat Moss. This has been attributed to the dissolution of halite derived from the Triassic Mercia Mudstone Group, which overlies the sandstone aquifer in the Cheshire area to the south. Given the absence of this particular geology beneath the groundwater study area, saline groundwater from this source is unlikely to be a concern for the Proposed Scheme.

14.7.52 Coal Measures groundwater is typically dominated by calcium, magnesium, and bicarbonate ions (Cheney, 2007). However, elevated concentrations of chloride and iron in groundwater from deep coal mines can also be encountered. Reducing conditions are common throughout the Coal Measures, with the evolution of methane and hydrogen sulphide often reported. Mining activities tend to lower the level of the groundwater table, allowing oxidation of certain minerals (for example pyrite) within the coal measures, and the production of iron oxide and sulphate. On the cessation of mine dewatering, groundwater levels rise, and dissolved concentrations of sulphate, arsenic, iron, and other metals increase in the groundwater. This can result in localised areas of acid groundwater conditions within mined areas. Such conditions may exist in the far west of the provisional Order Limits for the Proposed Scheme where the potential for underground coal mining exists. Where mine-impacted groundwater discharges (whether this be naturally or artificially), this can lead to rust-coloured watercourses due to precipitation of some or all of the dissolved iron to form the red, orange, or yellow ochreous sediments in the bottom of channels and banks.

14.7.53 Groundwater quality data for the study area have been requested from the Environment Agency and are also expected to be collected as part of the GI. Both sources of groundwater quality data will be considered in the groundwater assessment for the Environmental Statement (where available).

Land use, mineral extraction and groundwater vulnerability

14.7.54 As described in Chapter 10: Geology and Soils, underground coal mining last took place in 1970, in a coal seam located within 250m of the provisional Order Limits (western extent), and between 430 and 460m depth. Groundwater regimes would therefore have likely equilibrated since cessation of the works. However, mine entry points, abandoned mines, and development high risk areas are also shown in and around M60 J17 (Coal Authority, 2020). With the provisional Order Limits situated within the centre of multiple coal seams (BGS, 2022a), the potential for underground coal mining and unrecorded mine workings, shafts, or adits cannot be discounted.

14.7.55 There is one (revoked) potentially contaminated land site located 1.0km south-east of the provisional Order Limits, at Kelvin Avenue former landfill site (Environment Agency, 2022d). Potential other sources of groundwater contamination may include:

- Historic landfill sites (shown in Figure 14.4), the closest of which comprise land to the south of Whitehouse Farm, and land to the west of the M60 motorway, both of which lie adjacent to the M60
- Railway infrastructure
- Current and former industrial sites and fuel stations
- Pulverised Fuel Ash (PFA) / made ground deposits associated with the existing motorway junction

14.7.56 Further details are provided in Chapter 10: Geology and Soils.

14.7.57 The groundwater vulnerability map (Defra, 2022b) shows that the majority of the Proposed Scheme lies on aquifers with medium-high or medium vulnerability. That is, areas where pollutants from accidental spillages, ground disturbance etc. can easily transmit to groundwater (typically characterised by high-leaching soils and an absence of low-permeability superficial deposits) but also includes areas that offer some degree of groundwater protection. Small areas of low vulnerability are also present, which correlate with the mapped extent of peat deposits, and typically provide the greatest protection to groundwater from pollution due to the presence of low-leaching soils and / or low-permeability superficial deposits.

WFD Compliance

14.7.58 Baselines for WFD Regulations surface water and groundwater bodies (and associated receptors such as GWDTEs) are provided in Appendix 14.1: Water Framework Directive Regulations Assessment, which will be updated for the Environmental Statement (where appropriate). No designated WFD Regulations surface water bodies interact with the Proposed Scheme, but it does interact with non-designated hydrological pathways (or tributaries) to four WFD Regulations surface water bodies:

- Roch (Spodden to Irwell) (GB112069064600)
- Whittle Brook (Irwell) (GB112069061250)
- Irk (Wince to Irwell) (GB112069061131)
- Irwell (Croal to Irk) (GB112069061451).

14.7.59 There are two WFD Regulations groundwater bodies (Environment Agency, 2020) within the groundwater study area. The Northern Manchester Carboniferous Aquifers (GB41202G101800) are achieving poor overall status as of 2019, with good quantitative status and poor chemical status. The Manchester and East Cheshire Permo-Triassic Sandstone Aquifers (GB41201G101100) are also achieving poor overall status (2019) both with poor chemical and quantitative status.

Flood risk

14.7.60 A Preliminary FRA (Appendix 14.4) has been prepared for the Proposed Scheme in accordance with NPS NN requirements. A full description of the flood risk baseline is presented in the Preliminary FRA and summarised below.

Fluvial flood risk

14.7.61 The Environment Agency's Flood Map for Planning (Environment Agency, 2021c) defines flood zones as:

- Flood Zone 3: areas with greater than a 1% (1 in 100 year) AEP of fluvial flooding
- Flood Zone 2: areas with between 0.1% (1 in 1000 year) and 1% (1 in 100 year) AEP of fluvial flooding
- Flood Zone 1: areas with less than 0.1% (1 in 1000 year) AEP of fluvial flooding

14.7.62 The baseline fluvial flood risk from Main Rivers within the study area, from north to south is summarised in Table 14.18 and presented in Figure 14.6.

Table 14.18: Summary of baseline fluvial flood risk from main rivers

Watercourse	Baseline fluvial flood risk
Hollins Brook	Hollins Brook flows in a north-westerly direction through the study area passing underneath the M66 approximately 2.5km north of M60 J18. The river has areas classified as Flood Zone 2 and 3 although they are typically within the river corridor. The M66 is raised at the crossing on an embankment so although the Environment Agency Flood Zone mapping suggests the carriageway is at risk of flooding, this is not considered likely and the risk is very low.
Whittle Brook	Whittle Brook flows north-westerly into the study area to its confluence with Castle Brook, approximately 650m upstream of the Hollins Brook crossing of the M66. The river has areas classified as Flood Zone 2 and 3 although they are typically within the river corridor.
Brightley Brook	Brightley Brook flows south-eastwards into the study area to its confluence with Hollins Brook, approximately 300m upstream of the latter's crossing of the M66. There are areas of Flood Zone 2 and 3 associated with this watercourse.
Castle Brook	Castle Brook rises to the north-east of M60 J18 and flows northwards parallel and approximately 400m to the east of the M66. It is designated as a main river from the confluence of three smaller watercourses approximately 750m north of M60 J18 to where it meets Whittle Brook approximately 1.4km downstream. There is no Flood Zone 2 or 3 attributed to this watercourse beyond the river channel.
Parr Brook	Parr Brook rises to the north of the M60 approximately 600m to the north-west of M60 J18. It flows northwards to its confluence with the River Roch approximately 4.2km downstream at Blackbridge. The river runs approximately 600m to the west of the M66. The majority of this watercourse has no Flood Zone 2 or 3 attributed to it beyond the river channel with the exception of the residential area between Parr Lane and Mersey Drive, Simister, although the majority of this stretch is culverted.

14.7.63 The majority of the study area is located within Flood Zone 1 and there are no areas of the Proposed Scheme that interact with Flood Zones 2 or 3.

14.7.64 Ordinary watercourse is the term used to define all remaining rivers/watercourses within the UK not designated as main rivers. Activities on these watercourses are administered by the Lead Local Flood Authority (LLFA), in this location that is Bury Metropolitan Borough Council. The Greater Manchester SWMP mapping (JBA Consulting, 2012) has also been reviewed to inform the assessment of the fluvial flood risk for the smaller watercourses not evident in the Environment Agency's Flood Map for Planning.

14.7.65 There are eight ordinary watercourses within the study area. The tributary of Parr Brook passes in culvert under the M60 and Bradley Brook, where Outfall 6 (Figure 14.2) passes under the M60. The Proposed Scheme is anticipated to generate road runoff and flows to be attenuated (see Table 14.19).

Table 14.19: Summary of ordinary watercourses within the study area

Watercourse	Fluvial flood risk
Ordinary Watercourse 1 (Tributary of Parr Brook)	This watercourse rises to the north of the M60 in Whitefield and flows northwards through Thatch Leach Lane park to join Parr Brook. There is no surface water flow path evident from the RoFSW (Environment Agency, 2022f) mapping in the vicinity of the Proposed Scheme attributable to this watercourse.
Ordinary Watercourse 2 (Tributary of Castle Brook)	This watercourse rises to the north of M60 J18 and flows eastwards away from the M66 to join Ordinary Watercourse 3 and then Castle Brook approximately 450m east of the motorway. The watercourse forms the boundary of the provisional Order Limits and therefore it is not anticipated to impact the Proposed Scheme during operation.
Ordinary Watercourse 3 (Tributary of Castle Brook)	This watercourse rises south of the M62 and flows northwards crossing the motorway approximately 530m north-east of the M60 J18 and flows north-westwards parallel to the M66 to join Ordinary Watercourse 2 and then Castle Brook approximately 450m east of the M66. Flood extents based on the RoFSW (Environment Agency, 2022f) are within the river channel except for an area south of Egypt Lane, although that is outside the provisional Order Limits.
Ordinary Watercourse 4 (Tributary of Castle Brook)	This watercourse rises approximately 330m north-west of the M62 and flows south-westwards to join Castle Brook at the same point as Ordinary Watercourses 2 and 3. It flows parallel and approximately 40m north-west of Egypt Lane. Based on the RoFSW (Environment Agency, 2022f) flooding is retained in the river channel except for an area at the head of the watercourses approximately 1km north-east of M60 J18 and outside the provisional Order Limits.
Ordinary Watercourses 5, 6 & 7 (Tributaries of the River Irk)	These three ordinary watercourses rise within the study area to the east of the M60 south-east of M60 J18 and join to flow through farmland south-eastwards away from the Proposed Scheme to their confluence with the River Irk approximately 500m east of M60 J19. Based on the RoFSW (Environment Agency, 2022f) there are areas of flood risk attributed to these watercourses but not that intersect the provisional Order Limits.
Ordinary Watercourse 8 (Tributary of the Bradley Brook)	This watercourse rises to the north of the M60 in Whitefield Golf Club at the western end of the Proposed Scheme. It flows southwards crossing under the motorway approximately 700m to the west of M60 J17. Continuing southwards it joins Bradley Brook 250m south of the M60. The RoFSW (Environment Agency, 2022f) indicates areas of flood risk to the north of the M60 in the golf course which are outside the provisional Order Limits. There are also areas of low risk across the eastbound M60 carriageway south of Philips Park Road associated with a flow path that originates on the M60 carriageway rather than the watercourse.

Watercourse	Fluvial flood risk
Ordinary Watercourse 9 (Tributary of the Bradley Brook)	This watercourse rises to the north of the M60 in Park Lane at the western end of the Proposed Scheme. It flows southwards crossing under the motorway approximately 1.5km to the west of M60 J17. Continuing southwards it joins the Bradley Brook 500m south of the M60.

Surface water flood risk

14.7.66 Surface water (water accumulating and/or flowing across the ground surface) also presents a risk within the study area based on the Environment Agency RoFSW mapping (Environment Agency, 2021e) (Figure 14.7).

14.7.67 There are areas shown to be at risk of surface water flooding immediately adjacent to all of the main rivers and ordinary watercourses. However, these areas are largely located within the fluvial floodplain extent associated with those watercourses and are therefore likely to be associated with flows from these watercourses, and consequently are discussed in the fluvial flood risk sub-section above.

14.7.68 Other areas of surface water flood risk are located mainly within localised topographic depressions or against existing road embankments, and also the area near Outfall 4 where an attenuation pond has been proposed. It should be noted that the high-level models often used for large-scale surface water mapping do not take full account of the influence of existing drainage and culverts and may therefore overestimate flood risk in some areas.

14.7.69 There are several significant overland flow routes and other areas of high surface water flood risk within the study area. The Preliminary FRA provides further information on the location and extent of surface water flood risk across the study area.

14.7.70 There is an area of surface water ponding to the north-east of the M60 J18 where the proposed new Northern Loop would be. However, as this length of carriageway would be elevated it is unlikely to be at risk of surface water flooding.

Groundwater flood risk

14.7.71 As discussed in Section 14.7.36 BGS data show that there are three main areas within the provisional Order Limits with potential for groundwater flooding to occur at surface level, or to property or infrastructure situated below ground level (BGS, 2022a). These areas include most of M60 J18 and its immediate vicinity, the area between M60 J17 and J18 around Oak Bank and to the north of Parrenthorn Road, and in the far west of the Proposed Scheme, to the west of M60 J17. These areas are presented on Figure 14.8.

14.7.72 Where encountered, BGS borehole records show that groundwater was primarily struck within the sand and gravel dominated made ground deposits, with some groundwater strikes recorded in the underlying glaciofluvial deposits (where made ground was less than 1.2m deep). In the majority (18 out of 20) of the boreholes, groundwater was encountered at less than 3 mbgl, i.e. at a relatively shallow depth. Four boreholes had groundwater recorded at a depth of less than 1 mbgl.

14.7.73 Ordnance Survey maps and historic maps show a spring and a well located along the route of the M66 to the north of M60 J18, and a second spring just north of Parrenthorn

Road. Two “issues” are shown, one is along the northern boundary of the Northern Loop in the east of the provisional Order Limits and the other is 140m south of the provisional Order Limits, to the south of M60 J18. Two further wells are also mapped along the eastern flank of M60 J18. All of which could indicate the potential for shallow groundwater emergence in these locations.

14.7.74 The mapped locations of the springs, wells, “issues”, and the four historic borehole records with groundwater levels of less than 1 mbgl, broadly correlate with the areas of highest susceptibility to groundwater flooding. Based on this correlation, the generally shallow groundwater strike data recorded throughout the provisional Order Limits (i.e. less than 3 mbgl), and the potential for superficial deposits such as peat, and the more permeable horizons within the glacial deposits and made ground to store significant quantities of groundwater, the Proposed Scheme is conservatively considered (at this PEIR stage) to be at high risk of groundwater flooding. This will be reviewed, and refined (where appropriate), for the Environmental Statement taking into consideration available GI data.

14.7.75 Further to the above, a shallow water table can act as a direct source of groundwater flooding, but it can also indirectly affect other flooding sources and mechanisms present. Appendix 14.4: Preliminary FRA provides further information on both direct and indirect baseline groundwater flood risk across the Proposed Scheme.

Reservoir flood risk

14.7.76 The Environment Agency’s Risk of Flooding from Reservoirs mapping (Environment Agency, 2021d) presented in Figure 14.9 indicates that the M60 at J18 and its northern and southern slip roads are at risk of flooding due to the failure of a large, raised reservoir, as defined under the Reservoir Act 1975. The potential extent of reservoir flooding also reaches residential areas in Whitefield by crossing the M60 west of J18. The source of the risk is not stated but it may be Heaton Park Reservoir to the south-west of M60 J18. The flow path flows north-westwards and then follows the course of the Parr Brook.

14.7.77 All large, raised reservoirs, as defined by the Reservoirs Act 1975, are regularly inspected and maintenance is supervised by reservoir engineers. Therefore, the risk of failure is considered to be very low due to their monitoring and inspection regime and therefore reservoir flood risk will not be considered further.

Utilities

14.7.78 The Bury Council Preliminary Flood Risk Assessment (PFRA) (JBA Consulting, 2011) presents mapping to aid understanding of the volume of water discharging from the modelled sewer system during a 3.3% (1 in 30 year) AEP rainfall event. The map indicates the land and receptors in the south-west of the study area are at greater probability of sewer flooding than land in the north and east.

14.7.79 The exact location of sewer networks and water mains have not been considered at this stage but are discussed within the M60 Simister Island Drainage Strategy Report (National Highways, 2022).

Historic flood events

14.7.80 The Environment Agency's Historic Flood Map (Environment Agency, 2022c) identifies the maximum extent of recorded flood outlines from the rivers, sea and groundwater springs. A review of the map indicates there are no areas of historical flooding identified within the study area.

Future baseline

Surface water quality

14.7.81 The future baseline conditions for water quality could change as a consequence of land use changes and measures to improve water bodies in line with the WFD Regulations (2017) objectives. However, given that importance (value) is not determined by prevailing water quality there are not likely to be changes in the value assigned to identified receptors. No new receptors are expected within the study area.

Groundwater

14.7.82 In general, any new dewatering activities within the groundwater study area have the potential to reduce groundwater levels. Conversely, if existing dewatering regimes or abstractions cease, such as the licensed dewatering borehole at Pilsworth Landfill/Quarry, then groundwater levels may rise. The latter could result in increased volumes of water needing to be attenuated or conveyed by drainage systems designed for the Proposed Scheme, or their overrunning if the network capacity is unable to deal with the additional inflows. An increase in groundwater flood risk could also occur, primarily due to rising groundwater levels within the drainage area of influence, but also due to any sub-surface barriers introduced during the construction and/or operation phases of the development, that would present a greater barrier to groundwater flows than current groundwater levels suggest. For the Environmental Statement, detailed information for the licensed dewatering borehole at Pilsworth Landfill/Quarry will be requested to determine the potential impacts to and from the Proposed Scheme on groundwater bodies and associated sensitive receptors, if abstraction ceases.

14.7.83 Over the medium- and long-term, groundwater resources in the groundwater study area may be affected by climate change. However, any changes would be complex and may result in:

- A long-term decline in groundwater storage due to higher soil moisture deficits due to warmer, drier summers
- Increased frequency and severity of groundwater droughts leading to reduction in base flow to watercourses or GWDTE
- Increased groundwater flooding from high intensity summer storms

14.7.84 Baseline conditions for groundwater quality could change over the anticipated lifetime of the Proposed Scheme because of land use changes and measures to improve water bodies in line with WFD objectives and commitments made through the River Basin Management Plan(s). Consequently, it is intended that groundwater quality would generally improve on a national scale, as historical pollution sources are removed, (separate to the Proposed Scheme), and better water quality management measures are put into place.

14.7.85 Based on currently available information, there is unlikely to be a significant change in the baseline groundwater quality. Changes to the groundwater regime brought about by climate change are unlikely to affect groundwater quality within the study area, for example, increases in saline groundwaters would not be anticipated.

Flood risk

14.7.86 The Proposed Scheme is located within the Irwell Management Catchment in the North West River Basin District. In this Management Catchment it is predicted that by 2125 peak river flows could increase by 35% (central allowance), 46% (higher central allowance) and 75% (upper end allowance). Whilst the Proposed Scheme is entirely located within Flood Zone 1, this change is anticipated to increase the extent of Flood Zones 2 and 3, resulting in a risk that parts of the study area could be located in the future in Flood Zone 2 or 3. However, given the current extents this is considered unlikely. Over the anticipated lifetime of the Proposed Scheme (100 years) changes to the baseline as a consequence of climate change would likely occur, including a likely increase in the frequency and magnitude of flood events.

14.7.87 The peak rainfall intensity may also increase as a result of climate change, which could potentially increase the risk of surface water flooding to the site. The Environment Agency provides guidance on the central and upper end allowances for all of England. The total potential change anticipated up to 2115 is 30% (central allowance) and 45% (upper end allowance) in a 1% AEP event and 30% (central allowance) and 40% (upper end allowance) for a 3.3% AEP event.

Value of receptors

14.7.88 DMRB LA 113 section 3 (Highways England, 2020a) was the methodology used for the environmental assessment process. Further information on this methodology is provided below and in the Environmental Scoping Report (Highways England, 2021a). The approach to the assessment is based on the value/importance of the water features. The value is subject to change with more detailed assessment.

14.7.89 The value of receptors within the study area scoped into further assessment have been identified based upon the baseline data presented above. The value of these water receptors has been based on criteria set out in Table 3.70 in DMRB LA 113.

14.7.90 At this stage, individual ponds have not been identified within the 1km study area as the majority will not be affected and can be scoped out. Where ponds will be affected (i.e. at Pike Fold Golf Course) these have been identified in the baseline section and included in the general “ponds” category in Table 14.20. These will all be individually identified as receptors at the Environmental Statement stage. Based upon the criteria for establishing value in DMRB LA 113 the ponds identified have all been assigned the same level of value.

14.7.91 Ponds and un-named watercourses are unlikely to be of more than low value. Receptors and value will be reconfirmed during the assessment process reported in the Environmental Statement.

Table 14.20: Value of receptors in the study area for road drainage and the water environment

Value	RDWE matter	Typical examples (based upon Table 3.70 in LA 113)	Receptors within the study area
Very high	Surface water quality	Watercourse having a WFD classification shown in the River Basin Management Plan (RBMP) and a Q_{95}≥1.0m^3/s.	River Irwell River Roch[17]
	Hydromorphology	A watercourse that appears to be in complete natural equilibrium and exhibits a range of morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, free from any modification or anthropogenic influence.	No receptors of this value within the study area.
	Groundwater	Principal aquifer providing a valuable resource because of its high quality and yield, or extensive exploitation for public and/or agricultural and/or industrial supply.	Chester Formation/Collyhurst Sandstone Formation.
		Internationally designated sites of nature conservation dependent on groundwater.	No receptors of this type within the 250m buffer.
		SPZ1.	No receptors of this type within the groundwater study area.
		World Heritage Sites. Nationally important infrastructure and buildings.	No World Heritage Sites within the groundwater study area. Remainder to be confirmed at the Environmental Statement stage.
	Flood risk	Essential infrastructure or highly vulnerable development.	Motorways, A Roads, police, ambulance and fire stations.
High	Surface water quality	Watercourse having a WFD classification shown in RBMP and a Q_{95}<1.0m^3/s.	Whittle Brook and River Irk.
	Hydromorphology	A watercourse that appears to be in natural equilibrium and exhibits a natural range of morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, with very limited signs of modification or other anthropogenic influences.	No receptors of this value within the study area.

[17] The River Irwell and River Roch are both outside of the Study Area, however, as per Paragraph 14.6.3, these have been included as impacts may potentially occur beyond the Study Area.

Value	RDWE matter	Typical examples (based upon Table 3.70 in LA 113)	Receptors within the study area
	Groundwater	Principal or secondary A aquifer providing locally important resource or supporting a river ecosystem.	Coal Measures, Rossendale Formation, river terrace deposits, alluvium, glaciofluvial/glaciofluvial ice contact deposits.
		Licensed non-potable abstractions and unlicensed potable abstractions.	Seven licensed industrial/ commercial groundwater abstractions. Potable unlicensed abstractions to be confirmed following receipt of data from the local authority.
		Groundwater supporting a nationally designated or non-statutory locally designated site of nature conservation with high or moderate groundwater dependency.	Groundwater supporting parts of Hazlitt Wood SBI and Hollins Vale LNR and SBI, and Hollins Plantation SBI*, that are classified as having a high or moderate groundwater dependency. Groundwater supporting Philips Park and North Wood LNR and SBI.
		SPZ2.	No receptors of this type within the groundwater study area.
		Grade I and II* listed buildings. Regionally important infrastructure and buildings.	To be confirmed at the Environmental Statement stage.
	Flood risk	More vulnerable development.	Educational buildings and residential areas.
Medium	Surface water quality	Watercourse not having a WFD classification shown in RBMP and a Q_{95}>0.001m^3/s.	Castle Brook and tributary, Parr Brook (downstream in open channel), Hollins Brook, Bradley Brook, Brightly Brook, Heaton Park Reservoir, Ponds (based upon precautionary approach).
	Hydromorphology	A watercourse showing signs of modification, recovering to a natural equilibrium, and exhibiting a limited range of morphological features (such as pools and riffles). The watercourse is one with a limited range of fluvial processes and is affected by modification or other anthropogenic influences.	Whittle Brook, Hollins Brook, Castle Brook and Parr Brook.
	Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water.	Manchester Marls Formation, glacial till (diamicton), hummocky (moundy) glacial deposits, head.

Value	RDWE matter	Typical examples (based upon Table 3.70 in LA 113)	Receptors within the study area
		Unlicensed non-potable groundwater abstractions.	To be confirmed at the Environmental Statement stage.
		Groundwater supporting a nationally designated or non-statutory locally designated site of nature conservation with low groundwater dependency, or groundwater supporting a non-designated site (including HPI) with a moderate or high groundwater dependency.	Groundwater supporting parts of Hazlitt Wood SBI and Hollins Vale LNR and SBI, and Hollins Plantation SBI*, that are classified as having a low groundwater dependency.
		SPZ3.	No receptors of this type within the groundwater study area.
		Grade II listed buildings. Locally important infrastructure and buildings.	To be confirmed at the Environmental Statement stage.
	Flood risk	Less vulnerable development.	Commercial properties and car parks.
Low	Surface water quality	Watercourse not having a WFD classification shown in RBMP and a $Q_{95} \leq 0.001 m^3/s$.	Parr Brook headwaters/tributary, Unnamed Tributary of Bradley Brook, Unnamed Tributary of Whittle Brook, Blackfish.
	Hydromorphology	A highly modified watercourse that has been changed by channel modification or other anthropogenic pressures. The watercourse exhibits no morphological diversity and has a uniform channel, showing no evidence of active fluvial processes and not likely to be affected by modification.	Bradley Brook, Parr Brook, Tributary of Bradley Brook 1, Brightley Brook, Castle Brook Tributary, Tributary of Castle Brook Tributary, Unnamed Watercourse 1, Tributary of Unnamed Watercourse 2, Blackfish, Heaton Park Reservoir
	Groundwater	Unproductive strata.	Peat, glaciolacustrine deposits.
		Groundwater supporting a non-designated site (including HPI) with low groundwater dependency.	No receptors of this type identified at this stage within the groundwater study area.
		Undesignated historic buildings.	To be confirmed at the Environmental Statement stage.
	Flood risk	Water compatible development.	Water supply and wastewater infrastructure, and green space.

** NB. Some GWDTE sites will be repeated across multiple value classes listed above. This is due to the GWDTE value criteria being derived (in part) from the groundwater dependency of the GWDTE. Therefore, where a GWDTE is classified as having a range in groundwater dependencies, the value of different parts of the site will also vary. A detailed methodology used for assessing GWDTE is provided in Appendix 14.3: GWDTE Assessment.*

14.8 Potential impacts

14.8.1 Potential impacts on the water environment could arise from a number of direct and indirect sources during the construction and operational phases. This section summarises the potential effects associated with the Proposed Scheme. At this stage, due to the level of information, it is not possible to define specific magnitude of impact values for the activities on all receptors. These will be identified and assessed in detail and reported in the Environmental Statement.

Construction

Surface water quality

14.8.2 During construction, there are generally two sources of pollutants; sediments and the use of potentially polluting substances. There would be an increased pollution risk from sediments being mobilised in runoff which could reach watercourses via the drainage network and impact water quality. This could occur during earthworks (i.e. regrading and construction of new embankments), vegetation clearance and topsoil stripping through the movement of heavy machinery/vehicles and runoff from stockpiles. There is high likelihood of silt being generated from construction activities which would be greater after rainfall events.

14.8.3 During construction, there is a risk of surface water contamination from the accidental spillage of fuels, lubricants, cements, grouts, hydraulic fluids or other harmful substances, stored and used for construction activities. These could be stored and used throughout the Proposed Scheme, although the main storage areas would be in the construction compounds. Leaks and spills of these substances could migrate from the ground surface into surface watercourses via runoff or directly enter watercourses.

14.8.4 Pollution can occur where works occur within or immediately adjacent to a watercourse, such as during the construction or modifications of outfall structures and culverts. There is potential for construction work to take place on outfalls (shown on Figure 14.2) by Whitefield Interchange along the M60 (approximately 300m east of M60 J17) and Castle Road along the M66 (approximately 1.7km north of M60 J18). Furthermore, outfalls for earthworks drainage are yet to be confirmed. There is also a higher risk where works would take place close to existing gullies or drains forming part of the existing highways drainage network, creating a pathway for pollutants to reach the watercourses. Works on the existing highway drainage network on the Proposed Scheme are anticipated to be extensive.

14.8.5 The use of cementitious material, such as concrete, has the potential to contaminate surface waters, including altering its pH (becoming more alkaline). This is most likely to occur if concrete is used within a watercourse, such as for new outfalls or culverts.

14.8.6 Temporary construction drainage would be used to ensure the collection of rainfall run-off from construction areas, compounds and haul roads. This has the potential to be contaminated with pollutants, and should the drainage discharge to a watercourse, this would provide a pathway for pollutants.

14.8.7 To reduce the amount of construction traffic using the existing road network, temporary haul roads and site compounds would be needed. Discharge consents would be

required for controlled discharges to surface waters during construction (such as that from dewatering activities). It is assumed that, unless exempt, these would require environmental permits (surface water discharge activity) from the Environment Agency and that to obtain a permit any conditions would be met which would ensure that pollution of the water environment is prevented. Controlled discharges to surface water during construction have thus not been considered further.

14.8.8 During construction, surface water may need to be abstracted for construction purposes which, unless exempt, would require an abstraction licence. The location, timing, duration and quantities of water required are not known at this stage so have not been assessed. This will be considered further in the Environmental Statement as more construction information becomes available.

Hydromorphology

14.8.9 The greatest impacts to hydromorphology could potentially occur during the construction phase. Potential impacts to the hydromorphology of each watercourse within the study area would include:

- Potential increase in fine sediment delivered from surface runoff and the clearance of riparian vegetation.
- Potential in-channel and bankside works damaging morphological features of the watercourse. This would potentially directly impact on the hydromorphology of the watercourse, removing sensitive features such as natural bed and banks (leading to altered channel dimensions), altering longitudinal and lateral connectivity.
- Potential for the temporary alteration of existing drainage channels and hydrological connectivity within the catchment affecting hydromorphological processes in downstream receptors, for example altered flow velocities, altered discharge and sediment volumes.

Groundwater

14.8.10 During construction, it is considered likely that potential impacts to groundwater features (including superficial and bedrock aquifers, and associated groundwater receptors, such as licensed abstractions, PWS, GWDTE etc.) could arise from several activities described in the following paragraphs.

14.8.11 During construction, there is a risk of groundwater contamination from the accidental spillage of fuels, lubricants, cementitious materials, hydraulic fluids, or other harmful substances. These could be stored and used throughout the Proposed Scheme, although the main storage areas would be in the construction compounds. Leaks and spills of these materials could migrate from the surface into aquifers and subsequently to secondary receptors such as groundwater abstractions and GWDTE.

14.8.12 Physical contamination of groundwater from ground disturbance such as soil stripping, construction of cuttings, and foundations for embankments (if they need to reach bedrock and penetrate the full thickness of the superficial deposits), bridge

abutments/gantries, other excavations required, for example attenuation ponds[18], and piling, leading to the potential for increased sediment in groundwater reaching key receptors. The pollution risk to groundwater bodies, from the disturbance of contaminated ground specifically, is covered in Chapter 10: Geology and Soils.

14.8.13 The construction of cuttings, foundations, excavations for attenuation ponds, and piling activities could create vertical pathways for contaminated groundwater to migrate between aquifers. Even if groundwater is not contaminated, there is potential for mixing of different groundwater chemistries, which could be significant for WFD groundwater body status, as well as for sensitive groundwater receptors, including groundwater abstractions and GWDTE. This includes the potential for these works to intercept coal workings and mobilise mine water in the west of the Proposed Scheme, which could potentially have additional impacts on groundwater flows, levels, and quality. It also includes the potential groundwater quality impacts associated with the excavation required for the proposed attenuation pond five in the far south-east of the provisional Order Limits that lies within the footprint of the historic landfill located on land to the west of the M60 motorway (if contaminated groundwater is present).

14.8.14 Disturbances could occur to groundwater flow from temporary below ground structures, and/or shallow excavations that do not require dewatering (for example soil stripping which is assumed to reach a maximum depth of 1m), and the potential corresponding impact on groundwater levels and/or quality.

14.8.15 Local groundwater drawdown could occur as a result of temporary dewatering. This may be required to construct any sub-surface structures, such as cuttings, foundations, and other excavations required (such as attenuation ponds) that intercept the groundwater table. Drawdown impacts on groundwater levels, flows, and quality may be experienced in areas outside of the works area. Discharges from dewatering may also impact on receiving surface water or groundwater bodies.

14.8.16 In the absence of GI data (including groundwater level information), it has been assumed that all cuttings and widenings with a depth of more than 1m have the potential to intercept groundwater and would require dewatering[19] during construction. The locations of five potential cuttings have been provisionally taken from plan-view design drawings (due to vertical alignment information/excavation schedules being unavailable at the time of writing) and are listed in Table 14.21. Further assessment of dewatering requirements for cuttings and widenings will be undertaken for the Environmental Statement once GI data (including groundwater levels) have been obtained.

[18] At the time of writing, the outline drainage strategy for this PEIR stage does not include details regarding finished ground levels, because of earthworks required prior to excavating the proposed attenuation ponds. Impacts from these potential earthworks and excavations will be assessed at Environmental Statement stage following receipt of GI data and additional drainage design information.

[19] Dewatering requirements (and associated groundwater flow/quality impacts) would be reviewed at the Environmental Statement stage for all proposed excavations, such as those required for foundations, attenuation ponds etc.

Table 14.21: Cuttings with potential to intercept groundwater

Cutting location	Potential maximum depth (mbgl)	Assumed groundwater level (mbgl)	Expected geology	Provisional dewatering radius of influence (m)
M60 West of Sandgate Road	5	1	Made ground (sand and gravel) between 0-3.8 mbgl; over clay	15
South of M60 J18	5	1	Made ground (sand and gravel)	40
North of M60 J18	5	1	Made ground (sand and gravel)	40
M66 South of Hills Lane	10	1	Made ground (sand and gravel)	90
M66 Unsworth	2	1	Made ground (sand and gravel)	10

14.8.17 To gain a preliminary understanding of the potential maximum dewatering radius of influence for each proposed cutting, an initial review of the maximum likely cutting depth (also provisionally taken from plan-view design drawings), groundwater levels, and the expected geology at each cutting location has been undertaken. For the purposes of this conservative initial assessment, it has been assumed that groundwater levels are generally at 1 mbgl, the likely geological strata encountered has been taken from the nearest BGS borehole record (of sufficient depth and lithological coverage), and the upper end of literature-derived hydraulic conductivity values have been selected to generate a precautionary, worst-case dewatering radius of influence.

14.8.18 Using the maximum likely cutting depths listed in Table 14.21, and with the conservative assumptions listed above, the maximum potential dewatering radius of influence is currently estimated to range between 10m and 90m from the edge of the provisional Order Limits, depending on the cutting location[20]. Due to the conservative methodology adopted for the PEIR, the exact radius of influence for dewatering is expected to be lower than the values quoted above. This will be revisited in detail for the Environmental Statement but is presented here to provide an initial screening buffer for direct (and hence potentially significant) dewatering impacts to groundwater receptors located within the vicinity of each proposed cutting. Those groundwater receptors, identified to date, that lie within the provisional dewatering radius of influence for each location are listed in Table 14.22.

[20] Estimate has been derived using recommended methods outlined in CIRIA, C750 guidance (CIRIA, 2016a) and hydraulic conductivity values listed in Groundwater (Freeze, R.A. and Cherry, J.A., 1979), based on the known lithological information derived from available nearby BGS borehole records at the time of writing.

Table 14.22: Groundwater receptors located within the provisional dewatering radius of influence for cuttings

Receptor type	Receptor ID / location	Cutting location(s) that potentially interact with receptor	Distance from the proposed cutting(s)
Aquifer	Secondary A superficial aquifer.	M60 west of Sandgate Road; M60 south of J18; M60 north of J18; M66 south of Hills Lane.	0m (crosses cutting location).
	Secondary Undifferentiated superficial aquifer.	M60 west of Sandgate Road; M60 south of J18; M60 north of J18; M66 Unsworth.	0m (crosses cutting location).
		M66 south of Hills Lane.	55m north of cutting location.
	Principal bedrock aquifer.	M60 west of Sandgate Road; M60 south of J18.	0m (crosses cutting location).
	Secondary A bedrock aquifer.	M60 south of J18; M60 north of J18; M66 south of Hills Lane; M66 Unsworth.	0m
	Secondary B bedrock aquifer.	M60 south of J18	15m north-east of cutting location.
Historic landfill	Land to the south of Whitehouse Farm.	M60 south of J18.	0m (adjacent to cutting location).

14.8.19 Buildings have the potential to be affected by dewatering which may cause localised subsidence. Chapter 7: Cultural Heritage identifies listed buildings in the vicinity of the Proposed Scheme. Other buildings of regional and local importance are identified in Chapter 13: Population and Human Health. The impact assessment for these assets, in relation to construction phase dewatering, will be undertaken for the Environmental Statement.

14.8.20 Local groundwater recharge rates could potentially be disrupted due to the increased interception of overland flows. This could be through the introduction of impervious structures, compaction of soils, and/or the movement and storage of earth materials within the groundwater study area. The working area for construction is likely to be relatively small in comparison to the scale of the majority of aquifer(s) being crossed. Any effects, if they were to occur, would therefore likely be negligible. However, available GI data will be reviewed to identify the more permeable sand and gravel horizons (if/where present) within the made ground/superficial deposits, their value as a groundwater resource, and the potential impacts associated with changing recharge rates. This will be reviewed in conjunction with the evolving design for the Proposed Scheme and will be reported in the Environmental Statement. Particular attention will be given for where sensitive groundwater receptors are present, such as GWDTE.

Flood Risk

14.8.21 Potential impacts during construction in relation to flood risk include:

- Changes in flood risk due to constriction of watercourses by in channel works, blockages within channels or due to the removal of existing structures or blockages.
- Changes in flood risk due to changes in floodplain storage volume or flow capacity.

- Changes in flood risk due to changes in surface water runoff rates and volumes through the removal of vegetation, creation of impermeable surfaces or the diversion of flow.
- Potential damage to buried services or other water retaining infrastructure.
- Disruption to groundwater flow or the release of artesian pressure due to excavations or construction of below ground structures such as piles.

Operation

14.8.22 Operational impacts of the Proposed Scheme on the water environment are likely to include those outlined in this section without appropriate mitigation.

Surface water quality

14.8.23 There are two main types of pollution from roads during the operational phase: road runoff and accidental spillage risk. During routine operation pollutants, such as suspended solids, heavy metals, hydrocarbons, herbicides and de-icing materials (i.e. salts), can be present in the routine runoff from the road surface. These come from a variety of sources such as:

- Fuel and other oil deposits on the road surface due to leakage
- Hydrocarbons from exhaust deposits
- Lead, copper, zinc, iron and cadmium deposits from exhaust emissions, brake dust and tyre wear
- Synthetic rubber deposits from tyre wear
- Herbicides from vegetation management activities
- Chemicals used in windscreen washes such as detergents or de-icer
- De-icing agents such as road salt, but also potentially including trace amounts of impurities such as cyanide, metals and clays

14.8.24 These pollutants, when combined with rainfall, can run-off into the highway drainage system which discharges to a watercourse. This can impact the chemical and biological water quality within a receiving watercourse and the following potential impacts could occur:

- Suspended solids could smother substrate and increase turbidity with a consequent reduction in light penetration and lowering of oxygenation
- Heavy metals would be predominantly in soluble form and therefore more ‘bio-available’ and particularly toxic. Some heavy metals would also be sediment-bound
- Main types of hydrocarbons would be PAHs (polycyclic aromatic hydrocarbons). PAHs are of particular concern as they are toxic to freshwater organisms.

14.8.25 The following pollutants have been incorporated within the assessment process (HEWRAT):

- Soluble pollutants associated with acute and long-term pollution impacts, for dissolved copper and zinc

- Sediment-bound pollutants associated with chronic pollution impacts, total copper, zinc, cadmium, pyrene, fluoranthene, anthracene, phenanthrene and total PAH

14.8.26 Pollution from maintenance activities during the operational phase, such as the use of herbicides and de-icing salts, as a result of responsive activities are difficult to predict and design for. These sources can have adverse impacts on receiving watercourses, however be controlled through good operational management regimes by the road operator. The prevention of ice formation and the de-icing of highways within the UK is carried out almost exclusively using rock salt. Road salt is applied typically in the winter months and therefore only spread on the highway on a small number of days per year. In the Memorandum of Understanding (MoU) between National Highways (formerly Highways Agency) and the Environment Agency (Highways Agency and Environment Agency, 2009) Annex 1 Water Environment it is agreed that:

- Prior to the use of de-icing agents other than rock salt National Highways should consult with the Environment Agency.
- The Environment Agency does not require National Highways to apply for consent for normal routine maintenance operations, including the application of de-icing agents. However, National Highways are aware that the application of de-icing agents can have impacts on water quality in receiving watercourses, particularly high levels of Biological Oxygen Demand (BOD) and hence the Parties are committed to investigating alternatives to conventional products currently in use.

14.8.27 Data relating to abstraction licences and environmental permits for water discharge activities were obtained for the PEIR. Any impacts in relation to these will be assessed at the Environmental Statement stage. Impacts are not anticipated to be significant due to a lack of larger watercourses within the study area which could support major abstractions. Surface water quality relating to routine runoff has been assessed using the HEWRAT tool and is summarised in Section 14.10.

Hydromorphology

14.8.28 Potential impacts to hydromorphology during operation include:

- Changes to local flow dynamics following adaptations to the road drainage network (i.e. outfall structures)
- Localised bed and bank scour following adaptations to the road drainage network (i.e., increased discharge rates and increase in sediment)

14.8.29 These impacts are likely to be localised to the Proposed Scheme, whilst significant effects would be mitigated through design interventions during the detailed design stage.

Groundwater

14.8.30 During operation, it is considered likely that potential impacts to groundwater features could arise from the following:

- Increased pollution risks from accidental spillages of fuels and chemicals during the operational phase, for example due to road traffic accidents. However, the aim of the Proposed Scheme, as well as reducing congestion and improving journey time reliability, is to reduce the number of accidents. This should result in a lower likelihood of spillages occurring, but the magnitude of change in groundwater

quality could be important for sensitive groundwater receptors, such as groundwater abstractions and GWDTE.

- According to the outline drainage strategy, up to six new attenuation ponds are proposed within the provisional Order Limits, along with filter drains and oversized pipes. Other attenuation-based SuDS features, such as soakaways and swales do not form part of the current proposal. All drainage features could increase pollution risks from routine runoff during the operational life of the Proposed Scheme if drainage is discharged to the ground or groundwater. Potential substances would primarily consist of silts, hydrocarbons, and dissolved heavy metals, which may migrate to groundwater bodies. However, the outline drainage strategy assumes that all proposed attenuation ponds and filter drains would be lined, with no discharges to ground or groundwater. With no potential pollution pathway from the drainage assets to the groundwater environment, impacts associated with discharge-based drainage pollution can be scoped out at this PEIR stage. Similarly, there would be no pollution pathway between any contaminated groundwater that may be present in the historic landfill located on land to the west of the M60 motorway and the attenuation pond 5, and consequently no groundwater quality impacts from this source. This will be reviewed again for the Environmental Statement stage, following any updates to the drainage strategy at that time.
- Groundwater levels, flows, and quality could be altered in the superficial deposits, both underneath the proposed embankments, and in their vicinity (which is of particular importance for groundwater abstractions and GWDTE). This could be due to embankment surcharge causing consolidation of the materials underneath the embankment, which may cause the ground beneath the structure to compress affecting groundwater storage, pore-water pressure distribution, and magnitude and direction of groundwater flow.
- Changes to groundwater levels, flows and quality, due to the presence of permanent below ground structures, such as foundations for bridge abutments and sheet piles, resulting in barriers to sub-surface flows, and/or providing new pathways for groundwater migration. This could lead to subsequent changes to groundwater levels, flows, quality, and locations of discharge points, for example to GWDTE.
- Potential ongoing dewatering effects from the cuttings identified in Table 14.21 may cause the groundwater table to fall, impacting on groundwater receptors (see Table 14.22) as well as surface water flows and users. Where cuttings are proposed, additional assessment of the long-term dewatering requirements will be undertaken (where appropriate) for the Environmental Statement taking into consideration available GI data (including groundwater levels).
- Permanent reduction in recharge rates due to the increased surface area of impermeable ground. However, the increased area of impervious surfaces is likely to be relatively small in comparison to the scale of most aquifer(s) being crossed. Any effects, if they were to occur, would therefore be likely to be negligible, and as such, this effect is scoped out of the groundwater assessment, except for where sensitive groundwater receptors are present, such as GWDTE.

Flood Risk

14.8.31 There would be potential for an increased risk of flooding (fluvial, surface water, sewer and drainage infrastructure) due to increases in the rate and volume of runoff caused by an increase in impermeable surfaces.

14.8.32 Long-term changes to groundwater levels could occur in the superficial deposits, both underneath proposed embankments and in their vicinity. This would be due to embankment surcharge causing consolidation of the materials underneath the embankment, which may cause the ground beneath the structure to compress affecting groundwater storage and pore-water pressure distribution. This may locally increase groundwater flood risk if emergence is possible.

14.8.33 Potential ongoing dewatering for cuttings may cause the water table to fall, reducing localised groundwater flood risk. This will be confirmed with an assessment of the long-term dewatering requirements (where appropriate) for the Environmental Statement once GI data (including groundwater levels) have been obtained.

14.8.34 Permanent below ground structures, such as embankment foundations and sheet piles at gantry locations, could form a sub-surface barrier to groundwater flow. This could thereby locally increase the risk of groundwater flooding on the up-gradient side and decrease groundwater flood risk on the downgradient side of these structures.

14.8.35 In addition, permanent below ground structures may require new pathways for groundwater migration to form around these features, which may locally increase groundwater flood risk elsewhere. This is also the case for backfilled excavations, such as those associated with temporary works areas (for example haul roads, construction compounds etc.) and drainage assets.

14.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

14.9.1 Embedded (or design) mitigation are those measures that have been incorporated during the design process to avoid or reduce environmental impacts.

14.9.2 Mitigation measures would be incorporated into the design and assessment using a hierarchical approach, in accordance with section 3.2.3 of DMRB LA 104: Environmental Assessment and Monitoring (Highways England, 2020b) and section 3 of DMRB LA 113. The avoidance of impacts will be considered as the design progresses, however at this time avoidance is considered to be limited as the majority of the Proposed Scheme is connected to the existing highway. The design will also seek methods to reduce impacts, such as through the siting of Proposed Scheme elements, and these will be outlined in the Environmental Statement.

Surface water quality

14.9.3 Current embedded mitigation for the Proposed Scheme as part of the current drainage design (National Highways, 2022) includes the incorporation of swales and attenuation ponds which would be designed to be permanently wet. These provide treatment to road runoff prior to discharge. The HEWRAT assessments undertaken at this stage and reported in Appendix 14.2 inform whether further essential mitigation is required, as presented in Section 14.10. Maintenance and management of the drainage network

and assets would be required as part of the operation of the Proposed Scheme as per National Highways operating standards.

14.9.4 Consultation will be undertaken with the Environment Agency, Lead Local Flood Authority (LLFA), statutory bodies and local flood risk management authorities in order to identify the most appropriate drainage strategy for the Proposed Scheme.

Hydromorphology

14.9.5 At this stage, no embedded mitigation for watercourses has been confirmed as part of the design.

Groundwater

14.9.6 At this stage, the only embedded mitigation for groundwater comprises the use of impermeable liners for attenuation ponds and filter drains across the Proposed Scheme. This decision was taken to reduce potential impacts on groundwater quality to the underlying superficial (and potentially bedrock) aquifers.

Flood risk

Proposed Scheme drainage strategy

14.9.7 An assessment of the existing drainage network serving the M60 J18 has been undertaken (National Highways, 2022). This identified different types of primary drainage elements: carrier pipes and drains, filter drains, and kerbs and gullies.

14.9.8 The proposed drainage system will discharge into the existing system where feasible (subject to the outcome of the drainage surveys).

14.9.9 Outfall 1A is designed to manage surface water runoff from the Northern Loop. Runoff would be discharged into the existing Tributary 1 of Castle Brook (Egypt Farm Drain). An attenuation pond is proposed which would receive flow from the existing and proposed sections of road. The volume of storage available would enable discharge from the pond to be restricted to a rate that would be the equivalent of the greenfield runoff rate for the new section of road and the existing runoff rate for the existing section of road. As such, there would be no increase in the rate of runoff to the receiving watercourse.

14.9.10 The presence of existing surface water attenuation features, such as attenuation ponds, underground attenuation tanks, or pollution control measures were not confirmed during previous PCF stages. A drainage survey will be undertaken to inform the design work at this stage and any existing drainage assets will be confirmed and reported in the Environmental Statement.

Essential mitigation

Best practice (construction)

14.9.11 Best practice or standard mitigation are those measures that would be expected to occur on a typical highways scheme due to legislative requirements or standard sector practices during construction.

14.9.12 In line with DMRB LA 120 Environmental Management Plans (Highways England, Revision 1, 2020d), the 1st Iteration of the Environmental Management Plan (EMP) should be produced at the Environmental Assessment stage for DCO submission. Prior to construction, the 1st Iteration of the EMP would be updated and would become the 2nd Iteration of the EMP.

14.9.13 The 2nd Iteration of the EMP would be prepared and implemented at a later stage by the Principal Contractor. The 2nd Iteration of the EMP would include detail on the measures that would be undertaken during construction to mitigate temporary effects on the water environment that would have been outlined in principle in the 1st Iteration of the EMP.

14.9.14 The 2nd Iteration of the EMP would include a range of measures which accord with legal compliance and good practice guidance when working with or around water resources. These measures could include:

- Measures to control the storage, handling and disposal of potentially polluting substances during construction. Measures relating to the control of small or more significant spillages would be included in the Outline Water Management Plan (OWMP) which would be included with the 2nd Iteration of the EMP along with measures to support an emergency pollution response plan.
- Where required, environmental permits for any temporary water discharges or abstractions should be obtained by the Contractor from the Environment Agency or LLFA prior to undertaking any activities.
- Measures to control potential pollution as a result of fine sediments and/or potentially polluting substances within surface water runoff which may enter the local surface water system.
- The management of activities within areas at risk of flooding (i.e. kept to a minimum) with temporary land take required for construction to be located outside the floodplain as far as reasonably practicable or allowances made for floodplain control measures and contingency actions. Flood Risk Activity Permits (FRAPs) would be obtained as appropriate by the Contractor.
- Where necessary, implementation of measures to mitigate for any flood waters displaced during temporary construction works (e.g. raised storage areas, haul roads and cabins).
- Phasing of construction work. This would include works associated with any required floodplain compensation areas, which would be constructed prior to any encroachment into the floodplain caused by the Proposed Scheme to ensure no overall adverse impact.
- Managing the risk from groundwater flooding (during excavation) through appropriate working practices and with adequate plans and equipment in place for dewatering to ensure safe dry working environments. Management of the water removed from cuttings and other excavations for construction dewatering activities before discharge.
- Incorporating sustainable drainage mitigation for construction work with drainage implications (e.g. increasing surface water flood risk as a result of increased impermeable area).
- Adopting the Environment Agency flood warning system during construction and developing a suitable plan which would ensure effective and safe evacuation of

personnel (and plant if safe to do so) from areas at risk on receipt of a flood warning.

- Minimise vegetation clearance along the riparian corridor and floodplain.
- Good material handling practices including the avoidance of stockpiles within 10m of a waterbody and including breaks in stockpiles to reduce any impacts on surface water runoff.
- Utilise measures (e.g. cofferdams) during the construction of the outfalls in order to prevent flows entering the working area and entraining sediment downstream during construction.
- Aligning temporary construction outfalls downstream, making sure they do not protrude into the channel.
- Temporary culverts (if required) carrying haul roads across watercourses should be to a minimal length and appropriately tied into the bed and banks of associated watercourses bed and to prevent bank instability. This would involve submerging the invert below the bed substrate to prevent bed scour, knickpoint formation and to maintain sediment conveyance. Also, align wingwalls with the banks to prevent fluvial processes from outflanking the culvert.
- Reinstate the channel appropriately following the deconstruction of temporary structures in the channel or channel banks (i.e. culverts and outfalls). This would prevent knickpoint formation or additional channel instabilities from occurring.

14.9.15 During the construction of haul roads, watercourse crossings associated with the highway structure and outfalls, place green bed and bank reinforcement along areas that have evidence of erosion. This would help mitigate construction impacts and look to reduce the likelihood of increased bed and bank erosion.

Surface water quality

14.9.16 Potential mitigation measures that could be applied to surface water quality are as follows:

- Pollution prevention guidelines and best practice guidance produced by CIRIA for the protection of watercourses would be outlined in the 1st and 2nd Iterations of the EMP to mitigate changes in contaminant pathways. The appropriate best practice guidance is as follows:
  - Environmental Handbook for Building and Civil Engineering Projects (3 Parts: C512, C528 and C529) (CIRIA, 2000a, b,-c)
  - Control of water pollution from construction sites. Guidance for consultants and contractors (C532) (CIRIA, 2001)
  - Control of water pollution from linear construction projects. Site guide (C649) (CIRIA, 2006)
  - Environmental good practice on site guide (fourth edition) (C741) (CIRIA, 2015b)
  - SuDS Manual (C753) (CIRIA, 2015a)
  - Production of a Water Management Plan
  - Production of an Emergency Pollution Response Plan

Hydromorphology

14.9.17 Mitigation measures, which could be implemented to avoid, prevent and reduce possible impacts upon hydromorphology during the construction phase of the Proposed Scheme, include:

- Drainage and sediment management to control the quantity and quality of runoff and/or silt-laden runoff from construction areas
- Sediment management to control fine sediment delivery to watercourses via construction drainage
- Limiting the amount of vegetation clearance along riparian corridors and floodplains
- Attenuating discharge arising from construction drainage and aligning outfalls downstream
- Culverts for temporary haul roads and access tracks would be kept to minimal length and tied into the bed and banks to prevent bank instability (e.g. submerging the culvert beneath the bed substrate to prevent knickpoints and bed destabilisation up and downstream of the culvert connection, and align wingwalls with the banks to prevent outflanking)
- Installation of new outfalls to reduce impacts on the bed and banks. Best practice guidance will be followed as set out in DMRB CD 529 (National Highways, 2021) and CIRIA (CIRIA, 2019) in relation to design and positioning of outfalls to reduce scour to the bed and banks.

Groundwater

14.9.18 If piling is required for the construction of any structures, such as bridge abutments, then a piling risk assessment in line with Environment Agency guidance (Environment Agency, 2006) would be required to confirm that preferential flow paths would not be created. This would be of most relevance for areas of piling where contaminated land is identified. Other below-ground works would also be considered and would need to be risk assessed in a similar way, prior to construction.

14.9.19 If temporary dewatering is required in order for construction activities to take place, such as for cuttings, embankment/bridge foundations, or excavations for attenuation ponds, a dewatering risk assessment should be undertaken, for example by following the hydrogeological impact appraisal for dewatering abstractions (Environment Agency, 2007).

Flood risk

14.9.20 Mitigation measures, which could be implemented to mitigate flood risk impacts during the construction, are provided below:

- Management of activities within areas at risk of flooding (i.e. kept to a minimum) with temporary land take required for construction to be located outside the floodplain and away from surface water flowpaths as far as reasonably practicable, or allowances made for floodplain control measures and contingency actions.
- Where necessary, implementation of measures to mitigate for any flood waters displaced during temporary construction works (e.g. raised storage areas, haul roads and cabins).

- Managing the risk from groundwater flooding (during shallow excavations that do not require dewatering) through appropriate and best-practice working procedures and with adequate plans and equipment in place to ensure safe dry working environments.
- A dewatering risk assessment would need to be completed in order to appropriately manage groundwater removed from cuttings and excavations required for embankment foundations, bridge abutments etc. that are considered likely to intercept the water table.
- Where required, Environmental Permits for any temporary water discharges or dewatering of cuttings or other excavations would be obtained from the Environment Agency prior to undertaking any dewatering activities (to be included in EMP). This would be informed by the dewatering risk assessment (where appropriate).
- A piling risk assessment would also be undertaken in line with Environment Agency guidance to assess piling methodologies proposed, identify potential impacts to the groundwater and surface water environments, and identify the requirement for essential mitigation (where appropriate). This may include the need to ensure that preferential groundwater flow paths would not be created, that bedrock artesian pressures would not be released, and/or that there would be no interaction with groundwater stored in mine workings/adits.
- Incorporating sustainable drainage mitigation for construction work with drainage implications (e.g. increasing surface water flood risk as a result of increased impermeable area).
- Minimise vegetation clearance along riparian corridors and floodplains.
- Where feasible, site layout would ensure stockpiles are stored more than 10m from an adjacent watercourse.
- Utilise measures (e.g. cofferdams) during the construction of the outfalls in order to prevent flows contacting the working area and entraining sediment downstream during construction.
- Aligning temporary construction outfalls downstream, making sure they do not protrude into the channel.

14.9.21 Flood risk should be considered in the design of watercourse crossings as far as reasonably practicable in order to reduce the impact these would have on flood risk. The drainage design criteria (included in the Preliminary FRA) include a requirement for proposed new culverts and extensions of existing culverts to be designed such that they would not result in an increase in flooding (for up to the 1% (1 in 100 year) AEP plus climate change event).

Essential mitigation (construction and operation)

Surface water quality

14.9.22 Essential mitigation has not been deemed necessary based upon the HEWRAT assessments reported in the PWQAR in Appendix 14.2. Whilst the assessments indicate a failure of acute soluble copper and zinc, or sediment bound pollutants, these lead to a no greater than a Slight significance of effect. Opportunities for betterment are currently being explored and these will be considered and where feasible incorporated

into the drainage design. These will then be assessed and reported in the Environmental Statement. The opportunities for betterment considered at this PEIR stage for the proposed drainage outfalls are presented in the PWQAR in Appendix 14.2, along with the results of the assessments.

Hydromorphology

14.9.23 Given the outcomes of the likely significant effects assessment, additional mitigation for hydromorphology would not be a requirement at this stage.

Groundwater

14.9.24 If the drainage strategy evolves to include infiltration-based drainage features and discharges to ground or groundwater, there is a requirement for further assessments to be undertaken for the Environmental Statement, and potential for additional mitigation to be required for any significant impacts identified.

14.9.25 Where the further assessments identify significant impacts from cuttings, widenings or other excavation dewatering, further mitigation measures may be required for specific locations. The requirement for additional mitigation will be identified in the Environmental Statement, but could include:

- The use of sheet piling to minimise groundwater inflows into excavations
- The recharge of abstracted groundwater back to the aquifer to maintain groundwater levels and flows to secondary receptors such as abstractions and GWDTE
- Minimising the depth of excavations such that no or minimum groundwater dewatering is required
- Staging dewatering such that nearby excavations are not being dewatered at the same time
- Undertaking excavations at times when groundwater levels are naturally at their lowest
- Lowering of pumps in licensed abstraction boreholes or PWS below the temporary revised groundwater table
- Re-drilling of water well(s) where water user abstraction wells are not deep enough to accommodate pump lowering
- Providing alternative water supplies during construction (for example from a road tanker or connecting the property to the water mains)

Flood risk

14.9.26 No further mitigation for flood risk has been identified at this stage of assessment based upon current design information.

Enhancement

14.9.27 Enhancements would be considered where feasible as the design progresses and these should be based around incorporating green solutions, soft engineering approaches and following best design approaches where appropriate. Opportunities to

improve watercourses would also be identified where practicable. At this stage, enhancements have not been committed to and thus are not considered in the impact assessment in terms of beneficial effects. The option and feasibility to include enhancements will be considered during preparation of the ES chapter.

Surface water quality

14.9.28 The impact of the road network upon surface water quality may be reduced by using certain types of vegetative SuDS features to treat road runoff where HEWRAT assessments already indicate an acceptable level of pollution discharges without such features in place. Spillage risk assessments have been undertaken and are all shown to be within acceptable limits, however, the attenuation features proposed for some drainage outfalls should provide containment facilities where none currently exist leading to a betterment.

Hydromorphology

14.9.29 At this stage, no opportunities for enhancement to hydromorphological receptors, including river, floodplain and wetland restoration, have been committed to or considered. However, this would continue to be reviewed during preparation of the Environmental Statement or future design stages. Furthermore, enhancements to riparian and watercourse habitats, as per Biodiversity Net Gain, will be considered during preparation of the Biodiversity Chapter of the Environmental Statement.

Groundwater

14.9.30 At this stage, no opportunities for enhancement to groundwater have been identified within the groundwater study area.

Flood risk

14.9.31 As the Proposed Scheme design develops, opportunities for flood risk betterment will be explored. For example, it may be possible to further restrict outflows from, and increase storage in, attenuation ponds to reduce peak flows downstream.

14.10 Assessment of likely significant effects

Construction

14.10.1 For the most part, the implementation of a robust EMP would be sufficient to mitigate potential risks to a residual negligible or neutral effect during construction. Only when works are immediately adjacent to or within a watercourse would a potential residual risk be likely to remain.

Surface water quality

14.10.2 There is a risk of suspended solids and polluting substances used during the construction process (i.e. fuel, cement etc) discharging to watercourses through the surface water highway drainage system or directly via overland flow, with works adjacent to watercourses posing the greatest risk. There is always a residual risk of accidents or spillage incidents occurring that would have an adverse effect on surface waterbodies. Works within close proximity of the receptors, such as the construction or modification of outfalls and culverts, and compounds located near to watercourses pose

the greatest risk and for these watercourses there could be a minor adverse effect. However, following the EMP and best practice methods would likely reduce this impact to negligible and it is not anticipated that any of the effects would be significant.

Hydromorphology

14.10.3 Subject to the implementation of all best practice mitigation measures (Section 14.9; Essential Mitigation - best practice), all construction activities would be unlikely to lead to significant effects on hydromorphology. Effects would predominantly be associated with fine sediment release as a result of construction activities along the banks and floodplains of watercourses. This could affect all watercourses directly impacted by construction works by smothering local bed substrate material. However, with use of best practice measures and an EMP, the quantity of fine sediment would be unlikely to cause a significant effect.

14.10.4 The construction of a new outfall for earthworks drainage to the Tributary of Castle Brook could lead to disturbance and the subsequent erosion and potential failure of material along its bed and banks as excavations take place for the headwall structure. Further localised smothering of downstream bed substrate material could take place as the quantity of fine sediment transported along the watercourse increases. However, through the implementation of best practice measures, the effects from construction would be negligible.

14.10.5 Outfall 6 will discharge into a new culvert under the M60 which would ultimately drain into Bradley Brook via an outlet on the south side of the M60. Construction effects are anticipated to mirror those discussed in paragraph 14.10.4.

14.10.6 Where new outfall (Outfall 4) is proposed to discharge directly into a manhole, of which Parr Brook flows into, fine sediment would likely be the main impact as the outfall structure is proposed to be constructed where the watercourse is culverted. However, through the use of actions outlined in an EMP controlling distribution of fine sediment in construction areas, the quantity of fine sediment sourced from construction activities reaching the natural bed substrate would be negligible.

14.10.7 A temporary haul road is proposed to cross the Tributary of Castle Brook, which is assumed to cross the watercourse via a culvert crossing. The construction of culverts would require in-channel working as well as vegetation stripping. This could lead to temporary changes to the flow regime and dynamics, compact the bed substrate and increase the likelihood of bank scour and destabilisation. This could potentially impact sediment transport dynamics along the channel. Impacts would likely be localised and temporary and would be mitigated with best practices as discussed in Section 14.9. Therefore, leading to negligible effects on the watercourse.

Groundwater

14.10.8 Subject to the implementation of all mitigation measures (as listed in Section 14.9), there is potential for significant effects caused by construction activities to remain for the following groundwater receptors:

- GWDTE: from direct groundwater contamination (due to accidental leaks and spills of fuels and chemicals, or mobilisation of suspended solids) and direct and short-term disturbances to groundwater flows and levels (due to soil stripping and vegetation clearance within the footprint of the provisional Order Limits).

- Springs and “issues” located within the provisional Order Limits (such as the spring at Parrenthorn Road and the two “issues” in the east): due to direct groundwater quality and flow disturbances associated with soil stripping and vegetation clearance within the footprint of the provisional Order Limits. However, ground truthing to determine receptor sensitivity as well as further assessment would be required to confirm whether this remains the case for the Environmental Statement.
- The north-western edge of the historic landfill: Land to the south of Whitehouse Farm, due to local groundwater drawdown caused by temporary cutting dewatering (south of M60 J18). Impacts on the historic landfill (if lining is absent or ‘leaky’) may result in sources of leachate being drawn into aquifer reducing resource potential and/or affecting baseflow quality; or leading to degradation of WFD waterbodies from indirect discharge of cutting drainage from the Proposed Scheme. Similarly, the excavation associated with the proposed attenuation pond in the far south-east of the provisional Order Limits could intercept contaminated groundwater in the historic landfill land to the west of the M60 motorway which could impact on groundwater quality in the adjacent aquifer(s) if a pollutant pathway is created. Details regarding the potential presence of landfill liners are currently unknown (see Chapter 10: Geology and Soils for further information regarding these landfills).

14.10.9 For the Environmental Statement, the following updated assessments will need to be undertaken, to confirm that that these likely significant effects could remain. These updated assessments will identify any requirement for implementation of additional mitigation measures:

- Dewatering assessment for cuttings and other excavations, such as for bridge foundations, to quantify the extent of drawdown and potential impacts on receptors (including the historic landfills south of Whitehouse Farm and land to the west of the M60 motorway)
- A piling risk assessment in line with Environment Agency guidance (Environment Agency, 2006) would be required, to confirm that preferential flow paths would not be created for areas where contaminated land is identified, or where aquifer units of different groundwater chemistries would be crossed, for example at gantry locations. The assessment would also consider potential impacts created due to disturbances of groundwater flows, and potential for increased groundwater flow risk
- Further assessment of potential GWDTE dependency on groundwater is required to categorise the sensitivities of each site. This will concentrate on the GWDTE closest to the elements of the Proposed Scheme that could impact on the groundwater environment. This will be undertaken utilising UKTAG guidance (UKTAG, 2005)
- The above assessments will consider the potential for effects on surface water features which may be in connection with the groundwater

Flood risk

14.10.10 Subject to the implementation of all mitigation measures (as listed in Section 14.9), there are no likely significant effects from construction activities on most sources of flood risk. The Preliminary FRA provides details of how the proposed mitigation would achieve this.

14.10.11 However, for groundwater flood risk, potential remains for localised significant effects to occur to receptors adjacent to and upgradient of permanent below ground structures. Groundwater flood risk shall be reviewed at the Environmental Statement stage once GI data are available, and subject to the outcomes of the proposed dewatering and piling risk assessments.

Operation

Surface water quality

Spillage risk assessments

14.10.12 As DMRB LA 113 stipulates, a simple level spillage risk assessment has been undertaken for the Proposed Scheme using HEWRAT. Results show that all outfalls from the Proposed Scheme pass with a calculated annual probability of a serious pollution incident to be not greater than a 1% (1 in 100 year) AEP return period required to achieve the threshold defined in DMRB LA 113 paragraph 3.33. As the spillage risk is within acceptable limits mitigation is not deemed to be required. These results are presented in Table 14.23 with full assessment presented in Appendix 14.2. As the spillage risk achieves the required standards in DMRB LA 113 the magnitude of impact has been influenced by the routine runoff results.

Table 14.23: Spillage risk assessments results for the proposed drainage catchments

Outfall	Receiving Watercourse	Return period (years)
1 (1A+1B)	Tributary of Castle Brook	118,418
2	Castle Brook	935,891
4	Parr Brook headwaters	77,901
5	River Irk	282,931
6	Bradley Brook	33,107
7	Parr Brook headwaters	101,895

Routine runoff assessments

14.10.13 Routine runoff assessments have been undertaken using HEWRAT. For the assessment of the long-term risks HEWRAT estimates in-river annual average concentrations for the soluble pollutants dissolved copper and dissolved zinc. The tool is also designed to make an assessment of the short-term (i.e. acute) risks related to the intermittent nature of road runoff based upon Runoff Specific Thresholds (RST) established within the HEWRAT model for a 6-hour (RST6) and 24-hour period (RST24). The thresholds have been developed and agreed based upon research undertaken by Highways England and the Environment Agency. HEWRAT also provides assessment for the impact of sediment bound pollutants (total copper, zinc, cadmium, pyrene, fluoranthene, anthracene, phenanthrene and total Polyaromatic hydrocarbons (PAH)) and identifies whether accumulation of sediments will occur. Further information on the methodology for assessing sediment-bound and soluble pollutants as well as the EQS limits used in this assessment are presented in Appendix 14.2.

14.10.14 The results of the HEWRAT assessments are used to determine the magnitude of impact and subsequent significance of effect (following DMRB LA 113). Full results of the HEWRAT assessments can be found in Appendix 14.2.

14.10.15 DMRB CG 501 – Design of highway drainage systems (Highways England, Revision 2, 2020c) provides standards on the principles of pollution and flow control. Table 8.6.4N3 in CG 501 presents possible flow control measures and their indicative treatment efficiencies for the removal of contaminants. These treatment efficiencies have been used when assessing the proposed embedded mitigation as presented in the HEWRAT assessments. For locations of the proposed outfalls, refer to Figure 14.2.

14.10.16 The results show (Table 3.5, Appendix 14.2) that the current proposed drainage design with embedded mitigation passes HEWRAT (both EQS and RSTs) at Step 3 for Outfalls 1, 2 and 5 and the cumulative assessment for Outfalls 4+7. Outfall 4 at the outfall location fails the EQS for copper and the RSTs for copper and zinc, other than a pass for RST6 copper, with the embedded mitigation. Outfall 6 passes for all parameters, other than a failure for RST24 zinc. Outfall 7 passes for all parameters apart from a failure for sediment-bound pollutants.

14.10.17 Due to EQS failures at Step 3 for copper and zinc for Outfall 4, a detailed level assessment has been undertaken in line with DMRB LA 113. Detailed assessment using the Metal-Bioavailability Assessment Tool (M-BAT) have been carried out, full details are presented in Appendix 14.2. The key output of the M-BAT is an estimate of the bioavailable concentration of a metal under the conditions found at a site, which can then be compared with the $EQS_{bioavailable}$ to assess compliance. M-BAT also allows a site specific Predicted No Effect Concentration (PNEC) to be determined. The site specific PNEC can be considered a site specific EQS (expressed as dissolved concentration).

14.10.18 Using the M-BAT methodology, site-specific PNECs ranges for copper and zinc have been calculated for the outfall locations. When considering the site-specific conditions, effectively a site-specific EQS, the assessment has determined that all the outfalls are found to be within the PNEC for zinc. Similarly for copper, following M-BAT assessment, copper EQS values are considered to be within the site-specific PNEC calculated.

14.10.19 Therefore, no environmentally significant effects are predicted as the M-BAT assessment showed compliance with the EQS for both copper and zinc when the PNEC is considered.

14.10.20 The embedded mitigation will provide a betterment in surface water quality as currently there is no mitigation for water quality provided on the existing highway network.

Hydromorphology

14.10.21 Operational activities and structures would be unlikely to cause any significant effects. All outfalls, with the exception of Outfall 6, would either retain existing flow rates or match the local greenfield runoff rates, if they are new outfalls (Outfall 4).

14.10.22 Catchment 6, which discharges from Outfall 6, will involve multiple attenuation ponds draining surface waters at Bradley Brook, downstream of the M60. Flows draining from the outfall would likely lead to localised increases in peak discharge, and impact local

flow dynamics along Bradley Brook. Consequently, this would likely cause localised scour of the channel bed and banks. However, as impacts are likely to remain localised to the outfalls at Bradley Brook, not extending up- or downstream of them, significant effects would be unlikely to occur, due to the multiple attenuation ponds regulating surface waters. To confirm the extent of scour along the bed and banks, a scour assessment will be carried out. The impacts of any scour would be reduced through appropriate design and offsetting the angle of the outfall to the receiving watercourse.

14.10.23 The proposed outfalls along Tributary of Parr Brook 2 and Parr Brook (Outfalls 7 and 4 respectively) could lead to localised changes in flow dynamics. However, as the proposed flows are being designed to match existing green field runoff rates or 2 l/s, depending on which is higher, impacts are likely to remain localised to the outfall and not extend further downstream. The outfall structures for outfalls 7 and 4 are proposed to discharge directly into an artificial manhole and existing culvert, respectively. Therefore, no natural bed or bank material are likely to be affected from their operation. Overall, impacts are not considered to be significant.

Groundwater

14.10.24 Following application of mitigation (as listed in Section 14.9), potential significant effects during operation are considered unlikely for most groundwater receptors.

14.10.25 There is potential, however, for significant effects to remain on the two “issues” in the east. For the “issues” adjacent to the Northern Loop, for example, the embankment could compress the underlying superficial deposits, leading to permanent disruptions to groundwater flows within its vicinity. However, ground truthing to determine receptor sensitivity as well as further assessment would be required to confirm whether this remains the case for the Environmental Statement.

Flood risk

14.10.26 There would be no significant effects on flood risk during operation of the Proposed Scheme for most flood sources except for groundwater.

14.10.27 As stated in Section 14.4, as the provisional Order Limits are wholly within Flood Zone 1 and limited interaction with ordinary watercourses has been identified, fluvial flood risk impacts are not considered to be significant.

14.10.28 The Proposed Scheme would result in an increase in impermeable area due to the additional carriageway. Runoff from such areas would drain to new attenuation ponds that would restrict outflows to rates that do not increase flood risk as detailed in the drainage strategy, therefore ensuring no increase to flood risk and no significant effect.

14.10.29 There are areas of surface water flood risk within the provisional Order Limits. Most would be unaffected by the Proposed Scheme but there are areas where the new carriageway could displace ponded surface water (not overland flow paths). These are in grassed areas and it is considered that this would not increase flood risk to property and therefore would not result in a significant effect.

14.10.30 There is potential, however, for the Proposed Scheme to increase groundwater flood risk, both to the development and elsewhere. This may arise from; long-term changes in groundwater levels in superficial deposits beneath embankments and in their vicinity, permanent below ground structures such as embankment foundations, creating sub-

surface barriers to groundwater flow, and/or permanent below ground structures creating new pathways for groundwater migration to form, which may locally increase groundwater flood risk elsewhere. Potential significant effects on groundwater flood risk could therefore remain during the operation phase, and this will be assessed further at the Environmental Statement stage, following receipt of GI data.

15. Climate

15.1 Topic introduction

15.1.1 The purpose of this chapter is to provide information to enable consultees to understand potential climate effects, based on the preliminary information available at this time, and the measures proposed to mitigate such effects. In line with paragraph 1.2 of Design Manual for Roads and Bridges (DMRB) LA 114 Climate (Highways England, Revision 0.0.1, 2021a; hereafter referred to as DMRB LA 114), this chapter provides a preliminary assessment of:

- The potential impact of the Proposed Scheme on climate (by estimating resulting changes in greenhouse gas (GHG) emissions).
- The potential vulnerability of the Proposed Scheme to potential future changes in climate.

15.1.2 This chapter is supported by the following figure:

- Figure 15.1: Study Area for Operational Road User GHG Emissions

Greenhouse gas emissions

15.1.3 The Proposed Scheme has the potential to affect Earth's climate by causing (either directly or indirectly) the emission of GHGs into the atmosphere, both as a result of its construction and throughout its operational life. Earth absorbs energy from the Sun and re-emits this energy as thermal infrared radiation. GHGs in the atmosphere absorb this radiation, preventing it from escaping into space. The higher the concentration of GHGs in the atmosphere, the more heat energy is retained, and the higher global temperatures become. Due to human activities, the concentration of GHGs in the atmosphere has increased dramatically, leading to global warming. This warming leads to numerous indirect impacts (including hotter, drier summers; warmer, wetter winters; and more frequent and intense extreme weather events) as the climate responds to the increased atmospheric temperature.

15.1.4 As a result, the UK has entered into international obligations including the Paris Agreement (United Nations Framework Convention on Climate Change, 2016), which was ratified by the UK Government in 2016, after the National Policy Statement for National Networks (NPS NN) (Department for Transport (DfT), 2014) was published in 2014. This is translated in the UK by way of the carbon budgets set under the Climate Change Act 2008.

15.1.5 In June 2019, the Government announced a new carbon reduction 'Net Zero target' for 2050 which was given effect by the Climate Change Act 2008 (2050 Target Amendment Order 2019). This is a legally binding target for the Government to cut carbon emissions to net zero, against the 1990 baseline, by 2050. The Climate Change Act requires five-yearly carbon budgets to be set 12 years in advance so as to meet the 2050 target. Six carbon budgets have been adopted to-date. The time periods covering the fourth, fifth and sixth budgets are 2023-2027, 2028-2032 and 2033-2037 respectively. Achieving net zero will require future GHG emissions to be aligned with these and any future new or revised carbon budgets that may be set out by Government to achieve the target of net zero carbon by 2050.

15.1.6 The only statutory carbon targets are those at a national level. National Highways is not aware of any relevant non-statutory targets. It is to be noted that carbon budgets are only set out at a national scale and that these are themselves cumulative as they are a sum of carbon emissions for a range of sectors. It is not possible for the Applicant to produce a baseline at a local or regional scale and there is accordingly no reasonable basis upon which the Applicant can assess the effects of carbon emissions for anything other than at the national level.

15.1.7 The effective assessment and management of GHG emissions offers the opportunity to reduce the impact of a project on climate and by doing so contribute to the UK's target for net zero GHG emissions by 2050. This can be achieved by reducing the magnitude of GHG emissions, as far as practicable, by (in order of preference) avoiding / preventing emissions, reducing emissions and / or remediating emissions. Such measures will be informed by the Carbon Management Plan for the Proposed Scheme, which is currently under development.

Vulnerability to changes in climate

15.1.8 It is important that UK infrastructure projects are designed to be resilient to changes in climate which could happen in the future (e.g. higher temperatures, heavier rainfall and more extreme weather events).

15.1.9 As a result, this chapter provides a preliminary assessment of the potential vulnerability of the Proposed Scheme to current and potential future climatic conditions during both its construction and operation.

15.2 Stakeholder engagement

15.2.1 Table 15.1 summarises key requirements and responses relating to climate from the Planning Inspectorate's Scoping Opinion (2021), along with comments received from other stakeholders on this aspect.

Table 15.24: Key stakeholder feedback for climate aspect

Stakeholder	Comment	Response
Planning Inspectorate	Scoping Report paragraph 15.7.1 states that whether GHG emissions will be significant against Government targets will be determined through professional judgement, acknowledging that construction and operational phases of the Proposed Development will extend over multiple carbon budget periods. The Environmental Statement should set out how this judgement has been applied to changes brought about by the Proposed Development in relation to emission sources to reach conclusions to support the definition of significance.	As noted in paragraphs 15.4.4 to 15.4.9, as no specific guidance is provided within DMRB LA 114, or elsewhere, on the magnitude of a change in GHG emissions (relative to UK carbon budgets) which could be considered significant, professional judgement has been used for the purposes of this assessment.
	It is noted that there are a number of peat deposits within the red line boundary which are carbon stores. Effort should be made to avoid/reduce impact to these areas to avoid/reduce impacts from GHG emissions as part of the mitigation embedded into the design.	Surveys are currently being undertaken to confirm the location and extent of peat deposits within the application boundary. This issue will be considered within the Environmental Statement once these survey data are available.

Stakeholder	Comment	Response
	Traffic management measures have potential to cause congestion/vehicles to find alternative, longer routes which may increase GHG emissions. The Environmental Statement should consider this as part of the assessment of construction traffic effects and, where possible, set out traffic management measures for the Proposed Development to minimise these impacts.	Traffic data for the construction phase are not available at this stage. This issue will be considered within the Environmental Statement.
	Whilst the Inspectorate acknowledges there is uncertainty surrounding the future composition of the UK's vehicle fleet towards net zero (e.g. proposed ban on petrol cars), the Environmental Statement should set out and justify a proportionate worst case scenario on which to base the Environmental Statement assessment with appropriate cross referencing to the air quality assessment.	Road user GHG emissions presented in this assessment have been estimated using speed band emission factors which are derived from Version 11.0 of the Emission Factors Toolkit (EFT v11) (Department for the Environment Food and Rural Affairs (Defra), 2021). EFT v11 has been specifically developed to provide emissions outputs for all years up to 2050 in support of climate assessments and appraisals. The methodology used to estimate road user GHG emissions presented in this chapter is considered the most appropriate, however, it is subject to uncertainty, not least regarding the assumed uptake of electric vehicles and improvements in vehicle efficiency (i.e. fuel consumption) over time. While the vehicle fleet projections and engine efficiency factors used within EFT v11 were provided by National Highways and the Department for Transport in July 2021, it is likely that these will be updated in the near future (e.g. to account for policies within the recently published Transport Decarbonisation Plan (TDP) (DfT, 2021)). The vehicle fleet projections and fuel consumption parameters used within this assessment are, therefore, considered likely to be conservative, as they do not yet account for more recent Government plans to decarbonise the UK vehicle fleet (in particular heavy goods vehicles (HGVs)). Sensitivity testing has been undertaken to illustrate the potential impact of the TDP on the magnitude of estimated changes in road user GHG emissions as a result of the Proposed Scheme (see Table 15.17), however, the assessment of significance presented in this chapter has been based on the more conservative estimates based on EFT v11.

15.3 Legislative and policy framework

15.3.1 The NPS NN (DfT, 2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects on the national road and rail networks in England. The Secretary of State (SoS) uses the NPS NN as the primary basis for making decisions on DCO applications.

15.3.2 The NPS NN was, however, written in 2014, before the Government's legal commitment to achieving net zero by 2050, the new Sixth Carbon Budget (see paragraph 15.3.5) and the recently published Transport Decarbonisation Plan (DfT, 2021). While the NPS NN continues to remain in force, the DfT has committed to review it in the light of these developments, and update forecasts on which it is based to reflect more recent, post-pandemic conditions, once they are known.

15.3.3 Key policy from the NPS NN relevant to this aspect is set out below:

- Paragraph 4.40 of the NPS NN states that new national networks infrastructure should typically be long-term investments which should remain operational over many decades, in the face of a changing climate. Therefore, applications should consider the impacts of climate change when planning location, design, build and operation.
- Paragraph 4.41 states that where transport infrastructure has safety-critical elements and the design life of the asset is 60 years or greater, the applicant should apply the UK Climate Projections 2009 (UKCP09) high emissions scenario (high impact, low likelihood) against the 2080 projections at the 50% probability level. It is noted, however, that UKCP09 has since been superseded by the UK Climate Projections 2018 (UKCP18).
- Paragraph 4.42 states that applications should consider the potential impacts of climate change, over the estimated lifetime of the new infrastructure, using the latest UK Climate Projections available at the time, and that any Environmental Statement which is prepared should identify appropriate mitigation or adaptation measures.
- Paragraph 4.43 states that applications should demonstrate that there are no critical features of the design of new national networks infrastructure which may be seriously affected by more radical changes to the climate beyond that projected in the latest set of UK Climate Projections.
- Paragraph 5.17 states that applicants need to consider carbon impacts as part of the appraisal of scheme options and to describe an assessment of any likely significant climate factors within the Environmental Statement. The NPS NN states that it is very unlikely that the impact of a road project will, in isolation, affect the ability of the Government to meet its carbon reduction targets. However, the NPS NN requires that applicants should provide both evidence of the carbon impacts of a scheme and an assessment of these impacts against the Government's carbon budgets.
- Paragraph 5.19 outlines the need for appropriate climate mitigation measures to be implemented, in both design and construction of a road scheme, so that the associated carbon footprint is not unnecessarily high.

15.3.4 In addition to the national policy set out in the NPS NN, the Proposed Scheme must also have regard to relevant legislation and local plans and policy. Legislation and local planning policy will be complied with, and a summary of legislation and policy is provided in Appendix 1.1. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

15.3.5 On 12 December 2020, the UK communicated its new Nationally Determined Contribution under the Paris Agreement to the United Nations Framework Convention on Climate Change. The Nationally Determined Contribution commits the UK to

reducing economy-wide GHG emissions by at least 68% by 2030, compared to 1990 levels (UK Government, 2020).

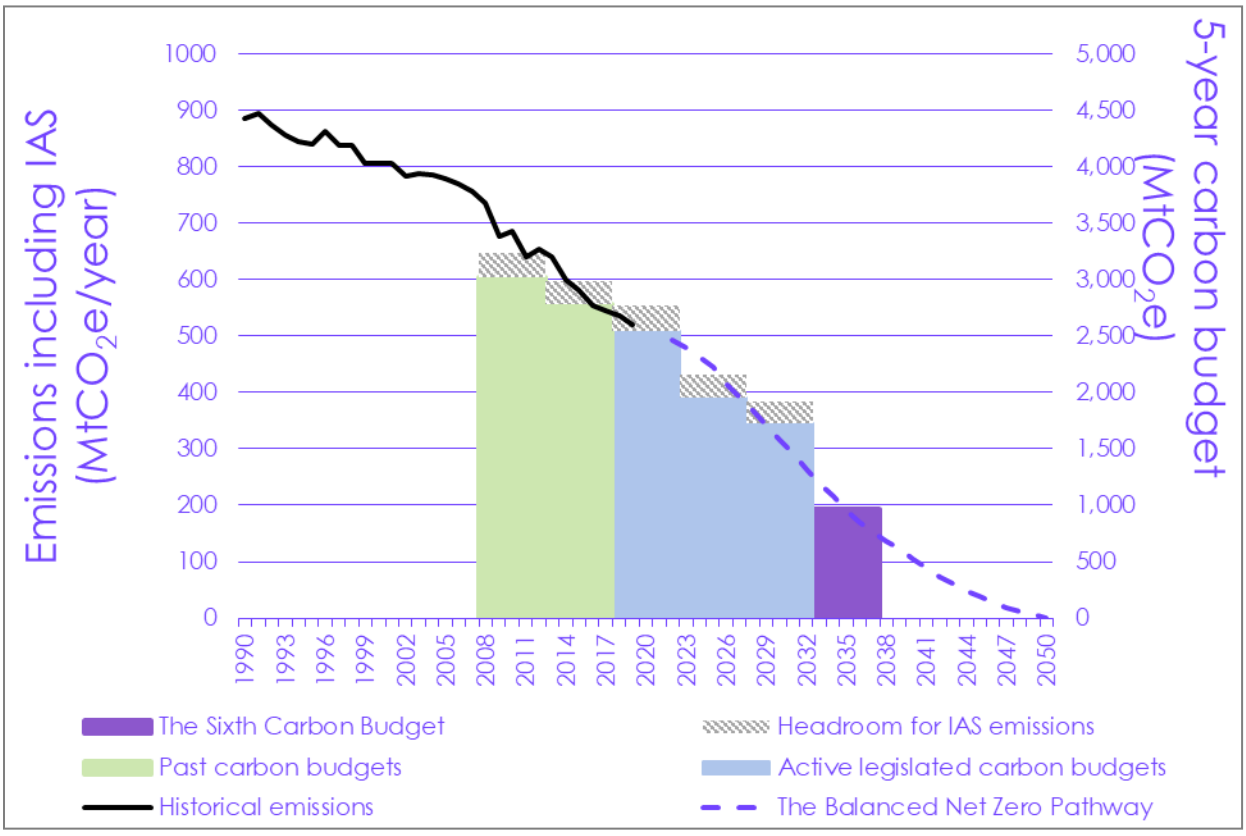
15.3.6 The UK's Climate Change Act 2008 commits the UK to reducing carbon emissions to 'net zero' by 2050. The Climate Change Act 2008 also requires the Secretary of State to set legally binding carbon budgets over five-year periods and to ensure that net UK carbon emissions do not exceed these budgets.

15.3.7 The UK Government carbon budgets which have been set to-date and that are relevant to the Proposed Scheme are as follows:

- The 4th carbon budget: 2023–2027 (defined within The Carbon Budget Order 2011) – 1,950 million tons of carbon dioxide equivalent ($MtCO_2e$), equivalent to a 36% reduction in annual emissions from a 1990 baseline.
- The 5th carbon budget: 2028–2032 (defined within The Carbon Budget Order 2016) – 1,725$MtCO_2e$, equivalent to a 57% reduction in annual emissions from a 1990 baseline.
- The 6th carbon budget: 2033–2037 (defined within The Carbon Budget Order 2021) – 965$MtCO_2e$, equivalent to a 78% reduction in annual emissions from a 1990 baseline. It is also the first budget which is in line with the 2050 net zero carbon target.

15.3.8 These carbon budgets are summarised in Plate 15.1.

Plate 15.1: UK carbon budgets set to achieve net zero carbon by 2050 (Committee on Climate Change, 2020)



15.3.9 A number of plans and strategies have also been published which are relevant to this aspect, including:

- Decarbonising Transport: A Better, Greener Britain (DfT, 2021) - This document sets out the Government's commitments and the actions needed to decarbonise the entire transport system in the UK. The plan includes commitments for zero emission vehicles, delivering a zero emission freight and logistics sector, maximising the benefits of sustainable low carbon fuels, more choice and better efficiency in the future transport system, hydrogen's role in decarbonising the transport system and increased investment in cycling and walking. The plan recognises, however, that continued high investment in our roads is, and will remain, as necessary as ever, to ensure the functioning of the nation and to reduce congestion which in itself is a major source of GHG emissions.
- Net Zero Highways: Our 2030/2040/2050 Plan (National Highways, 2021a) - This document sets out National Highway's programme for a net zero future. This centres on net zero GHG emissions for National Highways own operations by 2030 (corporate emissions); net zero for maintenance and construction of the National Highways network by 2040 (maintenance and construction emissions); and net zero carbon travel from users of the National Highways Network by 2050 (road user emissions).
- Preparing for Climate Change on the Strategic Road Network (National Highways, 2022a) - This adaption report identifies key climate change related risks relevant to the Strategic Road Network (SRN), assesses progress made towards adapting the SRN to these risks and sets out actions which will be undertaken by National Highways to respond to climate change related risks going forwards.

15.4 Assessment methodology

Greenhouse gas emissions

15.4.1 A preliminary assessment of the net change in GHG emissions associated with the Proposed Scheme compared to UK Government carbon budgets has been undertaken in accordance with paragraphs 3.8 to 3.20 of DMRB LA 114, and as required by the NPS NN. As the operational phase of the Proposed Scheme would extend over multiple carbon budget periods, changes in GHG emissions have been reported against each relevant carbon budget.

15.4.2 At this preliminary stage, only road user GHG emissions have been considered, as detailed information relating to the construction of the Proposed Scheme (e.g. the types and quantities of construction materials which would be used), are not yet available. A wider, more complete range of emission sources will be considered within the Environmental Statement, as detailed in Table 15.5 (in Section 15.5).

15.4.3 Road user GHG emissions have been estimated using the speed band emission factors contained within Version 9 of the DMRB Screening Method spreadsheet (National Highways, 2022b) which are derived from EFT v11 (Defra, 2021) and modelled traffic data, for the opening year (2027), design year (2042) and future year (2051) with the Proposed Scheme (Do-Something) and without the Proposed Scheme (Do-Minimum) scenarios. In order to estimate road user GHG emissions for each year of the 60-year appraisal period after scheme opening required by Table 3.11.1 of DMRB LA 114, estimated road user GHG emissions in the Do-Minimum and Do-Something scenarios, respectively, were assumed to change at a constant rate between 2027 and 2042 and 2042 and 2051, and then to remain constant between 2051 and 2086. The estimated change in road user GHG emissions as a result of the Proposed Scheme was then

derived by subtracting the total Do-Minimum road user GHG emissions from the total Do-Something road user GHG emissions.

15.4.4 There is no set significance threshold for changes in emissions of GHGs. Institute of Environmental Management and Assessment (IEMA) guidance (IEMA, 2022) indicates that the crux of significance is not whether a project emits GHGs, nor even the magnitude of GHG emissions alone, but whether the project contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050 (see section 6.2 of the IEMA guidance).

15.4.5 The IEMA guidance addresses significance principles and criteria in section 6.3 and Figure 5 and advises (amongst other things) that:

- A project that follows a 'business-as-usual' or 'do minimum' approach and is not compatible with the UK's net zero trajectory, or accepted aligned practice or area-based transition targets, results in significant adverse effects.
- A project that is compatible with the budgeted science-based 1.5 degree Celsius trajectory (in terms of rate of emissions reduction) and which complies with up-to-date policy and 'good practice' reduction measures to achieve that has a minor adverse effect that is not significant - such a project may have residual emissions but it is doing enough to align with and contribute to the relevant transition scenario to keep the UK on track towards net zero by 2050 with at least a 78% reduction by 2035 and thereby potentially avoiding significant adverse effects.
- A project that achieves emissions mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory, and has minimal residual emissions, is considered to have negligible effect that is not significant and such a project is playing a part in achieving the rate of transition required by nationally set policy commitments.

15.4.6 The adoption of a net zero target does not mean that consent cannot be granted for development that will increase GHG emissions; rather, as set out in paragraph 5.18 of the NPS NN, it is necessary to continue to evaluate whether (amongst other things) the increase in GHG emissions resulting from a proposed development would have a material impact on the ability of Government to meet its carbon reduction targets.

15.4.7 The Government has adopted the carbon budgets in order to meet the goals of the Paris Agreement. Thus, a proposed development which is compatible with the 2050 target and interim carbon budgets is consistent with the approach to addressing the adverse effects of climate change. This aligns with the approach to significance set out in the IEMA guidance (IEMA, 2022). The approach set out in the NPS NN continues to be relevant in light of international obligations and domestic obligations related to reducing carbon emissions that have come into force since the NPS NN was designated.

15.4.8 It is also to be noted that the carbon budgets are economy-wide and not just targets in relation to transport.

15.4.9 In the light of the above, an assessment has been made as to whether the estimated increases in GHG emissions as a result of the Proposed Scheme could have a material impact on the ability of the UK Government to meet its carbon reduction targets (and would therefore potentially be significant). As no specific guidance is provided within DMRB LA 114, or elsewhere, on the magnitude of a change in GHG emissions (relative

to UK carbon budgets) which could be considered significant, for the purposes of this assessment, therefore, professional judgement has been used.

Vulnerability to changes in climate

15.4.10 A preliminary assessment of the Proposed Scheme's vulnerability to climate change has been undertaken is reported within this PEIR in line with paragraphs 3.24 to 3.35 of DMRB LA 114, and as required by the NPS NN. This assessment has included:

- Analysis of current and projected baseline climate conditions, using appropriate UK Climate Projections, in order to identify the type and magnitude of changes in climate to which the Proposed Scheme could potentially be exposed.
- The identification of receptors, during both the construction (e.g. workforce, plant, machinery) and operational phases (e.g. scheme assets and end users), which are potentially vulnerable to changes in climate (e.g. increased rainfall and/or temperature extremes).
- The identification of climate change related impacts (e.g. flooding or landslides) on the receptors identified, which could potentially be significant.

15.4.11 At this stage, however, the measures which will be embedded within the design of the Proposed Scheme to improve its resilience to potential future changes in climate are still in the process of being identified. As such, it has not yet been possible to undertake a risk assessment of potential climate change impacts on the Proposed Scheme (in line with paragraphs 3.36 to 3.41 of DMRB LA 114) as paragraph 3.42 of DMRB LA 114 specifically states that "*significance conclusions for each impact shall be based on and incorporate confirmed design and mitigation measures*". The following further steps will therefore be reported within the Environmental Statement, once more detailed design information is available:

- The identification of mitigation measures which would be embedded within the design of the Proposed Scheme in order to improve its resilience to climate change, in liaison with the Proposed Scheme design team and relevant environmental aspect specialists.
- A qualitative risk assessment of potential residual impacts on the receptors identified with reference to the indicative framework set out in Table 3.39a (likelihood categories) and Table 3.39b (measure of consequence) of DMRB LA 114 (reproduced below as Table 15.2 and Table 15.3, respectively).

15.4.12 Within the Environmental Statement, in line with paragraphs 3.36 to 3.42 of DMRB LA 114, the likelihood and consequence of each climate related impact will be combined in the form of a matrix to identify the significance of each impact as per Table 3.41 of DMRB LA 114 (reproduced below as Table 15.4). As explained in paragraph 15.4.6, such an assessment is not possible at this stage, therefore a high-level, qualitative assessment of the likely vulnerability of the scheme to climate change has been made and reported within this PEIR, based on professional judgment and experience of similar schemes.

Table 15.2: Likelihood categories

Likelihood category	Description (probability and frequency of occurrence)
Very high	The event occurs multiple times during the lifetime of the project (60 years) e.g. approximately annually, typically 60 events.

Likelihood category	Description (probability and frequency of occurrence)
High	The event occurs several times during the lifetime of the project (60 years) e.g. approximately once every five years, typically 12 events.
Medium	The event occurs limited times during the lifetime of the project (60 years) e.g. approximately once every 15 years, typically 4 events.
Low	The event occurs during the lifetime of the project (60 years) e.g. once in 60 years.
Very low	The event can occur once during the lifetime of the project (60 years).

Table 15.3: Measure of consequence

Consequence of impact	Description
Very large adverse	Operation - national level (or greater) disruption to strategic route(s) lasting more than 1 week.
Large adverse	Operation - national level disruption to strategic route(s) lasting more than 1 day but less than 1 week or regional level disruption to strategic route(s) lasting more than 1 week.
Moderate adverse	Operation - regional level disruption to strategic route(s) lasting more than 1 day but less than 1 week.
Minor adverse	Operation - regional level disruption to strategic route(s) lasting less than 1 day.
Negligible	Operation - disruption to an isolated section of a strategic route lasting less than 1 day.

Table 15.4: Significance Matrix

		Measure of likelihood				
		Very low	Low	Medium	High	Very high
Measure of consequence	Very large	NS	S	S	S	S
	Large	NS	NS	S	S	S
	Moderate	NS	NS	S	S	S
	Minor	NS	NS	NS	NS	NS
	Negligible	NS	NS	NS	NS	NS
Note: NS = Not significant; S = Significant						

15.5 Assessment assumptions and limitations

Greenhouse gas emissions

15.5.1 The road user GHG emissions estimates presented in this report are based on data derived from the M60 Junction 18 PCF Stage 3 traffic model (based on a 2018 base year). There are uncertainties inherent within all modelled road traffic data, including those on which the operational road user GHG emissions calculations presented within this PEIR are based. Traffic model outputs have, however, been appropriately validated, as discussed within the Combined Modelling and Appraisal Report (which will be included as part of the DCO application).

15.5.2 The methodology used to estimate road user GHG emissions presented in this PEIR is considered the most appropriate; however, it is subject to uncertainty, not least

regarding the assumed uptake of electric vehicles in future years. As noted in Table 15.1, however, the vehicle fleet projections and fuel consumption parameters used within this assessment are considered likely to be conservative.

15.5.3 At this preliminary stage it has not been possible to estimate GHG emissions associated with a number of other sources, as the required data were either not available or were insufficiently developed. Within the Environmental Statement, changes in GHG emissions associated with the Proposed Scheme will also be estimated for each of the emission sources described in Table 15.5.

Table 15.5: Additional emission sources to be considered within the Environmental Statement

Emissions source	Emission estimation methodology	Data sources
Product stage (embodied carbon in construction materials)	National Highways Carbon Tool (v.2.4) (National Highways, 2021b)	Estimated types and quantities of materials / items (including earthworks mass haul and soil stabilisation assumptions)
Transport of construction materials to site	National Highways Carbon Tool (v.2.4) (National Highways, 2021b)	Assumed distances from suppliers to site
Energy consumption (on-site plant and machinery)		Estimates of on-site fuel, electricity and water consumption.
Energy consumption (staff vehicles)		Estimated staff numbers, travel modes and distances travelled to / from site
Electricity, gas and water consumption (construction)		Estimated on-site electricity, gas and water consumption
Transportation, treatment and disposal of waste materials		Estimated type, quantities, disposal method and transportation distances
Maintenance activities		Assumptions regarding likely maintenance activities and frequencies including assumed refurbishment and / or replacement frequencies for assets
Land use change and forestry	• Carbon storage by habitat: Review of the evidence of the impacts of management decisions and condition of carbon stores and sources (NERR043) (Natural England, 2012) • Equilibrium soil carbon density changes from Annex 3 of the UK Annual National Inventory Report (BEIS, 2021b) • Woodland Carbon Code Carbon Calculation Spreadsheet (v2.4, March 2021)	• Type and area of land use disturbed during construction • Type and area of land use permanently lost / gained • Number of trees, type and planting / management plans.
Peat extraction and / or drainage	On-site and off-site peat extraction and peat condition emission factors from Annex 3 of the UK Annual National Inventory Report (BEIS, 2021b)	• Mass of peat extracted • Condition and area of drained peatland

Emissions source	Emission estimation methodology	Data sources
Electricity consumption (operation)	Electricity emission factors (BEIS, 2021c)	Anticipated electricity consumption (e.g. for lighting and signage)

15.5.4 Whilst the assessment will follow DMRB LA 114, reference will also be made, where relevant and appropriate to do so, to the following:

- Publicly Available Specification (PAS) 2080: Carbon Management in Infrastructure (British Standards Institute (BSI), 2016)
- Woodland Carbon Code Carbon Calculation Guidance (UK WCC, 2021)
- National Highways Carbon Tool Guidance (National Highways, 2021b)
- Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (IEMA, 2020)
- Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2022)

15.5.5 As GHG emissions have not been estimated for those sources described in Table 15.5, benchmarking of the performance of the Proposed Scheme (i.e. by comparing GHG emissions to those estimated for other highway projects), as required by paragraph 3.21 of DMRB LA 114, has not been undertaken. Such a comparison will, however, be reported within the Environmental Statement where sufficient and appropriate data for comparable projects are available (e.g. by normalising estimated emissions to account for differences in size and scale between different projects).

Vulnerability to changes in climate

15.5.6 There is inherent uncertainty in the climate models which form the basis of the climate projections used to inform this assessment (i.e. the climate models used in the UK Climate Projections 2018 (UKCP18) datasets (Met Office, 2018a)). However, the use of the UKCP18 High Emissions Receptor Concentration Pathway 8.5 (RCP8.5) projections dataset is likely to provide a more precautious estimate of future climate change, as it represents the highest modelled GHG emissions scenario.

15.5.7 Only one grid cell, for each of the UKCP18 datasets considered (ranging from 2.2km to 25km), was selected to describe the climatic conditions in the study area considered within this assessment. Therefore, it is assumed that climate conditions across the study area are adequately described by the selected grid cell, particularly as climate conditions are not expected to vary substantially over relatively short distances (the length of the road within the provisional Order Limits is approximately 14km) and that in many cases the majority of the Proposed Scheme falls into the grid cell used.

15.5.8 There is substantial uncertainty regarding the likelihood and consequence of climate change related impacts on the performance of UK road transport infrastructure. A qualitative approach has therefore been used, supported by professional judgement where relevant. As described in Section 15.4, it has not been possible to undertake a risk assessment of potential climate change impacts on the Proposed Scheme (in line with paragraphs 3.36 to 3.42 of DMRB LA 114) within this assessment, as embedded mitigation measures are still in the process of being developed. Such an assessment

will be presented in the Environmental Statement once embedded mitigation has been finalised.

15.5.9 Where relevant, aspect-specific measures to mitigate the vulnerability of the Proposed Scheme to climate change are detailed in the corresponding chapters. For example, mitigation with regards to increased flood risk as a result of climate change is addressed in Chapter 14: Road drainage and the water environment.

15.5.10 The Proposed Scheme's vulnerability to climate change has been assessed on the basis that suitable design standards and robust engineering practices will be followed and the assumption that all relevant design standards are suitable for both current and future climatic conditions.

15.5.11 Paragraph 3.30 of DMRB LA 114 states that climate assessments should use the H++ climate scenarios to test the sensitivity of vulnerable safety-critical features, to ensure that such features would not be affected by more radical changes to the climate beyond that projected in the latest set of UK Climate Projections. The H++ scenarios cover heat waves, cold snaps, low and high rainfall, droughts, floods and windstorms. However, of these climate related events, the greatest risks to safety critical features (e.g. structures) are considered likely to be those associated with flooding. The H++ scenarios were developed using a set of climate change projections which have since been superseded (i.e. UKCP09); however, the Met Office does not propose to update these scenarios using UKCP18 (Met Office, 2018b). Following the publication of updated Environment Agency guidance on climate change allowances, the H++ scenarios are no longer used to inform peak river flow allowances on highway schemes. As discussed in paragraph 14.7.86 of Chapter 14: Road Drainage and the Water Environment, however, consideration has been given to potential changes to the risk of flooding should more radical changes in climate occur (termed "upper end allowances"). It is, however, considered unlikely that such changes would substantially increase the risk of flooding to the scheme. As the scheme is located in flood zone 1 (i.e. at less than 0.1% chance of flooding in any year), hydraulic modelling is not proposed to be undertaken, nor an assessment of a H++ scenario.

15.6 Study area

Greenhouse gas emissions

15.6.1 In line with paragraphs 3.8 and 3.9 of DMRB LA 114, different study areas need to be defined for different types of emission source. As such, the following study area is defined for the emission sources considered within this assessment:

- GHG emissions resulting from operational road users – the study area comprises the road network included within the Traffic Reliability Area (TRA) of the traffic model developed for the Proposed Scheme (as shown in Figure 15.1). The TRA is the area covered by the traffic model, that the competent expert for traffic has identified as being sufficiently reliable for inclusion in an environmental assessment.

15.6.2 The following study areas are defined for the emissions sources which have not been considered within this PEIR, but which will be considered within the Environmental Statement:

- GHG emissions resulting from construction – this is the study area necessary to consider all of the GHG emissions associated with construction materials and their

associated transport to site from the supplier. It also includes GHG emissions associated with construction activities carried out within the Order Limits, the distances that workers travel to and from the construction site and the transport and processing of waste off-site for reuse, recycling or treatment/disposal. As such, the study area is defined by the greatest extent of these activities, which assumes that some may occur at a national scale (i.e. within England).

- GHG emissions resulting from operation and maintenance – the study area is based on a similar extent as the construction phase (e.g. to include replacement of assets which may be delivered from suppliers located across England). It also includes the GHG emissions from the energy consumed within the Order Limits required to operate the Proposed Scheme.

Vulnerability to changes in climate

15.6.3 The study area for the Proposed Scheme's vulnerability to climate comprises the construction footprint of the Proposed Scheme, including compounds and temporary land take.

15.6.4 The Proposed Scheme and provisional Order Limits are shown on Figure 2.1.

15.7 Baseline conditions

Baseline sources

Greenhouse gas emissions

15.7.1 The following key sources of information have been used to define baseline and future baseline GHG emissions in the study area relevant to the Proposed Scheme:

- Carbon dioxide (CO_2) emissions at a UK and county level – UK Local Authority and Regional Carbon Dioxide Emissions National Statistics: 2005 to 2018 (BEIS, 2020)
- A preliminary estimate of Do-Minimum (i.e. without the Proposed Scheme) road user GHG emissions for the base year (2018), opening year (2027), design year (2042), future year (2051) and over a 60-year appraisal period after the Proposed Scheme opening year (2027), in line with Table 3.11.1 of DMRB LA 114.

15.7.2 No information is currently available regarding Do-Minimum GHG emissions associated with the current and future operation and maintenance activities for the extents of the existing M60/M62/M66 Simister Island Interchange and surrounding road network, which would be replaced by the Proposed Scheme. An estimate of future baseline GHG emissions from these activities will be made within the Environmental Statement using relevant assumptions and / or based on information provided by the network operator.

Vulnerability to changes in climate

15.7.3 The following key sources of information have been used to define the baseline and future baseline climate in the study area relevant to the Proposed Scheme:

- Current climate data within the study area for the Proposed Scheme – HadUK-Grid regional observations dataset v1.0.1.0 for the 'climate normal' period of 1981-2010 (Met Office *et al*., 2019), for the 25km grid square centred on grid reference SD 87500 12500.

- Climate extreme indices – State of the UK Climate 2017: Supplementary Report on Climate Extremes (Met Office, 2018c).
- Projected climate changes within the study area for the Proposed Scheme – UK Climate Projections 2018 (UKCP18) relative to the baseline period of 1981-2010 (Met Office, 2018a), under the high emissions scenario (i.e. RCP8.5) and for a 50% probability of occurrence, for the 25km grid square centred on grid reference SD 87500 12500.
- Projected climate data within the study area for the Proposed Scheme – UKCP18 relative to the baseline period of 1981-2010 (Met Office, 2018a), under the high emissions scenario (i.e. RCP8.5), for the 12km grid square centred on grid reference SD 78000 02000 and the 2.2km grid square centred on grid reference SD 82500 07500.
- Historical flooding events and areas at flood risk – see Chapter 14: Road Drainage and the Water Environment.
- Geological hazards – British Geological Survey (BGS) GeoIndex (BGS, 2021a) and GeoClimate Open (BGS, 2021b) datasets.

Baseline conditions

Greenhouse gas emissions

15.7.4 Estimated operational road user GHG emissions across the study area defined in Section 15.6 for the modelled base year (2018) are shown in Table 15.6.

Table 15.6: Estimated baseline GHG emissions

Source	Baseline GHG emissions (tCO_2e)
	2018
Road users	482,858

15.7.5 The estimated road user emissions shown in Table 15.6 equate to approximately 4% and less than 1% of 2018 national estimates of road user GHG emissions within the North West Region (13,146,100 tCO_2e) and the UK (122,651,000 tCO_2e), respectively (BEIS, 2020).

15.7.6 Within the Environmental Statement, baseline GHG emissions associated with the operation and maintenance of the existing M60/M62/M66 Simister Island will also be reported.

Vulnerability to changes in climate

15.7.7 Baseline climate data for the North West of England are summarised in Table 15.7, based on data for the most recent ‘climate normal’ period available from the Met Office (i.e. 1981-2010). These data have been compared to similar data for England as a whole, which indicate that:

- The climate in the North West of England region is colder compared to across England as a whole, throughout the year, with the most sizeable differences recorded during summertime.

- The climate in the North West of England region is wetter compared to across England as a whole, throughout the year, with the greatest difference in precipitation being in wintertime.

Table 15.7: Baseline climate data (1981 – 2010) for England and North West of England

Climate variable	Period	England	North West of England	Difference
Daily maximum temperature (°C)	Winter	7.1	6.4	-0.7
	Spring	12.7	11.7	-1.0
	Summer	20.1	18.4	-1.7
	Autumn	13.9	12.7	-1.2
Daily minimum temperature (°C)	Winter	1.3	1.0	-0.3
	Spring	4.4	4.1	-0.3
	Summer	10.9	10.5	-0.4
	Autumn	6.8	6.3	-0.5
Daily mean temperature (°C)	Annual	9.6	8.9	-0.7
	Winter	4.2	3.7	-0.5
	Spring	8.5	7.9	-0.6
	Summer	15.5	14.4	-1.1
	Autumn	10.3	9.5	-0.8
Mean accumulated precipitation (mm)	Annual	855	1,247	+392
	Winter	230	350	+120
	Spring	181	247	+66
	Summer	194	274	+80
	Autumn	250	376	+126

15.7.8 An overview of historical and more recent extreme weather conditions recorded in the North West of England is presented in Table 15.8, based on data contained within the State of the UK Climate 2017: Supplementary Report on Climate Extremes (Met Office, 2018c). These data indicate that:

- Maximum temperatures in the North West of England region are lower than across England as a whole and appear to be increasing
- The duration of ‘warm spells’ in the North West of England region, and across England as a whole, appear to be increasing
- The duration of ‘cold spells’ and number of ‘icing days’ are generally slightly higher in the North West of England region than across England as a whole, but appear to be decreasing
- Rainfall from ‘extremely wet days’ is higher in the North West of England region than across England as a whole and appears to be increasing
- Maximum ‘5-day precipitation’ is higher in the North West of England region than across England as a whole and appears to be decreasing

- The 'longest dry spell' is shorter in the North West of England region than across England as a whole and appears to be decreasing

Table 15.8: Summary of climate extremes for England and the North West of England

Climate variable	Period	England	North West of England	Difference
Highest maximum temperature [a]	1961-1990	27.3	26.2	-1.1
	1981-2010	28.3	26.9	-1.4
	2008-2017	28.5	26.8	-1.7
Warm spell duration index (days) [b]	1961-1990	5.3	6.5	+1.2
	1981-2010	10.0	10.4	+0.4
	2008-2017	15.0	12.7	-2.3
Cold spell duration index (days) [c]	1961-1990	3.1	2.9	-0.2
	1981-2010	2.8	3.5	+0.7
	2008-2017	2.0	3.1	+1.1
Number of icing days [d]	1961-1990	3.6	4.3	+0.7
	1981-2010	2.5	3.1	+0.6
	2008-2017	1.9	2.9	+1.0
Rainfall from extremely wet days (mm) [e]	1961-1990	64.8	92.9	+28.1
	1981-2010	69.3	93.1	+23.8
	2008-2017	72.0	104.2	+32.2
Maximum 5-day precipitation (mm) [f]	1961-1990	64.7	88.0	+23.3
	1981-2010	67.3	91.3	+24.0
	2008-2017	65.7	93.0	+27.3
Longest dry spell (days) [g]	1961-1990	22.7	20.0	-2.7
	1981-2010	22.2	18.8	-3.4
	2008-2017	20.1	17.0	-3.1

[a] Average highest daily maximum temperature recorded on an annual basis

[b] Count of days with at least 6 consecutive days when daily maximum temperature is above the 90th percentile centred on a 5-day window for the base period of 1961-1990

[c] Count of days with at least 6 consecutive days when daily minimum temperature is below the 10th percentile centred on a 5-day window for the base period of 1961-1990

[d] Number of days when the daily minimum temperature is below 0ºC

[e] Total rainfall falling on days with daily rainfall total in excess of the 99th percentile of daily rainfall

[f] Highest value of rainfall accumulated over 5 days

[g] Largest number of consecutive days with < 1 mm rainfall

15.7.9 Chapter 14: Road Drainage and the Water Environment uses the Environment Agency's Flood Map for Planning (Environment Agency, 2021) to identify baseline fluvial flood risk. Paragraph 14.7.63 of which states that the majority of the study area is located within Flood Zone 1 (i.e. at very low risk (less than 0.1% (1 in 1000) Annual Exceedance Probability (AEP)) and there are no areas of the Proposed Scheme that interact with Flood Zones 2 and 3.

15.7.10 Chapter 14: Road Drainage and the Water Environment (paragraphs 14.7.66 to 14.7.70) also indicates that in terms of surface water flood risk, the Environment Agency's Risk of Flooding from Surface Water (RoFSW) mapping (Environment Agency, 2021) shows that there are areas shown to be at risk of surface water flooding immediately adjacent to the main rivers and ordinary watercourses. However, these areas are within floodplains and therefore likely to be associated with fluvial flood risk. Other areas at risk of surface water flooding are mainly located within localised topographic depressions or against existing road embankments.

15.7.11 There is also an area of surface water ponding to the north-east of the junction where the proposed new 'Northern Loop' will be. However, as this length of carriageway would be elevated it is unlikely to be at risk of surface water flooding. There are other areas of high surface water flood risk and overland flow routes within the study area and these are detailed further in the Preliminary Flood Risk Assessment (Appendix 14.4).

15.7.12 Based on GeoIndex (BGS, 2020a), no historical landslide events are recorded in the vicinity of the Proposed Scheme, and therefore no such past vulnerability has been identified at this point.

15.7.13 No records were available at the time of writing regarding past incidences of subsidence within the footprint of the Proposed Scheme.

Future baseline

Greenhouse gas emissions

15.7.14 Preliminary estimates of Do-Minimum operational road user GHG emissions within the study area defined in paragraph 15.6.1 in the opening year (2027), design year (2042), future year (2051) and over the 60-year appraisal period after scheme opening (2027–2086) are shown in Table 15.9.

Table 15.9: Estimated future Do-Minimum GHG emissions

Source	Future baseline GHG emissions (tCO_2e)			
	Opening year (2027)	Design year (2042)	Future Year (2051)	Appraisal period (2027–2086)
Road users	472,036	367,307	339,626	21,769,020

15.7.15 The preliminary estimates of road user emissions shown in Table 15.9 indicates that road user GHG emissions would decrease by approximately 22% between the modelled opening year (2027) and modelled design year (2042) and by 8% between the modelled design year (2042) and modelled future year (2051). This is despite the total number of vehicle kilometres travelled within the study area being modelled to increase by approximately 14% and 4% over these periods respectively. An overall decrease in road user GHG emissions is estimated to occur because of a substantial projected increase in the proportion of electric vehicles in the national vehicle fleet (which result in lower GHG emissions than conventionally fuelled vehicles), coupled with improvements in vehicle efficiency. This illustrates the overriding influence that national policy (e.g. future bans on the sale of conventionally fuelled cars and vans) is expected to have on road user GHG emissions in future years.

15.7.16 Do-Minimum road user GHG emissions are assumed to remain constant between 2051 and 2086 in the absence of traffic data beyond 2051, whereas in reality they are likely to decrease substantially over time due to increasing proportions of electric vehicles.

15.7.17 Within the Environmental Statement, future baseline GHG emissions associated with the operation and maintenance of the existing M60/M62/M66 Simister Island Interchange will also be reported (where known).

Vulnerability to changes in climate

15.7.18 The Adaptation Committee's Independent Assessment of UK Climate Risk sets out the priority climate change risks and opportunities for the UK. In June 2021, the Committee published the UK's third Climate Change Risk Assessment (CCRA3) (Climate Change Committee, 2021).

15.7.19 CCRA3 notes that the UK is likely to experience an approximate additional 0.5°C increase in annual average temperature by 2050, even under ambitious global scenarios for cutting greenhouse gas emissions. The general pattern of change in the UK is towards warmer and wetter winters, hotter and drier summers, with high levels of variability. These changes will increase the UK's exposure to weather-related hazards including:

- Increases in average and extreme temperatures, in winter and summer
- Changes to rainfall patterns, leading to flooding in some places and water scarcity in others
- Increased coastal flooding and erosion, alongside increasing sea temperatures and ocean acidification
- Increased frequency and intensity of wildfire
- Potential changes to other weather variables including wind strength and direction, sunshine and UV levels, cloudiness, and sea conditions such as wave height.

15.7.20 Current and projected future changes in climate at the location of the Proposed Scheme, in terms of temperature and precipitation, are presented in Table 15.10. These data utilise the 25km spatial resolution UKCP18 probabilistic dataset for the grid cell centred at grid reference SD 87500 12500. The current climate conditions (i.e. observed baseline) refer to the most recent historic climate dataset of 1981–2010. The future climate conditions (i.e. climate projections) refer to projections made under the high emissions scenario (i.e. RCP8.5) with a 50% probability of occurrence for the 2030s (2020–2049), 2060s (2050–2079) and 2080s (2070–2099) respectively. These 30-year periods cover the lifespan of the Proposed Scheme (which is taken to be 60 years in accordance with paragraph 3.31 of DMRB LA 114).

Table 15.10: Projected changes in climate at the location of the Proposed Scheme

Climate metric	Observed baseline 1981–2010	Projected change (UKCP18 RCP8.5 (50% probability))		
		2030s (2020–2049)	2060s (2050–2079)	2080s (2070–2099)
Annual mean accumulated precipitation	1,278.5mm	+0.1%	+1.0%	+0.8%
Winter mean accumulated precipitation	362.8mm	+1.9%	+10.4%	+13.6%
Summer mean accumulated precipitation	283.1mm	-8.7%	-23.7%	-31.2%
Annual mean temperature	8.9°C	+0.9°C	+2.1°C	+3.3°C
Mean winter minimum temperature	3.6°C	+0.9°C	+2.0°C	+2.9°C
Mean summer maximum temperature	14.6°C	+1.3°C	+3.0°C	+4.7°C

15.7.21 Under the climate scenario considered, annual mean accumulated precipitation at the location of the Proposed Scheme is projected to slightly increase over time, and by the 2080s is projected to have increased by 0.8% compared to the observed baseline. However, projected changes in seasonal precipitation by the 2080s, i.e. +13.6% during wintertime and -31.2% during summertime, indicate wetter winters and substantially drier summers could occur.

15.7.22 All of the temperature related metrics considered indicate that there could be a steady increase in temperatures, with the largest increase occurring during summertime. Specifically, the annual mean, mean winter minimum and mean summer maximum temperatures are projected to increase by 3.3°C, 2.9°C and 4.7°C, respectively, by the 2080s compared to the observed baseline values.

15.7.23 Other climate variables selected to represent more extreme conditions (i.e. the 10th and 90th percentiles of projected values) are presented in Table 15.11. These variables were derived utilising the regional (12km) and, where relevant, local (2.2km) spatial resolution UKCP18 high emissions scenario (i.e. RCP8.5) datasets for the grid squares centred at grid reference SD 78000 02000 and SD 82500 07500, respectively.

15.7.24 Daily projections for the period 2061–2080 were used to assess potential changes in more extreme daily temperature, precipitation and wind events. The 90th percentile of projected values has been used to represent the value above which any event happening within a day (e.g. a precipitation event) is likely to occur less frequently. For instance, for the period 2061–2080, maximum daily precipitation events greater than 14.1mm are likely to occur relatively infrequently. Similarly, the 10th percentile has been used to represent the value below which any event happening within a day is likely to occur less frequently. The corresponding metrics for the observed baseline period 1981–2010 (which is the baseline for the 12km and 2.2km projection datasets) are also presented for comparison.

Table 15.11: Projected changes in climate extremes at the location of the Proposed Scheme

Meteorological parameter	Observed baseline 1981–2010		Projected (RCP8.5) 2061–2080		Projected change	
	10th %ile	90th %ile	10th %ile	90th %ile	10th %ile	90th %ile
Daily precipitation (mm/day)	-	10.7 to 13.5	-	10.9 to 14.1	-	+0.2 to +0.6
Minimum daily temperature (°C)	-1.3 to 1.3	11.9 to 14.2	2.2 to 4.1	15.4 to 18.4	+2.8 to +3.5	+3.5 to +4.2
Maximum daily temperature (°C)	2.7 to 5.5	18.4 to 20.9	6.1 to 8.1	22.7 to 27.1	+2.6 to +3.4	+4.3 to +6.2
Daily temperature (°C)	0.9 to 3.5	14.9 to 17.3	4.3 to 6.2	18.8 to 22.5	+2.7 to +3.4	+3.9 to +5.2
Maximum daily wind gusts (m/s)	7.3 to 8.6	18.6 to 19.7	7.3 to 8.0	18.1 to 19.7	-0.6 to 0.0	-0.5 to 0.0
Note: Ranges are provided for each variable to account for differences in the outputs of the 12 ensembles (i.e. model runs) included within the UKCP18.						

15.7.25 Under the climate scenario considered, the 90th percentile of daily precipitation values is projected to increase slightly from 13.5mm/day during 1981–2010 to 14.1mm/day during 2061–2080 (upper limits used), indicating that more extreme precipitation events have the potential to occur slightly more frequently. However, it should be noted in this instance that when even more extreme events are considered, i.e. in excess of the 90th percentile, precipitation intensity appears to increase between the two periods, suggesting that, while more extreme precipitation events could occur only slightly more frequently, very extreme precipitation events could be of higher intensity when they do occur. For instance, the 99th percentile of daily precipitation values is projected to increase by approximately 12% from 29.9mm/day during 1981–2010 to 33.7mm/day during 2061–2080 (upper limits used).

15.7.26 The 10th percentile of minimum daily temperatures is projected to increase from -1.3°C to 2.2°C (lower limits used), indicating that days with more extreme low temperatures have the potential to occur less frequently. The 90th percentile of maximum daily temperatures is projected to increase from 20.9°C to 27.1°C (upper limits used), indicating that days with more extreme high temperatures will potentially occur more frequently.

15.7.27 The intensity of the 90th percentile of maximum wind gusts is projected to remain the same at 19.7m/s (upper limits used) both during 1981–2010 and 2061–2080, indicating that higher wind speeds will potentially occur at the same frequency.

15.7.28 Utilising the same dataset as for Table 15.11, a number of climate extreme indices for the study area were also calculated (see Table 15.12), which underpin the warmer and drier conditions identified above. For example, the number of annual air frost days (upper limit) during 2061–2080 will potentially be substantially lower than during 1981–2010, i.e. from up to 27 events to up to two events. Hot spells and heatwaves will potentially increase from up to three events and up to two events per year during 1981–2010, to up to 25 events and up to 18 events per year, respectively, during 2061–2080. In addition, drought events and dry spells will potentially increase from up to one event to up to four events and from up to seven events to up to 14 events, respectively. The

annual number of days with wind gust events exceeding 45mph will potentially remain the same at up to 32 days.

Table 15.12: Projected changes in climate extreme indices at the location of the Proposed Scheme

Climate extreme indices	Observed baseline 1981–2010	Projected (RCP8.5) 2061–2080
Annual number of days when mean temperature >25°C	0–1	2–12
Annual air frost days	5–27	0–2
Annual hot spells (days)	0–3	5–25
Annual heatwaves (days)	0–2	3–18
Annual heavy rain days	3–7	5–10
Annual drought events	0–1	0–4
Annual dry spells	1–7	5–14
Annual number of days when maximum wind gust >45mph	19–32	18–32
Note: Ranges are provided for each variable to account for differences in the outputs of the 12 ensembles (i.e. model runs) included within the UKCP18.		

15.7.29 As noted in Chapter 14: Road Drainage and the Water Environment, over the anticipated lifetime of the Proposed Scheme, changes to the baseline as a consequence of climate change would likely occur. This includes a likely increase in the frequency and magnitude of flood events, as well as changes in both the low and high flows in watercourses leading to subsequent changes in dilution capacity and surface water quality.

15.7.30 Based on GeoIndex (BGS, 2020b) and specifcally the GeoClimateUKCP18 dataset, subsidence is considered '*improbable*' under '*average*' soil humidity conditions in the region of the Proposed Scheme in the 2080s.

15.7.31 Future changes in climate have the potential to exacerbate or reduce the effects of the Proposed Scheme on the environment (i.e. to result in 'in-combination' effects). This issue has been considered within each of the relevant aspect chapters using aspect significance criteria, rather than within this chapter, as recommended within the Institute of Environmental Management and Assessment's (2020) Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation.

Identified receptors

15.7.32 In line with DMRB LA 114, the following receptors have been identified:

- With regard to GHG emissions:
  - UK carbon budgets (as a proxy for the global climate).
- With regard to the Proposed Scheme's vulnerability to climate change:
  - Receptors associated with the construction process (including the construction workforce, plant and machinery).

- The assets and their operation, maintenance and refurbishment (e.g. road pavement surfaces, structures, earthworks and drainage, technology assets, soft estate).
- End-users (e.g. members of the public or commercial operators using the Proposed Scheme).

Value and sensitivity of receptors

15.7.33 The receptors relevant to climate are outlined in the baseline information above. In the absence of specific guidance in DMRB LA 114 on the valuation of receptors with regard to climate impacts, all receptors are considered to be of equally high value.

15.8 Potential impacts

Greenhouse gas emissions

15.8.1 Increases in GHG emissions could impact climate by contributing to the cumulative impact that GHG emissions have on climate change. It is not possible, however, to attribute the resulting impact of a certain quantity of GHG emissions to effects on a specific receptor. Instead, the most appropriate geographic level for an assessment of the impact of a certain quantity of GHG emissions is at a national level (i.e. by comparison to UK carbon budgets) as that is the level at which the UK Government has jurisdiction and has specified in NN NPS paragraph 5.18 the assessment shall be undertaken.

Construction

15.8.2 GHG emissions would be generated during the construction phase as a result of the following activities, in alignment with modules A1 to A5 of the ‘before use’ life cycle stage identified in PAS 2080:2016:

- Embodied GHG emissions associated with the required raw materials (product stage (modules A1–A3))
- Transport of materials to the construction site (construction process stage (module A4))
- Transport of waste from the construction site and subsequent treatment (construction process stage (module A5))
- Transport of construction workers, on-site staff and visitors to and from the construction site (construction process stage (module A5))
- Operation of construction plant and on-site activities (construction process stage (module A5))
- On-site consumption of fuel, electricity and water (construction process stage (module A5))
- GHG emissions mobilised by vegetation losses, soil disturbance or peat extraction / peat dewatering (construction process stage (module A5))

Operation

15.8.3 GHG emissions during the operational phase of the Proposed Scheme would be associated with:

- Maintenance and operation of the road infrastructure – through consumption of energy (e.g. through petrol or diesel combustion and use of electricity) and materials to support activities such as the repair and replacement of lighting and structures (including fencing) and highway resurfacing.
- Consumption of energy (e.g. through petrol and diesel combustion and use of electricity) by motorised vehicles using the road infrastructure – the Proposed Scheme has the potential to alter traffic volumes, composition and speeds on the local road network, both positively and negatively, which could act to alter the overall magnitude of road user GHG emissions.
- Ongoing changes in the emissions/sequestration balance within the scheme footprint associated with changes in land use, for example through changes in the spatial extents and management of carbon sinks such as woodland and peatland.

Decommissioning

15.8.4 As per paragraph 2.3 of DMRB LA 114, GHG emissions associated with decommissioning of the Proposed Scheme (i.e. modules C1 to C4 of the 'end of life' life cycle stage identified in PAS 2080 (British Standards Institution, 2016)) are excluded from the assessment due to the length of the operational phase of the Proposed Scheme's assets (which is assumed to be greater than the 60-year appraisal period required by Table 3.11.1 of DMRB LA 114).

Vulnerability to changes in climate

Construction

15.8.5 As identified in Table 15.7 and Table 15.8, the North West of England region appears to have experienced increasing temperatures and precipitation events of higher intensity in recent years. Furthermore, the projected changes in climate variables over the relatively short term (2020–2049) shown in Table 15.10 suggest that further increases in temperature have the potential to occur (especially during summer) and that precipitation has the potential to increase during winter. Table 15.13 identifies climate related impacts on construction phase receptors, which could potentially occur as a result of these changes.

Table 15.13: Potential impacts resulting from climate change during construction

Potential change in climate	Climate related hazard/opportunity	Impact receptor(s)	Potential impacts
Increased precipitation during winter months	Flooding of construction site, compounds, haul routes and/or excavations	Directly: Machinery and plant; materials; temporary facilities; earthworks Indirectly: Watercourses and adjacent land; construction workforce; Contractor; scheme operator; end users (if construction programme delayed)	Damage to equipment, materials stored on-site and compound facilities. Machinery and plant damaged or trapped. Site roads become impassable. Contamination of water bodies through runoff. Adverse impacts on health, safety and welfare of construction workforce. Delays to construction programme and increased costs.
	Flooding of local road network and site access roads	Directly: Contractor Indirectly: Scheme operator; end users (if construction programme delayed)	Disruption to supply of materials and goods required to support construction activities and associated delays to construction programme.
	Higher pore water pressure in embankments and earthworks, leading to instability and risk of failure	Directly: Structures; earthworks Indirectly: Machinery and plant; construction workforce; Contractor; scheme operator; end users (if construction programme delayed)	Damage to equipment and compound facilities. Adverse impacts on health, safety and welfare of construction workforce. Delays to construction programme and increased costs.
Higher temperatures and lower rainfall during summer	Very high summer temperatures and increased number of hot spells	Directly: Construction workforce; machinery and plant	Increased risk of heat stress or sunstroke for outdoor construction workers. Risk of mechanical failure of equipment due to overheating.
	Fewer very cold days with freezing conditions	Directly: Construction workforce; machinery and plant Indirectly: Contractor; scheme operator	Reduced health, safety and welfare risks to construction workers associated with icy conditions or very cold temperatures. Conditions for some construction activities/ processes/equipment more likely to be favourable, benefiting construction programme.
	Increased desiccation of soils	Directly: Earthworks Indirectly: Machinery and plant; construction workforce; Contractor	Slope stability reduction and earthworks failure during or immediately after summer storm events falling on desiccated soils.

Potential change in climate	Climate related hazard/opportunity	Impact receptor(s)	Potential impacts
	Accelerated hardening of bitumen	Directly: Pavements Indirectly: Contractor; scheme operator	Inappropriate conditions to lay pavements (e.g. very hot weather) resulting in delays to construction programme.

Operation

15.8.6 As identified in Table 15.10, projected changes in climate over the longer term suggest that there could be substantial increases in temperature especially during summer and precipitation during winter in the area of the Proposed Scheme. Furthermore, Table 15.11 indicates that maximum daily temperatures have the potential to increase substantially over the lifespan of the Proposed Scheme, while Table 15.12 indicates that climate events, such as hot spells, heatwaves, dry spells and droughts, have the potential to occur more frequently.

15.8.7 Table 15.14 sets out how such changes could impact the Proposed Scheme receptors during its operation, including infrastructure elements (e.g. structures, earthworks, drainage, road surfacing, lighting and signage, soft estate), road users, scheme operators and maintenance workers.

15.8.8 It should be noted that Chapter 14: Road Drainage and the Water Environment, has identified that the risk of surface water flooding is likely to increase as a result of climate change. This may impact the magnitude and frequency of flooding and, if unmitigated, result in additional areas of the Proposed Scheme becoming at risk of flooding in a 1% Annual Exceedance Probability (AEP) event. As discussed in Chapter 14, mitigation has therefore been proposed to account for the increases in surface water flood risk identified as a result of climate change.

Table 15.14: Potential impacts resulting from climate change during operation

Potential change in climate	Climate related hazard/opportunity	Impacted receptor(s)	Potential impacts
Increased precipitation during winter months More extreme rainfall events	Road surface flooding, should drainage capacity be exceeded	Directly: Road users; pavements Indirectly: Scheme operator	• Danger or delay/disruption to road users. • Damage to road pavements. • Increased management/maintenance requirements/costs.
	Rivers flooding roads and road infrastructure (e.g. bridges, underpasses)	Directly: Pavements; structures; road users Indirectly: Scheme operator	• Danger or delay/disruption to road users. • Damage to/accelerated degradation of scheme structures and assets. • Increased management/maintenance requirements/costs.
	Culvert scouring	Directly: Drainage; structures Indirectly: Scheme operator	• Culvert failure or increased maintenance requirements/costs.
	Bridge scouring	Directly: Structures Indirectly: Scheme operator	• Bridge foundation failure or increased maintenance requirements/costs.
	Erosion at toe of embankments	Directly: Earthworks Indirectly: Scheme operator	• Embankment failure or increased maintenance requirements/costs.
	Water ingress to cables and electrical equipment (e.g. signage)	Directly: Electrical infrastructure Indirectly: End users; scheme operator	• Damage to equipment, which could result in danger or delay/disruption to road users. • Increased maintenance requirements/costs.
	Rise in groundwater level	Directly: Structures; earthworks Indirectly: Scheme operator	• Change in groundwater level affecting earth pressures for retaining walls causing damage to retaining walls and subsequent ground movement. • Increased maintenance requirements/costs.
		Directly: End users; structures; pavement Indirectly: Scheme operator	• Flooding of underbridges (particularly in winter), which could result in danger or delay/disruption to road users. • Damage to/accelerated degradation of scheme structures and assets. • Increased maintenance requirements/costs.
	Flooding of roads, hard shoulders, verges and access routes, etc.	Directly: Contractor Indirectly: Scheme operator; end users	• Challenges for the maintenance regime (e.g. delays, failures).

Potential change in climate	Climate related hazard/opportunity	Impacted receptor(s)	Potential impacts
	Increased debris and sediment runoff	Directly: Drainage Indirectly: Soft estate	• Capacity reduction of sustainable drainage systems (SuDS) over time due to sediment build-up.
	Increased debris washing into drainage infrastructure (e.g. gullies and culverts)	Directly: Drainage Indirectly: End users; scheme operator	• Blockages of drainage system, which could result in danger or delay/disruption to road users and increased maintenance requirements/costs.
	Increased number of heavy rain days	Directly: Pavements Indirectly: End users; scheme operator	• Higher stripping rate of pavements leading to texture depth reduction, which could result in danger to road users and increased maintenance requirements/costs.
	Increased rainfall during winter	Directly: Pavements Indirectly: End users; scheme operator	• Potholing, rutting and cracking from moisture entering and remaining in pavements (particularly in combination with frost formation) which could result in damage to road users' vehicles and increased maintenance requirements/costs.
	Higher pore water pressure in embankments and earthworks, leading to instability and risk of failure	Directly: Structures; earthworks Indirectly: End users; scheme operator	• Delay/disruption to road users. • Increased maintenance requirements/costs.
	Increased groundwater level changes	Directly: Earthworks	• Variations in groundwater levels cause softening of embankment fill through capillary action and accelerated weathering effects, weakening embankments.
Lower rainfall during summer More frequent drought events and dry spells	Soil shrinkage and/or subsidence	Directly: Structures; earthworks Indirectly: Pavements; end users; scheme operator	• Adverse impacts on foundations, including for bridges and other structures, which may result in increased maintenance requirements or failure.
	Reduced inflow into SuDS	Directly: Drainage; soft estate	• Planting/seeding failure, reducing SuDS functional capacity.

Potential change in climate	Climate related hazard/opportunity	Impacted receptor(s)	Potential impacts
	Increased desiccation of soils	Directly: Earthworks Indirectly: Pavements; end users	• Slope stability reduction and earthworks failure during or immediately after summer storm events falling on desiccated soils.
Increase in maximum summer temperatures and number/duration of hot days, hot spells and heatwaves	Heating and thermal expansion beyond the design capability of structures and assets	Directly: Structures	• Damage or failure of structures or assets.
	Increased number of hot days and maximum temperatures	Directly: Pavements	• Permanent deformation of asphalt (part of the paving mixture, i.e. flexible surfacing), particularly during prolonged hot weather conditions.
		Directly: Pavements Indirectly: End users	• Surface rutting leading to water ponding in ruts. • Reduced skid resistance due to fatting (accumulation of bituminous mix on the surface of the pavement).
	Acceleration of bitumen binder hardening	Directly: Pavements	• Pavements cracking and fretting with age and traffic loads.
	Increased annual and summer mean temperature may lead to longer growing season	Directly: Pavements; structures	• Stability impacts on structures and deformation of pavements due to overgrown tree roots.
		Directly: Soft estate; drainage	• Additional maintenance needs for soft estate and SuDS, due to overgrown vegetation.
	Increased maximum (summer) temperatures may impact on performance of electrical equipment	Directly: Electrical equipment	• Reduced efficiency and lifespan of LED luminaires etc.

15.9 Design, mitigation and enhancement measures

Net Zero Highways

15.9.1 The 'Net Zero Highways' plan (National Highways, 2021a) sets out National Highways' programme for achieving net zero GHG emissions for the Strategic Road Network (SRN) by 2050. The plan commits National Highways to achieving:

- Net zero for its own operations by 2030
- Net zero for maintenance and construction by 2040
- Net zero carbon travel on the SRN by 2050

15.9.2 Within the plan, a number of key targets have been set to achieve each of these commitments (from 2022 onwards). Many of these targets involve research and / or the development of future policies and procedures as National Highways transition towards achieving net zero, the outcomes of which will inform the design, development and operation of the Proposed Scheme going forwards (where applicable).

Embedded (design) mitigation

15.9.3 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the scheme design. This is referred to as embedded mitigation. Chapter 3: Assessment of Alternatives, details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

15.9.4 The Proposed Scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects, where feasible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

15.9.5 For example, as part of the process for evaluating GHG emissions associated with construction of the Proposed Scheme, processes have been implemented to evaluate these iteratively throughout the design process, thereby informing and identifying opportunities to reduce such emissions. These processes will inform design stages allowing GHG emissions to be considered in a timely manner, rather than at the end of the design process. The sharing of information is being promoted, along with the identification of innovations and engagement with suppliers across the project team to ensure that GHG emissions along the value chain have been considered.

Greenhouse gas emissions

15.9.6 Paragraph 3.22 of DMRB LA 114 indicates that projects shall seek to minimise GHG emissions to contribute to the UK's target for a net reduction in carbon emissions.

15.9.7 The following options will therefore be considered when identifying potential opportunities to reduce GHG emissions (in the order of priority shown):

- Avoid / prevent:
  - Maximise potential for re-using and/or refurbishing existing assets to reduce the extent of new construction required, and/or explore alternative lower carbon

options to deliver the project objectives (e.g. shorter road sections with smaller construction footprints).

- Identify through project and delivery programmes opportunities to influence road user GHG emissions.

- Reduce:
  - Apply low carbon and/or reduced resource consumption solutions (including technologies, materials and products) to minimise resource consumption during the construction, operation, and at end of life.
- Remediate:
  - Identify, assess and integrate measures to further reduce carbon through on or off-site offsetting or sequestration.

15.9.8 Indicative opportunities to reduce the magnitude of GHG emissions associated with construction activities include:

- Reduce the use of resources and maximise the use renewables or materials with recycled or secondary content to reduce the amount of carbon embodied in the construction materials.
- Reduction of import and export of fill and materials (e.g. by reusing site-won materials).
- Using lower carbon and more energy efficient construction plant and machinery such as hybrid, electric, hydrogen or alternative lower carbon fuels.

15.9.9 Indicative opportunities to reduce the magnitude of GHG emissions associated with the maintenance of the Proposed Scheme include:

- Designing, specifying and constructing the scheme with a view to increasing the operational lifespan of surfaces and structures and reducing the need for maintenance.
- Employing modular construction techniques to reduce on-site maintenance requirements and / or allow the use of lower carbon replacements in the future.
- Making adequate provision to support the use of low emission vehicles where appropriate.
- Specifying high efficiency and low emission mechanical and electrical equipment such as LED lighting and signal gantries.
- Maintaining equipment using current best practice techniques.

Vulnerability to changes in climate

15.9.10 Up-to-date design and construction standards, along with good engineering practice, will be applied to the design and construction of the Proposed Scheme. The application of such, which will be embedded in the design of the Proposed Scheme, is expected to secure the resilience of the Proposed Scheme for its whole lifecycle.

15.9.11 Specific mitigation measures identified as being relevant to the construction stage include:

- Modular design and off-site construction, to reduce on-site construction activities where it is practicable to do so.
- Installing site compound drainage that has sufficient capacity to withstand extreme precipitation events (and potentially re-using this water (e.g. for dust suppression) to reduce overall water consumption).
- Proactively planning the need for and location of material stockpiles etc., with regard to weather forecasts and the potential for extreme weather events (e.g. as part of materials management plan).
- Undertaking additional inspections of material stockpiles and structures during and following extreme weather events (e.g. floods, heatwaves, storms) to ensure stability and incorporating such measures into materials management plans.
- Proactively managing work patterns / automating work to avoid human exposure to extreme temperatures and, where this is not possible, the provision of appropriate personal protective equipment (e.g. sun cream) and facilities (e.g. cool rooms and shade) for workers during high temperature periods.
- Allowing sufficient time within the construction programme to accommodate a reduction of risks to site operatives, plant and machinery and other elements of the scheme associated with periods of high temperature and prolonged periods of heavy precipitation.

15.9.12 The following mitigation measures would potentially help reduce the vulnerability of the Proposed Scheme to climate effects during operation:

- Developing the Proposed Scheme design (in particular the drainage system) with reference to Environment Agency and Local Lead Flood Authority guidance regarding peak rainfall (including appropriate climate change allowances).
- Avoid or reduce the positioning of permanent structures within channels or within the floodplain and provision of flood compensation storage.
- Slope stabilisation measures (ideally low impact measures, which avoid the use of concrete).
- Designing and specifying pavement construction, expansion joints and other elements which are resilient to projected increases in peak summer temperatures.
- Designing and specifying pavement construction, drainage systems, embankments and other elements with a view to projected changes in precipitation characteristics as well as increased variability of ground conditions (e.g. increased shrink-swell from wetting and drying).
- Specifying regular inspection of drainage infrastructure, materials and structures to identify any deterioration along with additional inspections after extreme weather events.

15.9.13 Standard mitigation would occur as a matter of course due to legislative requirements or standard sector practices. Examples of standard mitigation for this aspect includes the following:

- Implementation of standard good practice construction measures (e.g. planning of site layouts and activities to minimise impacts of heavy rainfall).

- Implementation of a construction phase Travel Management Plan to minimise GHG emissions associated with the transportation of staff, construction workers, materials and waste to and from the construction site.
- Implementation of appropriate measures to reduce the vulnerability of construction activities associated with the Proposed Scheme to climate impacts. Such measures could include suitable management of site drainage and using weather forecasts to plan on-site activities.
- Implementation of an appropriate monitoring strategy to proactively identify potential climate related impacts (e.g. additional visual inspections of the Proposed Scheme's assets after extreme weather events).

15.9.14 Standard mitigation will be included in a first iteration of the Environmental Management Plan which will be prepared for the Environmental Statement and DCO submission (refer to Chapter 5: Environmental Assessment Methodology).

Essential mitigation

15.9.15 No essential mitigation measures are envisaged to be required, at this stage, following the implementation of embedded mitigation.

Enhancement

15.9.16 Indicative opportunities to reduce the magnitude of operational road user GHG emissions by encouraging modal shift from private car to active travel modes, which are currently being explored and have not yet been confirmed, include:

- Potential improvements to the Transport for Greater Manchester (TfGM) cycleways which run between Philips Park Road East and Philips Park Road West, and via the permissive route which runs through Haweswater Underpass in line with the TfGM's 'Beelines' initiative.
- Potential improvements to the underpass used by Unsworth Academy to access their playing fields. If taken forward, these measures would improve the quality of local walking and cycling routes, leaving a beneficial legacy for the scheme and complementing a separate programme of improvements to the Haweswater Underpass and Old Hall Lane footbridge which are being proposed as part of a designated funds project.

15.9.17 The creation and enhancements of additional ecological habitats and / or tree planting could also potentially be used to offset some GHG emissions through natural sequestration and soil carbon storage.

15.9.18 In addition to this, with regards to the potential for land use change as a result of the Proposed Scheme leading to the possible extraction of peat and / or peat de-watering, GHG emissions could possibly be offset through targeted peat restoration projects.

15.10 Assessment of likely significant effects

Greenhouse gas emissions

15.10.1 Paragraph 3.18 and 3.19 of DMRB LA 114 require that total GHG emissions in the Do Something scenario and the net change in GHG emissions as a result of the

Proposed Scheme are compared to relevant UK carbon budgets. Such a comparison has not, however, been fully possible at this stage because:

- As noted in paragraph 15.5.3, construction phase GHG emissions have not been quantified at this stage but instead will be estimated going forwards and reported within the Environmental Statement.
- At this stage, only GHG emissions associated with operational road users (i.e. emissions associated with the consumption of fuel and electricity by vehicles) have been considered. As noted in paragraph 15.5.3, GHG emissions from a wider range of operational phase emission sources will be estimated and reported within the Environmental Statement.

15.10.2 Preliminary estimates of operational road user GHG emissions following the implementation of the Proposed Scheme within the study area defined in paragraph 15.6.1 in the opening year (2027), design year (2042), future year (2051) and over a 60-year appraisal period after scheme opening (2027–2086) are shown in Table 15.15.

Table 15.15: Estimated future Do-Something GHG emissions

Source	Do-Something GHG emissions (tCO_2e)			
	Opening year (2027)	Design year (2042)	Future year (2051)	Appraisal period (2027–2086)
Road users	475,632	369,634	341,847	21,914,553

15.10.3 The preliminary estimates of road user emissions shown in Table 15.15 indicate that the Proposed Scheme is estimated to result in a 0.8%, 0.6% and 0.7% increase in road user GHG emissions across the study area in the opening year, design year and future year, respectively, compared to the Do-Minimum scenario shown in Table 15.9.

15.10.4 Preliminary estimates of the total Do-Something GHG emissions across the study area and the net change in operational road user GHG emissions (i.e. Do-Something minus Do-Minimum GHG emissions) within relevant carbon budget periods are shown in Table 15.16.

Table 15.16: Estimated GHG emissions compared to UK carbon budgets

Project Stage	Estimated GHG emissions over carbon budgets (tCO_2e) (Do-Something scenario)	Net change in GHG emissions with Proposed Scheme over carbon budgets (tCO_2e)	Net change in GHG emissions with Proposed Scheme within relevant carbon budget period (tCO_2e) (and as % of relevant carbon budget)		
			4th carbon budget (2023–2027)	5th carbon budget (2028–2032)	6th carbon budget (2033–2037)
Construction	To be reported within Environmental Statement			-	-
Operation (road users only)	4,843,292	34,903	3,596 (<0.001%)	16,711 (0.001%)	14,596 (0.002%)
Total	To be reported within Environmental Statement				

15.10.5 The NPS NN states that '*It is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets*', whilst Note 2 of paragraph 3.19 of DMRB LA 114 adds '*it is considered unlikely that projects will in isolation conclude significant effects on climate*.

15.10.6 The results in Table 15.16 indicate that estimated changes in road user GHG emissions as a result of the Proposed Scheme are negligible in comparison to relevant UK carbon budgets. On this basis, GHG emissions associated with the Proposed Scheme are considered unlikely to have a material impact on the ability of the UK Government to meet its carbon reduction targets and are therefore considered to be **'not significant'**, in line with Note 2 of paragraph 3.19 of DMRB LA 114 and the NPS NN. This conclusion will be confirmed within the Environmental Statement once further, more detailed information is available.

15.10.7 It should also be noted that this assessment is considered likely to be worst case as the estimated operational road user GHG emissions presented in this report (estimated using the DMRB Screening Method spreadsheet (National Highways, 2022b) which contains speed band emission factors derived from EFT v11 (Defra, 2021)) do not fully account for the most recent projections for the uptake of electric cars and vans described in the latest version of DfT's TAG data book (DfT, 2022). Nor do they take account of the projected reductions in GHG emissions depicted in Figure 2 of the TDP (DfT, 2021, page 45). The impacts of the TDP are expected to lead to a substantive decrease in GHG emissions from all forms of road transport between now and 2050. As the TDP has been published relatively recently, vehicle composition projections and emission factors have not yet been updated to reflect the emerging policy position described by the TDP. The DfT have advised National Highways that a sensitivity test based on the impact of the policy measures set out in TDP can now, however, be undertaken for schemes. The DfT have approved a sensitivity test based on the rate of improvement shown in Figure 2 of the TDP which can be applied to road user GHG emissions calculated for the Proposed Scheme assessment.

15.10.8 Table 15.17 presents total operation phase GHG emissions in the Do-Something scenario and the change in operation stage GHG emissions compared to the Do-

Minimum scenario, split by carbon budgets, for the TDP sensitivity test (upper and lower bounds).

15.10.9 The results in Table 15.17 indicate that the implementation of the TDP will result in substantially lower operational phase GHG emissions and changes in operational phase GHG emissions than presented in Table 15.16 within both the fifth and sixth carbon budget periods and in future years.

Table 15.17: TDP Sensitivity Test GHG emissions compared to UK carbon budgets

Project Stage	Estimated GHG emissions over carbon budget periods (tCO_2e) (Do-Something scenario)	Net change in GHG emissions with Proposed Scheme over carbon budget periods (tCO_2e)	Net change in GHG emissions with Proposed Scheme within relevant carbon budget period (tCO_2e) (and as % of relevant carbon budget)		
			4th carbon budget (2023–2027)	5th carbon budget (2028–2032)	6th carbon budget (2033–2037)
Operation (TDP upper bound)	3,999,643	29,014	3,531 (<0.001%)	15,334 (0.001%)	10,149 (0.001%)
Operation (TDP lower bound)	2,597,277	19,019	3,034 (<0.001%)	10,638 (0.001%)	5,347 (0.001%)

15.10.10 In addition to the TDP, National Highways has recently published its own 2030/2040/2050 Net Zero Highways Plan (National Highways, 2021a). This plan includes commitments to ensure that National Highways' corporate GHG emissions will become net zero by 2030, its maintenance and construction activities will become net zero by 2040 and an ambition that road user GHG emissions on the strategic road network will become net zero by 2050. Again, the impacts of these commitments have not been factored into this assessment, as vehicle composition projections and emission factors have not yet been updated to reflect the emerging policy position described by the Net Zero Highways Plan.

15.10.11 National Highways recognise it has a key role in the development and maintenance of the SRN that will facilitate the journey to net zero GHG emissions. As part of this, the National Highways Net Zero Highways Plan sets out commitments to develop a blueprint for electric vehicle charging and energy storage by 2023, and to report to Government on global HGV technology trials and set out proposals for trials in the UK in 2022.

Potential cumulative effects

15.10.12 The traffic model used for the Proposed Scheme has been developed in line with DfT requirements and is inherently cumulative. This is because, in brief, traffic models used to support scheme assessment contain data about the following:

- The Proposed Scheme and adjoining SRN and local road network.
- Other schemes promoted by National Highways in the near vicinity of the proposed scheme with high certainty that they are to be progressed, i.e. progressed beyond preferred route announcement stage.

- Foreseeable developments promoted by third parties that are likely (based on discussions with relevant local planning authorities) to be developed in a similar timeline to the proposed National Highways' scheme; knowing where the proposed third-party development is to be sited, the extents and types of development, and the timescales of when it is to be completed are requirements to ensure that the third-party developments can be reasonably described in the traffic model.
- National Government regional growth rates which include a representation of likely growth rates excluding known planning developments already included in the traffic model; this is represented by DfT's National Trip End Model (NTEM)/Trip End Model Presentation Program (TEMPRO) growth factors for car usage, and growth in freight is derived from DfT's National Transport Model.

15.10.13 Changes in operational road user GHG emissions as a result of the Proposed Scheme have been evaluated within this assessment by comparing changes in road user GHG emissions on the SRN and local road network between the Do-Minimum and the Do-Something. This takes into account the assessment of the Proposed Scheme and all other developments likely to have an influence on the Proposed Scheme and on the area the Proposed Scheme is likely to influence.

15.10.14 In essence, as both Do-Minimum and Do-Something scenarios already include all likely developments and traffic growth factors, the assessment presented above is inherently cumulative as regards operational GHG emissions.

Vulnerability to changes in climate

15.10.15 Following the application of embedded mitigation measures to reduce the vulnerability of the Proposed Scheme, climate change related impacts are considered unlikely to result in substantial disruption during the construction phase and are therefore considered '**not significant**'. This conclusion will be confirmed within the Environmental Statement once further, more detailed information is available.

15.10.16 For the operational phase, potential hazards which have been identified, at this stage, include:

- Various hazards related to increased rainfall and extreme rainfall events in winter (e.g. flooding road surfaces and underbridges, scouring and erosion of Proposed Scheme assets and foundations, damage to drainage and culverts, groundwater levels affecting earth pressures on structures such as retaining walls, increased maintenance requirements).
- Various hazards associated with decreased rainfall and higher occurrence of dry spells during summer months (e.g. soil shrinkage impacting foundations, desiccation of soils affecting slope stability during or after heavy rainfall events).
- Increased summer temperatures and heatwaves/hot spells (e.g. thermal expansion beyond design capability for structures and assets, degradation of pavements causing deformation of asphalt, pavements cracking, excessive growth causing stability impacts on structures from overgrown roots, increased maintenance requirements).

15.10.17 Mitigation measures will be embedded within the design, while materials will be chosen to comply with relevant highways design standards, guidance and good engineering practice. Additionally, the design will incorporate suitable climate change allowances in

accordance with relevant Environment Agency guidance (e.g. in relation to the sizing and capacity of the drainage systems).

15.10.18 As noted in paragraph 3.43 of DMRB LA 114, early engagement between design engineers and environmental assessment professionals is the most effective way of eliminating and reducing impacts on the project from climate, thereby reducing the need for additional / subsequent design and mitigation measures. Whilst this process is currently ongoing, it is assumed that embedded mitigation measures, coupled with appropriate asset management during operation, including monitoring and inspections, would adequately address the potential climate change hazards identified. As a result, it is considered that the potential climate related hazards identified would **not result in a significant effect** during the operational phase. This conclusion will be confirmed within the Environmental Statement once further, more detailed information is available.

16. Assessment of cumulative effects

16.1 Topic introduction

16.1.1 This chapter sets out the preliminary cumulative effects assessment (CEA) completed for this Preliminary Environmental Information Report (PEIR). The CEA has been undertaken following the guidance outlined in the Planning Inspectorate's Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects (Planning Inspectorate, 2019) and the environmental assessment requirements and advice outlined in Design Manual for Roads and Bridges (DMRB) LA 104: Environmental Assessment and Monitoring (Highways England, Revision 1, 2020a; hereafter referred to as DMRB LA 104).

16.1.2 Cumulative effects, as reported in this chapter, result from incremental environmental impacts caused by other developments together with the Proposed Scheme. Cumulative effects can be additive or interactive (synergistic) in nature. Cumulative effects can occur during both construction and operation of a development.

16.1.3 Combined effects are not reported in this chapter. Combined effects (also referred to as '*interrelationships between topics'* in Advice Note Seventeen (Planning Inspectorate, 2019) can arise from interrelationships between environmental aspects (for example between ecology and the water environment, population and human health), affecting a single resource or receptor. Combined effects have been reported within the relevant aspect chapters of the PEIR.

16.1.4 The CEA identifies '*other reasonably foreseeable development'* that can potentially contribute to cumulative effects with the Proposed Scheme. To aid this process, local planning authorities (LPA) were consulted to assist with the identification of '*other reasonably foreseeable development*' as part of the statutory consultation following the submission of the Environmental Scoping Report (Highways England, 2021) to the Planning Inspectorate in July 2021.

16.1.5 The focus of this CEA chapter for PEIR is to present how '*other existing development and/or approved development'* have so far been identified to establish a long list (Stage 1) and how a preliminary shortlist has subsequently been derived (Stage 2).

16.1.6 The CEA is currently at the information-gathering stage (Stage 3) whereby environmental information on shortlisted '*other existing development and/or approved development'* is being obtained, where available. The full assessment of cumulative effects (Stage 4) will be reported in the Environmental Statement.

16.1.7 Stage 1 of the CEA will be repeated when preparing for the Environmental Statement to capture new planning applications and other reasonably foreseeable developments which may come forward during the interim period.

16.1.8 This chapter is supported by the following figures and appendices:

- Figure 16.1: Zone of Influence (ZOI) for cumulative effects assessment
- Figure 16.2: Longlisted other developments for cumulative effects assessment
- Figure 16.3: Shortlisted other developments for cumulative effects assessment
- Appendix 16.1: Long list of other developments

- Appendix 16.2: Shortlist of other developments

16.2 Stakeholder engagement

16.2.1 The proposed CEA methodology, together with a copy of the preliminary Stage 1 long list of other developments was provided in the Environmental Scoping Report (Highways England, 2021) for formal consultation on the scope of the Environmental Impact Assessment (EIA) (see Chapter 5: Environmental assessment methodology).

16.2.2 Four local planning authorities (LPAs) fall within the study area for cumulative effects and were consulted by the Planning Inspectorate in relation to the Environmental Scoping Report (see Figure 16.1 for locations of LPA administrative boundaries and the study area for cumulative effects). The four LPAs are:

- Bury Metropolitan Borough Council (BMBC)
- Manchester City Council (MCC)
- Salford City Council (SCC)
- Rochdale Borough Council (RBC)

16.2.3 Of the four LPAs listed in paragraph 16.2.2, consultation feedback was received from RBC only. No specific comments in relation to the assessment of cumulative effects were received from RBC.

16.2.4 Four LPAs which fall outside of the cumulative effects study area were also consulted by the Planning Inspectorate (Blackburn with Darwen Council, Bolton Council, Lancashire County Council, and Rossendale Borough Council). Of these, consultation feedback was received from Blackburn with Darwen Council only. No specific comments in relation to the assessment of cumulative effects were received from Blackburn with Darwen Council.

16.2.5 A summary of the relevant stakeholder feedback during the scoping consultation and key requirements from the Planning Inspectorate, as identified within the Scoping Opinion (Planning Inspectorate, 2021) relevant to cumulative effects, is outlined in Table 16.1.

Table 16.1: Key stakeholder feedback for cumulative effects aspect

Stakeholder	Comment	Response
Planning Inspectorate	ID 4.11.1 On the basis that the assessment proposed in the materials and waste aspect chapter will consider the impact of the Proposed Development on national material recovery targets, regional recycled aggregate targets, sub-regional minerals sterilisation and regional landfill capacity, the Inspectorate agrees that relevant consideration of cumulative effects will be inherent in that assessment. The Inspectorate therefore agrees that these can be scoped out of further specific consideration in the cumulative effects assessment.	N/A. The Planning Inspectorate agreed with the approach outlined in the Environmental Scoping Report in relation to the cumulative effects assessment of the material assets and waste aspect.

Stakeholder	Comment	Response
	ID 4.11.2 The assessment proposed in the climate aspect chapter considers the Proposed Development's effect on the global climate and the effect of changes in climate on the Proposed Development (i.e. vulnerability to climate change). On the basis that consideration of the extent to which climate exacerbates or ameliorates the effects of the Proposed Development will be presented in the climate aspect chapter of the ES, the Inspectorate agrees that it can be scoped out of further specific assessment in terms of cumulative effects and this approach accords with industry standard guidance of the Institute of Environmental Management and Assessment (IEMA).	N/A. The Planning Inspectorate agreed with the approach outlined in the Environmental Scoping Report in relation to the cumulative effects assessment of the climate aspect.
	ID 4.11.3 The traffic modelling upon which the air quality and noise assessment are based will take into account committed development in the future traffic flow forecasts and therefore these two aspect chapters are "inherently cumulative". On the basis of the approach to the assessment set out in 16.3.13-16.3.25, the list of cumulative development schemes should be confirmed within the ES as being within the scope of the operational traffic scenario modelling to demonstrate that all relevant pathways of cumulative noise and air quality effects have been considered.	Noted. The Environmental Statement will confirm the list of committed developments within the scope of the operational traffic scenario modelling.
Natural England	Scoping Opinion response It will be important for any assessment to consider the potential cumulative effects of this proposal, including all supporting infrastructure, with other similar proposals and a thorough assessment of the 'in combination' effects of the proposed development with any existing developments and current applications. A full consideration of the implications of the whole scheme should be included in the ES. All supporting infrastructure should be included within the assessment.	Noted. A full assessment of combined ('in combination') and cumulative effects will be undertaken and reported in the Environmental Statement.
	Scoping Opinion response The assessment should also include the cumulative effect of the development with other relevant existing or proposed developments in the area. In this context Natural England advises that the cumulative impact assessment should include other proposals currently at Scoping stage. Due to the overlapping timescale of their progress through the planning system, cumulative impact of the proposed development with those proposals currently at Scoping stage would be likely to be a material consideration at the time of determination of the planning application.	Noted. The cumulative effects assessment takes into account proposed developments currently at scoping stage. Proposed developments are assigned a 'tier' (in accordance with Advice Note 17 (Planning Inspectorate, 2019)) to reflect the level of environmental information likely to be available for assessment.

Stakeholder	Comment	Response
	Scoping Opinion response A full consideration of the implications of the whole scheme should be included in the ES. All supporting infrastructure should be included within the assessment. The ES should include an impact assessment to identify, describe and evaluate the effects that are likely to result from the project in combination with other projects and activities that are being, have been or will be carried out. The following types of projects should be included in such an assessment, (subject to available information): a. existing completed projects; b. approved but uncompleted projects; c. ongoing activities; d. plans or projects for which an application has been made and which are under consideration by the consenting authorities; and e. plans and projects which are reasonably foreseeable, i.e. projects for which an application has not yet been submitted, but which are likely to progress before completion of the development and for which sufficient information is available to assess the likelihood of cumulative and in-combination effects.	Noted. A full assessment of combined ('in combination') and cumulative effects will be undertaken and reported in the Environmental Statement. The assessment will consider existing and/or approved developments and proposed developments.
Public Health England (now the UK Health Security Agency)	Scoping Opinion response Evaluate any potential cumulative impacts as a result of the development, currently approved developments which have yet to be constructed, and proposed developments which do not currently have development consent.	Noted. A full assessment of combined ('in combination') and cumulative effects will be undertaken and reported in the Environmental Statement. The assessment will take into account existing and/or approved developments and proposed developments.

16.2.6 The CEA methodology (including compilation of the long list and shortlist of other developments (see Section 16.4 for the CEA methodology)) will be reviewed and updated for the Environmental Statement to account for feedback as part of the pre-application statutory consultation.

16.3 Legislative and policy framework

16.3.1 The requirements for the assessment of cumulative effects for nationally significant infrastructure projects (NSIPs) under the Planning Act 2008 (as amended) are set out in the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 ('the EIA Regulations').

16.3.2 In the EIA Regulations, Schedule 3 paragraph 1(b) refers to the selection criteria for screening Schedule 2 development, and states that *'The characteristics of development must be considered with particular regard to…(b) cumulation with other existing development and/or approved development'.* Schedule 3 paragraph 3(g), which relates to the types and characteristics of the potential impact, also requires *'(g) the cumulation*

of the impact with the impact of other existing and/or approved development' to be taken into account.

16.3.3 In relation to the information for inclusion in an Environmental Statement, Schedule 4, paragraph 5 of the EIA Regulations requires:

'A description of the likely significant effects of the development on the environment resulting from, inter alia: I the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources' and 'The description of the likely significant effects on the factors specified in regulation 5(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development.'

16.3.4 The need to consider cumulative effects in planning and decision making is also set out in planning policy, in particular the National Policy Statement for National Networks (NPS NN). In relation to the assessment of cumulative effects, the NPS NN states that:

- (Point 4.3) *'…in considering any proposed development, and in particular, when weighing its adverse impacts against its benefits, the Examining Authority and the Secretary of State should take into account:*
  - *its potential adverse impacts, including any longer-term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.'*
- (Point 4.16) *'When considering significant cumulative effects, any environmental statement should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development (including projects for which consent has been granted, as well as those already in existence)'.* For the Proposed Scheme this would comprise '*other existing development and/or approved development' which is taken to include existing developments and existing plans and projects that are 'reasonably foreseeable'*.
- (Point 4.17) The Examining Authority should *'consider how significant cumulative effects and the interrelationship between effects might as a whole affect the environment, even though they may be acceptable when considered on an individual basis with mitigation measures in place'.*
- (Point 4.55) *'the effects of existing sources of pollution in and around the project are not such that the cumulative effects of pollution when the proposed development is added would make that development unacceptable, particularly in relation to statutory environmental quality limits'.*

16.3.5 The compliance with legislation and local planning policy in relation to cumulative effects will be provided and detailed in the Environmental Statement for the Proposed Scheme.

16.4 Assessment methodology

16.4.1 Certain aspect chapters of this PEIR, such as air quality and noise which assess effects of operational vehicular emissions, are inherently cumulative assessments. This is because those aspects depend on traffic forecasts that consider the impacts of other developments and other highway projects. Future growth figures in the traffic model

have made allowances for any developments that are already committed and so are cumulative. Therefore, in order to avoid double counting of effects, this CEA does not include effects arising from operational traffic from other developments.

Assessment of combined effects

16.4.2 A review of the PEIR aspect chapters has been undertaken to identify the potential for combined effects on receptors. Combined effects have been considered within the relevant aspect chapters, therefore combined effects are not reported here. Combined effects are reported within the following aspect chapters:

- Chapter 7: Cultural Heritage – the assessment of changes to the setting of heritage assets is inherently cumulative as it takes into account the impact of changes to views, noise and other aspects on the setting of heritage assets.
- Chapter 8: Biodiversity – the assessment of effects on ecological receptor takes into account effects from changes to air quality and water quality, for example.
- Chapter 13: Population and Human Health – the interaction of impacts on health determinants, such as air quality, landscape, noise, and access, are assessed in the human health assessment.

16.4.3 Another review will be undertaken for the Environmental Statement to identify the potential for combined effects on receptors and confirm that combined effects have been reported within aspect chapters. Where potential combined effects on receptors have not been reported in the aspect chapters, an assessment of combined effects will be undertaken and reported within the cumulative effects chapter of the Environmental Statement.

Assessment of cumulative effects

16.4.4 In terms of assessing cumulative effects DMRB LA 104 notes that the CEA should report on:

- Road projects which have been confirmed for delivery over a similar timeframe
- Other development projects with valid planning permissions or consent orders, and for which EIA is a requirement
- Proposals in adopted development plans with a clear identified programme for delivery

16.4.5 For the purposes of this CEA, it is considered that the categories of development identified in DMRB LA 104 would cover existing plans and projects that are ‘reasonably foreseeable’, and as such will be reported on in the Environmental Statement as per point 4.16 of the NPS NN. However, it should also be noted that the Planning Inspectorate Advice Note Seventeen (2019) lists broader types of developments to be included in the CEA than the DMRB LA 104 standard, as it lists developments which have been submitted for planning but have yet to be determined (see paragraph 16.4.23), and it also does not restrict the scope to planning applications for which EIA is a requirement. This has been taken into account in the methodology to be applied for this CEA, in accordance with paragraph E/1.6 of DMRB LA 104, which states that the methodology set out in Planning Inspectorate Advice Note Seventeen (2019) shall be applied to all Nationally Significant Infrastructure Project (NSIP) environmental assessments.

16.4.6 DMRB LA 104 notes that the assessment of cumulative effects shall:

- Establish the zone of influence of the project together with other projects
- Establish a list of projects which have the potential to result in cumulative impacts
- Obtain further information and detail on the list of identified projects to support further assessment

16.4.7 In addition, DMRB LA 104 notes that there are no defined limits or criteria for selecting the list of projects for cumulative assessment and professional judgement using Annex III of the EIA Directive should be applied and justification provided for developments selected (and excluded). Furthermore, DMRB LA 104 notes that the temporal and spatial scope, together with characteristics of the identified projects, are key considerations in identifying projects that require further assessment as part of the CEA.

16.4.8 Therefore, given the above, the CEA methodology captures the requirements given in DMRB LA 104 together with the staged approach and broader interpretation set out in Advice Note Seventeen (Planning Inspectorate, 2019). The methodology is outlined in further detail below.

Stage 1: Establish the Zone of Influence (ZOI) and long list of other developments

16.4.9 The long list of '*other existing development and/or approved development'* was identified by determining the zone of influence (ZOI) for each environmental aspect and using this to form a study area within which to identify reasonably foreseeable development, in accordance with DMRB LA 104, paragraph 3.22. It should be noted that the ZOIs vary according to environmental aspects and matters. Therefore, some developments on the long list would be included in further stages of the CEA for some environmental aspects and matters, but not for others.

16.4.10 ZOIs for environmental aspects are presented in Table 16.2. The ZOIs have been developed using professional judgement, taking into account relevant guidance and standards and knowledge of effects experienced on similar schemes. The environmental aspect ZOIs are based on the potential for likely significant effects from the Proposed Scheme and its interactions with other proposed developments. It is unlikely that proposed developments further away than these ZOIs could contribute to significant cumulative effects due to the area over which effects would be dispersed.

16.4.11 The study area for the landscape and visual aspect initially extended to 5km from the provisional Order Limits. Due to the type of development, context and scale, at this distance the Proposed Scheme is likely to be barely perceptible and unlikely to give rise to significant effects (see Chapter 8 Section 8.6). Further refinement of the study area has been undertaken following site work and a ZOI extending to 2km from the provisional Order Limits has initially been defined for this PEIR.

16.4.12 The ZOIs will be refined as the project moves forward to take into account, for example, the detailed ZTV of the project which will provide a more accurate reflection of the visibility of the project in relation to other developments.

16.4.13 Table 16.2 lists the ZOIs chosen for each environmental aspect for the CEA. As the maximum ZOI presented in Table 16.2 is 2km, an overall ZOI of 2km has been established to represent the search area within which *'other existing development*

and/or approved development' have been identified. LPA boundaries and the ZOI for the cumulative effects assessment are shown in Figure 16.1. Further consultation will be carried out with LPAs prior to the Environmental Statement to ascertain if other developments (further than 2km) should be considered in the CEA.

Table 16.2: ZOI for each environmental aspect

Environmental aspect	Zone of influence	Reasoning
Air quality	Construction dust – 0.4km of all construction activity.	DMRB LA 105 (Highways England, 2019a) indicates that dust can be a nuisance up to 200m. Therefore, a ZOI of 400m has been chosen to cover an adjacent development that also has a 200m study area for dust.
	Construction traffic emissions – 0.4km from the Affected Road Network (see Chapter 6: Air Quality).	DMRB LA 105 (Highways England, 2019a) indicates that emissions from road vehicles have negligible impacts after 200m. Therefore, 400m has been allowed for to cover an adjacent development that also has a 200m study area for vehicle emissions.
	Operational emissions – N/A.	N/A (see paragraph 16.4.1).
Cultural heritage	Effects on setting of designated heritage assets (construction and operation) – 1km from provisional Order Limits. Cumulative effects will consider the overlapping ZOIs from other developments on the setting of cultural heritage assets and may extend the Proposed Scheme's ZOI beyond 1km.	Cumulative effects will consider the way in which setting is a factor from other developments on the designated assets within the Proposed Scheme study area, in accordance with the professional guidance within the Setting of Heritage Assets - Historic England's Good Practice Advice Planning Note 3 for understanding the setting of heritage assets.
	Effects on non-designated assets and their settings (construction and operation) – 0.6km from provisional Order Limits.	The size of the study area is informed by standards within DMRB (LA 106, (Highways England, 2020b), Section 3.5) and takes into account the likely extent of physical impacts and setting changes on non-designated assets. The ZOI is double the study area to allow for developments with similar sized study areas.
Landscape and visual	Construction and operation effects – 2km. Cumulative effects will consider the overlapping ZOIs from other developments on visual amenity and landscape character and may extend the Proposed Scheme's ZOI beyond 2km.	Receptors within the 2km study area could be subject to cumulative effects with other development within and beyond 2km. These will be considered for the landscape and visual aspect following guidance in the Guidelines for Landscape and Visual Impact Assessment, Third Edition (GLVIA3) (Landscape Institute and Institute of Environmental Management and Assessment, 2013). The ZOI for cumulative effects will consider both the 'other development' and the receptor type. As stated in GLVIA3, paragraph 7.20, the study area should be defined so that it is proportional, ensuring that the focus is on cumulative effects that are likely to be significant.

Environmental aspect	Zone of influence	Reasoning
Biodiversity	General construction and operation effects – 2km from provisional Order Limits. Cumulative effects will consider the overlapping ZOIs from other developments on biodiversity and may extend the Proposed Scheme's ZOI beyond 2km.	Professional judgement based on CIEEM's Guidelines for Preliminary Ecological Appraisals (2017) and CIEEM's Guidelines for Ecological Impact Assessment in the UK and Ireland (2018).
	Protected and notable species – • Great crested newt – 1,000m from provisional Order Limits (extending further if part of a meta population). • Badger – 200m from provisional Order Limits (extending further if based on clan territories). • Birds – Barn owl – 100m; Breeding birds 500m; wintering birds 1km. • Otter and water vole – 400m. • Bats – potential roosts – 200m; transect surveys – 2km. • Terrestrial invertebrates – provisional Order Limits. • Reptiles – provisional Order Limits.	Based on professional judgement and knowledge of each species, along with industry guidance including Great Crested Newt Mitigation Guidelines (English Nature, 2001) and Bat Survey Guidelines for Professional Ecologists, 3rd Edition (Bat Conservation Trust, 2016). The study areas for all protected and notable species, except terrestrial invertebrates and reptiles, have been doubled to allow for overlapping study areas from adjacent developments. Study areas for terrestrial invertebrates and reptiles have not been extended as it is assumed that the other developments' study areas will also be their provisional Order Limits and therefore no overlap would occur.
Geology and soils	Construction and operation effects on geology and soil receptors – 0.5km from provisional Order Limits.	Follows study area requirements in DMRB LA 109 (Highways England 2019b). A study area of 250m has been used for the geology and soils assessment (see Chapter 10: Geology and Soils) as it is considered to be the furthest distance that contamination would reasonably travel from the provisional Order Limits. The distance from the provisional Order Limits has been doubled to allow for an adjacent development that also has a 250m study area for geology and soils.
Noise and vibration	Construction noise effects – 0.6km from provisional Order Limits.	Follows study area requirements in DMRB LA 111 (Highways England, 2020c). The distance for the ZOI has been doubled to cover an adjacent development that also has a 300m study area for construction noise.
	Construction vibration effects – 0.2km from provisional Order Limits.	Follows study area requirements in DMRB LA 111 (Highways England, 2020c). The distance for the ZOI has been doubled to cover an adjacent development that also has a 100m study area for construction vibration.
	Operational noise effects – N/A	N/A (see paragraph 16.4.1).
	Operational vibration effects – Scoped out.	N/A – scoped out.

Environmental aspect	Zone of influence	Reasoning
Population and human health	Land use and community health effects (construction and operation) – 1.2km from provisional Order Limits.	Follows study area requirements in DMRB LA 112 (Highways England, 2020d), LA 111 (Highways England, 2020c), LA 105 (Highways England, 2019a) and professional judgement that likely significant effects on land use and human health from noise, air quality, visual intrusion and local disruption would be typically up to 0.6km. The distance for the ZOI has been doubled to allow for overlapping study areas.
	Effects on physical activity opportunities (construction and operation) – 2km from provisional Order Limits.	A distance of 2km is considered for regular walking journeys and physical activity. The ZOI is intended to capture cumulative effects on journeys undertaken by WCH by expanding on the 500m land use and accessibility study area to include the full distance between trip origins and destinations. It was based on the Local Cycling and Walking Infrastructure Plans Technical Guidance for Local Authorities (Department for Transport, 2017).
Water environment	Effects on hydromorphology (construction and operation) – 1km from provisional Order Limits.	Study areas were set based upon professional judgement and similar schemes of this nature and study area requirements in DMRB LA 113 (Highways England, 2020e). Study areas have been doubled to allow for overlap with other developments, but consideration of catchment boundaries would be applied. 2km for groundwater is already considered a large precautionary study area and there would be further consultation to consider if any other developments outside this ZOI should be considered.
	Effects on flood risk, water quality and groundwater (construction and operation) – 2km from provisional Order Limits.	

16.4.14 Additional aspects which have not had a ZOI defined include:

- Material assets and waste – assessment reported in this aspect chapter considers the influence of constructing the Proposed Scheme on national material recovery targets, regional recycled aggregate targets, sub-regional minerals sterilisation and regional landfill capacity; and therefore does not require further assessment in the CEA.
- Climate – assessment reported in the aspect chapter considers the Proposed Scheme's potential to affect the global climate (as a result of changes in Greenhouse Gas (GHG) emissions) and the effect of changes in climate on the Proposed Scheme itself, and therefore does not require further assessment in the CEA. Furthermore, the Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation (2020) advises that the extent to which climate exacerbates or ameliorates the effects of a Proposed Scheme on the environment 'in-combination' effects should be considered. The IEMA guidance advises that the 'in-combination assessment' (where climate has the potential to exacerbate or conversely diminish

the effect of an existing impact of a Proposed Scheme) is best analysed in the existing environmental aspect chapters of an Environmental Statement and is suited to using traditional significance criteria from the respective chapters.

16.4.15 Stage 1 was undertaken as part of the scoping exercise. A preliminary long list of other developments was established and presented in the Environmental Scoping Report (Highways England, 2021).

16.4.16 The preliminary long list has been reviewed further since its publication in the Environmental Scoping Report (Highways England, 2021) to take account of feedback through the Scoping Opinion (as presented in Table 16.1) and any additional planning applications or development allocations made during the interim period. Subsequent reviews and updates of the long list will be undertaken to account for feedback as part of the pre-application statutory consultation and any additional planning applications or development allocations made during the interim period.

16.4.17 Appendix 16.1 presents the preliminary long list of other developments. The planning applications and development allocations included in the long list of other developments are shown in Figure 16.2 (the preliminary long list can also be viewed using the interactive table below Figure 16.2 in the digital version of the PEIR). The Manchester North West Quadrant (MNWQ) scheme is not shown on Figure 16.2 as a design option has not yet been selected and therefore the spatial extent of the scheme is not known.

16.4.18 The identification of the long list of other developments was based on a review of:

- Planning applications for major developments (as defined in paragraph 16.4.24) registered with the relevant Local Planning Authorities (Town and Country Planning Act 1990) since January 2016, including:
  - Development with planning consent and under construction (but not completed)
  - Extant planning consent (consent granted and not expired, but construction has not commenced)
  - Planning applications currently under consideration by the Local Planning Authority
  - Screening / scoping opinions currently under consideration by the Local Planning Authority (which may indicate a planning application is forthcoming)
- Development allocations proposed in an approved or emerging (with at least a draft having been submitted to the Planning Inspectorate) Local Plan
- Nationally Significant Infrastructure Projects listed on the Planning Inspectorate's register of projects (Planning Act 2008) including:
  - Where the developer has advised the Planning Inspectorate in writing that they intend to submit an application in the future
  - Where an application has already been made to the Planning Inspectorate and is undergoing the development consent process
  - Where a proposal has been decided
- Development of transport systems authorised by Transport and Works Act Order (TWAO) (Transport and Works Act 1992) including:
  - Applications currently under consideration by the Secretary of State; and

- Made Orders

- Hybrid Bills currently before parliament
- Reserved matter applications and discharge of conditions – these have been reviewed for cases where although the planning application to which they relate may pre-date 2016, they indicate large scale developments which are being brought forward in phases and so there is potential for temporal overlap with the Proposed Scheme

16.4.19 Major developments are defined under Development Management Procedure (England) Order 2010 (as amended) as development involving any one or more of the following:

'(a) the winning and working of minerals or the use of land for mineral-working deposits;

(b) waste development;

(c) the provision of dwelling houses where —

(i) the number of dwelling houses to be provided is 10 or more; or

(ii) the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);

(d) the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or

(e) development carried out on a site having an area of 1 hectare or more.'

16.4.20 The Planning Inspectorate Advice Note Seventeen (2019) does not specify any criteria to be considered before selecting other developments for the long list at Stage 1, other than being within a relevant ZOI for CEA. However, it is considered that the inclusion of all minor planning applications into the long list would not be proportionate and these have therefore been excluded from the preliminary long list prior to Stage 1. The exclusion of minor developments is justified on the basis that these would be developments of not more than local significance and are highly unlikely to give rise to cumulative effects of a scale that would be environmentally significant over and above the Proposed Scheme in isolation.

16.4.21 Based on the Advice Note Seventeen (Planning Inspectorate, 2019) guidance all developments identified in the long list of other developments have been categorised into Tier 1 to 3 developments. The level of available information decreases between each respective tier. The three tiers are briefly summarised as follows:

- **Tier 1 developments:** Those currently under construction or have a permitted or submitted planning application under the relevant planning regime.
- **Tier 2 developments:** Those projects on the Planning Inspectorate's Programme of Projects or in the local planning authorities' portal where a scoping report has been submitted.
- **Tier 3 developments:** Development land allocations identified in the relevant Development Plan (and emerging Development Plans), projects on the Planning Inspectorate's Programme of Projects or in the local planning authorities' portal where a scoping report has not been submitted, or projects that have requested a screening opinion from the relevant LPA.

16.4.22 A cut-off point for adding new development applications to the long list will be required to allow sufficient time for completion of the CEA and compilation of the Environmental Statement prior to the submission of the DCO. This is likely to be two to three months following the completion of pre-application statutory consultation. A further update to the long list will be made during the pre-Examination period to allow for an up-to-date record of relevant '*other existing development and/or approved development'* to be available should questions arise during the Examination.

16.4.23 The MNWQ scheme has also been included in the long list of other developments. The MNWQ scheme is at an early stage, having completed PCF Stage 1 (Option Identification) only. The current status of the project is uncertain. It was considered prudent to include the scheme in the long list and shortlist for further assessment due to the nature and scale of development.

16.4.24 The Stage 1 preliminary long list of other developments (Appendix 16.1) identified 110 records of planning applications, relevant development plan allocations and other reasonably foreseeable developments. The information was captured and assessed using criteria provided in Matrix 1 of Appendix 1 from Advice Note Seventeen (Planning Inspectorate, 2019) as a basis. Following review of consultation responses in the Scoping Opinion (Planning Inspectorate, 2021) and update of the Stage 1 preliminary long list to take into account any new planning applications and changes in application status, 17 applications were taken forward to Stage 2 shortlisting.

Stage 2: Establishing the shortlist of other developments

16.4.25 The four LPAs within the study area for cumulative effects (BMBC, MCC, RBC and SCC) were consulted by the Planning Inspectorate in relation to the Environmental Scoping Report (as stated in Section 16.2). No comments were received from the four LPAs in relation to the proposed methodology for the cumulative effects assessment and the preliminary long list of other developments.

16.4.26 At the commencement of Stage 2, a total of 17 applications were identified as having potential for cumulative effects. Matrix 1 of Appendix 1 from Advice Note Seventeen (Planning Inspectorate, 2019) was adapted for Stage 2 to determine which of the shortlisted other developments should progress to Stages 3 and 4 of the CEA, using the following criteria:

- Overlap in temporal scope
- Scale and nature of development likely to have a significant effect
- Other aspects

16.4.27 Professional judgement was used to supplement the threshold criteria, with consideration to the inclusion and exclusion criteria presented in Table 16.3.

Table 16.3: CEA Stage 2 inclusion and exclusion criteria

Consideration	Criteria
Temporal scope	Other development with overlapping construction (2025-2027) and operational periods (2027-2042) to the Proposed Scheme have been considered further. Other development with temporal scopes outside these periods have not been shortlisted for the CEA.
Scale and nature of development	Development identified as Schedule 1 and 2 developments in the EIA Regulations have been considered further. The following EIA Regulations Schedule 2 threshold criteria (no. 10, Infrastructure Projects) were used to screen developments: • Greater than 150 residential dwellings • Greater than 1ha for non-dwelling urban development • Area of land required exceeds 5ha overall Other developments not identified as Schedule 1 or 2 development have not been shortlisted for the CEA unless, after reviewing it against criteria in Schedule 3 of the EIA Regulations, it is considered that it has characteristics by which there is a likelihood of significant effects when considered in combination with other development and/or development phases.
Sensitivity of the receiving environment	Where there are potential source-pathway-receptor linkages between other developments and the Proposed Scheme, cumulative effects will be considered further. Other development with no clear source-pathway-receptor linkage will not be shortlisted for the CEA.

16.4.28 Screening of the Stage 1 preliminary long list against the threshold criteria in Table 16.3 is presented in Appendix 16.2 and shown in the interactive table below Figure 16.2 of the digital version of the PEIR.

16.4.29 Only developments deemed likely to have significant cumulative effects have been shortlisted for further assessment in Stages 3 and 4 of the CEA, rather than every development with a foreseeable potential interaction. Justification has been provided in the matrix to assist in providing a clear record of '*other existing development and/or approved development*' considered and the decision-making process taken with respect to including and excluding development from further assessment.

16.4.30 Following completion of the Stage 2 shortlisting process the number of '*other existing development and/or approved development*' was reduced to three, which were then taken forward to Stage 3 information gathering. The preliminary Stage 2 shortlist of other developments is provided in Appendix 16.2 and shown in the interactive table below Figure 16.2 of the digital version of the PEIR. Figure 16.3 indicates where two of the shortlisted developments are located (the MNWQ scheme is not shown on Figure 16.3 as a design option has not yet been selected and therefore the spatial extent of the scheme is not known).

Stage 3: Information gathering

16.4.31 The CEA has relied on the gathering of environmental information from a range of sources published as part of planning application submissions or planning documentation for the '*other existing developments and/or approved developments'*. Stage 2 of the CEA involved a review of planning application documentation (including supporting information such as Planning Statements and environmental assessments) for each of the shortlisted other developments in order to determine the scale of

development to allow for screening against the relevant EIA Regulations Schedule 1/2 criteria.

16.4.32 For Stage 3 of the CEA specific information on the '*other existing developments and/or approved developments'* will be obtained from the following sources:

- Consultation with LPAs on the Stage 2 shortlist of other developments
- Planning application documentation and supporting environmental assessments obtained from LPA planning portals
- Local Development Plans prepared by the respective LPAs
- Strategic Environmental Assessments / Sustainability Appraisals
- The Planning Inspectorate's website, including EIA documents prepared for NSIPs: https://infrastructure.planninginspectorate.gov.uk/

16.4.33 Stage 3 information gathering is a process for capturing information on the design and construction of a proposed development. Criteria include:

- Proposed design and location
- Construction, operation, and decommissioning
- Baseline data and effects arising from '*other existing development and/or approved development*'

16.4.34 In advance of the publication of the Environmental Statement, environmental information will be gathered for all of the other developments progressed to Stage 3 of the CEA, and any further applications added to the shortlist as part of the review identified above. Information gathered will be provided to each of the relevant environmental aspects to inform the detailed assessment of potential cumulative effects.

Stage 4: Assessment

16.4.35 The Stage 4 process will involve a detailed assessment of cumulative effects with the '*other existing developments and/or approved developments'* identified on the finalised shortlist matrix.

16.4.36 This detailed assessment will be completed for the Environmental Statement using Matrix 2 from Advice Note Seventeen (Planning Inspectorate, 2019) to record the results of this assessment process. The competence of the EIA practitioner and other assessors involved in the preparation of the CEA (i.e. in terms of their suitable experience, qualifications, and professional memberships) will also be set out in the Environmental Statement.

Assessment of significance

16.4.37 For the detailed assessment of cumulative effects to be undertaken at Stage 4 as part of the Environmental Statement, the value of a resource, magnitude of impact and significance of effect will be carried forward from the environmental aspect chapters and professional judgement will be used to identify the significance of cumulative effects with other identified developments on the shortlist. Where an effect is moderate or above (adverse or beneficial), it will be deemed to be 'significant'. Effects will be

identified as short-term or long-term, permanent or temporary, and adverse or beneficial as set out within the respective environmental aspect chapters. Mitigation measures will be considered at the detailed assessment stage, with the resulting residual significance of effects identified.

16.4.38 In line with Advice Note Seventeen (Planning Inspectorate, 2019), due consideration will be given to the following when determining significance:

- The duration of effect, i.e. will it be temporary or permanent
- The extent of effect, e.g. the geographical area of an effect
- The type of effect, e.g. whether additive (loss of two pieces of woodland of 1ha, resulting in 2ha cumulative woodland loss) or synergistic (two discharges combine to have an effect on a species not affected by discharges in isolation)
- The frequency of the effect
- The 'value' and 'resilience' of the receptor affected
- The likely success of any mitigation required

16.5 Assessment assumptions and limitations

16.5.1 Only planning applications submitted since January 2016 (nine years before the start of construction) have been considered on the basis that it is likely that older submissions will have been completed prior to the Proposed Scheme construction start of works and are therefore unlikely to give rise to cumulative effects.

16.5.2 Any gaps or uncertainties encountered, including the availability of third-party environmental information on shortlisted developments, will be noted in the Environmental Statement.

16.6 Assessment of likely significant effects

16.6.1 At this preliminary stage, the following stages of the CEA have been undertaken:

- Stage 1: establishment of a long list of other developments (presented in Appendix 16.1).
- Stage 2: identification of a shortlist of other developments (presented in Appendix 16.2). This included consideration to the nature and scale and temporal scope of each development included in the shortlist of other developments to determine where significant effects of the proposed developments in combination with the Proposed Scheme are likely.

16.6.2 Should several developments be under construction at the same time, the impacts of various construction sites with their associated traffic, construction plant, lighting, noise, dust, and other factors could combine to affect the amenity of a local community or environmental receptor.

16.6.3 At this preliminary stage the developments taken forward to Stage 3 are (see Appendix 16.2 for further details):

- ID BMBC-APP-010 (planning application reference 68530): A planning application for large commercial development and associated infrastructure. This development

is located within the ZOI of the cultural heritage, water environment, population and human health, landscape and biodiversity aspects. There is potential for significant cumulative effects due to the physical scale of such development and a potential increase in traffic, traffic emissions and traffic noise during construction.

- ID RBC-APP-025 (planning application reference 16/01399/HYBR): A planning application for major mixed-use development of up to 1,000 residential dwellings and employment land at South Heywood has been approved (see Figure 16.3 for the location of the proposed development). While the development is likely to be constructed in phases, it is located within the ZOI of the landscape and visual, biodiversity, population and human health (physical activity opportunities), flood risk, water quality and groundwater environmental aspects. Due to the scale of development an increase in traffic during construction and the redistribution of traffic along the highway network may lead to impacts such as noise and changes in air quality, which may be significant in combination with the Proposed Scheme. Construction of the proposed development could lead to an increasing urbanisation of the area from rural and change the character of the local area, impact on views from the surrounding area, and could lead to habitat loss or fragmentation.
- ID NH-PHS-001: As noted in paragraph 16.4.23, the MNWQ scheme is at an early stage, having completed PCF Stage 1 (Option Identification) only. Due to the nature and scale of the development there is potential for significant cumulative effects if a temporal overlap occurs.

16.6.4 Further assessment will be undertaken for each of the shortlisted developments (and other developments shortlisted during the EIA) to determine the likely significant effects of the proposed developments in combination with the Proposed Scheme.

16.7 Mitigation

16.7.1 Once the likely significant cumulative impacts on receptors have been identified and assessed, measures to avoid, prevent, reduce, or offset significant cumulative effects will be identified and described in the Environmental Statement.

16.7.2 While the measures identified for the aspects reported in other chapters of this PEIR would help to reduce the contribution of the Proposed Scheme to cumulative effects, there may be a requirement for additional mitigation as well as collaboration and co-operation with third-party developers, to further mitigate cumulative effects. If appropriate, and subject to the cooperation of third parties, there may be opportunities for holistic mitigation strategies.

16.7.3 Options for mitigation may relate to detailed programming and phasing of construction activities to avoid or reduce the likelihood of overlapping construction activities in a specific locality. Other considerations may relate to where construction workers would be accommodated, to help distribute the impacts on accommodation across a larger area, reducing the scale of impacts in any given location.

17. Summary

17.1 Summary of likely significant effects

17.1.1 Table 17.1 provides a summary of the potential residual significant environmental effects associated with the Proposed Scheme's construction and operation. Mitigation measures have been developed for this preliminary assessment to avoid or reduce environmental effects. Consideration of these mitigation measures has been taken into account when determining the significance of effects.

17.1.2 The conclusions presented in Table 17.1 are preliminary, and subject to the ongoing design and EIA process which includes further surveys, studies, and mitigation development. The final results of the environmental assessment will be reported in the Environmental Statement.

Table 17.1: Summary of preliminary assessment of likely significant effects

Aspect	Summary of significant (residual) environmental effects	
	Construction	Operation
Air quality	No likely significant effects identified.	No likely significant effects identified for human health receptors. Potential for significant adverse effects on biodiversity sites from nitrogen deposition will be assessed by the biodiversity specialist in the Environmental Statement.
Cultural heritage	No likely significant effects identified.	No likely significant effects identified.
Landscape and visual	Likely significant adverse effects on landscape character (LCA 26 and the Special Landscape Area) and townscape character due to construction activities and elements (for example, from the movement of construction machinery; the presence of compounds, haul roads and material stockpiles; and loss of vegetation). Likely significant adverse effects on people's views in some locations due to construction activities and elements including those noted above.	Likely significant adverse effects on landscape character (LCA 26) and townscape character in year 1 due to a permanent increase in the extent of highway infrastructure, night-time lighting on the Northern Loop, and changes in land use and field pattern. By summer year 15 effects would be not significant due to established mitigation planting. Likely significant adverse effects on visual receptors in close proximity to the Proposed Scheme and where the Northern Loop remains prominent in view. By summer year 15 effects would be not significant due to established mitigation planting.
Biodiversity	Potential for a significant adverse effect on Philips Park due to construction activities within the buffer zone of ancient woodland.	No likely significant effects identified.

Aspect	Summary of significant (residual) environmental effects	
	Construction	Operation
Geology and soils	Likely significant adverse effect on the following geology and soils receptors: • Soils, due to some permanent loss of resource and degradation resulting from stripping, handling and storage of topsoils. • Chester Formation aquifer and surface water, due to the potential deterioration of groundwater and surface water quality resulting from construction activities (subject to further assessment). • Human health, due to the location of some residential properties close to construction areas (subject to further assessment). Site-specific ground investigation (GI) data and surface water quality data were not available at the time of assessment, and therefore the significance of effects may change following review of GI and surface water quality data.	No likely significant effects identified, however the significance of effects may change following receipt of GI data.
Material assets and waste	No likely significant effects identified.	No likely significant effects identified.
Noise and vibration	Possible significant adverse effects due to an increase in noise during some phases of works including the activities of site clearance, earthworks, drainage works, roadworks, gantry works, retaining walls, piling for piers and construction of some of the attenuation ponds. The significance of these effects will be re-assessed in the Environmental Statement, based on a construction methodology and programme that has been further developed.	Likely significant adverse effects for some receptors in close proximity to the M60 eastbound mainline due to an increase in road traffic noise.
Population and human health	Potential significant adverse effects on the following land use and accessibility receptors: • Two community land assets • Five agricultural landholdings • Four routes used by walkers, cyclists and horse-riders No likely significant effects identified for population health.	No likely significant effects identified for land use and accessibility receptors or population health.

Aspect	Summary of significant (residual) environmental effects	
	Construction	Operation
Road drainage and the water environment	• Surface water – no likely significant effects identified. • Hydromorphology – no likely significant effects identified. • Groundwater – likely significant effects on groundwater dependent terrestrial ecosystems (GWDTEs), springs and "issues", a historic landfill and associated aquifer, and surface water courses and Water Framework Directive water bodies, resulting from direct groundwater contamination and disturbance to groundwater flows and levels. • Flood risk – likely significant effect on receptors adjacent to and upgradient of permanent below ground structures due to changes to groundwater flood risk. Further assessment will be undertaken following receipt of GI data to determine if likely significant effects remain.	• Surface water – no likely significant effects identified. • Hydromorphology – no likely significant effects identified. • Groundwater – likely significant adverse effects on two "issues" due to long-term alterations in groundwater flow. • Flood risk – likely significant effect on receptors adjacent to and upgradient of permanent below ground structures due to long-term changes in groundwater levels increasing flood risk locally. Further assessment will be undertaken following receipt of GI data to determine if likely significant effects remain.
Climate	No likely significant effects identified.	No likely significant effects identified.
Cumulative effects	Cumulative effects will be assessed and reported within the Environmental Statement.	

17.2 Next steps of the EIA

17.2.1 Scheme design development, further surveys, modelling, and assessment will continue throughout 2023. Stakeholders will continue to be consulted on the likely significant effects and proposed mitigation.

17.2.2 The results of the EIA will be reported within an Environmental Statement. An outline structure of the Environmental Statement is provided in Table 17.2.

17.2.3 The Environmental Statement, as well as other environmental reports such as the Environmental Management Plan, Habitats Regulations Assessment, Flood Risk Assessment, and Water Framework Directive Compliance Assessment, will form part of the application for development consent.

Table 17.2: Outline structure of the Environmental Statement

Subject	Description
Non-Technical Summary (NTS)	A summary of the EIA using non-technical language. The NTS will summarise the scheme description, alternatives considered, the likely significant effects, the proposed mitigation and monitoring requirements and opportunities for enhancements.
1. Introduction	A brief introduction to the purpose of the Environmental Statement, a brief overview of the scheme, legislative and policy framework, and the competent expertise used to undertake the EIA.

Subject	Description
2. The scheme	Description of the need for the scheme, scheme objectives, scheme location and baseline scenario. A scheme description will be provided comprising information on the site, design and physical characteristics of the development. The scheme description will describe both the construction (including demolition) and operation of the scheme and outline land use requirements, an estimate of expected residues and emissions where not included in the environmental aspect assessments, temporary works, clarity on the scale of development (including worst case parameters of height, width, depth etc.), confirmation of specific elements of the design required to reduce significant adverse effects, and confirmation of any off-site works required to facilitate the development. This chapter will also describe an outline construction programme, long-term management (including maintenance requirements) and a statement of whether the EIA is to consider decommissioning of the scheme.
3. Assessment of alternatives	Description of the main alternatives considered during the design and development of the scheme, the methodology used to consider alternative options, and the justification for the choice of the preferred option, including a comparison of environmental effects.
4. Environmental assessment methodology	This chapter will set out the scope of the EIA, including a summary of how this has been influenced by statutory consultation. The general assessment approach will be detailed including the guidance and methodologies to be used, general assessment assumptions and limitations, general assessment criteria and terminology to be used, the approach to mitigation, enhancement and monitoring, and duplication of assessment.
5. Air quality **6. Cultural heritage** **7. Landscape and visual** **8. Biodiversity** **19. Geology and soils** **10. Material assets and waste** **11. Noise and vibration** **12. Population and health** **13. Road drainage and the water environment** **14. Climate**	Chapters 5-14 will assess the potential significant effects from the Proposed Scheme. Each of the aspect chapters will include the following: • Aspect introduction • Competent expert evidence • Legislative and policy framework • Assessment methodology • Assessment assumptions and limitations • Study area • Baseline conditions • Potential impacts • Design, mitigation and enhancement measures • Assessment of likely significant effects • Monitoring requirements
15. Assessment of cumulative effects	This chapter will assess the cumulative effects of other major developments which could overlap with the Proposed Scheme, and the interrelationship between aspects (combined effects). The chapter will also summarise any mitigation proposed and monitoring requirements.
16. Summary	Summary of the residual effects (highlighting where significant residual effects are predicted), and a summary of mitigation measures and monitoring requirements. This will form the basis of a commitments schedule to be included within the Environmental Management Plan.
Acronyms, glossary and references	
Technical appendices and figures (including location, design and constraints plans).	

Acronyms

Acronym	Term
µg	Microgram
AADT	Annual Average Daily Traffic
ABC	Ambient Background Concentrations
ADMS	Atmospheric Dispersion Modelling
ADS	Archaeological Data Service
AEP	Annual Exceedance Probability
AGMA	Association of Greater Manchester Authorities
AIA	Arboricultural Impact Assessment
ALC	Agricultural Land Classification
ALR	All Lane Running
AMI	Advanced Motorway Indicator
AOD	Above Ordnance Datum
AoS	Area of Search
APIS	Air Pollution Information System
AQMA	Air Quality Management Area
AQO	Air Quality Objective
ARN	Affected Road Network
AW	Ancient Woodland
AWI	Ancient Woodland Inventory
AWP	Aggregates Working Party
BAP	Biodiversity Action Plan
BCR	Benefit Cost Ratio
BEIS	Department for Business, Energy and Industrial Strategy
BFI	Baseflow Index
BGS	British Geological Survey
BIS	Department of Business Innovation & Skills
BMBC	Bury Metropolitan Borough Council
BMV	Best and Most Versatile
BNL	Basic Noise Level
BOD	Biochemical Oxygen Demand
BPM	Best Practicable Means
BRE	Building Research Establishment
BS	British Standard
BSI	British Standards Institution
C&D	Construction and demolition
CC	Climate Change
CCTV	Closed-circuit television
CD&E	Construction, demolition and excavation
CDA	Critical Drainage Area
CDM	Construction (Design and Management) Regulations 2015
CEA	Cumulative Effects Assessment
CERC	Cambridge Environmental Research Consultants

Acronym	Term
CITB	Construction Industry Training Board
CJP	Costain Jacobs Partnership
CL	Critical Load
CL:AIRE	Contaminated Land: Applications in Real Environments
CNI	Critical National Infrastructure
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
CoCP	Code of Construction Practice
CoPA	Control of Pollution Act
COPD	Chronic obstructive pulmonary disease
COVID-19	Coronavirus
CROW	Countryside and Rights of Way
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
CSO	Combined Sewer Overflow
D5M	Dual 5-Lane Motorway
dB	Decibel
DCO	Development Consent Order
DDMS	Drainage Data Management System (Highways England)
Defra	Department for Environment, Food and Rural Affairs
DF	Design Fix
DfRE	Design for Resource Efficiency
DLL	District Level Licence
DM	Do-Minimum
DMFY	Do-Minimum Future Year scenario
DMOY	Do-Minimum Opening Year scenario
DMRB	Design Manual for Roads and Bridges
DOC	Dissolved Organic Carbon
DPD	Development Plan Document
DS	Do-Something
DSFY	Do-Something Future Year scenario
DSOY	Do-Something Opening Year scenario
EAR	Environmental Assessment Report
EAV	External Aspect Verification
EB	Eastbound
eDNA	Environmental deoxyribonucleic acid
EFT v11	Emissions Factors Toolkit Version 11.0
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Act
EPSM	European Protected Species Mitigation
EQS	Environmental Quality Standard
ES	Environmental Statement
EU	European Union
EUPHA	European Public Health Association

Acronym	Term
FMfP	Flood Map for Planning
FRA	Flood Risk Assessment
GCN	Great Crested Newt
GEP	Good Ecological Potential
GES	Good Ecological Status
GHG	Greenhouse Gas
GI	Ground Investigation
GIR	Ground Investigation Report
GLVIA3	Guidelines for Landscape and Visual Impact Assessment, 3rd Edition
GMCA	Greater Manchester Combined Authority
GMEU	Greater Manchester Ecology Unit
GMMH	Greater Manchester Mental Health
GMSF	Greater Manchester Spatial Framework
GWDTE	Groundwater Dependent Terrestrial Ecosystem
GWP	Global-Warming Potential
HADDMS	Highways Agency Drainage Data Management
HADECS	Highways Agency Detection Enforcement Camera System
HAGDMS	Highways Agency Geotechnical and Drainage Management System
HASP	Health and Safety Plan
HDV	Heavy Duty Vehicle
HEA	Historic England Archive
HER	Historic Environment Record
HEWRAT	Highways England Water Risk Assessment Tool
HGV	Heavy Goods Vehicle
HLC	Historic Landscape Classification
HLT	Historic Landscape Types
HPI	Habitat of Priority Importance
HRA	Habitats Regulations Assessment
HRA	Hot Rolled Asphalt
HSE	Health and Safety Executive
HSI	Habitat Suitability Index
IAIA	International Impact Association
IAS	International Aviation and Shipping
IDB	Internal Drainage Board
IEMA	Institute of Environmental Management and Assessment
INNS	Invasive and Non-Native Species
JNCC	Joint Nature Conservation Committee
LAQM	Local Air Quality Management
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Area
LCRM	Land Contamination Risk Management
LCST	Landscape Character sub-type
LCT	Landscape Character Type
LDF	Local Development Framework

Acronym	Term
LED	Light Emitting Diode
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
LNS	Low Noise Surfacing
LOAEL	Lower Observed Adverse Effect Level
LPA	Local Planning Authority
LSE	Likely Significant Effect
LTT	Long-term trends
LV	Limit Value
LV	Low Voltage
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
mAOD	Metres Above Ordnance Datum
M-BAT	Metal Bioavailability Assessment Tool
mbgl	Metres below ground level
MCC	Manchester City Council
MIDAS	Motorway Incident Detection and Automatic Signalling
MLP	Minerals Local Plan
MMP	Material Management Plan
MNWQ	Manchester North West Quadrant
MoRPH	Modular River Physical
MoU	Memorandum of Understanding
MP	Medium Pressure
MPA	Minerals Planning Authority
MSA	Mineral Safeguarding Area
Mt	Megatonne (or million tonnes)
Mtpa	Million tonnes per annum
NB	Northbound
NCA	National Character Areas
NERC	Natural Environmental and Rural Communities
NGR	National Grid Reference
NHLE	National Heritage List for England
NIA	Noise Important Area
NNNPS	National Networks National Policy Statement
NNR	National Nature Reserve
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPS	National Policy Statement
NPS NN	National Policy Statement for National Networks
NPSE	Noise Policy Statement for England
NRFA	National River Flow Archive
NRR	National Risk Register
NSIP	Nationally Significant Infrastructure Project

Acronym	Term
NTS	Non-Technical Summary
NVC	National Vegetation Classification
NVZ	Nitrate Vulnerable Zone
OMBC	Oldham Metropolitan Borough Council
ONS	Office for National Statistics
OWMP	Outline Water Management Plan
PAH	Polycyclic aromatic hydrocarbons
PAS	Publicly Available Specification
PBDE	Polybrominated diphenyl ethers
PC	Predicted Contributions
PCF	Project Control Framework
PCM	Pollution Climate Mapping
PEIR	Preliminary Environmental Information Report
PEL	Probable Effect Level
PFA	Pulverized fly ash
PFOS	Perfluorooctane sulphonate
PFRA	Preliminary Flood Risk Assessment
PHE	Public Health England
PLCM	Pennine Lower Coal Measures
PM_{10}	Particulate matter
PMCM	Pennine Middle Coal Measures
PNEC	Predicted No Effect Concentration
PRA	Preferred Route Announcement
ProW	Public Right of Way
PSSR	Preliminary Sources Study Report
PWQAR	Preliminary Water Quality Assessment Report
RBC	Rochdale Borough Council
RBD	River Basin District
RBMP	River Basin Management Plan
RCB	Rigid concrete barrier
RCP	Receptor Concentration Pathway
RDWE	Road Drainage and the Water Environment
REAC	Register of Environmental Actions and Commitments
RIGS	Regionally Important Geological Site
RIS2	Road Investment Strategy 2
RMSE	Root mean square error
RoFSW	Risk of Flooding from Surface Water
RSTs	Runoff Specific Thresholds
SAC	Special Area of Conservation
SB	Southbound
SBI	Site of Biological Importance
SCC	Salford City Council
SEPA	Scottish Environmental Protection Agency
SFRA	Strategic Flood Risk Assessment
SLP:DMP	Salford Local Plan: Development Management Policies

Acronym	Term
SNRHW	Stable Non-Reactive Hazardous Wastes
SOAEL	Significant Observed Adverse Effect Level
SOBC	Strategic Outline Business Case
SoCC	Statement of Community Consultation
SoS	Secretary of State
SPA	Special Protection Area
SPD	Supplementary Planning Document
SPP	Sustainable Procurement Plan
SPZ	Source Protection Zone
SRN	Strategic Road Network
SSSI	Site of Special Scientific Interest
STEM	Science, Technology, Engineering and Mathematics
SuDS	Sustainable drainage system
SVD	Stopped vehicle detection
SWMP	Site Waste Management Plan
SWMP	Surface Water Management Plan
t	Tonnes
TAG	Transport Analysis Guidance
TAR	Technical Appraisal Report
tCO_2e	Tonnes of carbon dioxide equivalent
TDP	Transport Decarbonisation Plan
TEL	Threshold Effect Level
TfGM	Transport for Greater Manchester
TRA	Traffic Reliability Area
UDP	Unitary Development Plan
UK	United Kingdom
UKCP	UK Climate Projections
UKCP18	United Kingdom Climate Projections 2018
UKHab	UK Habitat Classification
UKHSA	UK Health Security Agency
UKTAG	UK Technical Advisory Group
UNESCO	United Nations Educational, Scientific and Cultural Organization
VRS	Vehicle restraint system
WB	Westbound
WCH	Walkers, cyclists and horse-riders
WCHAR	Walking, Cycling and Horse-Riding Assessment and Review
WER	Water Environment Regulations
WFD	Water Framework Directive
WHO	World Health Organization
WQSR	Water Quality Study Report
WRAP	Waste and Resources Action Programme
WSI	Written Scheme of Investigation
WTW	Water Treatment Works
ZOI	Zone of Influence
ZTV	Zone of Theoretical Visibility

Glossary

Term	Definition
Active travel	Travelling to specific destinations (e.g. work or school) by active modes such as walking or cycling.
Additive (cumulative effects assessment)	Where similar types of impact from a scheme or different developments affect a receptor at the same time and in a similar way e.g. loss of two pieces of woodland of 1ha, resulting in 2ha cumulative woodland loss overall.
Affected Road Network	All roads that trigger the traffic screening criteria from DMRB LA 105 and adjoining roads within 200m.
Aggregates	Minerals which are used primarily to support the construction industry including soft sand, sand and gravel, and crushed rock.
Air quality management area	An area declared by a local authority which has been determined will exceed the relevant air quality strategy objective.
Air quality threshold	Generic term to represent the relevant pollutant averaging period and concentration value described by the air quality strategy objectives or EU limit values.
Ambient noise	Ambient noise is the total sound in a given situation at a given time usually composed of sound from many sources, near and far.
Ancient Woodland Inventory Site	The Ancient Woodland Inventory identifies over 52,000 ancient woodland sites in the UK. Ancient woodland in England is defined as woodland that has existed since 1600 or before.
Annual Exceedance Probability (AEP)	Annual Exceedance Probability (AEP) refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which may be calculated to have a 1% chance to occur in any one year, is described as a 1% AEP event.
Aquiclude	A geological formation which is impermeable to the flow of water. It contains a large amount of water in it but it does not permit water through it and also does not yield water.
Aquitard	A body of rock or stratum of sediment that retards but does not prevent the flow of groundwater from one aquifer to another.
Aspect	This refers to an environmental topic (e.g. air quality, biodiversity, noise etc.).
Assessment of effects	The assessment of changes arising from the development that is being assessed.
A-weighting (dB(A))	In addition to its non-linear amplitude response, the human ear has a non-linear frequency response; it is less sensitive at low and high frequencies and most sensitive in the mid-range frequencies.
Backfilling (Material assets and waste)	Backfilling means a recovery operation where waste is used in excavated areas for the purpose of slope reclamation or safety or for engineering purposes in landscaping and where the waste is substituting other non-waste materials which would have had to be used for the purpose.
Barn owl roost	A barn owl's home.
Baseline	In EIA, 'baseline conditions' are the environmental conditions in existence before the occurrence of an impact from a development i.e. they are the existing conditions that would be affected.
Baseline studies	Work to provide an outline, understanding of landscape and visual conditions before or without implementation of the project requiring a mix of desk study consultation and field work. DMRB LA 107.
Bat roost	A bat's home.
Bed substrate	The material that rests at the bottom of a stream and along the channel margins.
Best overall environmental outcome	A departure from the waste hierarchy which delivers better overall environmental outcomes.

Term	Definition
Bill of quantities	A document containing details on the volumes of excavated arisings from, and materials required for, a development. Also 'Schedule of Rates'.
Bioavailable	This is the fraction of dissolved metal that has the potential to contribute to toxic effects in aquatic animals or plants as determined in accordance with the method, metals bioavailability assessment tool (M-BAT).
BNL Calculations	BNL calculations are undertaken by using traffic flow, speed and HGV percentage to calculate a reference noise emission from the road link, as set out in CRTN.
Borrow pit	A temporary mineral working to supply material for a specific construction project.
British Geological Society (BGS)	Location of British data on geology.
Carbon budgets	A carbon budget, defined in accordance with the Climate Change Act 2008, places a restriction on the total amount of greenhouse gases the UK can emit over a defined five-year period.
Carbon dioxide equivalent ($CO2_e$)	Carbon dioxide equivalent (abbreviated as $CO2_e$) is a metric used to compare the emissions of various greenhouse gases, based on their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of CO_2 with the same GWP. For example, the GWP for methane (CH_4) is 25, and for nitrous oxide (N_2O) it is 298. This means that an emission of 1 tonne of CH_4 is equivalent to an emission of 25 tonnes of CO_2 and an emission of 1 tonne of N_2O is equivalent to 298 tonnes of CO_2.
Carbon emissions	Shorthand for emissions of any of the seven GHGs that contribute to climate change under the Kyoto Protocol, namely carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3).
Carboniferous	A geological time period that spans from approximately 358 to 298 million years ago.
CDM	Construction Design and Management regulations pertaining to health and safety on construction sites.
Channel realignment	The artificial straightening of a river channels to accommodate structures, flood control, or navigation.
Characteristics	Elements or combination of elements, which make a particular contribution to distinctive character. DMRB LA 107.
Circular economy	A circular economy is an alternative to a traditional linear economy (of make, use, dispose) in which we keep resources in use for as long as possible; extract the maximum value from resources while in use; recover and regenerate products and materials at the end of life; and keep products, components and materials at their highest utility and value at all times.
Climate	Long-term weather conditions prevailing over a region.
Climate extreme indices	With regard to climate change, extreme weather events and climate events are often referred to collectively as climate extremes. The World Climate Research Programme (WCRP) and World Meteorological Organization (WMO) expert team on climate change detection and indices (ETCCDI) coordinate, organise and collaborate on climate extremes, indices and climate change detection. This team have defined a set of 27 core indices (the 'ETCCDI' indices) which can be derived from land surface observations of daily temperature and precipitation.
Climate scenario	UKCP18 uses emissions scenarios, called Representative Concentration Pathways (RCPs). RCPs specify the concentrations of greenhouse gases that would result in target amounts of radiative forcing at the top of the atmosphere by 2100, relative to pre-industrial levels. Four forcing levels have been set: 2.6, 4.5, 6.0 and 8.5 W/m2. These create four RCPs that are used in UKCP18: RCP2.6, RCP4.5, RCP6.0 and RCP8.5.
Cold spell duration index	Count of days with at least six consecutive days when daily minimum temperature is below the 10th percentile.

Term	Definition
Combined effects (interrelationship of effects)	The combined action of a number of different environmental topic specific effects upon a single resource/receptor.
Committed development	A development that has full or outline planning permission, or is allocated in an adopted development plan.
Conceptual Site Model (CSM)	A conceptual model is a representation of a system that uses concepts and ideas to form said representation. here it provides conceptual information on contamination within the area of the site.
Construction materials	Primary, recycled / secondary and renewable sources of materials required for constructing a project.
Construction, demolition and excavation waste	Arisings and waste from the demolition of buildings and structures, site preparation and clearance, remediation, excavation and construction activities.
Controlled motorway	Motorway that uses variable speed limits but retains a traditional hard shoulder.
Correlation coefficient	The linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship.
Cumulative effects	Effects upon the environment that result from the incremental impact of an action when added to other past, present or reasonably foreseeable actions. Each impact by itself may not be significant but can become a significant effect when combined with other impacts.
Cumulative effects (inter-project effects)	The combined action of a number of different projects, in combination with the project being assessed, on a single resource/receptor.
Decibel	The unit of measurement used for sound pressure levels and noise levels quoted in decibels (dB). The decibel scale is logarithmic rather than linear; the threshold of hearing is zero decibels while, at the other extreme, the threshold of pain is about 130 decibels. These limits are seldom experienced and typical levels lie within the range of 30 dB(A) (a quiet night-time level in a bedroom) to 90 dB(A) (at the kerb side of a busy road).
Design Manual for Roads and Bridges (DMRB)	Provides standards, advice notes and other documents relating to the design, assessment and operation of trunk roads, including motorways in the United Kingdom.
Development Consent Order (DCO)	Introduced by the Planning Act in 2008, a DCO is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects (NSIP).
Dewatering (groundwater)	Groundwater control which typically involves pumping groundwater from an array of wells or sumps, located in or around an excavation, to temporarily lower groundwater levels to allow excavation to be carried out in dry and stable conditions.
Discharge	The volume of flow passing a point in a given time period.
Disposal	Any operation which is not recovery, even where the operation has as a secondary consequence the reclamation of substances or energy.
District level licence	District level licences are granted and authorised by Natural England to permit developments that affect great crested newt *Triturus cristatus* and involve habitat creation and mitigation being carried out at the local authority level, providing an alternative to the standard EPSM licensing process.
Do-Minimum	A future year scenario including other committed developments and infrastructure schemes, but not the Proposed Scheme.
Do-Minimum (DM)	Scenario without the project.
Do-Something	A future year scenario including other committed developments and infrastructure schemes together with the Proposed Scheme.
Do-Something (DS)	Scenario with the project.
DNA	Deoxyribonucleic acid - a molecule that determines the genetic makeup of all living organisms.

Term	Definition
Effect	Term used to express the consequence of an impact. The significance of effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Effect (landscape and visual)	Term used to express the consequence of an impact (expressed as the 'significance of effect'). DMRB LA 107.
Embedded mitigation	Design measures which are integrated into a project for the purpose of minimising environmental effects (DMRB LA 104).
Embodied carbon	Carbon (GHG) emissions associated with energy consumption and chemical processes during the extraction, transport and/or manufacture of construction materials or products.
End of first life	The point at which an asset is no longer useful in the capacity for which it was originally intended.
Enhancement	A beneficial measure that is over and above what is required to mitigate the adverse effects of a project.
Environmental Impact Assessment (EIA)	Environmental Impact Assessment. A process by which information about environmental effects of a proposed development is collected, assessed and used to inform decision making. For certain projects, EIA is a statutory requirement.
Environmental Management Plan (EMP)	The EMP sets out the conclusions and the actions needed to manage environmental effects identified within the environmental assessment during construction and operation of a development.
Environmental Statement	A document produced in accordance with the EIA Directive as transported into UK law by the EIA Regulations to report the results of an EIA.
Essential mitigation	Measures required to reduce and if possible offset likely significant adverse environmental effects, in support of the reported significance of effects in the environmental assessment. Mitigation critical for the delivery of a scheme which can be acquired through statutory powers.
European protected species mitigation (EPSM) licence	The licence issued that permits an activity affecting a European protected species, that would otherwise constitute an offence under the relevant legislation.
Examining Authority	The person(s) appointed by the Secretary of State (SoS) to assess the Development Consent Order application and make a recommendation to the SoS.
Features	Particularly prominent, "eye-catching" elements or characteristic components (i.e. tree clumps, church towers, or wooded skylines). DMRB LA 107.
First study area (material assets and waste)	Project footprint (including temporary land take) for which consent is being sought. The area within which construction materials will be consumed (used / deployed), and waste generated (including temporary compounds and storage areas etc.).
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flow dynamics	The manner in which flow behaves, i.e., turbulent flows, non-energetic and laminar flows.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a main river.
Geology	The physical structure, substance and history of the earth (rocks and minerals).
Ghost licence	An EPSM licence that is written, prepared and agreed prior to a Development Consent Order (DCO) being granted but which cannot be officially granted until the DCO planning consent has been given.
GLVIA3	Guidelines for Landscape and Visual Assessment, 3rd Edition.
Greenfield	Undeveloped parcel of land.
Greenhouse gases (GHGs)	A gaseous compound that absorbs infrared radiation and traps heat in the atmosphere. Greenhouse gases are usually expressed in terms of carbon dioxide equivalent ($CO2_e$).

Term	Definition
Greenspace	Any area of vegetated land, urban or rural. This can include public or private parks and gardens, amenity greenspace, sports pitches, allotments, green corridors such as canals and green cycleways, as well as the natural and semi-natural environment such as woodland and fields.
Groundwater dependent terrestrial ecosystem (GWDTE)	Wetlands which critically depend on groundwater flows and/or chemistry.
H++	Defined as plausible 'high-end' climate change scenarios, which are typically extreme climate change scenarios on the margins or outside of the 10th to 90th percentile range presented in the 2009 UK climate change projections (also known as 'UKCP09').
Habitats Regulations Assessment (HRA)	A Habitats Regulations Assessment refers to the several distinct stages of assessment which must be undertaken in accordance with the Conservation of Habitats and Species Regulations 2017 (as amended) if a plan or project may affect the protected features of a habitats site, before a decision can be made on whether to authorise it.
HAGDMS	Highways Agency Geotechnical Data Management System (HAGDMS).
Hazardous waste	Defined in line with Article 3(2) of the Waste Framework Directive (Council Directive 2008/98/EC) as: 'waste which displays one or more of the hazardous properties listed in Annex III' of the Directive.
Health inequalities	The unfair and avoidable differences in exposure to health risk factors and to health status, health across the population, and between different groups within society. Note that where these are unfair and avoidable differences, these are also known as health inequities.
Holt	An otter's home.
Hydromorphology	The scientific study of the form and function of rivers and the interaction between streams and the landscape around them.
Impact	This distinguishes between the 'impact', defined as the action being taken, and the 'effect', defined as the change resulting from that action (GLVIA3). For consistency within LVIA "impact" cannot be used interchangeably with "effect" nor to mean a combination of several effects. DMRB LA 107.
Incidental extraction	Incidental extraction: Where any minerals that are incidentally extracted during site preparation would be processed and used on site (e.g. from excavating the road box, foundations, drainage works etc). This is typically the minimum level of prior extraction that the MPA would seek as part of any non-minerals development in an MSA.
In-combination effects (climate)	When a projected future climate impact (e.g. increase in temperatures) interacts with an effect identified by another topic and exacerbates its impact.
Inert waste	Waste which meets one or more of the following criteria: 1. that does not undergo any significant physical, chemical or biological transformations; 2. that does not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health; and 3. where its total leachability and pollutant content and the ecotoxicity of its leachate are insignificant and, in particular, do not endanger the quality of any surface water or groundwater. See Directive 1999/31/EC and Council Decision 2003/33/EC.
Institute of Environmental Management and Assessment (IEMA)	A professional body for environmental managers and EIA professionals.
Invasive Non-Native Species (INNS)	Species that have been released either deliberately or accidentally outside of their natural range, where they have become established and cause adverse ecological, environmental, or economic impacts.

Term	Definition
Key construction material	Construction materials which, by weight, constitute the majority of material required to deliver the scheme.
Land bank	The stock land with planning permissions but where minerals development has yet to take place.
Landfill capacity	The known, forecast or estimated remaining landfill void space, either regionally or nationally. Landfill capacity is generally measured in cubic metres.
Landscape	An area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors. European Landscape Convention 2000
Landscape and visual impact assessment (LVIA)	A "... tool used to identify and assess the significance of and the effects of change resulting from..." a project on both the landscape as a resource and on people's views and visual amenity. GLVIA3.
Landscape character	A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse. GLVIA3.
Landscape character area	Single unique areas which are the discrete geographical areas of particular landscape type. GLVIA3.
Landscape effects	The consequence of an impact (expressed as the 'significance of effect') on the landscape as a resource in its own right. GLVIA3.
Landscape receptors	Defined aspect of the landscape resource that potentially could be affected by the project. GLVIA3.
Landscape sensitivity	Applied to specific landscape receptors, combining judgements of the susceptibility of the receptor to the specific type of change proposed and the value related to the receptor LVIA: Landscape and Visual Assessment. GLVIA3.
LCTs and LCSTs - Landscape Character Types and Sub-Types	Distinct types of landscape that are relatively homogeneous in character. These are generic in nature, in that they may occur in different areas in different parts of the country, but wherever they occur they share similar characteristics.
Lead Local Flood Authority	Local Authority responsible for taking the lead on local flood risk management. The duties of LLFAs are set out in the Floods and Water Management Act.
LiDAR	Light Detection and Ranging.
Life cycle stage	PAS 2080:2016 proposes a modular approach for the quantification of infrastructure related GHG emissions over a number of stages over the ‘life cycle’ of a project, namely ‘before use (A)’, ‘use (B)’ and ‘end of life (C)’. These stages are further disaggregated into modules (e.g. product stage (A1–A3) and construction process stage (A4–A5)).
Local Biodiversity Action Plan (LBAP)	Local Biodiversity Action Plans set the focus for conservation of locally valued species and habitats.
Local Nature Reserve (LNR)	Sites that are designated by the local authority under Section 21 of the National Parks and Access to the Countryside Act 1949 for nature conservation which have wildlife or geological features that are of special interest locally.
Local Planning Authority	The local authority or Council that is empowered by law to exercise planning functions for a particular area. This is typically the local study area or study area Council.
Local Wildlife Site (LWS)	Local Wildlife Sites are non-statutory designated sites that have been identified and selected for their substantive nature conservation value.
Longest dry spell	Highest number of consecutive days with <1mm rainfall.
Long-term (in relation to noise and vibration assessment)	15 years after the scheme has opened to traffic.

Term	Definition
Low noise road surface	A surface that, when compared with traditional surfacing, has properties to reduce the noise from the tyre / road interface.
Macrophyte	An aquatic plant large enough to be seen with the naked eye.
Magnitude of effect	Combines judgements about size and scale of effect, extent of area it occurs over, whether reversible or irreversible and whether short or long term in duration.
Main river	Main rivers are usually larger rivers and streams, designated as such, and shown on the Main River Map. The Environment Agency carries out maintenance, improvement or construction work on main rivers to manage flood risk.
Material impact	An event/outcome that is a key decision-making consideration.
Matter	This relates to sub-topics of an environmental aspect (e.g. designated sites, protected species, etc.).
Maximum five-day precipitation	Highest value of rainfall accumulated over five days.
Mineral area of search	A broad area within which mineral sites are sought for development.
Mineral Planning Authority	The mineral planning authority is the county council (in 2-tier parts of the country), the unitary authority, or the national park authority responsible for planning control of minerals development.
Mineral resource	Natural concentrations of minerals in or on the Earth's crust that are or may become of economic interest because they are present in such form, quality and quantity that there is the potential for eventual economic extraction. Generally, a mineral resource is known to exist within the boundaries outlined by BGS geological mapping.
Mineral safeguarding area	An area designated by a Mineral Planning Authority which covers known deposits of minerals which are desired to be kept safeguarded from unnecessary sterilisation by non-mineral development.
Mineral safeguarding sites	Operational extraction sites or mineral sites specifically identified / allocated in strategic planning documents as those that will be mined or extracted.
Mitigation	The action of reducing the severity and magnitude of change (impact) to the environment. Measures to avoid, reduce, remedy or compensate for significant adverse effects.
National Character Assessment	Natural England has divided England into 159 distinct natural areas which are called National Character Areas (NCA). Each is defined by a unique combination of landscape, biodiversity, geodiversity, history, and cultural and economic activity. Their boundaries follow natural lines in the landscape rather than administrative boundaries.
National Highways	National Highways (was Highways England) is the public body that operates, maintains and improves England's motorways and major A roads.
National Policy Statement for National Networks (NPS NN)	The NPS for National Networks (NNNPS) sets out "the need for, and the Government's policies to deliver development of nationally significant infrastructure projects on the national road and rail networks".
Nationally Significant Infrastructure Project (NSIP)	Major infrastructure developments in England and Wales, such as proposals for power plants, large renewable energy projects, new airports and airport extensions, and major road projects, as set out in the Planning Act (2008). See entry for Development Consent Order.
Natural England	A public body responsible for ensuring that England's natural environment is protected and improved.
Natural resources	Any physical, tangible and valued element of the natural environment (e.g. soil, land, water and biodiversity).
Net zero	Net zero means any emissions would be balanced by schemes to offset an equivalent amount of greenhouse gases from the atmosphere, such as planting trees or using technology like carbon capture and storage.

Term	Definition
Nitrogen deposition	The transfer of reactive nitrogen from the atmosphere to the biosphere.
Noise barrier	A purpose-built structure to reduce the passage of noise from the source to receiver. These are traditionally wooden but the use of other materials (e.g. plastic) is becoming more common.
Noise Important Area (NIA)	'Hotspot' locations where noise levels at residential locations are within the highest 1% across the country for either road or railway related noise.
Noise modelling	Software to predict noise levels. NOTE: This can be undertaken either by specialist software to provide a 3D representation of the project and nearby noise sensitive receptors or a simple spreadsheet.
Noise monitoring	Measurement of noise levels.
Noise-sensitive receptor	Receptors which are potentially sensitive to noise. Examples include dwellings, hospitals, healthcare facilities, education facilities, community facilities, international and national or statutorily designated sites, public rights of way and cultural heritage assets.
Non-hazardous waste	Waste that is not classified as hazardous, and which encompasses both inert and non-hazardous waste classes.
Opening year	The first full calendar year of operation.
Order Limits	The spatial boundaries of the Proposed Scheme. For the PEIR, the Order Limits are provisional as they have not been finalised.
Ordinary watercourse	Ordinary watercourses include every river, stream, ditch, drain, cut, dike, sluice, sewer (other than a public sewer) and passage through which water flows and which does not form part of a main river. Lead local flood authorities, district councils and internal drainage boards carry out flood risk management work on ordinary watercourses.
Oxidation	A chemical reaction in which oxygen is added to or hydrogen is removed from an element, molecule or a compound.
PAS 2080	PAS 2080:2016 'Carbon Management in Infrastructure' specifies requirements for the management of whole-life carbon in infrastructure.
Peat resource	Existing or potential peat extraction sites.
Pennine Lower Coal Measures (PLCM)	Term to describe local geology.
Pennine Middle Coal Measures (PMCM)	Term to describe local geology.
Permian	A geological time period which follows the Carboniferous era, with dates ranging from approximately 298 to 251 million years ago.
Permo-Triassic	A geological time period which spans two periods (Permian and Triassic), with dates ranging from approximately 298 to 201 million years ago.
Phase 1 habitat survey	A rapid system for the recording of semi-natural vegetation and other wildlife habitats first published by the Joint Nature Conservancy Council in 1990.
Photomontage	Visualisation which superimposes an image of a proposed development upon a photograph following Landscape Institute Guidelines or the Highland Council, July 2016 guidelines.
Planform	The birds-eye view of the channel and the form of the channel from that perspective.
Planning Inspectorate (PINS)	The Planning Inspectorate is an executive agency of the Department for Levelling Up, Housing and Communities with responsibility to make decisions and provide recommendations and advice on a range of land use planning-related issues including operating the planning process for Nationally Significant Infrastructure Projects.
Pluvial flooding	Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity.

Term	Definition
Pore water pressure	The pressure exerted on its surroundings by water held in pore spaces in rock or soil, an increase in which can result in a decrease in the shear strength of a slope material, reducing slope stability.
Preliminary sources study report	A combination of desk study and site reconnaissance, the purpose of which is to develop an initial conceptual site model.
Preparing for reuse	Checking, cleaning or repairing operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing.
Prevention (Material assets and waste)	Measures taken before a substance, material or product has become waste, that reduce: 1. the quantity of waste, including through the re-use of products or the extension of the life span of products; 2. the adverse impacts of the generated waste on the environment and human health; or 3. the content of harmful substances in materials and products.
Primary materials	Physical substances from non-renewables sources, i.e. those that cannot or will not be replaced in short (non-geological) periods of time. Also referred to as 'virgin' materials.
Principal aquifer	Geology that exhibits high permeability and/or provides a high level of water storage. They may support water supply and/or river baseflow on a strategic scale.
Priority habitats	Priority habitats are the habitats of conservation priority which are listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006.
Priority species	Priority species are species of conservation priority which are listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006.
Protected and notable species	Species of plant and animal protected by legislation, and species of conservation importance such as priority species or species of principal importance.
Protected species mitigation license	The license issued to permit an activity affecting protected species that would otherwise be an offence.
Proximity principle	The requirement to treat and/or dispose of wastes in reasonable proximity to their point of generation.
Public right of way (PRoW)	A widely known right to cross private land is known as a 'right of way'. If this is a right granted to everyone it is a 'public right of way'.
Pulverised Fuel Ash (PFA)	PFA is the ash resulting from the burning of pulverised coal in coal-fired electricity power stations.
Q_{95}	The low flow value in a watercourse that is exceeded 95% of the time.
Rainfall from extremely wet days	Total rainfall falling on days with daily rainfall total in excess of the 99th percentile of daily rainfall.
Ramsar site	Wetlands of international importance designated under the Ramsar Convention 1971.
RCP8.5	RCP8.5 refers to the concentration of carbon that delivers global warming at an average of 8.5 watts per square meter across the planet. The RCP8.5 pathway delivers a temperature increase of about 4.3°C by 2100, relative to pre-industrial temperatures.
Receptor	A defined individual environmental feature usually associated with population, fauna and flora that have potential to be impacted by a development.
Recharge	Recharge of an aquifer occurs water added to the aquifer through the unsaturated zone after infiltration and percolation following any storm rainfall event.
Recovery (material assets and waste)	Any operation, the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.
Recycled aggregates	Aggregates that are typically derived from reprocessing materials previously used in construction, such as road planings, railway ballast, crushed concrete or masonry from construction and demolition activities.
Recycling	Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. Recycling includes the

Term	Definition
	reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for back filling operations.
Reducing conditions	A chemical reaction where oxygen is reduced because it adds hydrogen to form water.
Refugia	Habitat features where an animal may take refuge.
Region	The defined geographical areas or physical extents of the second study area. For the purposes of this aspect, the recommended physical extent is the former North West England Planning Region.
Region (material assets and waste)	The defined geographical areas or physical extents of the second study area. For the purposes of this aspect, the recommended physical extent is the former East of England Planning Region.
Residual effect	The predicted consequential change on the environment from the impacts of a development after mitigation.
Return Period	Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.
Re-use	Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.
Riparian zone	The corridor of land which runs along the banks of a river channel. If vegetated, it is known as the vegetated riparian zone.
Root Mean Square Error	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared.
Runoff	The movement of water above and below the surface.
Scoping	The process of identifying the issues to be addressed by an environmental impact assessment process. It is a method of ensuring that an assessment focuses on the important issues and avoids those that are considered unlikely to be significant.
Second study area (material assets and waste)	1. Feasible sources and availability of construction materials required to construct the main elements of a project. 2. Suitable recovery and waste management infrastructure that could accept arisings and/or waste generated by a project.
Secondary A aquifer	Permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of baseflow to rivers.
Secondary B aquifer	Predominantly lower permeability strata which may in part have the ability to store and yield limited amounts of groundwater by virtue of localised features such as fissures, thin permeable horizons and weathering.
Secondary materials / aggregates	Useful by-products from manufacturing or industrial processes. Secondary aggregates are typically by-products of industrial and other processes. These can be subdivided into manufactured and natural aggregates, depending on their source and can include materials such as pulverised fuel ash, ground granulated blast furnace slag, furnace bottom ash, incinerator bottom ash, recycled glass etc. Both secondary and recycled aggregates offer appropriate engineering specifications to allow them to replace primary aggregates.
Secondary Undifferentiated aquifer	Designation used in cases where it has not been possible to attribute either category A or B to a rock type.
Sediment transport dynamics	The manner in which sediment is eroded, transported and deposited along a watercourse.
Seep/seepages	A seep or flush is a moist or wet place where groundwater reaches the surface from an underground aquifer.

Term	Definition
Sensitivity	Receptor or resource environmental value.
Sensitivity (landscape and visual)	A term applied to specific receptors, combining judgements of the susceptibility of the receptor to the specific type of change or development proposed, and the value related to the receptor. GLVIA3.
Sett	A badger's home.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Short-term (in relation to noise and vibration assessment)	When the scheme opens to traffic.
Significance of effect	A measure of the importance, or gravity, of the environmental effect, defined by significance criteria specific to the environmental aspect.
Sinks	Where a watercourse disappears into the ground.
Sinuosity	The degree in which a channel meanders, a sinuous channel generally has a sinuosity ratio between 0 and 1.5. Straight channels have a ratio of 0.
Site arisings	Construction, demolition, excavation and other arisings generated from within a project boundary, during both construction, and operation and maintenance phases.
Site of Special Scientific Interest (SSSI)	Site designated as being of special interest for its flora, fauna or geological or physiographical features and protected under the Wildlife and Countryside Act 1981.
Soil	An assemblage of mineral particles and/or organic matter which includes variable amounts of water and air (and sometimes other gases).
Snuffle hole	Small holes in the ground made by badgers as they forage for food such as earthworms.
Special Area of Conservation (SAC)	An area which has been identified as being important for a range of vulnerable habitats, plant and animal species within the EU and is designated under the Habitats Directive.
Special Protection Area (SPA)	A site designated under the Birds Directive due to its international importance for the breeding, feeding, wintering, or the migration of, rare and vulnerable species of birds.
Speed band	A range of categories for which outputs from the traffic model are grouped into to describe their emissions.
Spraint	An otter's dung.
Spreads	A place where a stream spreads into a marsh or onto a sand or shingle beach or an area of rough grass.
Springs	A point at which groundwater discharges onto the surface.
Stable non-reactive hazardous waste	Hazardous waste, the leaching behaviour of which will not change adversely in the long-term, under landfill design conditions or foreseeable accidents: in the waste alone (for example, by biodegradation); under the impact of long-term ambient conditions (for example, water, air, temperature or mechanical constraints); by the impact of other wastes (including waste products such as leachate and gas).
Sterilise	Substantially constrain / prevent existing and potential future use and extraction of mineral resources, typically by constructing infrastructure over or adjacent to a deposit.
Strikes	The level at which water is first encountered when drilling.
Sub-region (in relation to material assets and waste)	The defined geographical areas or physical extents of Greater Manchester sub-region (Association of Greater Manchester Authorities).

Term	Definition
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
Surface water runoff	Rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer.
Susceptibility	The ability of a defined landscape or visual receptor to accommodate the specified proposed development without negative consequences. GLVIA3
Synergistic	Where different types of impact affect a receptor and interact to increase their combined significance e.g. two discharges combine to have an effect on a species not affected by discharges in isolation.
Townscape	The landscape within the built-up area, including the buildings, urban open spaces, including green spaces and the relationship between buildings and between buildings and open spaces. GLVIA3
Traffic Reliability Area	Defined in DMRB LA 105 Air Quality (Highways England, 2019b) as the *'area covered by the traffic model, that the competent expert for traffic has identified as reliable for inclusion in an environmental assessment'.*
Tranquil areas	Places which are sufficiently away from visual or noise intrusion of development or traffic to be considered unspoilt by urban influences.
UKCP18	The UK Climate Projections 2018 (UKCP18) are a set of UK climate projection tools designed to help decision-makers assess their risk exposure to climate change. The UKCP18 project uses cutting-edge climate science to provide climate change projections out to 2100. UKCP18 provides probabilistic projections over land and a set of high-resolution, spatially coherent future climate projections for the UK at 25km and 12km scale. The 12km climate model has been further downscaled to 2.2km scale – a level previously only used for short-term weather forecasts, allowing realistic simulation of high impact events such as localised heavy rainfall in summer.
Unproductive strata	These are geological strata with low permeability that have negligible significance for water supply or river base flow.
Value	Relative value or importance of a landscape's quality, special qualities including perceptual aspects such as scenic beauty, tranquility, or wildness, cultural associations or other conservation issues. GLVIA3
Veteran tree	A tree that, by recognised criteria, shows features of biological, cultural or aesthetic value that are characteristic of, but not exclusive to, individuals surviving beyond the typical age range for the species concerned.
Visual amenity	Overall enjoyment of a particular area, surroundings, or views in terms of people's activities - living, recreating, travelling through, visiting, or working. GLVIA3
Visual effects	Effects on specific views and on the general visual amenity experienced by people
Visual receptor	Individuals and / or defined groups of people who have the potential to be affected by a project. GLVIA3
Visual sensitivity	Visual experience be it sensitivity to light or visual clutter. DMRB LA107
Vulnerability	The degree to which a system/asset is exposed and resilient to adverse effects of climate change.
Walkers, cyclists and horse riders (WCH)	Users that include: • pedestrians – including mobility impaired and vulnerable pedestrians

Term	Definition
	• cyclists – including mobility impaired and vulnerable cyclists • equestrians – including mobility impaired and vulnerable equestrians Other users considered as part of this group include (but are not limited to): • scooter riders (non-motorised) • cyclists with electrically assisted pedal cycles (where these conform to Department for Transport or other relevant regional regulations and where they can legally be used) • users of powered wheelchairs (where these conform to Department for Transport regulations and where they can legally be used)
Warm spell duration index	Count of days with at least six consecutive days when daily maximum temperature is above the 90th percentile.
Waste	Defined in line with Article 3(1) of the Waste Framework Directive (Council Directive 2008/98/EC) as: 'any substance or object which the holder discards or intends or is required to discard'. Waste is commonly split into the following classifications: Inert, Hazardous and Non-hazardous: waste that is classified neither as inert nor hazardous.
Waste classification	As part of waste Duty of Care, waste holders must classify their waste: before it is collected, disposed of or recovered; to identify the controls that apply to the movement of the waste; to complete waste documents and records; to identify suitably authorised waste management options; and to prevent harm to people and the environment. Technical Guidance WM3 'Waste Classification - Guidance on the classification and assessment of waste' provides guidance on waste classification in the UK. It is a comprehensive reference manual for anyone involved in producing, managing and regulating waste. Appendix A of WM3 includes the waste classification codes, also referred to as LoW (List of Waste) or EWC (European Waste Catalogue) codes.
Waste infrastructure	Facilities that handle, treat/prepare for reuse, recycle and dispose (landfill) of waste.
Wider determinant of health	Personal, social, economic and environmental factors which determine the health status of individuals and communities.
Zone of Influence (ZOI)	This is established for each environmental aspect considered within the Environmental Statement in order to establish the relevant 'other existing development and/or approved development' to be considered within the cumulative effects assessment.
Zone of theoretical visibility (ZTV)	Map produced (usually digitally) to specific criteria to illustrate the area(s) from which a project can theoretically be visual. Note: For cumulative visual effects assessment it is the areas of overlap with the ZTV which can prove significant. DMRB LA 107

References

Chapter 1: Introduction

Department for Transport (DfT) (2014). National Policy Statement for National Networks. London: Her Majesty's Stationary Office.

Department for Transport (DfT) (2015). Highways England: Licence.

Highways England (2015). Biodiversity Plan.

Highways England (2017a). Air Quality Strategy.

Highways England (2017b). Environment Strategy.

Highways England (2017c). Sustainable Development Strategy.

Highways England (2020). Delivery Plan 2020-2025.

Highways England (2021). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

National Highways (2021). Net Zero Highways: Our 2030 / 2040 / 2050 Plan.

Planning Inspectorate (2015). Advice Note Two: The Role of Local Authorities in the Development Consent Process.

Planning Inspectorate (2020). Advice Note Seven: Environmental Impact Assessment: Preliminary Environmental Information, Screening and Scoping.

Planning Inspectorate (2021). Scoping Opinion for M60/M62/M66 Simister Island Interchange. Accessed August 2021. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010064/TR010064-000030-TR010064%20-%20Scoping%20Opinion.pdf.

Chapter 2: The scheme

British Standards Institution (BSI) (2020). BS 5489-1:2020: Design of Road Lighting. Lighting of Roads and Public Amenity Areas. Code of Practice.

Department for Transport (DfT) (2020). Road Investment Strategy 2 (RIS2): 2020 to 2025. Accessed July 2021. https://www.gov.uk/government/publications/road-investment-strategy-2-ris2-2020-to-2025.

Highways Agency (2014). Route Based Strategy (RBS) Evidence Report.

Highways England (2016). The Strategic Outline Business Case.

Highways England (2018). The Road to Good Design. Accessed July 2021. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/672822/Good_road_design_Jan_18.pdf.

Highways England (2019). Design Manual for Roads and Bridges, GG 103 Introduction and general requirements for sustainable development and design. Revision 0.

Highways England (2020a). Design Manual for Roads and Bridges, LD 117 Landscape Design. Revision 0.

Highways England (2020b). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Highways England (2020c). Design Manual for Roads and Bridges, TA 501 Road lighting appraisal. Revision 0.

Institution of Lighting Professionals (2018). Guidance Note 8 Bats and Artificial Lighting.

Institution of Lighting Professionals (2020). Guidance Note 1 for the Reduction of Obtrusive Light.

National Highways (2023). M60 J18 Simister Island Traffic Modelling Report for Consultation.

Planning Inspectorate (2018). Advice Note Nine: Rochdale Envelope.

Chapter 3: Assessment of alternatives

CH2M (2017). M60 Junction 18 Simister Island PCF Stage 1 – Identification of Options Report. Report no. HE548642-CH2-HGN-M60J18_XX-RP-C-0003. P01.

CH2M (2019). M60 Junction 18 Simister Island Improvement PCF Stage 2 – Environmental Assessment Report. Report no. HE548642-CH2-EGN-M60J18_XX-RP-C-0019. P06.

Highways England (2020). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Hyder (2015). Value Management Report. Report no. HE548642-HYD-GEN-M60J18-RP-PM-0006. P02.

Chapter 4: Consultation

Accent (2020). M60 Junction 18 Simister Island Interchange Report on Public Consultation. Accessed April 2021. https://highwaysengland.citizenspace.com/he/m60-j18-simister-island/results/reportonpublicconsultation_final.pdf.

Chapter 5: Environmental assessment methodology

CH2M (2018a). M60 Junction 18 Simister Island PCF Stage 2 – Preliminary Sources Study Report. Report no. HE548642-CH2-GEN-M60J18_XX-RP-C-0015. HAGDMS no. 30640. P01.

CH2M (2018b). M60 Junction 18 Simister Island PCF Stage 2 – Screening Report to Inform Habitats Regulations Assessment. Report no. HE548642-CH2-EBD-M60J18_XX-RP-C-0002. P02.

Highways England (2019). Design Manual for Roads and Bridges (DMRB), LA 110 Material assets and waste. Revision 0.

Highways England (2020a). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Highways England (2020b). Design Manual for Roads and Bridges, LA 111 Noise and Vibration. Revision 2.

Highways England (2020c). Design Manual for Roads and Bridges, LA 120 Environmental Management Plans. Revision 1.

Highways England (2021). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

National Highways (2023). M60 J18 Simister Island Traffic Modelling Report for Consultation.

Planning Inspectorate (2017). Advice Note Eighteen: The Water Framework Directive.

Planning Inspectorate (2021). Scoping Opinion for M60/M62/M66 Simister Island Interchange. Accessed August 2021. https://infrastructure.planninginspectorate.gov.uk/wp-

content/ipc/uploads/projects/TR010064/TR010064-000030-TR010064%20-%20Scoping%20Opinion.pdf.

Chapter 6: Air quality

Cambridge Environmental Research Consultants (2020). Air Dispersion Model Software (ADMS-Roads). Version 5.0.

Department for Environment, Food and Rural Affairs (Defra) (2016). NO2 Fall Off With Distance Calculator v4.2. Accessed December2021. https://laqm.defra.gov.uk/air-quality/air-quality-assessment/no2-falloff/.

Department for Environment, Food and Rural Affairs (Defra) (2016). NO_2 Fall Off With Distance Calculator v4.2. Accessed December 2021. https://laqm.defra.gov.uk/air-quality/air-quality-assessment/no2-falloff/.Department for Environment, Food and Rural Affairs (Defra) (2020a). NO_X to NO_2 Calculator v8.1; and NO2 Adjustment for NOx Sector Removal Tool v8.0. Accessed December2021. https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc.

Department for Environment, Food and Rural Affairs (Defra) (2020b). Background Maps (2018 Base Year). Accessed January 2022. https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html.

Department for Environment, Food and Rural Affairs (Defra) (2020c). 2020 NO2 Pollution Climate Mapping projections data (2018 reference year). Accessed December 2021. https://uk-air.defra.gov.uk/library/no2ten/2020-no2-pm-projections-from-2018-data.

Department for Environment, Food and Rural Affairs (Defra) (2021). Local Air Quality Management: Technical Guidance Note (LAQM TG(16)).

Department for Environment, Food and Rural Affairs (Defra) (2022). The Environment Act 1995 (Greater Manchester) Air Quality Direction 2022.

Department for Transport (DfT) (2014). National Policy Statement for National Networks (NPS NN). London: Her Majesty's Stationary Office.

European Union (2008). Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, 2008.Greater Manchester Combined Authority (GMCA) (2020). 2019 Air Quality Annual Status Report.

Greater Manchester Combined Authority (GMCA) (2021). 2021 Air Quality Annual Status Report.

Greater Manchester Combined Authority (GMCA) (2022). Greater Manchester Air Quality Administration Committee, GM Clean Air Plan – August 2022 Update.

Her Majesty's Stationery Office. (2002). Air Quality (England) (Amendment) Regulations 2002 (SI 3043). Available from: https://www.legislation.gov.uk/uksi/2002/3043/contents/made. Accessed September 2022.

Her Majesty's Stationery Office. (2010). Air Quality Standards (England) Regulations 2010 (SI 1001). Available from: https://www.legislation.gov.uk/uksi/2010/1001/contents/made. Accessed September 2022.

Her Majesty's Stationery Office. (2020). The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 (SI 1313). Available from: https://www.legislation.gov.uk/uksi/2020/1313/contents/made. Accessed September 2022.

Highways England (2019). Design Manual for Roads and Bridges, LA 105 Air Quality. Revision 0.

Highways England (2020a). Highways Englan speed banded emissions factors for use with IAN185/13 v4.2Highways England (2020b). Air Quality Monitoring Survey Data.

Highways England (2021). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

Jacobs (2021). Jacobs Monitoring Data for the Proposed Scheme.

National Highways (2022). Air Quality on England's Strategic Road Network: Phase 3 Assessment Commission No. 1. Analysis of Potential Non-Compliance with Limit Values for Nitrogen Dioxide, as Identified by Government's Pollution Climate Mapping Model. Available from: https://s3.eu-west-2.amazonaws.com/assets.nationalhighways.co.uk/Air+quality+progress+update/Index/Commission+1/Phase+3+AQ+Report/Phase%2B3%2BAir%2BQuality%2BReport%2Bv4.pdf. Accessed October 2022.

Natural England (2021). Open Data Geoportal. Accessed February 2021. https://naturalengland-defra.opendata.arcgis.com/.

The Planning Inspectorate (2021). Scoping Opinion: Proposed M60/M62/M66 Simister Island Interchange. Accessed January 2022. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010064/TR010064-000030-TR010064%20-%20Scoping%20Opinion.pdfSalford City Council (SCC) (2021). Salford City Council Historical Annual Average Nitrogen Dioxide Diffusion Tube Results. Accessed October 2021. https://www.salford.gov.uk/pests-nuisances-pollution-and-food-hygiene/protecting-the-environment/air-quality-and-monitoring/monitoring/

Transport for Greater Manchester (TfGM) (2020). Air Quality Monitoring Survey Data.

UK Centre for Ecology and Hydrology (2021). Air Pollution Information System (APIS). Accessed December 2021. http://www.apis.ac.uk/

Chapter 7: Cultural heritage

Department for Transport (DfT) (2014). National Policy Statement for National Networks. London: Her Majesty's Stationary Office.

Highways England (2020a). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Highways England (2020b). Design Manual for Roads and Bridges, LA 106 Cultural Heritage Assessment. Revision 1.

Historic England (2008). Conservation Principles Policy and Guidance.

Historic England (2017). The Setting of Heritage Assets, Historic Environment Good Practice Advice in Planning Note 3 (2nd Edition).

Ian Farmer Associates (2022). Factual Report on Ground Investigation.

Ministry of Housing, Communities & Local Government (MHCLG) (2019). National Planning Policy Framework.

Chapter 8: Landscape and visual

Bury Metropolitan Borough Council (BMBC) (2009). Bury Landscape Character Assessment. Accessed April 2021.

Bury Metropolitan Borough Council (BMBC) (2010). Bury's Green Infrastructure, Advice on Strategy and Implementation (TEP). Accessed April 2021.

https://www.bury.gov.uk/CHttpHandler.ashx?id=17536&p=0#:~:text=The%20green%20infrastructure%20of%20Greater,suburbs%20and%20our%20rural%20fringe.

CPRE The Countryside Charity (2007). Tranquillity Mapping England. Accessed April 2021. https://www.cpre.org.uk/resources/tranquility-map-england/.

CPRE The Countryside Charity (2019). England's Light Pollution and Dark Skies. Accessed April 2021. https://www.nightblight.cpre.org.uk/.

Department for Environment, Food and Rural Affairs (Defra) (2021). MAGIC Map application. Accessed April 2021. https://magic.defra.gov.uk/magicmap.aspx.

Greater Manchester Combined Authority (GMCA) / LUC (2018). Greater Manchester Landscape Character and Sensitivity Assessment. Accessed April 2021. https://www.greatermanchester-ca.gov.uk/media/1727/greater-manchester-landscape-character-and-sensitivity-report.pdf.

Highways England (2020a). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Highways England (2020b). Design Manual for Roads and Bridges, LA 107 Landscape and Visual Effects. Revision 2.

Highways England (2020c). Design Manual for Roads and Bridges, LD 117 Landscape Design. Revision 0.

Highways England (2021). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

Landscape Institute (2018). Townscape Character Assessment Technical Information Note 05/2017. Accessed April 2021. https://www.landscapeinstitute.org/technical-resource/townscape/.

Landscape Institute (2019). Visual Representation of Development Proposals Technical Guidance Note 06/19 (TGN 06/19).

Landscape Institute and Institute of Environmental Management and Assessment (IEMA) (2013). Guidelines for Landscape and Visual Impact Assessment 3rd Edition (GLVIA3).

Natural England (2014). National Character Area Profiles. Accessed April 2021. https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles.

Rochdale Borough Council (RBC) (2006). Unitary Development Plan (UDP). Accessed April 2021. http://rochdale.gov.uk/pdf/2012-11-02_udp_adopted_written_statement_june_2006_v2.pdf.

Rochdale Borough Council (RBC) (2017). Local Development Framework (LDF): Biodiversity and Development Supplementary Planning Document (SPD). Accessed April 2021. http://www.rochdale.gov.uk/pdf/2017-02-21-biodiversity-development-spd-updated-v2.pdf.

Chapter 9: Biodiversity

Defra (2021). Multi-Agency Geographic Information for the Countryside (MAGIC).

Eaton, M., et al. (2015). Birds of Conservation Concern 4: the Red List for Birds.

Highways England (2019). Design Manual for Roads and Bridges, LA 105 Air Quality. Revision 0.

Highways England (2020a). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Highways England (2020b). Design Manual for Roads and Bridges, LA 108 Biodiversity. Revision 1.

Highways England (2020c). Design Manual for Roads and Bridges, LA 111 Noise and Vibration. Revision 2.

Highways England (2020d). Design Manual for Roads and Bridges, LA 113 Road Drainage and the Water Environment. Revision 1.

Highways England (2020e). Design Manual for Roads and Bridges, LA 115 Habitats Regulations Assessment. Revision 1.

Highways England (2020f). Delivery Plan 2020-2025.

Highways England (2021). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

Musgrove et al. (2013). Population Estimates of Birds in Great Britain and the United Kingdom, British Birds 106.

Natural England (2021). Ancient Woodland Inventory.

Planning Inspectorate (2017). Advice Note Ten: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects.

Stroh, P., et al. (2014). A Vascular Plant Red List for England Botanical Society of Britain and Ireland, Bristol. ISBN: 978095397186.

Chapter 10: Geology and soils

ADAS (2022). Soil Survey at Simister Island, Manchester. March 2022.

British Geological Survey (BGS) (2021a). GeoIndex (onshore). Accessed October 2022. https://www.bgs.ac.uk/map-viewers/geoindex-onshore/.

British Geological Survey (BGS) (2021b). Lexicon of Named Rock Units. Accessed October 2022. https://webapps.bgs.ac.uk/lexicon/home.cfm?_ga=2.69586128.1948668052.1618905189-1397892841.1618905189.

CH2M (2018). M60 Junction 18 Simister Island PCF Stage 2 – Preliminary Sources Study Report. Report no. HE548642-CH2-GEN-M60J18_XX-RP-C-0015. HAGDMS no. 30640. P01.

Coal Authority (2017). Coal Mining Report reference: HMD-252-4559913.

Cranfield University (2021). LandIS Soilscapes Map. Accessed October 2022. http://www.landis.org.uk/services/soilscapes.cfm.

Department for Environment, Food and Rural Affairs (Defra) (2021). MAGIC Map application. Accessed April 2021. https://magic.defra.gov.uk/magicmap.aspx.

Department for Transport (DfT) (2014). National Policy Statement for National Networks. London: Her Majesty's Stationary Office.

Environment Agency (2020). Land contamination risk management. Accessed July 2021. https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm.

Groundsure (2017a). EnviroInsight report reference: HMD-252-4559910.

Groundsure (2017b). GeoInsight report reference: HMD-252-4559911.

Groundsure (2017c). MapInsight report reference: HMD-252-4559912.

Health and Safety Executive (HSE). The Construction (Design and Management) Regulations 2015. Accessed October 2022. https://www.hse.gov.uk/construction/cdm/2015/index.htm

Highways England (2019). Design Manual for Roads and Bridges, LA 109 Geology and Soils. Revision 0.

Highways England (2020a). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Highways England (2020b). Design Manual for Roads and Bridges, LA 113 Road Drainage and the Water Environment. Revision 1.

Highways England (2021a). Highways England Geotechnical Data Management System (HAGDMS). Accessed October 2022. https://www.hagdms.com/.

Highways England (2021b). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

National House Building Council et al. (2008). Guidance for the Safe Development of Housing on Land Affected by Contamination.

Natural England (2021a). Provisional Agricultural Land Classification (ALC) Survey. Accessed October 2022. https://naturalengland-defra.opendata.arcgis.com/datasets/5d2477d8d04b41d4bbc9a8742f858f4d_0?geometry=-16.018%2C50.531%2C11.733%2C55.169.

Natural England (2021b). Agricultural Land Classification (ALC) Grades – Post 1988 (England) Survey. Accessed October 2022. https://naturalengland-defra.opendata.arcgis.com/datasets/agricultural-land-classification-alc-grades-post-1988-england?geometry=-15.693%2C50.588%2C12.058%2C55.221.

Planning Inspectorate (2017). Advice Note Eighteen: The Water Framework Directive.

Planning Inspectorate (2019). Advice Note Seventeen: Cumulative Effects Assessment Relevant to Nationally Significant Infrastructure Projects.

Chapter 11: Material assets and waste

Association of Greater Manchester Authorities (AGMA) (2012). Greater Manchester Joint Waste Development Plan. Accessed September 2022https://secure.manchester.gov.uk/downloads/download/4804/greater_manchester_joint_waste_development_plan_documents.

Association of Greater Manchester Authorities (AGMA) (2013). Joint Minerals Plan April 2013. Accessed September 2022.https://secure.manchester.gov.uk/info/200074/planning/6161/greater_manchester_joint_minerals_development_plan.

BRE (2014). BES 6001 – The Framework Standard for Responsible Sourcing. Accessed September 2022.https://www.bregroup.com/services/standards/responsible-sourcing/.

British Geological Survey (BGS) (2005). Greater Manchester Mineral Resources Map in Support of National, Regional and Local Planning. Accessed September 2022.https://www2.bgs.ac.uk/mineralsuk/download/england/gmanchesterMap.pdf.

British Geological Survey (BGS) (2020). BritPits dataset. Accessed September 2022.https://www.bgs.ac.uk/datasets/britpits/.

British Geological Survey (BGS) (n.d.). Minerals Information Online. Accessed September 2022.https://www.bgs.ac.uk/mineralsuk/maps/maps.html.

British Standards Institution (BSI) (2009). BS 8902:2009 Responsible sourcing sector certification schemes for construction products. Specification.

Capita (2022). North West Aggregate Working Party Annual Monitoring Report 2021 [Including data from 2019 and 2020],. Accessed August2021. https://www.warrington.gov.uk/sites/default/files/2021-03/NW%20AWP%20-%20AMR%202019%20%28Period%20Jan%20to%20Dec%202018%29.pdf.

Contaminated Land: Applications in Real Environments (CL:AIRE) (2011). Definition of Waste: Development Industry Code of Practice (Version 2). Accessed September 2022. https://www.claire.co.uk/projects-and-initiatives/dow-cop.

Crown Estates (2021). Marine Aggregates Capability and Portfolio Document 2020. Accessed August 2022. https://www.thecrownestate.co.uk/media/3634/2020-capability-portfolio-report.pdf.

Department for Environment, Food and Rural Affairs (Defra) (2018). Resources and Waste Strategy for England. Accessed September 2022. https://www.gov.uk/government/publications/resources-and-waste-strategy-for-england.

Department for Environment, Food and Rural Affairs (Defra) (2022). UK Statistics on Waste - Statistical Notice (June 2020). Accessed August 2022.https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/874265/UK_Statistics_on_Waste_statistical_notice_June_2020_accessible_FINAL_rev_v0.5.pdf.

Department for Transport (DfT) (2014). National Policy Statement for National Networks. London: Her Majesty's Stationary Office.

Environment Agency (2013). End of Waste Criteria for the Production of Aggregates from Inert Waste. Accessed September 2022. https://www.gov.uk/government/publications/quality-protocol-production-of-aggregates-from-inert-waste.

Environment Agency (2022a). Waste Data Interrogator 2019. Accessed October 2022.https://data.gov.uk/dataset/d409b2ba-796c-4436-82c7-eb1831a9ef25/2019-waste-data-interrogator.

Environment Agency (2022b). 2021 Remaining Landfill Capacity. Accessed October 2022. https://www.data.gov.uk/dataset/237825cb-dc10-4c53-8446-1bcd35614c12/remaining-landfill-capacityEuropean Union (n.d.). Forest Law Enforcement Governance and Trade. Accessed September 2022. http://www.euflegt.efi.int/what-is-flegt.

Glenigan, CITB, BIS and Constructing Excellence (2018). UK Industry Performance Report 2018 – Based on the UK Construction Industry Key Performance Indicators. Accessed September 2022. https://constructingexcellence.org.uk/kpi-reports/.

Highways England (2018). Sustainable Development Strategy an Action Plan. Accessed September 2022. . https://www.gov.uk/government/publications/highways-england-sustainable-development-strategy.

Highways England (2019). Design Manual for Roads and Bridges (DMRB), LA 110 Material assets and waste. Revision 0.

Highways England (2020). Design Manual for Roads and Bridges (DMRB), LA 104 Environmental assessment and monitoring. Revision 1.

MacArthur. C, (Coal Authority), 07 January 2018. RE: Request for Minerals Planning Consultation for the M60 J18 Simister Island Scheme. Email to Lean. D (Jacobs) on behalf of the Coal Authority Planning Advice Team.

Ministry of Housing, Communities and Local Government (2021a). The Aggregate Minerals Survey for England and Wales 2019. Accessed September 2022. https://www.gov.uk/government/publications/aggregate-minerals-survey-for-england-and-wales-2019.

Ministry of Housing, Communities and Local Government (2021b). The National Planning Policy Framework (NPPF). Accessed September 2022. https://www.gov.uk/government/publications/national-planning-policy-framework--2.

Ministry of Housing, Communities & Local Government (MHCLG) (2009). National and Regional Guidelines for Aggregates Provision in England 2005 to 2020. Accessed September 2022.https://www.gov.uk/government/publications/national-and-regional-guidelines-for-aggregates-provision-in-england-2005-to-2020.

Williams. C, (Urban Vision), 30 October 2018 and 07 January 2019. RE: Request for Minerals Planning Consultation for the M60 J18 Simister Island Scheme. Email to Lean. D (Jacobs) on behalf of the Greater Manchester Minerals and Waste Planning Unit.

Wilson. S (2020) (Highways England). SMP LA 110 Material Assets and Waste. E-mail message to Tomlinson. P (Jacobs). Sent 09 January 2020 15:42.

WRAP (2008). Net Waste Tool – Data. Accessed September 2022. http://nwtool.wrap.org.uk/Reports/WRAP%20NW%20Tool%20-%20Data%20download.xls.

WRAP (2009). Construction Procurement Guidance: Delivering Higher Recycled Content in Construction Projects. Accessed September 2022. http://www.wrap.org.uk/sites/files/wrap/Delivering%20higher%20recycled%20content%20in%20construction%20projects.pdf.

WRAP (2011). The Business Case for optimising materials in Civil Engineering design: Reducing waste and optimising materials in design saves money and carbon. Accessed September 2022. http://www.wrap.org.uk/sites/files/wrap/Materials%20in%20civil%20engineering%20design%20RE%20Business%20Case_0.pdf.

WRAP (2013). Resource Efficiency Benchmarks for Construction Projects. Accessed September 2022. http://www.wrap.org.uk/content/resource-efficiency-benchmarks-construction-projects-0.

Chapter 12: Noise and vibration

British Standards Institution (BSI) (2003). BS 7445-1:2003 Description and Measurement of Environmental Noise - Guide to Quantities and Procedures.

British Standards Institution (BSI) (2014a). BS 5228-1:2009 + A1:2014 Code of practice for Noise and Vibration Control on Construction and Open Sites Part 1 – Noise.

British Standards Institution (BSI) (2014b). BS 5228-2:2009 + A1:2014 Code of practice for Noise and Vibration Control on Construction and Open Sites Part 2 – Vibration.

CH2M (2019). M60 Junction 18 Simister Island Improvement PCF Stage 2 – Environmental Assessment Report. Report no. HE548642-CH2-EGN-M60J18_XX-RP-C-0019. P06.

Department for Environment, Food and Rural Affairs (Defra) (2019). Noise Action Plan: Roads.

Department for Transport (DfT) (2014). National Policy Statement for National Networks. London: Her Majesty's Stationary Office.

Department for Transport/Welsh Office (1988). Calculation of Road Traffic Noise.

Google Earth (2020). Aerial Imagery. Accessed July 2021. http://www.google.com/earth/index.html.

Highways England (2020a). Design Manual for Roads and Bridges, LA 111 Noise and Vibration. Revision 2.

Highways England (2020b). Design Manual for Roads and Bridges, LA 112 Population and Human Health. Revision 1.Highways England (2021). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

Planning Inspectorate (2021). Scoping Opinion for M60/M62/M66 Simister Island Interchange. Accessed August 2021. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010064/TR010064-000030-TR010064%20-%20Scoping%20Opinion.pdf.

Chapter 13: Population and human health

Bassett, D., et al. (2008). Walking, cycling, and obesity rates in Europe, North America and Australia. Journal of Physical Activity and Health. Vol. 5, pp795-814.

British Medical Association (2012). Health transport = health lives [Online]. Accessed August 2021. https://www.cycling-embassy.org.uk/document/healthy-transport-healthy-lives.

Cave, B., Fothergill, J., Pyper, R., Gibson, G., and Saunders, P. (2017). Health in Environmental Impact Assessment: A Primer for a Proportionate Approach. Accessed January 2021. https://www.iema.net/document-download/33596.

Cycling UK (2019). Cycling statistics. Accessed July 2020. https://www.cyclinguk.org/statistics.

Day, B. H., and G. Smith (2018). Outdoor Recreation Valuation (ORVal) User Guide: Version 2.0, Land, Environment, Economics and Policy (LEEP) Institute, Business School, University of Exeter.

Department for Transport (2020). Local Transport Note 1/20: Cycle Infrastructure Design. Available at: https://www.gov.uk/government/publications/cycle-infrastructure-design-ltn-120. Accessed October 2022.

Gov.uk (2022) Get information about schools. Parrenthorn High School. Accessed October 2022. https://get-information-schools.service.gov.uk/Establishments/Establishment/Details/105358.

Greater Manchester Combined Authority (2021) Places for Everyone Joint Development Plan Document – Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford, Wigan. Publication Stage. Accessed November 2022. Available at: https://www.greatermanchester-ca.gov.uk/media/4838/places-for-everyone.pdf

Highways England (2019). Design Manual for Roads and Bridges, GG 142 Walking, Cycling and Horse-riding Assessment and Review. Revision 0.

Highways England (2020). Design Manual for Roads and Bridges, LA 112 Population and Human Health. Revision 1.

Highways England (2021). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

International Association for Impact Assessment and European Public Health Association (2020). Human Health: Ensuring a high level of protection. Accessed January 2021. https://ec.europa.eu/health/ph_overview/Documents/key07_en.pdf.

Joffe, M. and Mindell, J. (2002). A framework for the evidence base to support Health Impact Assessment. Journal of Epidemiology and Community Health 2002; 56:132–138.

Marmot, M. (2010). Fair society, healthy lives: The Marmot Review: strategic review of health inequalities in England post-2010. ISBN 9780956487001.

Office for Health Improvement and Disparities. (2022) Public health profiles. Accessed October 2022. https://fingertips.phe.org.uk.

Office for National Statistics (ONS) (2018). Household projections for England. Accessed March 2021. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/householdprojectionsforengland.

Office for National Statistics (ONS) (2020). Mid-year 2019 population estimate. Accessed March 2021. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates.

Office for National Statistics (ONS) (2022) Is hybrid working here to stay?. Accessed October 2022. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/ishybridworkingheretostay/2022-05-23

Planning Inspectorate (2021). Scoping Opinion for M60/M62/M66 Simister Island Interchange.

Public Health England (2020a). Health Impact Assessments in spatial planning: a guide for local authority public health and planning teams. Accessed September 2021. https://www.gov.uk/government/publications/health-impact-assessment-in-spatial-planning.

Public Health England (2020b). Scoping Consultation Response to A12 Chelmsford to A120 Widening Scheme. Scoping Opinion for M60/M62/M66 Simister Island Interchange, Annex A.

Pyper, R., Waples, H., Beard, C.,Barratt, T., Hardy, K., Turton, P., Netherton, A., McDonald, J., Buroni, A., Bhatt, A., Phelan, E., Scott, I., Fisher, T., Christian, G., Ekermawi, R., Devine, K., McClenaghan, R., Fenech, B., Dunne, A., Hodgson, G., Purdy, J., Cave, B. (2022) IEMA Guide: Determining Significance for Human Health in Environmental Impact Assessment.

World Health Organization (WHO) (1948). World Health Organization Constitution. Accessed March 2021. https://www.who.int/about/who-we-are/constitution.

WHO Regional Office for Europe (2018). Environmental Noise Guidelines for the European Region. WHO Regional Office for Europe. DK-2100 Copenhagen Ø, Denmark. Available at: https://www.who.int/europe/publications/i/item/9789289053563. Accessed October 2022.

Chapter 14: Road drainage and the water environment

British Geological Survey (BGS) (2020). Onshore GeoIndex. Accessed June 2021. http://mapapps2.bgs.ac.uk/geoindex/home.html.

British Geological Survey (BGS) (2022). Groundwater Flooding Susceptibility dataset via an information request. Received August 2021.

Cheney. C (2007). British Geological Survey baseline groundwater quality information for the Pennine Coal Measures Group (Technical Report: OR/07/039).

CIRIA (2000a). Environmental handbook for building and civil engineering projects. Part 1: design and specification (C512).

CIRIA (2000b). Environmental handbook for building and civil engineering projects. Part 2: construction (C528).

CIRIA (2000c). Environmental handbook for building and civil engineering projects. Part 3: demolition and site clearance (C529).

CIRIA (2001). Control of water pollution from construction sites: Guidance for consultants and contractors (C532).

CIRIA (2006). Control of water pollution from linear construction projects: Site guide (C649).

CIRIA (2015a). The SuDS Manual (C753).

CIRIA (2015b). Environmental good practice on site guide, fourth edition (C741).

CIRIA (2016a). Groundwater control: design and practice, second edition (C750).

CIRIA (2019). Culvert, screen and outfall manual (C786).

Coal Authority (2020). Interactive Map Viewer. [online]. Available at: https://mapapps2.bgs.ac.uk/coalauthority/home.html (accessed: April 2021).

Department for Environment, Food and Rural Affairs (Defra) (2015). Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems.

Department for Environment, Food and Rural Affairs (Defra) (2022a). ENV-15 Water Abstraction tables for England, electronic dataset. Available at: https://www.gov.uk/government/statistical-data-sets/env15-water-abstraction-tables (accessed: October 2022).

Department for Environment, Food and Rural Affairs (Defra) (2022b). Magic Map Application. Accessed October 2022. https://magic.defra.gov.uk/MagicMap.aspx.

Department for Transport (DfT) (2014). National Policy Statement for National Networks. London: Her Majesty's Stationary Office.

Environment Agency (2006). Science Report SC020074/SR Piling in layered ground: risks to groundwater and archaeology. Available at:https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/320701/scho0906bllt-e-e.pdf (accessed June 2021).

Environmental Agency (2007). Science Report – SC040020/SR1 Hydrogeological impact appraisal for dewatering abstractions. Accessed June 2021. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291080/scho0407bmae-e-e.pdf.

Environment Agency (2009). Irwell Catchment Flood Management Plan – summary report. [online]. 36pp. Available at: https://www.gov.uk/government/publications/irwell-catchment-flood-management-plan (accessed: October 2022).

Environment Agency (2018). Part 1: North West River Basin District River Basin Management Plan. [online]. 103pp. Available at: https://www.gov.uk/government/publications/north-west-river-basin-district-river-basin-management-plan (accessed: October 2022).

Environment Agency (2019). Long Term Flood Risk Information Mapping. [online]. Available at: https://www.gov.uk/check-long-term-flood-risk (Accessed: October 2022).

Environment Agency (2021a). Catchment Data Explorer. Accessed June 2021. https://environment.data.gov.uk/catchment-planning/.

Environment Agency (2021b). Ecology and Fish Data Explorer. Accessed August 2021. https://environment.data.gov.uk/ecology/explorer/.

Environment Agency (2021c). Flood Map for Planning. Accessed October 2022. https://flood-map-for-planning.service.gov.uk/.

Environment Agency (2021d). Risk of Flooding from Reservoirs. Accessed August 2021. https://data.gov.uk/dataset/7974050c-f6af-414c-a95a-3d3b591c0fa3/risk-of-flooding-from-reservoirs-maximum-flood-speed-web-mapping-service.

Environment Agency (2021e). Risk of Flooding from Surface Water (RoFSW) Extent: 0.1, 1 and 3.3 percent annual chance datasets. Accessed August 2021. https://data.gov.uk/dataset/d5ca01ec-e535-4d3f-adc0-089b4f03687d/risk-of-flooding-from-surface-water-suitability.

Environment Agency (2022a). Historic Flood Map. Accessed October 2022. https://data.gov.uk/dataset/76292bec-7d8b-43e8-9c98-02734fd89c81/historic-flood-map.

Environment Agency (2022b). Statutory Main River Map, electronic dataset. Available at: https://www.data.gov.uk/dataset/4ae8ba46-f9a4-47d0-8d93-0f93eb494540/statutory-main-river-map (accessed October 2022)

Environment Agency (2022c). Water Quality Archive datasets. Accessed October 2022. https://environment.data.gov.uk/water-quality/view/download.

Environment Agency (2022d). Contaminated Land Special Sites – Part 2A, electronic dataset. Available at: https://www.data.gov.uk/dataset/e3770885-fc05-4813-9e60-42b03ec411cf/contaminated-land-special-sites (accessed: October 2022).

Environment Agency (2022e). Licensed Surface Water and Groundwater Abstraction, electronic datasets. Available at: https://www.arcgis.com/apps/mapviewer/index.html?layers=fc92e5a3c298491aae8e566280f48d77 (accessed October 2022).

Freeze, R.A. and Cherry, J.A. (1979) Groundwater. Printice-Hall, New Jersey.

Griffiths, K. J., Shand, P., and Ingram, J (2003). British Geological Survey baseline groundwater quality information for the Permo-Triassic Sandstones of Manchester and East Cheshire (Technical Report: NC/99/74/8).

Highways Agency (2010). HADDMS Priority Registers Priority Outfalls Verification User Guide.

Highways England (??) Highways England Water Risk Assessment Tool (HEWRAT) v2.0.4 . Available at: www.haddms.co.uk. (Accessed: October 2022)

Highways England (??) HEWRAT Help Guide v2.0. Available at: www.haddms.co.uk. (Accessed: October 2022)

Highways England (2020a). Design Manual for Roads and Bridges, LA 113 Road Drainage and the Water Environment. Revision 1.

Highways England (2020b). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Highways England (2020c). Design Manual for Roads and Bridges, CG 501 Design of highway drainage systems.

Highways England (2020d). Design Manual for Roads and Bridges, LA120 Environmental Management Plans.

Highways England (2020e). M60 Junction 18 Simister Island Water Quality Study Report.

Highways England (2021a). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

Highways England and Environment Agency (2009). Memorandum of Understanding. [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/341284/MoU_Env_Agency.pdf (accessed: October 2022).

Institute of Hydrology (IoH) (1995). Report No. 108. Low flow estimation in the United Kingdom.

Jacobs (2021a). Flood Estimation Report: Bradley Brook at M60 Culvert.

JBA Consulting (2009). Bury, Rochdale and Oldham Strategic Flood Risk Assessment, Volume II – Level 1 SFRA. 42pp.

JBA Consulting (2011). Bury Council Preliminary Flood Risk Assessment. 25pp.

JBA Consulting (2012). Greater Manchester Surface Water Management Plan: Stage 1 – A Strategic Assessment of Surface Water Flood Risk. [online]. 67pp. Available at: https://www.bury.gov.uk/CHttpHandler.ashx?id=11439 (accessed: October 2022).

Ministry of Housing, Communities & Local Government (MHCLG) (2021). National Planning Policy Framework. [online] London: Ministry of Housing. 75pp. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf (accessed: October 2022).

National Highways (2021). Design Manual for Roads and Bridges CD 529 Design of outfall and culvert details. Revision 1.0.1

National Highways (2022). M60/M62/M66 Simister Island Interchange Drainage Strategy Report.

Ordnance Survey (OS) (2022). OS Open Rivers dataset. Accessed October 2022. https://www.ordnancesurvey.co.uk/business-government/products/open-map-rivers.

Planning Inspectorate (2021). Scoping opinion: proposed M60/m62/M66 Simister Island Interchange. Case reference: TR010064. 121pp.

Preene. M., Roberts. T. O. L., and Powrie. W (2016). Groundwater control: design and practice, second edition, CIRIA, C750, London, UK.

Scottish Environmental Protection Agency (2010). Engineering in the water environment: Good Practice Guide - River Crossings (second edition). [online]. Ref ID: WAT-SG-25. 54pp. Available at: https://www.sepa.org.uk/media/151036/wat-sg-25.pdf (accessed October 2022).

Scottish Environmental Protection Agency (2017). Land Use Planning System SEPA Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. [online] REF ID: LUPS-GU31. 28pp. Available at: https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions-and-groundwater-dependent-terrestrial-ecosystems.pdf (accessed: October 2022).

Scottish Environmental Protection Agency (2019). Engineering in the Water Environment: Good Practice Guide - Intakes and Outfalls (second edition). [online]. REF ID: WAT-SG-28. 45pp. Available at: https://www.sepa.org.uk/media/150984/wat_sg_28.pdf (accessed: October 2022).

Tameside Metropolitan Borough Council (MBC) (2022). Greater Manchester Ecology Unit. [online]. Available at: https://www.tameside.gov.uk/ecologyunit (accessed: October 2022).

UKCEH (2021). National River Flow Archive. [online] Available at: https://nrfa.ceh.ac.uk/data/search (accessed July 2021).

UK Technical Advisory Group on the Water Framework Directive (UKTAG) (2005). Guidance on the identification and risk assessment of groundwater dependent terrestrial ecosystems. [online]. Available at: https://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Risk%20assessment%20of%20terrestrial%20ecosystems%20groundwater_Draft_210104.pdf (accessed: October 2022).

UK Technical Advisory Group on the Water Framework Directive (UKTAG) (2014). Metal Bioavailability Assessment Tool (M-BAT). [online]. Available at:https://www.wfduk.org/sites/default/files/Media/Environmental%20standards/MBAT%20UKTAG%20Method%20Statement.pdf (accessed: October 2022).

Chapter 15: Climate

British Geological Survey (BGS) (2021a). GeoIndex (onshore). Accessed July 2021. https://www.bgs.ac.uk/map-viewers/geoindex-onshore/.

British Geological Survey (BGS) (2021b). GeoClimate Open. Accessed July 2021. https://www.bgs.ac.uk/datasets/geoclimateukcp18-open/.

British Standards Institute (BSI) (2016). PAS 2080:2016: Carbon Management in Infrastructure.

Committee on Climate Change (2020). The Sixth Carbon Budget: The UK's path to Net Zero.

Committee on Climate Change (CCC) (2021). Independent Assessment of UK Climate Risk. Advice to Government for the UK's Third Climate Change Risk Assessment (CCRA3). Accessed July 2021. https://www.theccc.org.uk/publication/independent-assessment-of-uk-climate-risk/.

Department for Business, Energy and Industrial Strategy (BEIS) (2020). UK Local Authority and Regional Carbon Dioxide Emissions National Statistics: 2005 to 2018. Accessed July 2021. https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2018.

Department for Business, Energy & Industrial Strategy (BEIS) (2021a). National Statistics, Final UK greenhouse gas emissions national statistics: 1990 to 2019, 2019 UK greenhouse gas emissions: final figures – statistical summary, March 2021. Accessed July 2021. https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2019.

Department for Business, Energy & Industrial Strategy (BEIS) (2021b). UK Greenhouse Gas Inventory, 1990 to 2019: Annual Report for submission under the Framework Convention on Climate Change. Accessed July 2021. https://naei.beis.gov.uk/reports/reports?report_id=1015.

Department for Business, Energy and Industrial Strategy (BEIS) (2021c). Green Book Supplementary Guidance: Valuation of Energy Use and Greenhouse Gas Emissions for Appraisal. Data Table 1. Accessed July 2021. https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal.

Department for Environment, Food and Rural Affairs (Defra) (2021). Emissions Factors Toolkit v11.0. Accessed August 2022. https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/

Department for Transport (DfT) (2014). National Policy Statement for National Networks. London: Her Majesty's Stationary Office.

Department for Transport (DfT) (2021). Decarbonising Transport. Accessed July 2021. https://www.gov.uk/government/publications/transport-decarbonisation-plan.

Department for Transport (DfT) (2022). TAG Data Book. Accessed August 2022. https://www.gov.uk/government/publications/tag-data-book.

Environment Agency (2021a). Flood Map for Planning. Accessed July 2021. https://flood-map-for-planning.service.gov.uk/.

Environment Agency (2021b). Risk of Flooding from Surface Water (RoFSW) Extent: 0.1, 1 and 3.3 percent annual chance datasets. Accessed July 2021. https://data.gov.uk/dataset/b391e876-4571-44f9-85c5-3485ddf6333a/risk-of-flooding-from-surface-water-depth-0-1-percent-annual-chance.

Highways England (2019). Design Manual for Roads and Bridges, LA 105 Air Quality. Revision 0.

Highways England (2021a). Design Manual for Roads and Bridges, LA 114 Climate. Revision 0.0.1.

Highways England (2021b). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

Institute of Environmental Management and Assessment (IEMA) (2020). Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation.

Institute of Environmental Management and Assessment (IEMA) (2022). Assessing Greenhouse Gas Emissions and Evaluating their Significance.

Met Office (2018a). UK Climate Projections. Accessed July 2021. https://ukclimateprojections-ui.metoffice.gov.uk/products.

Met Office (2018b). UKCP18 Guidance: UKCP18 for UKCP09 users. Accessed July 2021. https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-guidance-ukcp18-for-ukcp09-users.pdf.

Met Office (2018c). State of the UK Climate 2017: Supplementary Report on Climate Extremes.

Met Office, et al. (2019). HadUK-Grid Climate Observations by Administrative Regions over the UK, v1.0.1.0 (1862-2018). Centre for Environmental Data Analysis, 14 November 2019.

National Highways (2021a). Net zero highways: our 2030 / 2040 / 2050 plan. Accessed November 2021. https://nationalhighways.co.uk/media/eispcjem/net-zero-highways-our-2030-2040-2050-plan.pdf.

National Highways (2021b). National Highways Carbon Tool (v2.4). Accessed November 2021. https://nationalhighways.co.uk/industry/carbon-emissions-calculation-tool/.

National Highways (2022a). Preparing for climate change on the strategic road network - third adaptation report under the Climate Change Act.

National Highways (2022b). Version 9 of the DMRB Screening Method spreadsheet. Available upon request from National Highways.

Natural England (2012). Natural England Research Report NERR043. Carbon Storage by Habitat: Review of the Evidence of the Impacts of Management Decisions and Condition of Carbon Stores and Sources.

Office for National Statistics (ONS) (2020). UK Environmental Accounts: 2020. Accessed July 2021. https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/ukenvironmentalaccounts/2020.

UK Government (2020). United Kingdom of Great Britain and Northern Ireland's Nationally Determined Contribution. Accessed July 2021.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/943618/uk-2030-ndc.pdf.

UK Woodland Carbon Code (2021). Woodland Carbon Code Carbon Calculation Spreadsheet (v2.4, March 2021). Accessed July 2021. https://woodlandcarboncode.org.uk/standard-and-guidance/3-carbon-sequestration/3-3-project-carbon-sequestration.

United Nations Framework Convention on Climate Change (2016). Paris Agreement. Accessed June 2021. https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.

Chapter 16: Assessment of cumulative effects

Bat Conservation Trust (2016). Bat Survey Guidelines for Professional Ecologists, 3rd Edition.

CIEEM (2017). Guidelines for Preliminary Ecological Appraisals.

CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland.

Department for Transport (DfT) (2017). Local Cycling and Walking Infrastructure Plans Technical Guidance for Local Authorities.

English Nature (2001). Great Crested Newt Mitigation Guidelines.

Highways England (2019a). Design Manual for Roads and Bridges, LA 105 Air Quality. Revision 0.

Highways England (2019b). Design Manual for Roads and Bridges, LA 109 Geology and Soils. Revision 0.

Highways England (2020a). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Highways England (2020b). Design Manual for Roads and Bridges, LA 106 Cultural Heritage Assessment. Revision 1.

Highways England (2020c). Design Manual for Roads and Bridges, LA 111 Noise and Vibration. Revision 2.

Highways England (2020d). Design Manual for Roads and Bridges, LA 112 Population and Human Health. Revision 1.

Highways England (2020e). Design Manual for Roads and Bridges, LA 113 Road Drainage and the Water Environment. Revision 1.

Highways England (2021). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

Historic England (2017). The Setting of Heritage Assets - Historic England's Good Practice Advice Planning Note 3 (Second Edition).

Institute of Environmental Management and Assessment (IEMA). (2020). EIA Guide to Climate Change Resilience & Adaptation.

Landscape Institute and Institute of Environmental Management and Assessment (2013). Guidelines for Landscape and Visual Impact Assessment, Third Edition.

Planning Inspectorate (2019). Advice Note Seventeen: Cumulative Effects Assessment Relevant to Nationally Significant Infrastructure Projects.

Planning Inspectorate (2021). Scoping Opinion for M60/M62/M66 Simister Island Interchange. Accessed August 2021. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010064/TR010064-000030-TR010064%20-%20Scoping%20Opinion.pdf.

Chapter 17: Summary

Highways England (2020). Design Manual for Roads and Bridges, LA 112 Population and Human Health. Revision 1.

Appendix 1.1: Legislation and policy

Association of Greater Manchester Authorities (AGMA) (2012). Greater Manchester Joint Waste Development Plan. Accessed June 2021. https://secure.manchester.gov.uk/downloads/download/4804/greater_manchester_joint_waste_development_plan_documents.

Association of Greater Manchester Authorities (AGMA) (2013). Joint Minerals Plan April 2013. Accessed June 2021. https://secure.manchester.gov.uk/info/200074/planning/6161/greater_manchester_joint_minerals_development_plan.

Bury Metropolitan Borough Council (BMBC) (1997). Bury Unitary Development Plan.

Bury Metropolitan Borough Council (BMBC) (2018). Bury Local Plan: Policy Directions.

Department for Environment, Food and Rural Affairs (Defra) (2010). Noise Policy Statement for England.

Department for Environment, Food and Rural Affairs (Defra) (2011). Safeguarding our Soils: A Strategy for England.

Department for Environment, Food and Rural Affairs (Defra) (2019). Clean Air Strategy.

Department for Environment, Food and Rural Affairs (Defra) (2020). Biodiversity 2020: A strategy for England's wildlife and ecosystem services.

Department for Transport (DfT) (2012). Business Plan 2012-2015.

Department for Transport (DfT) (2013). Action for Roads: A Network for the 21st Century.

Department for Transport (DfT) (2014). National Policy Statement for National Networks. London: Her Majesty's Stationary Office.

Department for Transport (DfT) (2020). Road Investment Period 2.

Department for Transport (DfT) (2021a). Outcome Delivery Plan.

Department for Transport (DfT) (2021b). Decarbonising Transport A Better, Greener Britain.

Greater Manchester Combined Authority (GMCA) (2017). Greater Manchester Strategy.

Greater Manchester Combined Authority (GMCA) (2021). Places For Everyone Joint Development Plan Document – Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford, Wigan. Accessed July 2021. https://www.greatermanchester-ca.gov.uk/media/4682/places-for-everyone-compressed.pdf.

Highways England (2017a). Air Quality Strategy.

Highways England (2017b). Environment Strategy.

Highways England (2017c). Sustainable Development Strategy.

Highways England (2020a). Strategic Business Plan 2020-2025.

Highways England (2020b). Delivery Plan 2020-2025.

HM Government (2011a). Healthy Lives, Healthy People: Our Strategy for Public Health in England.

HM Government (2011b). Healthy Lives, Healthy People: A Call to Action on Obesity in England.

HM Government (2017). UK Climate Change Risk Assessment 2017.

HM Government (2018). A Green Future: Our 25 Year Plan to Improve the Environment.

HM Government and Strategic Forum for Construction (2008). Strategy for Sustainable Construction.

HM Treasury (2013). Investing in Britain's Future.

Infrastructure and Projects Authority (2016). National Infrastructure Delivery Plan 2016-2021.

Manchester City Council (MCC) (1995). Manchester Unitary Development Plan.

Manchester City Council (MCC) (2012). Manchester Core Strategy.

Ministry of Housing, Communities & Local Government (MHCLG) (2021). National Planning Policy Framework.

National Highways (2021). Net Zero Highways: Our 2030 / 2040 / 2050 Plan.

Oldham Metropolitan Borough Council (OMBC) (2006). Unitary Development Plan.

Oldham Metropolitan Borough Council (OMBC) (2011). Local Development Framework – 'Joint Core Strategy and Development Management Policies' Development Plan.

Rochdale Borough Council (RBC) (2006). Rochdale Borough Unitary Development Plan.

Rochdale Borough Council (RBC) (2016). Core Strategy.

Rochdale Borough Council (RBC) (2017). Local Development Framework (LDF): Biodiversity and Development Supplementary Planning Document (SPD). Accessed April 2021. http://www.rochdale.gov.uk/pdf/2017-02-21-biodiversity-development-spd-updated-v2.pdf.

Salford City Council (SCC) (2006). Salford Unitary Development Plan.

Salford City Council (SCC) (2021). Salford Local Plan: Development Management Policies and Designations (emerging).

Salford City Council (SCC) (2021). Salford Local Plan: Development Management Policies and Designations Addendum (Main Modifications).

Transport for Greater Manchester (TfGM) (2017). Greater Manchester Transport Strategy 2040.

Transport for Greater Manchester (TfGM) (2019). The Emerging Greater Manchester 2040 Transport Strategy Draft Delivery Plan 2020-2025.

Transport for the North (2018). Draft Strategic Transport Plan.

Appendix 6.1: Air quality methodology and factors

Cambridge Environmental Research Consultants (2020). Air Dispersion Model Software (ADMS-Roads). Version 5.0.

Department for Environment, Food and Rural Affairs (Defra) (2011). Trends in NO_x and NO_2 emissions and ambient measurements in the UK.

Department for Environment, Food and Rural Affairs (Defra). (2020a). Background Maps (2018 Base Year). Accessed July 2021. https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html.

Department for Environment, Food and Rural Affairs (Defra). (2020b). NO_X to NO_2 Calculator v8.1; and NO_2 Adjustment for NO_x Sector Removal Tool v8.0. Accessed July 2021. https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc.

Department for Environment, Food and Rural Affairs (Defra). (2021). Local Air Quality Management - Technical Guidance (TG16).

Highways Agency (2013). Note on HA's Interim Alternative Long-Term Annual Projection Factors (LTTE6) for Annual Mean NO_2 and NO_x Concentrations Between 2008 and 2030. Accessed July 2021. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010019/TR010019-002231-Environment%20-%20Air%20Quality%20-%20Appendix%20E%20-%20IAN%20170_12%20NOx%20and%20NO2%20_631077_0.pdf.

Highways England (2019). Design Manual for Roads and Bridges, LA 105 Air Quality. Revision 0.

Appendix 14.1: Water Framework Directive (WFD) Assessment

Department for Environment, Food and Rural Affairs (Defra) (2021). Magic Map Application. Accessed June 2021. https://magic.defra.gov.uk/MagicMap.aspx.

Environment Agency (2021). Catchment Data Explorer. Accessed April 2021. https://environment.data.gov.uk/catchment-planning/.

Greater Manchester Ecology Unit (GMEU) (2017).

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

Appendix 14.2: Preliminary Water Quality Assessment Report (PWQAR)

CIRIA (2015). The SuDS Manual (C753).

Environment Agency (2020). Catchment Data Explorer. Accessed June 2021.

Environment Agency (2021). Water Quality Archive datasets. Accessed October 2021.

Highways England (2020a). Design Manual for Roads and Bridges, LA 113 Road Drainage and the Water Environment. Revision 1.

Highways England (2020b). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Highways England (2020c). Design Manual for Roads and Bridges, CG501 Design of highway drainage systems. Revision 2.

Highways England (2021). Highways Agency Drainage Data Management System (DDMS). Accessed July 2021.

Highways England Water Risk Assessment Tool (HEWRAT) v2.0.4 and HEWRAT Help Guide v2.0. www.haddms.co.uk.

Institute of Hydrology (IoH) (1995). Report No. 108. Low flow estimation in the United Kingdom.

Jacobs (2020). M60 Junction 18 Simister Island Water Quality Study.

UK Government (2017). The Water Environment (Water Framework Directive (WFD) (England and Wales) Regulations 2017 (WER).

UK Technical Advisory Group on the Water Framework Directive (UKTAG) (2014). UKTAG River & Lake Assessment Method Specific Pollutants (Metals) - Metal Bioavailability Assessment Tool (M-BAT).

UKCEH (2021). National River Flow Archive. Accessed July 2021.

Appendix 14.3: Groundwater Dependent Terrestrial Ecosystems (GWDTE) Assessment

British Geological Survey (BGS) (2021a). British Geological Survey GeoIndex: Superficial deposits 1:50,000 scale; Bedrock geology 1:50,000 scale; and Borehole scans. Accessed July 2021. http://mapapps2.bgs.ac.uk/geoindex/home.html?submit=Open+the+onshore+GeoIndex and 1:10,000 scale geological mapping and permeability index/aquifer properties datasets via an information request. Received July 2021.

British Geological Survey (BGS) (2021b). British Geological Survey: Susceptibility to Groundwater Flooding dataset via an information request, Received August 2021.

Bury Metropolitan Borough Council (2001). Phase 1 Habitat Survey. Accessed July 2021. Information provided with HPI designation description (Natural England, 2010).

Bury Metropolitan Borough Council (2003). Hollins Vale Local Nature Reserve leaflet. Accessed July 2021. https://www.bury.gov.uk/CHttpHandler.ashx?id=2772&p=0.

Coal Authority (2018). Interactive Map Viewer. Accessed July 2021. https://mapapps2.bgs.ac.uk/coalauthority/home.html.

Cranfield University (2021). The Soils Guide. Accessed July 2021. www.landis.org.uk.

Department for Environment, Food and Rural Affairs (Defra) (2016). UK Biodiversity Action Plan Priority Habitat Descriptions: Lowland Fens. Accessed July 2021. https://jncc.defra.gov.uk/Docs/UKBAP_BAPHabitats-27-LowlandFens.doc.

Department for Environment, Food and Rural Affairs (Defra) (2021). Multi-Agency Geographical Information for the Countryside (MAGIC). Accessed July 2021. https://magic.defra.gov.uk/MagicMap.aspx.

Google Earth (2021). M60 and Simister Island, Greater Manchester. Accessed July 2021. https://www.google.com/earth/index.html.

Greater Manchester Ecology Unit (GMEU) (2017). Sites of Biological Importance Register. Accessed July 2021. https://data.gov.uk/dataset/81cbf1a0-6304-470c-ade8-60272be0d219/sites-of-biological-importance-sbi-in-greater-manchester.

Highways England (2021). M60/M62/M66 Simister Island Interchange PCF Stage 3 Environmental Scoping Report. Report no. HE548642-JAC-EGN-SII_MLT-RP-LE-0013. P04.

Joint Nature Conservation Committee (JNCC) (2010). Handbook for Phase 1 Habitat Survey. Accessed July 2021. http://jncc.defra.gov.uk/PDF/pub10_handbookforphase1habitatsurvey.pdf.

Natural England (2010). Priority Habitat Inventory (England). Accessed July 2021. https://data.gov.uk/dataset/4b6ddab7-6c0f-4407-946e-d6499f19fcde/priority-habitat-inventory-england.

Natural England (2021). Local Nature Reserve Inventory (England). Accessed July 2021. https://data.gov.uk/dataset/acdf4a9e-a115-41fb-bbe9-603c819aa7f7/local-nature-reserves-england.

Scottish Environment Protection Agency (SEPA) (2017). Land Use Planning System SEPA Guidance Note 31 – Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Accessed July 2021. https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions-and-groundwater-dependent-terrestrial-ecosystems.pdf.

UK Technical Advisory Group (UKTAG) (2005). Water Framework Directive – Draft Protocol for determining "Significant Damage" to a "Groundwater Dependent Terrestrial Ecosystem." Accessed July 2021. http://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Determining%20significant%20damage%20to%20a%20groundwater%20dependent%20terrestrial%20ecosystem_Draft_011205.pdf.

Appendix 14.4: Preliminary Flood Risk Assessment (FRA)

British Geological Survey (2021). Groundwater Flooding Susceptibility dataset via access request. Received August 2021.

British Geological Survey (2022). Geology of Britain viewer. http://mapapps.bgs.ac.uk/geologyofbritain/home.html

Coal Authority (2022). Interactive Map Viewer. Accessed October 2022. https://mapapps2.bgs.ac.uk/coalauthority/home.html.

Defra and Environment Agency (2005). Flood Risks to People FDR231.

Defra (2022). Magic Map Application. Accessed October 2022. https://magic.defra.gov.uk/MagicMap.aspx.

Environment Agency (2022a). Environment Agency Flood Map for Planning. https://flood-map-for-planning.service.gov.uk/.

Environment Agency (2022b). Historic Flood Map. https://data.gov.uk/dataset/76292bec-7d8b-43e8-9c98-02734fd89c81/historic-flood-map.

Environment Agency (2022c). Environment Agency Long Term Flood Risk Information Mapping. Available at: https://flood-warning-information.service.gov.uk/long-term-flood-risk.

Environment Agency (2022d). Risk of Flooding from Reservoirs. Available at: https://data.gov.uk/dataset/44b9df6e-c1d4-40e9-98eb-bb3698ecb076/risk-of-flooding-from-reservoirs-maximum-flood-extent-web-mapping-service.

Environment Agency (2022e) Statutory Main River Map. Available at: https://www.data.gov.uk/dataset/4ae8ba46-f9a4-47d0-8d93-0f93eb494540/statutory-main-river-map

Environment Agency (2022f). Flood risk assessments: climate change allowances. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances (Accessed October 2022).

Greater Manchester (2021). Joint Development Plan – Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford, Wigan. https://www.greatermanchester-ca.gov.uk/media/4838/places-for-everyone.pdf

Highways England (2020a). LA 113 Road Drainage and the Water Environment. Revision 1.

Highways England (2020b). LA 120 Environment Management Plans. Revision 1.

National Highways (2022a). CG 501 Design of highway drainage systems. Revision 2.1.

National Highways (2022b). M60 Simister Island Drainage Strategy Report.

JBA Consulting (2009a). Bury Rochdale and Oldham Level 1 Strategic Flood Risk Assessment. https://www.bury.gov.uk/CHttpHandler.ashx?id=5496&p=0

JBA Consulting (2009b). Bury Rochdale and Oldham Level 2 Strategic Flood Risk Assessment. https://www.bury.gov.uk/CHttpHandler.ashx?id=5498&p=0

JBA Consulting (2011). Bury Preliminary Flood Risk Assessment. https://www.bury.gov.uk/CHttpHandler.ashx?id=8904&p=0

JBA Consulting (2012). Greater Manchester Surface Water Management Plan. https://www.bury.gov.uk/CHttpHandler.ashx?id=11439&p=0

Manchester City Council (2012). Manchester's Local Development Framework Core Strategy Development Plan Document. https://secure.manchester.gov.uk/downloads/download/5672/core_strategy

Ministry of Housing, Communities and Local Government (MHCLG) (2021). National Planning Policy Framework. https://www.gov.uk/government/publications/national-planning-policy-framework--2

Oldham Council (2011). Oldham Local Development Framework Development Plan Document – Joint Core Strategy and Development Management Policies. https://www.oldham.gov.uk/downloads/file/1445/development_plan_document-joint_core_strategy_and_development_management_policies

Ordnance Survey (OS) (2022). Detail River Network Mapping. https://data.gov.uk/dataset/dc29160b-b163-4c6e-8817-f313229bcc23/os-open-rivers

Appendix 1.1. Legislation and policy

1.1 Consenting regime

1.1.1 The following legislation is relevant to the consenting of the M60/M62/M66 Simister Island Interchange scheme (the 'Proposed Scheme').

Planning Act 2008

1.1.2 The Planning Act 2008 is the legislative instrument for determining Nationally Significant Infrastructure Projects (NSIPs) and is a decision-making process that requires the submission of an application for a Development Consent Order (DCO). The Planning Act and DCO process were introduced by the UK Government with the intention of reducing the amount of time taken to approve major new infrastructure projects amongst other objectives.

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

1.1.3 These regulations are secondary legislation to complement the Planning Act 2008. This provides details about consultees, publicising a proposal and consulting upon a proposal prior to making an application, application procedures and forms to prepare and submit a DCO application.

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

1.1.4 These regulations are secondary legislation to complement the Planning Act 2008. This provides the details and requirements as to when and how to carry out an Environmental Impact Assessment (EIA) to support a DCO application.

The Infrastructure Planning (Publication and Notification of Applications etc.) (Amendment) Regulations 2020

1.1.5 These regulations are secondary legislation to complement the Planning Act 2008. This provides amendments to the Infrastructure Planning Regulations in regard to publicising, notifying and sharing information on websites maintained by the applicant and/or Secretary of State instead of physical locations only.

1.2 Legislation for environmental aspects

1.2.1 This section lists the key retained European Union (EU) legislation by the United Kingdom (UK) government and national legislation relevant to the protection of the environment. The legislation is split by the aspect headings used within the Preliminary Environmental Information Report (PEIR).

1.2.2 Table 1.1 lists the key legislation for each environmental aspect. There is overlap between geology and soils, and material assets and waste; these two aspects have therefore been combined. Some legislation crosscuts over more than one aspect area, but for simplicity, the table identifies the key legislation for each aspect and minimises repetition.

1.2.3 The UK is no longer a member of the EU. EU legislation as it applied to the UK on 31 December 2020 is now part of UK domestic legislation, under the control of the UK's Parliaments and Assemblies, and is published on legislation.gov.uk. This retained legislation is being kept up to date on legislation.gov.uk in the same way as other forms of domestic legislation. Table 1.1 lists the retained legislation relating to applicable EU Directives.

1.2.4 The Environment Act 2021 was granted Royal Assent on 9 November 2021. Key provisions include the requirement for new developments to deliver a biodiversity net gain, new air quality and water quality standards, powers to implement resource and waste efficiency measures, as well as a number of environmental governance provisions. Many of the provisions within the Environment Act 2021 will be enacted or enabled through future secondary legislation and are not yet in force.

Table 1.1: Legislation relevant for environmental aspects

Receptor	Legislation
Air quality	• The Air Quality Standards Regulations 2010 (as amended) • Environment Act 1995, Part IV • Air Quality (England) Regulations 2000 (as amended) • Environment Act 2021
Cultural heritage	• European Convention on the Protection of Archaeological Heritage (Revised), 2001 • Ancient Monuments and Archaeological Areas Act 1979 (amended by the National Heritage Act 1983 and 2002) • Planning (Listed Buildings and Conservation Areas) Act 1990 (amended by the Enterprise and Regulatory Reform Act 2013)
Landscape and visual	• European Landscape Convention, 2000 • Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000 (CROW) and the Natural Environmental and Rural Communities Act 2006 (NERC) • The National Parks and Access to the Countryside Act 1949
Biodiversity	• The Conservation of Habitats and Species Regulations 2017 (as amended) • Wildlife and Countryside Act 1981 (as amended) • Natural Environment and Rural Communities Act 2006 (NERC) • Countryside and Rights of Way Act 2000 (CROW) (as amended) • Protection of Badgers Act 1992 • Wild Mammals (Protection) Act 1996 • Animal Welfare Act 2006 • The Hedgerows Regulations 1997 • The Eels (England and Wales) Regulations 2009 • Salmon and Freshwater Fisheries Act 1975 (as amended) • The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 • Environment Act 2021
Geology and soils, and material assets and waste	• Environmental Protection Act (EPA) 1990 • Environmental Permitting (England and Wales) Regulations 2016 (as amended) • Control of Pollution (Applications, Appeals and Registers) Regulations 1996

Receptor	Legislation
	• Environment Act 1995 • Environment Act 2021
Noise and vibration	• Land Compensation Act 1973 • The Noise Insulation Regulations 1975 (as amended) • Control of Pollution Act 1974 • The Highways Noise Payments and Movable Homes (England) Regulations 2000 (as amended) • The Environmental Noise (England) Regulations 2006 (as amended) • Environmental Protection Act 1990
Population and human health	• The Localism Act 2011
Road drainage and the water environment	• The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended) • The Urban Waste Water Treatment (England and Wales) Regulations 1994 • Flood Risk Regulations 2009 • Environmental Permitting (England and Wales) Regulations 2016 (as amended) • The Nitrate Pollution Prevention Regulations 2015 • Control of Pollution (Applications, Appeals and Registers) Regulations 1996 • Environmental Protection Act 1990 • Water Resources Act 1991 (as amended) • Land Drainage Act 1991 (as amended) • Environment Act 1995 (as amended) • Water Act 2003 (as amended) • Flood and Water Management Act 2010 (as amended) • Ditches and Watercourses Act 1989 • Anti-Pollution Works Regulations 1999 (as amended) • Environmental Damage (Prevention and Remediation) Regulations 2009 (as amended) • Salmon and Freshwater Fisheries Act 1975 (as amended) • Eels (England and Wales) Regulations 2009 (as amended) • Environment Act 2021
Climate	• Climate Change Act 2008 • The Climate Change Act 2008 (2050 Target Amendment) Order 2019

1.3 National policy context

Introduction

1.3.1 There are several national policy and strategy documents that are relevant to the Proposed Scheme. However, in terms of determining the DCO, the Planning Act 2008 specifies that each type of NSIP must be determined in line with any relevant National Policy Statement (NPS). For road schemes such as the Proposed Scheme, the key document is the National Policy Statement for National Networks (NPS NN) (Department for Transport (DfT), 2014). Therefore, this is the primary document for

determining a DCO for highway schemes. The Secretary of State must decide the application in accordance with any relevant NPS..

1.3.2 The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG), 2021) is also capable of being 'important and relevant' to the Secretary of State's decision.

1.3.3 There are also national transport strategies and plans along with environmental strategies. Details of these are set out below.

National Policy Statement for National Networks

1.3.4 An application for development consent is determined in accordance with the relevant NPS.

'the Secretary of State must decide an application for a national networks nationally significant infrastructure project in accordance with this NPS unless he/she is satisfied that to do so would:

- *lead to the UK being in breach of its international obligations;*
- *be unlawful;*
- *lead to the Secretary of State being in breach of any duty imposed by or under any legislation;*
- *result in adverse impacts of the development outweighing its benefits;*
- *be contrary to legislation about how decisions are taken.'*

1.3.5 Section 2 of the NPS NN sets out the Government's vision and strategic objectives for the national networks:

'The Government will deliver national networks that meet the country's long-term needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system. This means:

- *Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs.*
- *Networks which support and improve journey quality, reliability, and safety.*
- *Networks which support the delivery of environmental goals and the move to a low carbon economy.*
- *Networks which join up our communities and link effectively to each other.'*

1.3.6 The need for transport infrastructure in general is acknowledged in paragraph 2.2 of the NPS NN, which states:

'There is a critical need to improve the national networks to address road congestion and crowding on the railways to provide safe, expeditious and resilient networks that better support social and economic activity; and to provide a transport network that is capable of stimulating and supporting economic growth. Improvements may also be required to address the impact of the national networks on quality of life and environmental factors.'

1.3.7 The Proposed Scheme has been developed to support the socioeconomic development of the region, through the improved connectivity and reliability of the strategic network to connect different communities and business. The need for this approach is recognised under paragraph 2.6 of the NPS NN, which states:

'There is also a need for development on the national networks to support national and local economic growth and regeneration, particularly in the most disadvantaged areas. Improved and new transport links can facilitate economic growth by bringing businesses closer to their workers, their markets and each other. This can help rebalance the economy.'

1.3.8 Paragraph 2.10 of the NPS NN states: 'The Government has therefore concluded that at a strategic level there is a compelling need for development of the national networks – both as individual networks and as an integrated system. The Examining Authority and the Secretary of State should therefore start their assessment of applications for

1.3.9 Section 3 of the NPS NN sets out the wider Government policy on national networks; this includes policies on minimising social and environmental impacts and improving quality of life. In delivering new schemes, the Government expects applicants to *'avoid and mitigate environmental and social impacts in line with the principles set out in the NPPF and the Government's planning guidance. Applicants should also provide evidence that they have considered reasonable opportunities to deliver environmental and social benefits as part of schemes.'*

1.3.10 The key considerations for a range of environmental aspects are set out in Chapter 5 of the NPS NN. Aspects covered are as follows:

- Air quality
- Carbon emissions
- Biodiversity and ecological conservation (includes geological conservation)
- Waste management
- Civil and military aviation and defence interests
- Dust, odour, artificial light, smoke, steam
- Flood risk
- Land instability
- The historic environment
- Landscape and visual impacts
- Land use including open space, green infrastructure, and green belt
- Noise and vibration
- Water quality and resources

1.3.11 An NPS NN Accordance Table will set out how the development aligns with the NPS NN policies for these aspects and will be submitted with the Proposed Scheme's DCO application.

1.3.12 In considering the Proposed Scheme, particularly when weighing its adverse effects against its benefits, the Examining Authority and the Secretary of State will account for:

- Its potential benefits, including the facilitation of economic development, including job creation, housing, environmental improvement, and any long-term or wider benefits.
- Its potential adverse effects, including any longer-term and cumulative adverse effects, as well as any measures to avoid, reduce or compensate for any adverse effects.

1.3.13 The NPS NN is undergoing a process of review, and a revised NPS NN is due to be published by no later than Spring 2023. Until a revised NPS comes into force, the existing NPS NN remains the basis for which applications for development consent are determined.

National Planning Policy Framework

1.3.14 The NPPF (2021) is also of relevance to the Proposed Scheme. Paragraph 1.18 of the NPS NN states, 'The NPPF is also likely to be an important and relevant consideration in decisions on nationally significant infrastructure projects, but only to the extent relevant to that project.' However, paragraph 1.19 goes on to say, 'the NPPF makes clear that it is not intended to contain specific policies for NSIPs where quite particular considerations can apply. The National Networks NPS will assume that function and provide transport policy which will guide individual development brought under it.'

1.3.15 The overarching policy contained in the NPPF is a presumption in favour of sustainable development. It states:

'Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

- *An economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure.*
- *A social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being.*
- *An environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.'*

1.3.16 It includes national planning policy on sustainable transport and environmental protection, amongst other things.

National Infrastructure Delivery Plan 2016-2021

1.3.17 The National Infrastructure Delivery Plan 2016-2021 (Infrastructure and Projects Authority, 2016) showed that the Government is clear about the economic importance of investment in highways infrastructure, especially in areas where congestion is a problem. Section3 of the Delivery Plan covering roads states:

'*A reliable and high-performing road network helps improve productivity, but over decades, the quality of the network has declined and congestion, noise and poor air quality have become problems at certain hotspots. Poor or missing links mean cities which are close together do less business with one another. The government is committed to addressing these challenges by building a better network with smarter roads that use technology and modern road building techniques. In this way it can ensure the country has a road network that drives, instead of constrains, growth*.'

Other relevant national transport policy documents

1.3.18 The following national policy documents are of relevance to the Proposed Scheme:

- Department for Transport Outcome Delivery Plan (2021a)
- Department for Transport Decarbonising Transport A Better, Greener Britain (2021b)
- National Highways Net Zero Highways: Our 2030 / 2040 / 2050 Plan (2021)
- Road Investment Period 2 (Department for Transport, 2020), including the associated Strategic Business Plan 2020-2025 and Delivery Plan 2020-2025 (Highways England, 2020a; 2020b)
- Highways England Air Quality Strategy (2017a)
- Highways England Environment Strategy (2017b)
- Highways England Sustainable Development Strategy (2017c)
- Highways England: Licence (Department for Transport, 2015)
- Highways England Biodiversity Plan (2015)
- HM Treasury Investing in Britain's Future (2013)
- Department for Transport Action for Roads: A Network for the 21st Century (2013)
- Department for Transport Business Plan 2012-2015 (2012)

Key national environmental policy documents

1.3.19 The following environmental policy documents are of relevance to the Proposed Scheme:

- Clean Air Strategy 2019 (Department for Environment, Food and Rural Affairs (Defra), 2019)
- Biodiversity 2020: A strategy for England's wildlife and ecosystem services (Defra, 2020)
- Noise Policy Statement for England (Defra, 2010)

- Strategy for Sustainable Construction (HM Government and Strategic Forum for Construction, 2008)
- Healthy Lives, Healthy People: Our Strategy for Public Health in England (HM Government, 2011a)
- Healthy Lives, Healthy People: A Call to Action on Obesity in England (HM Government, 2011b)
- UK Climate Change Risk Assessment 2017 (HM Government, 2017)
- Safeguarding our Soils: A Strategy for England (Defra, 2011)
- A Green Future: Our 25 Year Plan to Improve the Environment (HM Government, 2018)

1.4 Local planning policy

Introduction

1.4.1 Local planning policy is an important and relevant consideration of a DCO application and may inform the Local Impact Report produced by local authorities during the DCO examination process.

1.4.2 The NPPF states that local planning authorities may also give weight to relevant policies within emerging plans, the degree of which can be determined according to the stage of plan, the level of unresolved objections, and the degree of consistency with the NPPF. Given the programme for adoption for the relevant emerging local plans, they may be adopted before the DCO for the Proposed Scheme is determined.

1.4.3 It is acknowledged that the list of policies is only relevant at the time of writing. Emerging plans will be monitored, and policies added as they are adopted, so that the Environmental Statement and other planning documents are up to date at the point that the DCO application is submitted. The policies they replace will be removed, as appropriate.

1.4.4 Details of the local planning policy documents prepared by each local authority are detailed below. In addition to these documents, the Greater Manchester Joint Waste Development Plan Document (2012) and the Greater Manchester Joint Minerals Development Plan Document (2013) are extant policy covering all the authority areas for the Proposed Scheme and key relevant policies are considered separately in the below ‘Minerals and Waste Plans’ sub-section.

1.4.5 The environmental aspect study areas (see aspect chapters and Chapter 16: Assessment of cumulative effects) were used to determine which local planning authority plans and policies should be considered for specific aspects. For example, the study area for Geology and Soils was 0.25km (see Chapter 10: Geology and Soils), which falls within the administrative boundaries of Bury Metropolitan Borough Council (BMBC) and Manchester City Council (MCC). Therefore, only BMBC and MCC local plan policies relevant to Geology and Soils were considered.

Greater Manchester Combined Authority

1.4.6 The Greater Manchester Spatial Framework (GMSF) was produced by the Greater Manchester Combined Authority (GMCA). The GMSF: Publication Plan was published for consultation between 1 December 2020 and 26 January 2021. However, on the 3 December 2020, Stockport Council voted against adoption of the plan.

1.4.7 The remaining nine councils (Bolton, Bury, Manchester City, Oldham, Rochdale, Salford, Tameside, Trafford and Wigan) agreed to form a joint committee to develop a new planning strategy based on the GMSF, titled, 'Places for Everyone', covering the long-term plans for jobs, new homes and sustainable growth across their respective boroughs. Reference to the Proposed Scheme was made in the Places for Everyone plan submitted to the Secretary of State for examination on 14 February 2022, stating, *'Works to improve the capacity of Simister Island (the junction of the M62, M60 and M66 motorways) are already planned, but additional investment in the motorway network will be required to support the scale of development proposed within the North-East Growth Corridor'* (GMCA, 2022 p.61).

1.4.8 The programme is that this plan is adopted by the end of 2023.

1.4.9 A list of relevant emerging policies from submission draft, arranged by relevance to discipline, are outlined in Table 1.2.

Table 1.2: Emerging Places for Everyone planning policy

Places for Everyone: Plan	Places for Everyone: Policy
Air quality	Policy JP-S 6: Clean Air Policy JP-G 7: Trees and Woodland Policy JP-C 1: An Integrated Network Policy JP-C 3: Public Transport Policy JP-C 4: Streets for All Policy JP-C 5: Walking and Cycling Policy JP-C 6: Freight and Logistics Policy JP-C 7: Transport Requirements of New Development
Cultural heritage	Policy JP-G 1: Valuing Important Landscapes Policy JP-P 1: Sustainable Places Policy JP-P 2: Heritage Policy JP-P 3: Cultural Facilities
Landscape and visual	Policy JP-H 3: Type, Size and Design of New Housing Policy JP-G 1: Valuing Important Landscapes Policy JP-G 2: Green Infrastructure Network Policy JP-G 3: River Valleys and Waterways Policy JP-G 4: Lowland Wetlands and Mosslands Policy JP-G 5: Uplands Policy JP-G 6: Urban Green Space

Places for Everyone: Plan	Places for Everyone: Policy
	Policy JP-G 7: Trees and Woodland Policy JP-G 8: Standards for Greener Places
Biodiversity	Policy JP-G 2: Green Infrastructure Network Policy JP-G 3: River Valleys and Waterways Policy JP-G 4: Lowland Wetlands and Mosslands Policy JP-G 5: Uplands Policy JP-G 7: Trees and Woodland Policy JP-G 9: A Net Enhancement of Biodiversity and Geodiversity Policy JP-G 10: The Green Belt
Geology and soils	Policy JPG 1: Valuing Important Landscapes Policy JP-G 7: Trees and Woodland Policy JP-G 9: A Net Enhancement of Biodiversity and Geodiversity
Material assets and waste (For further policy see 'Minerals and Waste Plans' sub-section)	Policy JP-S 7: Resource Efficiency Policy JP-G 7: Trees and Woodland Policy JP-G 11: Safeguarded Land
Noise and vibration	Policy JP-G 7: Trees and Woodland Policy JP-C 4: Streets for All Policy JP-C 7: Transport Requirements of New Development
Population and human health	Policy JP-S 4: Resilience Policy JP-J 1: Supporting Long-Term Economic Growth Policy JP-J 2: Employment Sites and Premises Policy JP-J 3: Office Development Policy JP-J 4: Industry and Warehousing Development Policy JP-H 1: Scale, Distribution and Phasing of New Housing Development Policy JP-H 2: Affordability of New Housing Policy JP-G 6: Urban Green Space Policy JP-G 8: Standards for Greener Places Policy JP-G 11: Safeguarded Land Policy JP-P 1: Sustainable Places Policy JP-P 4: New Retail and Leisure Uses in Town Centres Policy JP-P 5: Education, Skills and Knowledge Policy JP-P 6: Health Policy JP-P 7: Sport and Recreation Policy JP-C 1: An Integrated Network Policy JP-C 2: Digital Connectivity Policy JP-C 3: Public Transport Policy JP-C 4: Streets for All

Places for Everyone: Plan	Places for Everyone: Policy
	Policy JP-C 5: Walking and Cycling Policy JP-C 6: Freight and Logistics Policy JP-C 7: Transport Requirements of New Development
Road drainage and the water environment	Policy JP-S 5: Flood Risk and the Water Environment Policy JP-G 3: River Valleys and Waterways Policy JP-G 4: Lowland Wetlands and Mosslands Policy JP-G 5: Uplands
Climate	Policy JP-S 1: Sustainable Development Policy JP-S 2: Carbon and Energy Policy JP-G 2: Green Infrastructure Network Policy JP-G 3: River Valleys and Waterways Policy JP-G 4: Lowland Wetlands and Mosslands Policy JP-G 5: Uplands Policy JP-G 6: Urban Green Space Policy JP-G 7: Trees and Woodland Policy JP-C 1: An Integrated Network

Bury Metropolitan Borough Council

17.2.4 The current development plan documents of relevance to Bury Metropolitan Borough Council comprise:

- Saved policies of the Bury Unitary Development Plan (UDP) (1997)
- Bury Supplementary Planning Documents (SPDs) (2007-2020)
- Greater Manchester Joint Waste Development Plan Document (2012)
- Greater Manchester Joint Minerals Development Plan Document (2013)

17.2.5 The Bury Metropolitan Borough UDP consists of saved policies from the original 1997 document, which will continue to be used to make planning decisions until the adoption of the Emerging Plan. The Council has also produced various SPDs which, although not material, provide additional information on how the Council implements the saved policies of the Bury UDP.

17.2.6 The Council are also currently in the very early stages in the process of preparing a new Bury Local Plan, with the 'Bury Local Plan: Policy Directions' published for consultation in October 2018. This document seeks to identify key issues for consideration, however it has not progressed to the stage of developing substantive policies as yet, therefore is not included in the table below.

17.2.7 The relevant Local Plan policies are listed in Table 1.3.

Table 1.3: Bury Metropolitan Borough Council planning policy

Bury Metropolitan Borough District Council: Plan	Bury Metropolitan Borough District Council: Policy
Air quality	
Saved policies of the Bury Unitary Development Plan (UDP) (Adopted August 1997)	Policy EN7: Pollution Control Policy EN7/1: Atmospheric Pollution
Bury SPDs	N/A
Cultural heritage	
Saved policies of the Bury UDP (Adopted August 1997)	Policy EN1: Built Environment Policy EN1/2: Townscape and Built Design Policy EN2: Conservation and Listed Buildings Policy EN2/1: Character of Conservation Areas Policy EN2/2: Conservation Area Control Policy EN2/3: Listed Buildings Policy EN2/4: Historic Parks Policy EN3: Archaeology Policy EN3/1: Impact of Development on Archaeological Sites Policy EN3/2: Development Affecting Archaeological Sites Policy EN3/3: Ancient Monuments
Bury SPDs (2007-2020)	SPD 4: Percent for public art
Landscape and visual	
Saved policies of the Bury UDP (Adopted August 1997)	Policy EN1: Built Environment Policy EN1/1: Visual Amenity Policy EN1/2: Townscape and Built Design Policy EN1/3: Landscaping Provision Policy EN8: Woodland and Trees Policy EN8/1: Tree Preservation Orders Policy EN8/2: Woodland and Tree Planting Policy EN8/3: Red Rose Forest Policy EN9: Landscape Policy EN9/1: Special Landscape Areas Policy EN10: Environmental Improvement Areas Policy EN10/2: Riverside and Canalside Improvement in Urban Areas Policy OL5: River Valleys
Bury SPDs (2007-2020)	N/A

Bury Metropolitan Borough District Council: Plan	Bury Metropolitan Borough District Council: Policy
Biodiversity	
Saved policies of the Bury UDP (Adopted August 1997)	Policy EN6: Conservation of the Natural Environment Policy EN6/1: Sites of Nature Conservation Interest Policy EN6/2: Sites of Nature Conservation Interest Policy EN6/3: Features of Ecological Value Policy EN6/4: Wildlife Links and Corridors Policy EN6/5: Sites of Geological Interest Policy EN8: Woodland and Trees Policy EN8/1: Tree Preservation Orders Policy EN8/2: Woodland and Tree Planting
Bury SPDs (2007-2020)	SPD 2: Wildlife links and corridors
Geology and soils	
Saved policies of the Bury UDP (Adopted August 1997)	Policy EN6: Conservation of the Natural Environment Policy EN7: Pollution Control Policy EN10 Environmental Improvement Policy OL4: Agriculture Policy OL4/1: Agricultural Land Quality
Bury SPDs (2007-2020)	N/A
Material assets and waste (For further policy see 'Minerals and Waste Plans' sub-section)	
Saved policies of the Bury UDP (Adopted August 1997)	Policy OL1/5: Mineral Extraction and Other Development in the Green Belt
Bury SPDs (2007-2020)	N/A
Noise and vibration	
Saved policies of the Bury UDP (Adopted August 1997)	Policy EN7: Pollution Control Policy EN7/2: Noise Pollution
Bury SPDs (2007-2020)	N/A
Population and human health	
Saved policies of the Bury UDP (Adopted August 1997)	Policy EN1/1: Visual Amenity Policy OL3: Urban Open Space Policy OL3/1: Protection of Urban Open Space Policy OL4/3: Development Impact on Farming Areas Policy OL5/3: Riverside and Canalside Development in Urban Areas Policy RT1/1: Protection of Recreation Provision in the Urban Area Policy RT2/3: Education Recreation Facilities Policy RT3: Recreation in the Countryside

Bury Metropolitan Borough District Council: Plan	Bury Metropolitan Borough District Council: Policy
	Policy RT3/1: Protection of Existing Recreation Provision in the Countryside Policy RT3/3: Access to the Countryside Policy RT3/4: Recreational Routes Policy RT4/2: Safeguarding Tourism Assets Policy HT5: Accessibility for those with Special Needs Policy HT5/1: Access for Those with Special Needs Policy HT6: Pedestrians and Cyclists Policy HT6/1: Pedestrian and Cyclist Movement Policy HT6/2: Pedestrian/Vehicular Conflict
Bury SPDs (2007-2020)	N/A
Road drainage and the water environment	
Saved policies of the Bury UDP (Adopted August 1997)	Policy EN5: Flood Protection and Defence Policy EN5/1: New Development and Flood Risk Policy EN7/3: Water Pollution Policy EN7/4: Groundwater Protection Policy EN7/5: Waste Water Management Policy RT4/7: The Manchester, Bolton and Bury Canal
Bury SPDs (2007-2020)	SPD 12: Travel plans in Bury
Climate	
Saved policies of the Bury UDP (Adopted August 1997)	Policy EN5: Flood Protection and Defence
Bury SPDs (2007-2020)	N/A

Rochdale Borough Council

17.2.8 The current development plan documents of relevance to Rochdale Borough Council comprise:

- Core Strategy (2016)
- 1996-2016 Local Plan (2006)
- Rochdale SPDs (2007)
- Greater Manchester Joint Waste Development Plan Document (2012)
- Greater Manchester Joint Minerals Development Plan Document (2013)

17.2.9 The Rochdale Borough Council Core Strategy is the main document, providing an overview of objectives around which all other plans and policies must fit. In addition, policies from the Unitary Development Plan of the 1996-2016 Local Plan will remain until the forthcoming Allocations Development Plan is adopted. There are also a number of SPDs providing further guidance on how the plan policies are implemented.

17.2.10 The relevant Local Plan policies are listed in Table 1.4.

Table 1.4: Rochdale Borough Council planning policy

Rochdale Borough Council: Plan	Rochdale Borough Council: Policy
Air quality	
Rochdale Core Strategy (October 2016)	Policy G9: Reducing the impact of pollution, contamination and land instability Policy DM1: General development requirements
Rochdale UDP (June 2006)	Policy EM/2: Pollution
Rochdale SPDs	N/A
Cultural heritage	
Rochdale Core Strategy (October 2016)	Policy P2: Protecting and enhancing character, landscape and heritage
Rochdale UDP (June 2006)	Policy G/BE/9: Conservation of the Built Heritage Policy BE/10: Development Affecting Archaeological Sites and Ancient Monuments Policy BE/11: Protection of Locally Important Buildings and Features of Architectural and Historic Interest Policy BE/12: Demolition of Listed Buildings Policy BE/13: Changes of Use to Listed Buildings Policy BE/14: Alterations and Extensions to Listed Buildings Policy BE/15: New Development Affecting the Setting of a Listed Building Policy BE/16: Demolition of Buildings in Conservation Areas Policy BE/17: New Development Affecting Conservation Areas Policy BE/18: Changes of Use to Buildings in Conservation Areas Policy BE/19: Protection of Parks and Gardens of Special Historic Interest
Rochdale SPDs	N/A
Landscape and visual	
Rochdale Core Strategy (October 2016)	Policy P2: Protecting and enhancing character, landscape and heritage Policy P3: Improving design of new development Policy G6: Enhancing green infrastructure Policy DM1: General development requirements
Rochdale UDP (June 2006)	Policy G/RE/1: Countryside and the Rural Economy LT/7: Rochdale Canal Policy G/8: Greenspace Corridors
Rochdale SPDs	N/A
Biodiversity	
Rochdale Core Strategy (October 2016)	Policy G1: Tackling and adapting to climate change Policy G5: Managing protected open land

Rochdale Borough Council: Plan	Rochdale Borough Council: Policy
	Policy G6: Enhancing green infrastructure Policy G7: Increasing the value of biodiversity and geodiversity
Rochdale UDP (June 2006)	Policy LT/7: Rochdale Canal Policy G/8: Greenspace Corridors Policy NE/2: Designated Sites of Ecological and Geological / Geomorphological Importance
Rochdale SPDs	Biodiversity and Development SPD
Population and human health	
Rochdale Core Strategy (October 2016)	Policy C6: Improving health and well being Policy P3: Improving design of new development Policy G5: Managing protected open land Policy G6: Enhancing green infrastructure Policy T2: Improving accessibility Policy DM1: General development requirements Policy E2 - Increasing Jobs and Prosperity
Rochdale UDP (June 2006)	Policy D/10: Protected Open Land Policy LT/7: Rochdale Canal Policy G/3: Protection of Existing Recreational Open Space Policy G/7: Protection of Allotments Policy G/8: Greenspace Corridors Policy RE/6: Recreational Rights of Way
Rochdale SPDs	Heywood Green Infrastructure Action Plan SPD
Road drainage and the water environment	
Rochdale Core Strategy (October 2016)	Policy G1: Tackling and adapting to climate change Policy G8: Managing water resources and flood risk Policy G9: Reducing the impact of pollution, contamination and land instability Policy DM1: General development requirements
Rochdale UDP (June 2006)	Policy EM/7: Development and Flood Risk Policy EM/8: Protection of Surface and Ground Water Policy CF/7: Water and Waste Water Infrastructure
Rochdale SPDs	Climate Change Adaptation SPD

Salford City Council

17.2.11 The current development plan documents of relevance to Salford City Council comprise:

- Saved policies of the Salford Unitary Development Plan (UDP) (June 2006)

- Emerging Salford Local Plan: Development Management Policies and Designations (SLP:DMP) (Submitted to SoS June 2021)
- SLP:DMP Addendum (Main Modifications) (Submitted to Secretary of State (SoS) June 2021)
- Greater Manchester Joint Waste Development Plan Document (April 2012)
- Greater Manchester Joint Minerals Development Plan Document (April 2013)

17.2.12 Salford City Council initially consulted on the draft local plan between January and March 2019. Since then, a decision has been made to narrow the scope, considering its interlinked nature with the forthcoming GMCA 'Places for Everyone' plan.

17.2.13 The latest version of the Salford City Council Local Plan is titled 'Salford Local Plan: Development Management Policies and Designations' and was submitted to the Secretary of State for examination on 30 June 2021. An addendum to the Publication SLP:DMP was published for public comment on 5 February 2021 to reflect new evidence, changes to Government policy, and to formalise the plan. This was submitted to the Secretary of State in June 2021 for examination along with the main Publication SLP:DMP.

17.2.14 The relevant adopted and emerging Local Plan policies are listed in Table 1.5.

Table 1.5: Salford City Council planning policy

Salford City Council: Plan	Salford City Council: Policy
Air quality	
Salford UDP (June 2006)	Policy ST 14: Global Environment Policy EN 17: Pollution Control
Emerging SLP:DMP & SLP:DMP Addendum (Submitted to SoS June 2021)	Policy PH1: Pollution control
Landscape and visual	
Salford UDP (June 2006)	Policy DES1: Respecting Context Policy DES9: Landscaping Policy EN2: Worsley Greenway Policy EN5: Irwell Valley Policy EN12: Important Landscape Features Policy EN13: Protected Trees Policy EN23: Environmental Improvement Corridors
Emerging SLP:DMP & SLP:DMP Addendum (Submitted to SoS June 2021)	Policy D1: Design principles Policy D2: Local character and distinctiveness Policy GI1: Green infrastructure requirements for development Policy GI2: Chat Moss Policy GI3: Irwell Valley Policy GI5: Local Green Space Policy GI6: Trees and woodland

Salford City Council: Plan	Salford City Council: Policy
Biodiversity	
Salford UDP (June 2006)	Policy ST13: Natural Environmental Assets Policy EN7: Nature Conservation Sites of National Importance Policy EN8: Nature Conservation Sites of Local Importance Policy EN9: Wildlife Corridors Policy EN11: Mosslands Policy EN13: Protected Trees
Emerging SLP:DMP & SLP:DMP Addendum (Submitted to SoS June 2021)	Policy GI1: Green infrastructure requirements for development Policy GI2: Chat Moss Policy GI6: Trees and woodland Policy BG1: Nature improvement areas Policy BG2: Development and biodiversity Policy GB1: Green Belt Policy GB4: Agricultural, Forestry and Other Occupational Dwellings within the Green Belt
Population and human health	
Salford UDP (June 2006)	Policy ST3: Employment Supply Policy ST5: Transport Networks Policy DES2: Circulation and Movement Policy DES9: Landscaping Policy A2: Cyclists, Pedestrians and the Disabled Policy EN20: River Irwell Flood Control Policy R1: Protection of Recreation Land and Facilities Policy R5: Countryside Access Network
Emerging SLP:DMP & SLP:DMP Addendum (Submitted to SoS June 2021)	Policy A1: Supporting sustainable transport Policy A2: Transport hierarchy and sustainable streets Policy A3: Walking and cycling Policy A4: Public transport Policy R1: Recreation standards Policy R2: Recreation facilities and residential amenity Policy R3: Protection of recreation land and facilities Policy R4: Strategic recreation routes Policy R5: Outdoor and indoor sports facilities Policy F2: Societal Value and Inclusion Policy TC5: Community Facilities Policy HH1: Development and Health Policy HH2: Provision of Health and Social Care Facilities Policy HH3: Salford Royal Hospital

Salford City Council: Plan	Salford City Council: Policy
	Policy GB1: Green Belt Policy GI5: Local Green Space
Road drainage and the water environment	
Salford UDP (June 2006)	Policy EN17: Pollution Control Policy EN18: Protection of Water Resources Policy EN19: Flood Risk and Surface Water
Emerging SLP:DMP & SLP:DMP Addendum (Submitted to SoS June 2021)	Policy WA1: Delivering the North West River Basin Management Plan Policy WA2: Water supply and water efficiency Policy WA3: Flood risk management and infrastructure Policy WA4: Development and flood risk Policy WA5: Surface water and sustainable drainage

Manchester City Council

17.2.15 The current development plan documents of relevance to Manchester City Council comprise:

- Manchester Core Strategy (July 2012)
- Manchester Extant (remaining) UDP policies (1995)
- Greater Manchester Joint Waste Development Plan Document (April 2012)
- Greater Manchester Joint Minerals Development Plan Document (April 2013)

17.2.16 Manchester City Council are also beginning the process of developing the Manchester Local Plan. The first steps were what the authority called an 'Issues Consultation' stage, the formal public consultation for which finished on 1 May 2020. The next stage will be the production of a Draft Local Plan, which will have more detail on specific plans and policies relating to the area. Therefore, there are currently no policies of relevance for inclusion in the table below.

17.2.17 The relevant Local Plan policies are listed in Table 1.6.

Table 1.6: Manchester City Council planning policy

Manchester City Council: Plan	Manchester City Council: Policy
Air quality	
Manchester Core Strategy (July 2012)	Policy DM1: Development Management Policy EN16: Air Quality
Manchester Extant (remaining) UDP policies (1995)	N/A
Cultural heritage	
Manchester Core Strategy (July 2012)	Policy EN1: Design Principles and Strategic Character Areas Policy EN3: Heritage Policy DM1: Development Management

Manchester City Council: Plan	Manchester City Council: Policy
Manchester Extant (remaining) UDP policies (1995)	Policy DC18.1: Conservation Areas Policy DC19.1: Listed Buildings Policy DC20.1: Archaeology
Landscape and visual	
Manchester Core Strategy (July 2012)	Policy EN1: Design Principles and Strategic Character Areas Policy EN9: Green Infrastructure Policy DM1: Development Management
Manchester Extant (remaining) UDP policies (1995)	N/A
Biodiversity	
Manchester Core Strategy (July 2012)	Policy EN 9: Green Infrastructure Policy EN15: Biodiversity and Geological Conservation Policy DM1: Development Management
Manchester Extant (remaining) UDP policies (1995)	N/A
Geology and soils	
Manchester Core Strategy (July 2012)	Policy EN15: Biodiversity and Geological Conservation Policy EN18: Contaminated Land and Ground Stability
Manchester Extant (remaining) UDP policies (1995)	N/A
Noise and vibration	
Manchester Core Strategy (July 2012)	Policy DM1: Development Management
Manchester Extant (remaining) UDP policies (1995)	Policy DC26: Development and Noise
Population and human health	
Manchester Core Strategy (July 2012)	Policy T1: Sustainable Transport Policy EN9: Green Infrastructure Policy EN10: Safeguarding Open Space, Sport and Recreation Facilities Policy EN11: Quantity of Open Space, Sport and Recreation Policy EN12: Area priorities for Open Space, Sport and Recreation Policy EN13: Green Belt Policy DM1: Development Management
Manchester Extant (remaining) UDP policies (1995)	Policy DC22.1: Footpath Protection
Road drainage and the water environment	
Manchester Core Strategy (July 2012)	Policy EN8: Adaptation to Climate Change Policy EN14: Flood Risk

Manchester City Council: Plan	Manchester City Council: Policy
	Policy EN17: Water Quality Policy DM1: Development Management
Manchester Extant (remaining) UDP policies (1995)	N/A

Oldham Metropolitan Borough Council

17.2.18 The current development plan documents of relevance to Manchester City Council comprise:

- Oldham Local Development Framework – 'Joint Core Strategy and Development Management Policies' Development Plan Document (LDF DPD) - (November 2011)
- Saved Policies of the Unitary Development Plan (UDP) (2006)
- Greater Manchester Joint Waste Development Plan Document (April 2012)
- Greater Manchester Joint Minerals Development Plan Document (April 2013)

17.2.19 The LDF DPD sets out the spatial, strategy, objectives and planning policies for the borough up to 2026. It superseded the majority of the UDP 2006 policies. However, some policies from the 2006 document were retained.

17.2.20 The relevant Local Plan policies are listed in Table 1.7.

Table 1.7: Oldham Metropolitan Borough Council planning policy

Oldham Metropolitan Borough Council: Plan	Oldham Metropolitan Borough Council: Policy
Air quality	
LDF DPD (November 2011)	Policy 1: Climate Change and Sustainable Development Policy 9: Local Environment
Oldham UDP (July 2006)	N/A
Biodiversity	
LDF DPD (November 2011)	Policy 6: Green Infrastructure Policy 9: Local Environment Policy 21: Protecting Natural Environment Assets
Oldham UDP (July 2006)	Policy D1.5: Protection of Trees on Development Sites

Minerals and Waste Plans

17.2.21 In addition to the policy documents listed in the sub-sections above, two policy documents for minerals and waste form part of the development plan for each of the ten Greater Manchester authorities, which include all the local councils within the study area. These documents comprise:

- Greater Manchester Joint Waste Development Plan document (April 2012)
- Greater Manchester Joint Minerals Development Plan document (April 2013)

17.2.22 The purpose of the Waste Plan is to set the waste planning strategy to 2027 for the adequate provision and appropriate siting of municipal, commercial and industrial waste management facilities. Similarly, the purpose of the Minerals Local Plan is to provide policy guidance for the development and operation of minerals operations until 2027, and to safeguard key minerals sites against inappropriate development that may harm their current or future viability.

17.2.23 The key policy within these documents consists of Policy 11 of the Waste Plan relating to the safeguarding of allocated sites for waste development states, *'regard will be had to any potential adverse impact the proposed development might have on the future of the site as a location for waste management and thus on the Waste Plan's aim and objectives.'* Similarly, Policy 11 of the Minerals Plan relating to the protection of existing minerals sites states that, *'Development on or adjoining an existing mineral working or site containing minerals infrastructure will be permitted provided it would not have an unacceptable impact on the continuation of mineral working or the continued operation of the minerals infrastructure.'*

1.5 Other

1.5.1 The following local and regional strategies and policy documents are also considered relevant to the project:

- Strategic Transport Plan (Transport for the North, 2019)
- Greater Manchester Transport Strategy 2040 (Transport for Greater Manchester, 2017)
- Greater Manchester 2040 Transport Strategy Delivery Plan 2021-2026 (Transport for Greater Manchester, 2021)
- Greater Manchester Strategy (GMCA, 2017)

Appendix 1.2. Figures

Appendix 5.1. Major accidents and disasters

1.1 Introduction

1.1.1 A disaster is defined as a sudden, catastrophic event that can result in serious damage to human welfare or the environment. A disaster can result in major disruption to society or communities and can result in economic and environmental losses. Disasters can be caused by both natural processes and human actions.

1.1.2 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations') require that risks due to accidents and disasters be considered within the Environmental Impact Assessment (EIA). This appendix provides a risk assessment of the major accidents and disasters that could affect the Proposed Scheme, and where these are being reported and mitigated within the environmental assessment.

1.2 Methodology

1.2.1 A screening matrix (Table 1.1) has been completed detailing a long list of major accidents and disasters that could reasonably occur. This long list has been compiled using information from the International Federation of Red Cross and Red Crescent Societies website[21] and National Risk Register (NRR) of Civil Emergencies[22].

1.2.2 The screening matrix considers the Proposed Scheme's location and intended land use to determine if it is at risk from a major accident or disaster. For example, as there are areas close to the scheme at high risk of surface water flooding, the location presents a potential risk from major flooding. Likewise, as the scheme would be used as a transport route, the risk of a major transport accident exists. Where potential risks were identified, these were taken forward for further consideration.

[21] International Federation of Red Cross and Red Crescent Societies (n.d.). Accessed July 2021. http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/.

[22] Cabinet Office (2020). National Risk Register of Civil Emergencies 2020 Edition.

Table 1.1: Major accidents and disasters screening matrix

Accident / disaster	Location risk	Land-use risk	Further consideration required
Biological hazards: epidemics	×	×	×
Biological hazards: animal and insect infestation	×	×	×
Earthquakes	×	×	×
Mass movements / ground hazards	✓	×	✓
Tsunamis	×	×	×
Volcanic eruptions	×	×	×
Drought	×	×	×
Heatwaves	✓	×	✓
Wildfires	×	×	×
Inland floods	✓	×	✓
Coastal floods	×	×	×
Tropical storms	×	×	×
Storms and gales	✓	×	✓
Industrial accidents	×	×	×
Transport accidents	✓	✓	✓
Famine	×	×	×
Displaced populations	×	×	×
Malicious attacks on infrastructure	×	✓	✓
Cyber attacks	×	×	×
Public disorder	×	×	×
Critical infrastructure failure	×	✓	✓
Heavy snowfall / low temperatures	✓	×	✓
Armed conflict / complex emergency	×	×	×

Note: Bold text indicates major accidents or disasters requiring further consideration due to either the location of the Proposed Scheme or its intended use.

1.2.3 Accidents and disasters requiring further consideration were subject to a more detailed risk assessment (Table 1.2). This looked at the probability of an event occurring, and the consequence/effect if an event did occur. Probabilities of event occurrence were obtained from the NRR, considering the local context of the Proposed Scheme and future climate change (see Chapter 15: Climate of this Preliminary Environmental Information Report (PEIR)). These factors were used to determine if an event presented a significant risk and how this is considered in the environmental assessment. In this instance, a significant risk is one with the potential to cause loss of life or long-

lasting/permanent environmental damage and would require a response beyond existing response measures in place.

1.3 Screening and scoping

1.3.1 The risk assessment (Table 1.2) has been used to screen and scope potential environmental impacts from major accidents and disasters.

1.3.2 This shows how risks are being managed through the scheme design or reported and mitigated within other areas of the environmental assessment (e.g. climate change adaptation). Major accidents and disasters will therefore not be scoped into the environmental assessment as an EIA aspect chapter but will be reported on within relevant aspects. The scheme design will consider the potential effects associated with accidents and disasters, with mitigation embedded into the design where required.

Table 1.2: Major accidents and disasters risk assessment

Note: yellow - risks considered within the scheme design; green - risks that are not considered further.

Event	Likelihood	Consequence	Further considerations
Mass movements/ground hazards	A Preliminary Sources Study Report (PSSR) (CH2M, 2018) has been produced for the Proposed Scheme at PCF Stage 2. This contains a risk register which has identified several ground hazards which are 'likely' to occur, including collapsible and compressible ground.	Subsidence and other ground hazards can occur rapidly with little warning. They can cause damage to infrastructure, disruption to the traffic network, and casualties/fatalities. Depending on the nature of the incident, environmental damage can occur through release of contaminants and opening source-pathway-receptor linkages.	Geophysical hazards are being considered in the scheme design. The PSSR summarises the potential hazards and risks associated with the ground conditions that need to be factored into the design process and assessed going forward. Ground investigations will be undertaken. The findings of the investigations, along with the associated design requirements and risk mitigation, will be documented in a Ground Investigation Report.
Heatwaves	The NRR probability of a heatwave occurring in the next year is between 25 to 125 in 500. Summer temperatures are predicted to increase in the UK due to climate change, potentially increasing the likelihood of this event occurring.	Hot weather increases the risk of tarmac melting and technology overheating. This could result in unsafe driving conditions, potentially leading to accidents. Hot temperatures could also result in increased driver stress, increasing the likelihood of an accident occurring. Environmental damage could occur if a crash resulted in discharge of contaminants (e.g. if an oil tanker crashed).	The UK Met Office has a system in place for providing warnings of extreme weather, which reduces the risk of drivers driving in extreme weather. There is a minor risk of high temperatures damaging the road surface and technology, however, the likelihood of this resulting in a catastrophic event is considered unlikely. Heatwaves will therefore not be considered further.
Storms and gales	The NRR probability of a storm/gale occurring in the next year is between 25 to 125 in 500. It is uncertain if wind speeds are likely to increase or decrease in the north of England due to climate change.	High wind speeds can fell trees and man-made structures. This can result in property damage, disruption to the transport network, disruption to critical infrastructure, and casualties/fatalities. Large scale events have the potential to impact at a regional or even national scale.	High wind speeds have caused historic disruption to transport networks in England, and there is potential for future events to impact the M60, M62 and M66. The Proposed Scheme will be designed in accordance with best practice (BS EN 1991-1-4:2005 – Actions on Structures (covering wind)[23] and the associated UK National Annex)[24], and no further measures taken. Therefore, no additional consideration is needed.

[23] BSI (2005). BS EN 1991-1-4:2005+A1:2010: Eurocode 1. Actions on structures. General actions. Wind actions.

[24] BSI (2005). NA to BS EN 1991-1-4:2005+A1:2010: UK National Annex to Eurocode 1. Actions on structures. General actions. Wind actions.

Event	Likelihood	Consequence	Further considerations
Inland floods	The NRR probability of inland flooding occurring in the next year is between 5 to 25 in 500. Locally, the Proposed Scheme is located in areas of Flood Zone 1 (1 in 1000-year event), however there are areas at medium to high risk from surface water flooding. Winters are predicted to get wetter in the UK due to climate change, potentially increasing the likelihood of this event occurring.	Large scale flooding events can result in damage to property, disruption of the transport network, casualties and fatalities. There can also be impacts on local communities if they are not equipped to deal with a large-scale event in their area. Depending on the nature of the event, environmental damage can occur through release of contaminants and opening source-pathway-receptor linkages. The magnitude and severity of an event could increase due to future climate change and land use change (e.g. development within floodplain).	The Proposed Scheme is located in areas of Flood Zone 1, however there are areas at medium to high risk from surface water flooding. There are also areas at medium to high risk of flooding from rivers. The Proposed Scheme is therefore at risk from a flood event and potentially increases the risk of flooding elsewhere. This problem is likely to be exacerbated by future climate change. As such this event is being considered in the scheme design, along with other climate change adaptation measures. The flood risk assessment will also consider future risk due to climate change and propose mitigation measures as required.
Transport accidents	The NRR probability of a major transport accident occurring in the next year is less than 1 in 500. This probability could increase (e.g. due to future stress on the network) or decrease (e.g. through advances in technology).	Major accidents can result in fatalities, casualties, and damage to infrastructure, causing disruption to the network. There can also be impacts on local communities if they are not equipped to deal with a large-scale event in their area. Environmental damage could occur if a crash resulted in discharge of contaminants (e.g. if an oil tanker crashed).	Although accidents are likely to take place on the M60, M62 and M66, these are not likely to occur at a scale that would be considered a national or regional disaster. The Proposed Scheme is also being designed to increase capacity and improve safety, which should reduce the probability of an incident occurring. Traffic accidents would be managed through existing emergency service procedures and would be unlikely to need a coordinated government response. Traffic accidents will therefore not be considered further.
Critical infrastructure failure	The NRR probability of a widespread electricity failure occurring in the next year is between 5 to 25 in 500. A regional or national blackout has never occurred in the UK; however it has occurred in Argentina and South Australia within the last decade. The risk could increase due to the increased risk of severe weather.	The M60/M62/M66 Simister Island Interchange is a strategic route that relies on powered technology, such as variable message signs and traffic signals, to allow safe operation of the road. A critical electricity failure could disrupt this technology, resulting in potential casualties and fatalities due to road accidents.	The Department for Business, Energy & Industrial Strategy works closely with industry and government to provide contingency planning in the event of a widespread electricity shutdown occurring. Existing measures are in place to manage this event, and it is therefore not considered further.

Event	Likelihood	Consequence	Further considerations
Malicious attacks on infrastructure	The NRR probability of a malicious attack on critical infrastructure occurring in the next year is between 25 to 125 in 500. Terrorists in the UK have previously attacked, or planned to attack, national infrastructure; attempts were made to attack electricity substations in the 1990s.	Consequences of an attack on a transport system may include fatalities and physical and / or psychological casualties, damage to property and infrastructure, disruption to essential services, particularly transport, and disruption and negative impact on local, regional and national economy.	The UK has a comprehensive and well-established programme of work to protect its national infrastructure from terrorism and other security threats. The Centre for the Protection of National Infrastructure is the government authority providing protective security advice to businesses and organisations who own or operate UK Critical National Infrastructure (CNI). They provide integrated advice on physical and personnel security, which aims to reduce risk and vulnerability to terrorism, espionage and other national security threats. Existing measures are in place to manage this event, and it is therefore not considered further.
Heavy snowfall / low temperatures	The NRR probability of low temperatures and heavy snowfall occurring in the next year is between 25 to 125 in 500. Winters are predicted to get milder in the UK due to climate change, potentially reducing the likelihood of this event occurring.	Heavy snowfall can result in serious disruption to the transport network, resulting in road closures and increasing the hazard of vehicle accidents. This has the potential to result in casualties and fatalities. Environmental damage could occur if a crash resulted in discharge of contaminants (e.g. if an oil tanker crashed).	The UK Met Office has a system in place for providing warnings of extreme weather. Highways England and local authorities operate gritting lorries and manage operations for removing snow. These existing mitigation measures reduce the risk of accidents occurring. Although a residual risk remains for an accident to occur, the chance of one resulting in catastrophic damage to human health or the environment is considered unlikely. As such, snowstorms will not be considered further.

Appendix 5.2. Assessment criteria

1.1 Sensitivity criteria

1.1.1 This tabulates how the baseline has been assessed in terms of its value and sensitivity. The assessment is based on Table 3.2N from DMRB LA 104 and Table 3.9 from DMRB 108 (recreated in Table 1.1). It has then been interpreted by technical specialists for each aspect in Table 1.2. Additional notes are provided under the aspect heading where applicable. The table is used as guidance for the assessment and is not designed to be prescriptive. Technical judgement will be used to provide the final values.

Table 1.1: Criteria to assign value (sensitivity) to receptors, taken from DMRB LA 104/LA 108

Value (sensitivity) of receptor/resource importance	Typical descriptors
Very high/International or European	Very high importance and rarity, international scale and very limited potential for substitution.
High/UK or national	High importance and rarity, national scale, and limited potential for substitution.
Medium/Regional	Medium or high importance and rarity, regional scale, limited potential for substitution.
Low/ County or equivalent authority	Low or medium importance and rarity, local scale.
Negligible/Local	Very low importance and rarity, local scale.

Table 1.2: Topic-specific interpretation of the DMRB value (sensitivity) criteria for the Proposed Scheme

Value (sensitivity)/ resource importance	Typical descriptors
Air Quality (operational and construction traffic/dust effects; DMRB LA 105)	
Note:	All sensitive receptors are considered to be of equal value (high).

Value (sensitivity)/ resource importance	Typical descriptors
Cultural Heritage (DMRB LA 104, DMRB LA 106 and using professional judgement)	
Very high	**Archaeological remains**: World Heritage Sites (including nominated sites). Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives. **Historic buildings**: Structures recognised as of universal importance as World Heritage Sites. Other buildings of recognised international importance. **Historic landscapes**: World Heritage Sites recognised for their historic landscape qualities. Historic landscapes of international value, whether designated or not. Extremely well-preserved historic landscapes with exceptional coherence, time-depth, or other critical factor(s).
High	**Archaeological remains**: Scheduled monuments (including proposed sites). Undesignated assets of schedulable quality and importance. Assets that can contribute significantly to acknowledged national research objectives. **Historic buildings**: Scheduled monuments with standing remains. Grade I, Grade II* and Grade II listed buildings. Other listed buildings that can be shown to have exceptional qualities in their fabric or historical associations not adequately reflected in the listing grade. Conservation areas containing very important buildings. Undesignated structures of clear national importance. **Historic landscapes**: Designated historic landscapes of outstanding interest. Undesignated landscapes of outstanding interest. Undesignated landscapes of high quality and importance, and of demonstrable national value. Well preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factor(s).
Medium	**Archaeological remains**: Designated or undesignated assets that contribute to regional research objectives. **Historic buildings**: Historic (unlisted) buildings that can be shown to have exceptional qualities in their fabric or historical associations. Conservation areas containing buildings which contribute significantly to their historic character. Historic townscape or built-up areas with important historic integrity in their buildings or built settings (e.g. including street furniture and other structures). **Historic landscapes**: Designated special historic landscapes. Undesignated historic landscapes that would justify special historic landscape designation, landscapes of regional value. Averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factor(s).
Low	**Archaeological remains**: Designated and undesignated assets of local importance. Assets compromised by poor preservation and/or poor survival of contextual associations. Assets of limited value, but with potential to contribute to local research objectives. **Historic buildings**: 'Locally listed' buildings. Historic (unlisted) buildings of modest quality in their fabric or historical association. Historic townscape or built-up areas of limited historic integrity in their buildings or built settings (e.g. including street furniture and other structures). **Historic landscapes**: Robust undesignated historic landscapes. Historic landscapes with importance to local interest groups. Historic landscapes whose value is limited by poor preservation and/or poor survival of contextual associations.

Value (sensitivity)/ resource importance	Typical descriptors
Negligible	**Archaeological remains:** Assets with very little or no surviving archaeological importance. **Historic buildings:** Buildings of no architectural or historical note; buildings of an intrusive character. **Historic landscapes:** Landscapes with little or no significant historical interest.
Landscape and Visual (DMRB LA 107)	
Note:	DMRB LA 107 considers landscape 'sensitivity' which incorporates judgements on 'value' and 'susceptibility', Table 3.22 Landscape sensitivity (susceptibility and value) and typical descriptions. This differs from LA 104 Table 3.2N, Environmental value (sensitivity) and descriptions, which describes value for determining sensitivity. LA 107 Table 3.22, sensitivity criteria will be used.
Very high	**Landscape:** Landscapes of very high international/national importance and rarity or value with no or very limited ability to accommodate change without substantial loss/gain (i.e. national parks, internationally acclaimed landscapes - UNESCO World Heritage Sites). **Visual:** • Static views from and of major tourist attractions • Views from and of very important national/international landscapes, cultural/historical sites (e.g. National Parks, UNESCO World Heritage sites) • Receptors engaged in specific activities for enjoyment of dark skies
High	**Landscape:** Landscapes of high national importance containing distinctive features/elements with limited ability to accommodate change without incurring substantial loss/gain (i.e. designated areas, areas of strong sense of place - registered parks and gardens, country parks). **Visual:** • Views by users of nationally important PRoW / recreational trails (e.g. national trails, long distance footpaths) • Views by users of public open spaces for enjoyment of the countryside (e.g. country parks) • Static views from dense residential areas, longer transient views from designated public open space, recreational areas • Views from and of rare designated landscapes of national importance

Value (sensitivity)/ resource importance	Typical descriptors
Medium (Landscape) Moderate (Visual)	**Landscape:** Landscapes of local or regional recognition of importance able to accommodate some change (i.e. features worthy of conservation, some sense of place or value through use/perception). **Visual:** • Static views from less populated residential areas, schools and other institutional buildings and their outdoor areas • Views by outdoor workers • Transient views from local/regional areas such as public open space, scenic roads, railways or waterways, users of local/regional designated tourist routes of moderate importance • Views from and of landscapes of regional importance
Low	**Landscape:** Local landscape areas or receptors of low to medium importance with ability to accommodate change (i.e. non-designated or designated areas of local recognition or areas of little sense of place). **Visual:** • Views by users of main roads or passengers in public transport on main arterial routes • Views by indoor workers • Views by users of recreational/formal sports facilities where the landscape is secondary to enjoyment of the sport • Views by users of local public open spaces of limited importance with limited variety or distinctiveness
Negligible	**Landscape:** Landscapes of very low importance and rarity able to accommodate change. **Visual:** • Quick transient views such as from fast moving vehicles • Views from industrial area, land awaiting re-development • Views from landscapes of no importance with no variety or distinctiveness

Value (sensitivity)/ resource importance	Typical descriptors
Biodiversity (DMRB LA 108)	
International or European importance	Sites including: • European sites: - Sites of Community Importance (SCI) - Special Protection Areas (SPA) - Potential SPAs (pSPA) - Special Areas of Conservation (SAC) - Candidate or possible SACs (cSAC or pSAC) - Wetlands of International Importance (Ramsar sites) • Biogenetic Reserves, World Heritage Sites (where recognised specifically for their biodiversity value) and Biosphere Reserves • Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such
	Habitats: N/A
	Species: • Resident, or regularly occurring, populations of species which can be considered at an international or European level where: • The loss of these populations would adversely affect the conservation status or distribution of the species at an international or European scale; or • The population forms a critical part of a wider population at this scale; or • The species is at a critical phase of its life cycle at an international or European scale
UK or national importance	Sites including: • Sites of Special Scientific Interest (SSSI) or Areas of Special Scientific Interest (ASSI) • National Nature Reserves (NNR) • National Parks • Marine Protected Areas (MPA) including Marine Conservation Zones (MCZ) • Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such

Value (sensitivity)/ resource importance	Typical descriptors
	Habitats including: • Areas of UK BAP priority habitats • Habitats included in the relevant statutory list of priority species and habitats • Areas of irreplaceable habitats including: - ancient woodland - ancient or veteran trees - blanket bog - limestone pavement - sand dunes - salt marsh - lowland fen • Areas of habitat which meet the definition for habitats listed above but which are not themselves designated or listed as such
	Species: • Resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: - The loss of these populations would adversely affect the conservation status or distribution of the species at a UK or national scale; or - The population forms a critical part of a wider population at this scale; or - The species is at a critical phase of its life cycle at a UK or national scale
Regional importance	Designated sites (non-statutory) including heritage coasts.
	Areas of habitats identified (including for restoration) in regional plans or strategies (where applicable).
	Species including: • Resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: - The loss of these populations would adversely affect the conservation status or distribution of the species at a regional scale; or - The population forms a critical part of a wider regional population; or - The species is at a critical phase of its life cycle • Species identified in regional plans or strategies

Value (sensitivity)/ resource importance	Typical descriptors
County or equivalent importance	Wildlife / nature conservation sites designated at a county (or equivalent) level including: • Local Wildlife Sites (LWS) • Local Nature Conservation Sites (LNCS) • Local Nature Reserves (LNR) • Sites of Importance for Nature Conservation (SINC) • Sites of Nature Conservation Importance (SNCI) • County Wildlife Sites (CWS)
	Areas of habitats identified in county or equivalent authority plans or strategies (where applicable).
	Species including: • Resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: - the loss of these populations would adversely affect the conservation status or distribution of the species at a county or unitary authority scale; or - the population forms a critical part of a wider county or equivalent authority area population, e.g. metapopulations; or - the species is at a critical phase of its life cycle • Species identified in a county or equivalent authority area plans or strategies
Local importance	Wildlife / nature conservation sites designated at a local level including: • Local Wildlife Sites (LWS) • Local Nature Conservation Sites (LNCS) • Local Nature Reserves (LNR) • Sites of Importance for Nature Conservation (SINC) • Sites of Nature Conservation Importance (SNCI) • Sites of Local Nature Conservation Importance (SLNCI)
	Areas of habitat considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange.
	Populations / communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal or genetic exchange.

Value (sensitivity)/ resource importance	Typical descriptors
Geology and Soils (DMRB LA 109 and LA 113).	
Very high	**Geology:** • International designated sites of geological value (e.g. UNESCO World Heritage Sites). **Soil:** • ALC grades 1 and 2 or LCA grade 1 & 2. • Soils directly supporting an EU designated site (e.g. Special Area of Conservation or Special Protection Area). **Contamination:** • **Human health:** - Very sensitive land use such as residential or allotments. • **Surface water quality:** - Watercourse having a Water Framework Directive (WFD) classification shown in a River Basin Management Plan (RBMP) with a Q95≥1.0m3/s. - Site protected/designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water)/Species protected by EC legislation LA 108. • **Groundwater quality:** - Groundwater that locally supports a groundwater dependent terrestrial ecosystem (GWDTE). - Inner source protection zone (SPZ1). - Principal aquifer.

Value (sensitivity)/ resource importance	Typical descriptors
High	**Geology:** • Rare and of national importance with little potential for replacement (e.g. geological SSSI). **Soil:** • ALC subgrade 3a or LCA grade 3.1. • Soils directly supporting a UK designated site (e.g. SSSI). **Contamination:** • **Human health:** - High sensitivity land use such as public open space. • **Surface water quality:** - Watercourse having a WFD classification shown in RBMP with a Q95<1.0m^3/s. - Species protected under EC or UK legislation LA 108. • **Groundwater quality:** - Principal or secondary A aquifer providing locally important resource or supporting a river ecosystem. - Outer source protection zone (SPZ2).

Value (sensitivity)/ resource importance	Typical descriptors
Medium	**Geology:** • Regionally Important Geological Sites (RIGS) with limited potential for replacement. **Soil:** • ALC subgrade 3b or LCA grade 3.2. • Soils supporting non-statutory designated sites (e.g. LNR). **Contamination:** • **Human health:** - Medium sensitivity land use such as commercial or industrial. • **Surface water quality:** - Watercourse not having a WFD classification shown in RBMP and a Q95>0.001m^3/s. • **Groundwater quality:** - Aquifer providing water for agricultural or industrial use with limited connection to surface water. - Unlicensed private water supply. - Total catchment source protection zone (SPZ3).
Low	**Geology:** • Geology of local importance / interest with potential for replacement (e.g. non designated geological exposures, former quarries / mining sites). **Soil:** • ALC grades 4 and 5. • Soils supporting non-designated notable or priority habitats. **Contamination:** • **Human health:** - Low sensitivity land use such as highways and rail. • **Surface water quality:** - Watercourses not having a WFD classification shown in a RBMP and Q95 ≤0.001m^3/s. • **Groundwater quality:** - Unproductive strata. - Groundwater supporting a non-designated site (including HPI) with low groundwater dependency.

Value (sensitivity)/ resource importance	Typical descriptors
Negligible	**Geology:** • No geological exposures, little / no local interest. **Soil:** • Previously developed land formerly in 'hard uses' with little potential return to agriculture. **Contamination:** • **Human health:** - Undeveloped surplus land / no sensitive land use proposed. • **Surface water quality:** not applicable. • **Groundwater quality:** not applicable.
Material Assets and Waste (no sensitivity criteria assigned to this aspect in DMRB LA 110 as assessment is based on significance criteria alone)	
Noise and Vibration (DMRB LA 111)	
Notes	The DMRB LA 111 does not explicitly refer to the concept of receptor value (sensitivity), nor does it define a value for receptors. Rather, the assumption is made that a receptor is either sensitive or not sensitive. Within DMRB LA 111 are examples of receptors that are potentially sensitive to noise and vibration. Examples include dwellings, hospitals, healthcare facilities, education facilities, community facilities, international and national designated sites, public rights of way and cultural heritage assets.
Population and Human Health (criteria for land use and accessibility adapted from DMRB LA 112)	
Very high	**Residential property and housing** • Residential settlements within the study area which exceed 5ha or 150 houses • Land allocated for housing located in a local authority area where the number of households are expected to increase by >25% by 2041 (ONS data)

Value (sensitivity)/ resource importance	Typical descriptors
	Community land and assets • Community land and assets providing essential services for the daily health and functioning of the community where: - there are no alternatives within a reasonably accessible distance - they are frequently used by the majority of the community or by vulnerable groups who could be disproportionately affected by changes in the baseline due to potentially different needs • Locations where access between residents and community land and assets is physically severed, or highway conditions prevent access for people with characteristics protected under the Equality Act 2010
	Development land and businesses: Large employment sites and allocations within study area which exceed 5ha.
	Agricultural land holdings: Large agricultural holdings which are dependent on very regular access between fields and agricultural infrastructure, for example dairy farms.
	Walkers, cyclists and horse riders • National trails and routes likely to be used regularly by high numbers for commuting and/or recreation (with limited potential for substitution) • Routes regularly used by vulnerable travelers such as the elderly, school children and people with disabilities, who could be disproportionately affected by small changes in the baseline due to potentially different needs • Rights of way for walkers, cyclists and horse riders crossing existing roads at grade with >16,000 vehicles per day
High	**Residential property and housing** • Small settlements (>1-5ha / circa 30 – 150 houses) • Land allocated for housing located in a local planning authority area where the number of households are expected to increase by 16-25% by 2041 (ONS data)
	Community land and assets • Community land and assets supporting the health and functioning of the community where: - alternatives are available only by travel to other settlements / areas - they are regularly used by a large portion of the community or by vulnerable groups who could be disproportionately affected by changes in the baseline due to potentially different needs • Locations where access between residents and community land and assets is substantially severed or difficult to negotiate, or highway conditions offer limited provision which is compliant with Equality Act 2010 standards
	Development land and businesses: Employment sites and allocations (circa >1 – 5ha).

Value (sensitivity)/ resource importance	Typical descriptors
	Agricultural land holdings: Farm holdings dependent on access to extensive land to maintain high productivity, for example extensive arable farms.
	Walkers, cyclists and horse riders • Regional trails and routes (e.g. promoted circular walks) located close to communities likely to be used for recreation and to a lesser extent commuting, that record frequent (daily) use and have limited potential for substitution • At grade crossings with >8,000 - 16,000 vehicles per day and/or routes with limited accessibility provision
Medium	**Residential property and housing:** Isolated houses and very small hamlets (<1ha and/or <30 houses) within study area.
	Community land and assets • Community land and assets supporting the health and functioning of the community where: - limited alternatives are available within an easily accessible distance (i.e. in adjacent neighbourhoods) - they are regularly used by the community • Locations where access between residents and community land and assets is indirect due to areas of severance but has access provision compliant with the Equality Act 2010
	Development land and businesses: Small employment sites and land allocated for employment (circa <1ha).
	Agricultural land holdings: Small agricultural land holdings requiring access to limited areas of land with potential for relocation, for example free range poultry sites.
	Walkers, cyclists and horse riders • Public rights of way and other routes close to communities which are used for recreational purposes (e.g. dog walking), but for which alternative routes can be taken. These routes are likely to link to a wider network of routes to provide options for longer, recreational journeys • Rights of way for WCH crossing roads at grade with >4000 – 8000 vehicles per day
Low	**Residential property and housing:** Proposed housing development on unallocated sites providing housing with planning permission or are in the planning process.

Value (sensitivity)/ resource importance	Typical descriptors
	Community land and assets • Community land and assets where: - alternatives are available at a local level in the wider community; or - level of use is infrequent; or - land and assets are used by a minority in the community
	Development land and businesses: Proposed employment development on unallocated sites providing employment with planning permission or are in the planning process.
	Agricultural land holdings: Agricultural business not dependent on direct land access and with potential for relocation, for example farm shops.
	Walkers, cyclists and horse riders: Routes which have fallen into disuse through past severance and/or which are scarcely used because they do not offer a meaningful route for either utility or recreational purposes.
Negligible	**Residential property and housing:** • Community land and assets where there is a combination of the following: - 1) no or limited severance or accessibility issues; - 2) alternative facilities are available within the same community; - 3) the level of use is very infrequent (a few occasions yearly); and - 4) the land and assets are used by the minority (>=50%) of the community.
	Community land and assets: N/A.
	Development land and businesses: N/A.
	Agricultural land holdings: Areas of land which are infrequently used on a non-commercial basis.
	Walkers, cyclists and horse riders: N/A.

Value (sensitivity)/ resource importance	Typical descriptors
Road Drainage and the Water Environment (DMRB LA 113, except for the value classification for Groundwater Dependent Terrestrial Ecosystems, and hydromorphology)	
Notes	The value classifications presented in this table (and outlined within the Environmental Scoping Report) for Groundwater Dependent Terrestrial Ecosystems (GWDTE), are based on the Water Framework Directive; and align with the UK Technical Advisory Group (UKTAG) guidance. The UKTAG guidance brings together the degree of groundwater dependency (low, moderate, and high), *and* the level of ecological designation / protection of a site, to determine the overall importance of each potential GWDTE. This deviates from the value (importance) definitions proposed in Table 3.70 of LA 113, although the impact magnitude criteria in LA 113 are used for GWDTE. There are no sensitivity criteria in DMRB LA 113 for the hydromorphology aspect. The sensitivity criteria for hydromorphology below are based on organisational judgement.
Very high	**Flood risk and drainage**: Essential infrastructure or highly vulnerable development that is at risk of potential flood risk impacts. **Surface water**: Watercourse having a WFD classification shown in a RBMP and $Q_{95} \geq 1.0$ m^3/s. Site protected/designated under EC or UK legislation (SAC, Special Protection Area (SPA), SSSI, Ramsar site, salmonid water) and species protected by EC legislation. **Hydromorphology**: A watercourse that appears to be in complete natural equilibrium and exhibits a natural range of morphological features. There is a diverse range of fluvial processes present, free from any modification or anthropogenic influence. Morphological features and processes would be highly sensitive to change as a result of temporary or permanent works. **Groundwater**: Principal aquifer providing a regionally important resource because of its high quality and yield, or extensive exploitation for public and/or agricultural and/or industrial supply. Internationally designated sites of nature conservation dependent on groundwater. Groundwater quality within a Source Protection Zone (SPZ) 1 (Inner Protection Zone) for a licensed abstraction. World Heritage Sites. Nationally important infrastructure and buildings.
High	**Flood risk and drainage**: More vulnerable development that is at risk of potential flood risk impacts. **Surface water**: Watercourses having a WFD classification shown in a RBMP and Q_{95} <1.0m^3/s. **Hydromorphology:** A watercourse that appears to be in natural equilibrium and exhibits a natural range of morphological features. There is a diverse range of fluvial processes present, with very limited signs of modification or other anthropogenic influences. Morphological features and processes would be sensitive to change as a result temporary or permanent works. **Groundwater**: Principal or secondary A aquifer providing locally important resource or supporting a river ecosystem. Licensed non-potable abstractions and unlicensed potable abstractions. Groundwater supporting a nationally designated or non-statutory locally designated site of nature conservation with high or moderate groundwater dependency. Groundwater quality within a SPZ2 (outer protection zone) for a licensed abstraction. Grade I and II* listed buildings. Regionally important infrastructure and buildings.

Value (sensitivity)/ resource importance	Typical descriptors
Medium	**Flood risk and drainage**: Less vulnerable development that is at risk of potential flood risk impacts. **Surface water**: Watercourses not having a WFD classification shown in a RBMP and Q_{95} >0.001m^3/s. **Hydromorphology**: A watercourse showing signs of modification, recovering to a natural equilibrium, and exhibiting a limited range of morphological features (such as pools and riffles). The watercourse is one with a limited range of fluvial processes and is affected by modification or other anthropogenic influences. Morphological features and processes could be sensitive to change as a result temporary or permanent works. **Groundwater:** Aquifer providing water for agricultural or industrial use with limited connection to surface water. (Secondary B and Secondary undifferentiated aquifers, as defined by the Environment Agency, are assigned a Medium importance). Unlicensed non-potable groundwater abstractions. Groundwater supporting a nationally designated or non-statutory locally designated site of nature conservation with low groundwater dependency, or groundwater supporting a non-designated site (including HPI) with a moderate or high groundwater dependency. Groundwater quality within a SPZ3 (total catchment zone) for a licensed abstraction. Grade II listed buildings. Locally important infrastructure and buildings.
Low	**Flood risk and drainage**: Water compatible development that is at risk of potential flood risk impacts. **Surface water**: Watercourses not having a WFD classification shown in a RBMP and Q_{95} ≤0.001m^3/s. **Hydromorphology**: A highly modified watercourse that exhibits no morphological diversity and has a uniform channel, showing no evidence of active fluvial processes. Has likely been significantly affected by anthropogenic factors which may include modification of flow regime, resulting in a dry channel during prolonged dry periods. Morphological features and processes would be unlikely to be sensitive to temporary or permanent works. Includes heavily modified main rivers and drainage channels. **Groundwater:** Unproductive strata. Groundwater supporting a non-designated site (including HPI) with low groundwater dependency. Undesignated historic buildings.
Climate (DMRB LA 114, Table 3.39a)	
Note:	The assessment criteria below relate to the Proposed Scheme's vulnerability to climate change. The assessment of significance is a function of the likelihood of a climate event occurring, and the consequence if an event occurred. The below criteria therefore relate to likelihood, rather than sensitivity / value of receptor.
Very high	The event occurs multiple times during the lifetime of the project (60 years) e.g. approximately annually, typically 60 events.
High	The event occurs several times during the lifetime of the project (60 years) e.g. approximately once every five years, typically 12 events.
Medium	The event occurs limited times during the lifetime of the project (60 years) e.g. approximately once every 15 years, typically 4 events.
Low	The event occurs during the lifetime of the project (60 years) e.g. once in 60 years.

Value (sensitivity)/ resource importance	Typical descriptors
Very low	The event can occur once during the lifetime of the project (60 years).

1.2 Magnitude criteria

1.2.1 This section tabulates how the magnitude of impacts will be determined. The criteria are based on Table 3.4N from DMRB LA 104 (recreated in Table 1.3). It has then been interpreted by technical specialists for each aspect in Table 1.4.

Table 1.3: Criteria to assess the magnitude of impacts, taken from DMRB LA 104

Magnitude of impact	Typical criteria descriptors
Major adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.
Moderate adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
Minor adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
Negligible adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.
Negligible beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
Minor beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Moderate beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Major beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.

Table 1.4: Topic-specific interpretation of the DMRB magnitude of impact criteria for the Proposed Scheme

Magnitude	Typical descriptors
Air Quality (using the criteria of change set out in DMRB LA 105 to support the determination of significant effects)	
Note:	Change in pollutant levels can be either adverse or beneficial, depending on the direction of change. Construction dust impacts will be assessed in accordance with DMRB LA 105.
Large	Large change (>4 µg/m³). Greater than of 10 % of annual mean NO_2 and PM_{10} air quality objectives (4µg/m³). For receptors above the air quality objective or limit value.
Medium	Medium change (>2 to 4 µg/m³). Greater than 5 % (2µg/m³), but less than (4µg/m³) of 10% of annual mean NO_2 and PM_{10} air quality objectives. For receptors above the air quality objective or limit value.
Small	Small change (>0.4 to 2µg/m³). More than 1% of objective (0.4µg/m³) and less than 5% (2µg/m³). For receptors above the air quality objective or limit value.
Imperceptible	Imperceptible change (≤ 0.4 µg/m³). Less than or equal to 1% of annual mean NO_2 and PM_{10} air quality objectives (0.4µg/m³). For receptors above the air quality objective or limit value.
Ecological receptors	Greater than 1% change in nitrogen deposition (then to be assessed by scheme ecologist for significance and associated mitigation).
Cultural Heritage (using criteria set out in DMRB LA 104, DMRB LA 106 and using professional judgement)	
Note:	Changes to asset setting can be either adverse or beneficial, depending on the direction of change.
Major	**Archaeological remains**: Change to most or all key archaeological materials, such that the resource is totally altered. Comprehensive changes to setting. **Historic buildings**: Change to key historic building elements, such that the resource is totally altered. Comprehensive changes to the setting. **Historic landscapes**: Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit.

Magnitude	Typical descriptors
Moderate	**Archaeological remains**: Changes to many key archaeological materials, such that the resource is clearly modified. Considerable changes to setting that affect the character of the asset. **Historic buildings**: Change to many key historic building elements, such that the resource is significantly modified. Changes to the setting of an historic building, such that it is significantly modified. **Historic landscapes**: Changes to many key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, noticeable differences in noise or sound quality, considerable changes to use or access; resulting in moderate changes to historic landscape character.
Minor	**Archaeological remains**: Changes to key archaeological materials, such that the asset is slightly altered. Slight changes to setting. **Historic buildings**: Change to key historic building elements, such that the asset is slightly different. Change to setting of an historic building, such that it is noticeably changed. **Historic landscapes**: Changes to few key historic landscape elements, parcels or components, slight visual changes to few key aspects of historic landscape, limited changes to noise levels or sound quality; slight changes to use or access; resulting in limited changes to historic landscape character.
Negligible	**Archaeological remains**: Very minor changes to archaeological materials or setting. **Historic buildings**: Slight changes to historic buildings elements or setting that hardly affect it. **Historic landscapes**: Very minor changes to key historic landscape elements, parcels or components, virtually unchanged visual effects, very slight changes in noise levels or sound quality; very slight changes to use or access; resulting in a very small change to historic landscape character.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.
Landscape and Visual (DMRB LA 107)	
Note:	DMRB LA 107 refers to ‘magnitude of effects’, not ‘magnitude of impacts’.
Landscape	
Major adverse	Total loss or large-scale damage to existing landscape character or distinctive features or elements; and/or addition of new uncharacteristic, conspicuous features or elements (i.e. road infrastructure).
Moderate adverse	Partial loss or noticeable damage to existing landscape character or distinctive features or elements; and/or addition of new uncharacteristic, noticeable features or elements (i.e. road infrastructure).

Magnitude	Typical descriptors
Minor adverse	Slight loss or damage to existing landscape character of one (maybe more) key features and elements; and/or addition of new uncharacteristic features and elements.
Negligible adverse	Very minor loss, damage or alteration to existing landscape character of one or more features and elements.
No change	No noticeable alteration or improvement, temporary or permanent, of landscape character of existing features and elements.
Negligible beneficial	Very minor noticeable improvement of character by the restoration of one or more existing features and elements.
Minor beneficial	Slight improvement of landscape character by the restoration of one (maybe more) key existing features and elements; and/or the addition of new characteristic features.
Moderate beneficial	Partial or noticeable improvement of landscape character by restoration of existing features or elements; or addition of new characteristic features or elements or removal of noticeable features or elements.
Major beneficial	Large scale improvement of landscape character to features and elements; and/or addition of new distinctive features or elements, or removal of conspicuous road infrastructure elements.
Visual	
Note:	Effects may be adverse or beneficial, depending on the direction of change.
Major	The project, or a part of it, would become the dominant feature or focal point of the view.
Moderate	The project, or a part of it, would form a noticeable feature or element of the view which is readily apparent to the receptor.
Minor	The project, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the project work or activity would be discernible, or being at such a distance it would form a barely noticeable feature or element of the view.
No change	No part of the project work or activity would be discernible.
Biodiversity (DMRB LA 108)	
Major adverse	• Permanent/irreversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource
Moderate adverse	• Temporary/reversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource

Magnitude	Typical descriptors
Minor adverse	• Permanent/irreversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource
Negligible adverse	• Temporary/reversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource
No change	• No observable impact, either positive or negative.
Negligible beneficial	• Temporary addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource
Minor beneficial	• Permanent addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource
Moderate beneficial	• Temporary addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource
Major beneficial	• Permanent addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource
Geology and Soils (DMRB LA 109)	
Note:	The descriptors below all relate to adverse effects. Beneficial effects will be based on the potential for betterment of adverse soil quality which may be harmful to human health, surface water and groundwater. This could be through removal of impacted soils off site or in situ / ex-situ remediation of soils as part of the site development. Where there is the potential for beneficial effects to soils quality as part of the development, professional judgement will be used. **Human health:** contaminant concentrations reduced below levels outlined in relevant screening criteria (e.g. category 4 screening levels). **Surface water quality:** removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification **Groundwater quality:** removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body WFD classification.

Magnitude	Typical descriptors
Major	**Geology:** Loss of geological feature / designation and/or quality and integrity, severe damage to key characteristics, features or elements. **Soil:** Physical removal or permanent sealing of agricultural land. **Contamination:** • **Human health:** Significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (e.g. category 4 screening levels) with potential for significant harm to human health. Contamination heavily restricts future use of land. • **Surface water quality:** Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT and compliance failure with EQS values. Calculated risk of pollution from a spillage ≥2% annually (spillage assessment). Loss of regionally important public water supply (licensed surface water abstraction for public water supply). Reduction in water body WFD classification • **Groundwater quality:** Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Potential high risk of pollution to groundwater from routine runoff - risk score >250 (groundwater quality and runoff assessment). Calculated risk of pollution from spillages ≥2% annually (spillage assessment)
Moderate	**Geology:** Partial loss of geological feature / designation, potentially adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements. **Soil:** Permanent loss / reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource). **Contamination:** • **Human health:** Contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g. category 4 screening levels). Significant contamination can be present. Control / remediation measures are required to reduce risks to human health / make land suitable for intended use • **Surface water quality:** Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages ≥1% annually and <2% annually. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification • **Groundwater quality:** Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial/ industrial/ agricultural supplies. Potential medium risk of pollution to groundwater from routine runoff - risk score 150-250. Contribution to reduction in water body WFD classification.

Magnitude	Typical descriptors
Minor	**Geology:** Minor measurable change in geological feature / designation attributes, quality or vulnerability. Minor loss of, or alteration to, one (maybe more) key characteristics, features or elements **Soil:** Temporary loss / reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource). **Contamination:** • **Human health:** Contaminant concentrations are below relevant screening criteria (e.g. category 4 screening levels). Significant contamination is unlikely with a low risk to human health. Best practice measures can be used to avoid or reduce risks to human health. • **Surface water quality:** Failure of either acute soluble or chronic sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages ≥0.5% annually and < 1% annually. Minor effects on water supplies. • **Groundwater quality:** Potential low risk of pollution to groundwater from routine runoff - risk score <150. Calculated risk of pollution from spillages ≥0.5% annually and <1% annually. Minor effects on an aquifer and abstractions.
Negligible	**Geology:** Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature / designation. Overall integrity of resource not affected. **Soil:** No discernible loss / reduction of soil function(s) that restrict current or approved future use. **Contamination:** • **Human health:** Contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g. category 4 screening levels). No requirement for control measures to reduce risks to human health / make land suitable for intended use. • **Surface water quality:** No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5%. • **Groundwater quality:** No measurable impact upon an aquifer and/or groundwater receptors and risk of pollution from spillages <0.5%.
Material Assets and Waste (no magnitude criteria assigned to this aspect in DMRB LA 110 as assessment is based on significance criteria alone)	
Noise and Vibration	
Noise and Vibration – effect levels (DMRB LA 111)	

	Time period	LOAEL	SOAEL
Construction time period LOAEL and SOAEL	Day (0700-1900 weekday and 0700-1300 Saturdays)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 of BS 5228-1

Magnitude	Typical descriptors		
	Night (2300-0700)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 of BS 5228-1
	Evening and weekends (time periods not covered above)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 of BS 5228-1
Construction vibration LOAELs and SOAELs for all receptors	All time periods	0.3mm/s PPV	1.0mm/s PPV
Operational noise LOAELs and SOAELs for all receptors	Day (06:00-24:00)	55dB $L_{A10,18hr}$ facade	68dB $L_{A10,18hr}$ facade
	Night (23:00-07:00)	40dB $L_{night, outside}$ (free-field)	55dB $L_{night, outside}$ (free-field)
Noise and Vibration – magnitude (DMRB LA 111)			
Note:	Beneficial effects are not possible from construction noise or vibration as construction activities cannot lower the existing acoustic climate at a receptor.		
Major adverse	**Construction Noise: Construction noise level above or equal to SOAEL +5dB** **Construction traffic noise:** Increase in BNL of closest public road used for construction traffic (dB) above or equal to +5dB. **Construction vibration:** Vibration level above or equal to 10 mm/s PPV. **Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) greater than or equal to +5.0. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) greater than or equal to +10.0.		
Moderate adverse	**Construction Noise: Construction noise level above or equal to SOAEL and below SOAEL +5dB** **Construction traffic noise:** Increase in BNL of closest public road used for construction traffic (dB) above or equal to +3dB and below +5dB. **Construction vibration:** Vibration level above or equal to SOAEL of 1.0 mm/s and below 10 mm/s PPV. **Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) +3.0 to +4.9. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) +5.0 to +9.9.		

Magnitude	Typical descriptors
Minor adverse	**Construction Noise: Construction noise level above or equal to LOAEL and below SOAEL** **Construction traffic noise:** Increase in BNL of closest public road used for construction traffic (dB) above or equal to +1dB and below+3dB. **Construction vibration:** Vibration level above or equal to LOAEL and below SOAEL of 1.0 mm/s. **Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) +1.0 to +2.9. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) +3.0 to +4.9.
Negligible adverse	**Construction Noise: Construction noise level below LOAEL** **Construction traffic noise:** Increase in BNL of closest public road used for construction traffic (dB) below +1dB. **Construction vibration:** Vibration level below LOAEL. **Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) less than +1.0. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) less than +2.9.
No change	**Operational noise (short-term / long-term):** No noise change
Negligible beneficial	**Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) less than -1.0. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) less than -2.9.
Minor beneficial	**Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) -1.0 to -2.9. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) -3.0 to -4.9.
Moderate beneficial	**Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) -3.0 to -4.9. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) -5.0 to -9.9.
Major beneficial	**Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) greater than or equal to -5.0. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) greater than or equal to -10.0.

Magnitude	Typical descriptors
Population and Human Health (DMRB LA 112)	
Major	**Private property and housing, community land and assets, development land and businesses, and agricultural land holdings:** • Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements. e.g. direct acquisition and demolition of buildings and direct develop`ent of land to accommodate highway assets • Introduction (adverse) or removal (beneficial) of complete severance with no/full accessibility provision **Walkers, cyclists, horse riders:** >500m increase (adverse) / decrease (beneficial) in walking/cycling/horse rider journey length.
Moderate	**Private property and housing, community land and assets, development land and businesses, and agricultural land holdings:** • Partial loss of/damage to key characteristics, features or elements, e.g. partial removal or substantial amendment to access or acquisition of land compromising viability of property, businesses, community assets or agricultural holdings • Introduction (adverse) or removal (beneficial) of severe severance with limited / moderate accessibility provision **Walkers, cyclists, horse riders:** >250m - 500m increase (adverse) or decrease (beneficial) in walking/cycling/horse rider journey length.
Minor	**Private property and housing, community land and assets, development land and businesses, and agricultural land holdings:** • A discernible change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements, e.g. amendment to access or acquisition of land resulting in changes to operating conditions that do not compromise overall viability of property, businesses, community assets or agricultural holdings • Introduction (adverse) or removal (beneficial) of severance with adequate accessibility provision **Walkers, cyclists, horse riders:** >50m - 250m increase (adverse) or decrease (beneficial) in walking/cycling/horse rider journey length.
Negligible	**Private property and housing, community land and assets, development land and businesses, and agricultural land holdings:** • Very minor loss or detrimental alteration to one or more characteristics, features or elements. e.g. acquisition of non-operational land or buildings not directly affecting the viability of property, businesses, community assets or agricultural holdings • Very minor introduction (adverse) or removal (beneficial) of severance with ample accessibility provision **Walkers, cyclists, horse riders:** <50m increase (adverse) or decrease (beneficial) in walking/cycling/horse rider journey length.
No change	No loss or alteration of characteristics, features, elements or accessibility; no observable impact in either direction.

Magnitude	Typical descriptors
Road Drainage and the Water Environment (DMRB LA 113, except for hydromorphology)	
Notes:	There are no magnitude criteria in DMRB LA 113 for the hydromorphology aspect. The magnitude criteria for hydromorphology below are based on organisational judgement.
Major adverse	**Flood risk:** Increase in peak flood level (1% annual probability event) >100mm. **Hydromorphology**: Loss or extensive damage to habitat due to extensive modification of natural channel planform, and/or sediment and flow processes. Replacement of a large extent of the natural bed and/or banks with artificial material. **Surface water quality**: Failure of both soluble and sediment bound pollutants in HEWRAT and compliance failure with environmental quality standard (EQS) values. Calculated risk of pollution from a spillage >2% annually (spillage assessment). Loss or extensive change to a fishery. Loss of regionally important public water supply. Loss or extensive change to a designated nature conservation site. Reduction in water body WFD classification. **Groundwater:** Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Potential high risk of pollution to groundwater from routine runoff or spillages on the carriageway. Loss of, or extensive change to GWDTEs, baseflow contributions to protected surface water bodies, or springs/sinks/sources/issues. Reduction in water body WFD classification. Loss or significant damage to major structures through subsidence or similar effects.
Moderate adverse	**Flood risk:** Increase in peak flood level (1% annual probability event) >50mm. **Hydromorphology**: Moderate deterioration from baseline conditions, with partial loss or damage to habitat due to modifications and/or changes to natural fluvial forms and processes. Replacement of the natural bed and/or banks with artificial material. **Surface water quality**: Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from a spillage >1% annually and <2% annually. Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification. **Groundwater:** Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial/ industrial/ agricultural supplies. Potential medium risk of pollution to groundwater from routine runoff or spillages on the carriageway. Partial loss of the integrity of GWDTEs, baseflow contributions, or springs/sinks/sources/issues. Contribution to reduction in water body WFD classification. Damage to major structures through subsidence or similar effects or loss of minor structures.

Magnitude	Typical descriptors
Minor adverse	**Flood risk**: Increase in peak flood level (1% annual probability event) >10mm. **Hydromorphology**: Slight deterioration from baseline conditions, with partial loss/damage to habitat due to modifications and/or changes to natural fluvial forms and processes. **Surface water quality**: Failure of either soluble or sediment bound pollutants in HEWRAT. Calculated risk of pollution from a spillage ≥0.5 annually and <1% annually. Minor effects on water supply. **Groundwater:** Potential low risk of pollution to groundwater from routine runoff or spillages on the carriageway. Minor effects on an aquifer, GWDTEs, abstractions, baseflow contributions, springs/sinks/sources/issues, and structures.
Negligible	The project may adversely affect the integrity of the water environment, although this is not considered measurable. **Flood risk:** Negligible change to peak flood level (1% annual probability event) ≤ ± 10mm. **Hydromorphology:** Very slight change from surface water baseline conditions, approximating to a 'no change' situation. **Surface water quality:** No risk identified in HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5% annually. **Groundwater:** No measurable impact upon an aquifer and/or groundwater receptors.
Minor beneficial	**Flood risk:** Creation of flood storage and decrease in peak flood level (1% annual probability event) >10mm. **Hydromorphology**: Slight improvement of baseline conditions through partial improvement/gain in riparian or in-channel habitat. Slight diversification of flow processes and/or sediment processes. **Surface water quality**: HEWRAT assessment of either acute-soluble or chronic-sediment related pollutants becomes a 'pass' from an existing baseline of a 'fail' condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage is <1% annually). **Groundwater:** Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding.
Moderate beneficial	**Flood risk:** Creation of flood storage and decrease in peak flood level (1% annual probability event) >50mm. **Hydromorphology**: Moderate improvement from baseline conditions, with partial creation of both in-channel and riparian habitat. Removal of existing superfluous structure or artificial channel bed/bank. Moderate diversification of flow processes and/or sediment processes. **Surface water quality**: HEWRAT assessment of both acute-soluble and chronic-sediment-bound pollutants becomes a 'pass' from an existing baseline of a 'fail' condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage is >1% annually). Contribution to improvement in water body WFD classification. **Groundwater:** Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management Strategy (or equivalent) classification. Support to significant improvements in damaged GWDTE.

Magnitude	Typical descriptors
Major beneficial	**Flood risk:** Creation of flood storage and decrease in peak flood level (1% annual probability event) >100mm. **Hydromorphology**: Extensive enhancement in-channel habitat and/or riparian habitat, as well as diversification of flow and sediment processes. Removal of an existing superfluous structure or artificial channel bed/bank. Extensive diversification of flow processes and/or sediment processes. **Surface water quality**: Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification. **Groundwater:** Recharge of an aquifer. Improvement in water body WFD classification.
Climate (DMRB LA 114, Table 3.39b)	
Note	The assessment criteria below relate to the project's vulnerability to climate change and the associated consequences, rather than magnitude of impact.
Very large adverse	National level (or greater) disruption to strategic route(s) lasting more than 1 week.
Large adverse	National level disruption to strategic route(s) lasting more than 1 day but less than 1 week or regional level disruption to strategic route(s) lasting more than 1 week.
Moderate adverse	Regional level disruption to strategic route(s) lasting more than 1 day but less than 1 week.
Minor adverse	Regional level disruption to strategic route(s) lasting less than 1 day.
Negligible	Disruption to an isolated section of a strategic route lasting less than 1 day.

Appendix 6.1. Air quality assessment methodology

1.1 Air quality dispersion modelling process

Introduction

1.1.1 The ADMS-Roads model has been developed by Cambridge Environmental Research Consultants (CERC) Ltd and is a version of an atmospheric modelling system that focuses on road traffic as a source of pollutant emissions. Version 5.0 (March 2020) has been used for this study (CERC, 2020).

1.1.2 The modelling system takes into account the emissions produced by light-duty and heavy duty-vehicles (LDV and HDV, respectively) travelling at a certain speed along a section of road over an average hour and predicts the dispersion of these emissions using appropriate historical meteorological data. The effect of meteorological conditions on dispersion is given a complex treatment within the model. The most significant factors are wind speed and direction, and the boundary layer height, which is the calculated mixing depth of the lower atmosphere.

Background concentrations (and adjustment factor)

1.1.3 The background concentrations across the study area have been derived using the national pollution maps published by Defra (Defra, 2020a). These cover the whole country on a 1km x 1km grid and are published for each year from 2018 until 2030.

1.1.4 To address the potential variation between mapped and monitored background nitrogen dioxide (NO_2) concentrations in the air quality study area, a comparison was made of 2018 background monitoring data from a number of nearby urban background Automatic Urban and Rural Network (AURN) monitoring sites against the 2018 mapped background concentrations for the corresponding grid square .

1.1.5 The comparison of monitored to mapped background oxides of nitrogen (NO_x) concentrations identified that the Defra maps tend to largely underpredict NO_x concentrations. An adjustment factor of 1.09 was therefore applied to the mapped background NO_x concentrations for each grid square used in the assessment. The calculations undertaken to determine the adjustment factor are shown in Table 1.1.

Table 1.1: Monitored and mapped concentrations for background adjustment (2018)

Site Name	Location (m)		Monitored concentration (µg/m^3)		Mapped concentration (µg/m^3)		Monitored NO_x/ mapped NO_x
	X	Y	NO_x	NO_2	NO_x	NO_2	
Salford Eccles	377925	398729	39.64	24.75	35.50	23.78	1.12
Manchester Piccadilly	384311	398337	56.96	34.64	49.38	30.42	1.15
Trafford Park Moss	378783	394726	29.50	17.97	25.69	18.19	1.15

Site Name	Location (m)		Monitored concentration (µg/m^3)		Mapped concentration (µg/m^3)		Monitored NO_x/ mapped NO_x
	X	Y	NO_x	NO_2	NO_x	NO_2	
Trafford Wellacre Academy	373758	394473	20.81	14.58	21.90	15.85	0.95
Adjustment factor:							1.09

1.1.6 The 'in-grid square' contribution from major road sectors included in the model has been removed from the background annual mean NO_x and PM_{10} (particulate matter with an aerodynamic diameter of less than 10µm) concentration estimates, and background annual mean NO_2 estimates have been corrected using the Defra Sector Removal Tool Version 8.0 and Defra NO_x to NO_2 Calculator Version 8.1 (Defra, 2020b). This process has been undertaken to avoid double-counting of road traffic emissions modelled in ADMS-Roads. The estimated background pollutant concentrations in the study area are well below the relevant Air Quality Objectives (AQOs) for NO_2 and PM_{10} in 2018.

Road parameters

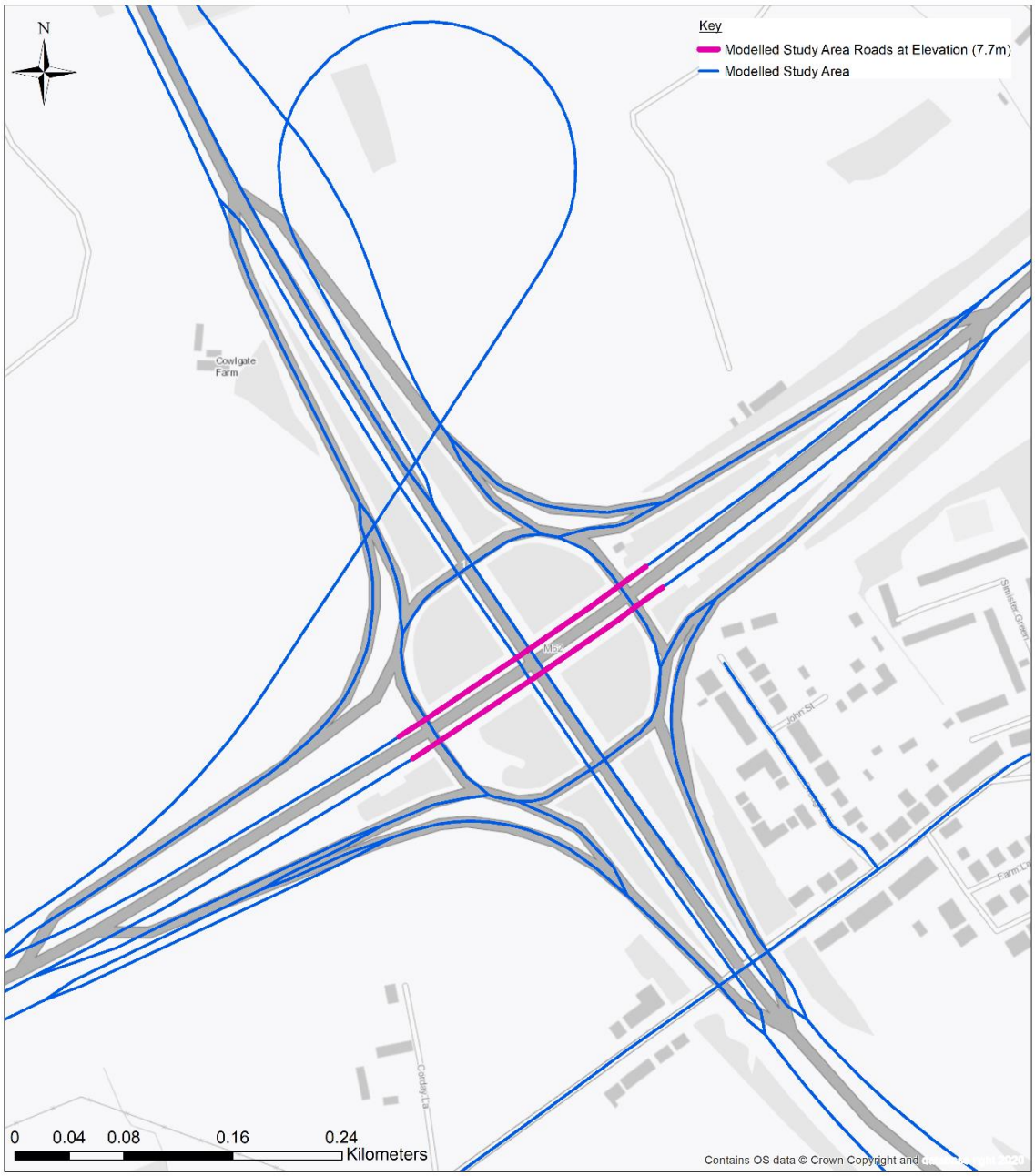
1.1.7 The ADMS-Roads model requires lengths of road of equal width (and height if specified as a canyon) to be input into the model. Road alignment and width were determined using the OS MasterMap base mapping within ArcGIS.

Road elevation

1.1.8 Two road sections have been modelled at elevation to better account for the dispersion of pollutants from those roads within the air quality study area.

1.1.9 Specifically, a section of the M62 at J18 was modelled at height due to its elevation over the Simister Island roundabout. This section of road was modelled at 7.7m elevation with the modelled height above the Simister Island roundabout approximated using Google StreetView. The location and extent of the road links modelled at elevation are shown below on Plate 1.1.

Plate 1.1: Location and extent of roads modelled at elevation (7.7m)



Traffic data

1.1.10 Traffic data for the modelling scenarios has been provided from the traffic model, which has been developed by Jacobs. The base year air quality modelling uses traffic data, pollution measurements and meteorological measurements from 2018.

1.1.11 Traffic data were provided for the following scenarios:

- Base year (2018) – the existing situation
- Operational opening year (2027) – without Proposed Scheme – 'Do-Minimum' (DM):
  - Represents the future baseline conditions in 2027, without the Proposed Scheme in place, utilising 2027 transport growth factors.

- Accounts for known planning commitments and developments in 2027, including the modified South Heywood Link Road – A4064 approach to M62 J19.

- Operational opening year (2027) – with Proposed Scheme – 'Do-Something' (DS):
  - Same as the opening year DM scenario but with the Proposed Scheme in place.

1.1.12 Traffic data which represents the average conditions occurring in specific time periods were provided for the periods specified in Table 1.2.

Table 1.2: Annual average time periods used

Traffic period		Time period
Annual average daily traffic (AADT)		00:00 – 24:00
Annual average weekday traffic (AAWT)	AM peak (AM)	07:00 – 10:00
	Inter peak (IP)	10:00 – 16:00
	PM peak (PM)	16:00 – 19:00
	Off peak (OP)	19:00 – 07:00

1.1.13 For each time period, the following traffic data parameters were provided:

- Total traffic flow, defined as vehicles/hour
- Percentage HDV
- Vehicle speed, in kilometres per hour (kph)
- Speed band

Screening approach

1.1.14 The traffic data within the Traffic Reliability Area (TRA) were screened using the criteria and thresholds set out within Design Manual for Roads and Bridges (DMRB) LA 105 (Highways England, Revision 0, 2019) which determined the Affected Road Network (ARN). The screening criteria are listed in Section 6.4 of Chapter 6: Air Quality, of the Preliminary Environmental Information Report (PEIR). Road links triggered as affected were discussed with the project transport modelling team for inclusion or exclusion within the air quality assessment.

Road traffic emissions

1.1.15 Emission rates for NO_X and PM_{10} were calculated from speed-banded traffic data inputs using the speed banded Highways England emission calculation tool (v4.2, based on v11.0 of Defra's Emission Factors Toolkit) (Highways England, 2020).

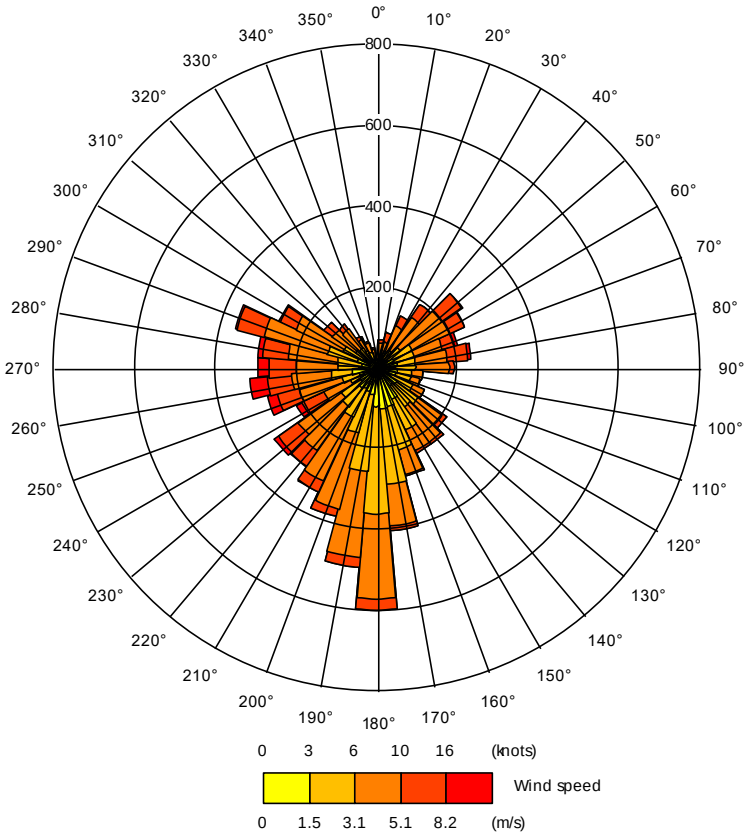
Meteorological data

1.1.16 In order to assess the impact of the Proposed Scheme upon local air quality using a dispersion model, it is important to use representative meteorological data. In simple

terms, meteorology is the next most significant factor in determining ambient pollutant levels after emissions.

1.1.17 Meteorological data for the dispersion modelling assessment were taken from Manchester Airport, which is considered to be the most representative source for the study area. The wind rose for Manchester Airport for 2018 is shown below in Plate 1.2 and shows the prevailing wind direction is from the south and south-west.

Plate 1.2: Manchester Airport windrose for 2018



Surface Roughness Length

1.1.18 The surface roughness length at the meteorological data site, where the wind speed measurements were taken, was set at 0.2m, whilst for the dispersion site, it was set at 0.5m to reflect the relative difference in surface roughness between the more rural setting of the meteorological site and the more suburban setting of the air quality study area.

Monin-Obukhov Length

1.1.19 ADMS-Roads models use the Monin-Obukhov length as a parameter to describe the turbulent length scale which is dependent on meteorological conditions. A minimum length can be used to account for the urban heat island effect, whereby retained heat in cities causes convective turbulence, which prevents the formation of a very shallow boundary layer at night. The larger the urban area, the stronger the effect of the urban heat island affecting the boundary layer. Cities and large towns, as well as mixed urban

areas with industrial spaces, have higher Monin-Obukhov length than small towns and locations with a predominance of vegetation. A Monin-Obukhov length of 30m was set for the modelled air quality study area..

Terrain

1.1.20 Terrain has an effect on the flow field in the air above it. It is recommended that the effect of terrain is incorporated into the ADMS-Roads model where gradients of greater than 1:10 exist within the modelled area, or a short way outside of it. No substantial gradients were identified in the air quality study area, and therefore terrain has not been explicitly accounted for in the air quality modelling.

1.2 Air quality model verification and adjustment

Introduction

1.2.1 The comparison of modelled atmospheric pollutant concentrations with local monitored concentrations is a process termed ‘verification’. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. The following are examples of potential causes of such discrepancies:

- Estimates of background pollutant concentrations
- Meteorological data uncertainties
- Traffic data uncertainties
- Vehicle emission factors uncertainties
- Model input parameters, such as ‘roughness length’
- Factors influencing dispersion such as buildings, barriers or vegetation
- Overall limitations of the dispersion model

Model precision

1.2.2 Residual uncertainty may remain after systematic error or ‘model accuracy’ has been accounted for in the final predictions. Residual uncertainty may be considered synonymous with the ‘precision’ of the model predictions, i.e. how wide the scatter or residual variability of the predicted values compare with the monitored true value, once systematic error has been allowed for. The quantification of model precision provides an estimate of how the final predictions may deviate from true (monitored) values at the same location over the same period.

Model performance

1.2.3 An evaluation of model performance has been undertaken to establish confidence in the modelled results. LAQM TG(16) (Defra, 2021a) identifies a number of statistical procedures that are appropriate to evaluate model performance and assess uncertainty. The statistical parameters of model uncertainty are presented in Table 1.3.

Table 1.3: Model performance statistics

Statistical Parameter	Comments	Ideal Value
Root Mean Squared Error (RMSE)	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared. If the RMSE values are higher than 25% of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. For example, if the model predictions are for the annual mean NO_2 AQO of 40µg/m^3, an RMSE of 10µg/m^3 or above would suggest the model parameters and model verification should be revisited. Ideally, an RMSE within 10% of the AQO would be derived, which equates to 4µg/m^3 for the annual mean NO_2 AQO.	<4.0
Fractional Bias (FB)	FB is used to identify if the model shows a systematic tendency to over or underpredict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model overprediction and positive values suggest a model underprediction.	0.0
Correlation Coefficient (CC)	CC is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of one means absolute relationship. This statistic can be particularly useful when comparing a large number of modelled and observed data points.	1.0

1.2.4 These parameters estimate how the model results agree or diverge from the observations.

1.2.5 These calculations have been carried out prior to and after adjustment and provide information on the improvement of the model predictions as a result of the application of the verification adjustment factors.

1.2.6 The verification process involves a review of the modelled air pollutant concentrations against corresponding monitoring data to determine how well the air quality model has performed. Depending on the outcome it may be considered that the model has performed adequately and that there is no need to adjust any of the modelled results.

1.2.7 Alternatively, the model may not perform well against the monitoring data, in which case there is a need to check all the input data to ensure that it is reasonable and accurately represented by the air quality modelling process. Where all input data, such as traffic data, emissions rates and background concentrations have been checked and considered reasonable, then the modelled results may require adjustment to improve alignment with the monitoring data. This adjustment may be made either by using a single verification adjustment factor (to be applied to the modelled concentrations across the study area) or a range of different adjustment factors to account for different situations in the study area.

1.3 Air quality monitoring annualisation and bias-adjustment

1.3.1 The air quality monitoring data collected as part of this assessment (i.e. the surveys carried out by Greater Manchester Combined Authority (GMCA), National Highways, Salford City Council (SCC) and Transport for Greater Manchester (TfGM)), were

reviewed to determine the suitability of each of the monitoring locations for inclusion in the model verification process.

1.3.2 As detailed in Section 6.7 of Chapter 6: Air Quality, those monitoring sites with data capture less than 75%, and/or with data only available for 2019 or 2021, were bias-adjusted (where required) and annualised to the 2018 base year. This was done in accordance with the guidance provided in LAQM TG(16).

1.3.3 All annualisation factors used in this assessment were derived from Automatic Urban and Rural Network (AURN) monitoring data for Trafford Wellacre Academy, Salford Eccles, Trafford Moss Park and Manchester Piccadilly, for the base year 2018 and the respective monitoring data year (Defra, 2021b).

Local authority and Transport for Greater Manchester monitoring

1.3.4 Bias-adjusted annual mean monitoring data was obtained from the GMCA 2019 Air Quality Annual Status Report (ASR) (GMCA, 2020) and the TfGM monitoring data (TfGM, 2021). The monitoring data for those sites with 2019 data only included: BU15, BU16, BU17, BU19 and MAN98 for local authority, and BUR-A1 – 5 and BUR-B1 – 3 for TfGM. The monitoring data for these sites was annualised to the 2018 base year using an annualisation factor of 0.96. This factor was derived from an average of the ratios of measured 2018 and 2019 annual mean NO_2 concentrations at four nearby AURN sites (namely Trafford Wellacre Academy (0.94), Salford Eccles (0.99), Trafford Moss Park (0.95) and Manchester Piccadilly (0.96)).

1.3.5 The annualisation adjustment for the local authority and TfGM monitoring sites is shown in Table 1.4.

Table 1.4: Annualised local authority and Transport for Greater Manchester monitoring data

Site ID	Source	X (m)	Y (m)	Data capture (%)	Bias Adjusted NO_2 2019 annual mean (µg/m^3)	Annualisation factor	Annualised and bias adjusted NO_2 2018 annual mean (µg/m^3)
BU15	GMCA	380852	405209	100.0	46.6	0.96	44.7
BU16	GMCA	380914	404898	100.0	46.8	0.96	44.9
BU17	GMCA	381105	404279	100.0	35.4	0.96	34.0
BU19	GMCA	381321	405115	91.7	42.1	0.96	40.4
MAN98	GMCA	388460	403313	91.7	36.2	0.96	34.8
BUR-A1	TfGM	381138	404194	100.0	48.6	0.96	46.6
BUR-A2	TfGM	381085	404275	85.7	56.5	0.96	54.2
BUR-A3	TfGM	380917	404886	100.0	47.6	0.96	45.6
BUR-A4	TfGM	380888	404927	100.0	60.2	0.96	57.8
BUR-A5	TfGM	380877	405085	100.0	54.2	0.96	52.0
BUR-B1	TfGM	384152	404624	100.0	60.9	0.96	58.4
BUR-B2	TfGM	384533	405037	85.7	42.9	0.96	41.1

Site ID	Source	X (m)	Y (m)	Data capture (%)	Bias Adjusted NO_2 2019 annual mean ($\mu g/m^3$)	Annualisation factor	Annualised and bias adjusted NO_2 2018 annual mean ($\mu g/m^3$)
BUR-B3	TfGM	384772	405108	100.0	35.7	0.96	34.2
Note: The diffusion tubes were supplied by Staffordshire Scientific Services and prepared using 20% triethanolamine (TEA) in water.							

National Highways monitoring

1.3.6 Monitoring data was obtained from the National Highways monitoring survey (National Highways, 2020). A portion of the data for the 2018 base year, due to a low data capture (less than 75%), were annualised using the Defra annualisation tool (Defra, 2020c) and then bias-adjusted using a 2018 Defra national bias-adjustment factor of 0.88 (Defra, 2021c). Specifically, this was done for M60_Oldham_2A/B/C, M60_Oldham_12A/B/C and M60_Oldham_18A/B/C.

1.3.7 The annualisation and bias adjustment for this first set of National Highways monitoring data is shown in Table 1.5.

Table 1.5: Annualised and bias-adjusted National Highways monitoring data (set 1)

Site ID	X (m)	Y (m)	Data capture (%)	NO_2 2018 period mean ($\mu g/m^3$)	Annualisation factor	Annualised and adjusted NO_2 2018 annual mean ($\mu g/m^3$)
M60_Oldham_2A	388466	403388	66.7	35.9	1.10 [a]	34.8
M60_Oldham_2B	388466	403388	66.7	38.0	1.10 [a]	36.8
M60_Oldham_2C	388466	403388	58.3	37.9	1.06 [b]	35.3
M60_Oldham_18A	386974	403889	66.7	30.5	1.10 [a]	29.5
M60_Oldham_18B	386974	403889	66.7	27.0	1.10 [a]	26.1
M60_Oldham_18C	386974	403889	58.3	28.5	1.09 [c]	27.2
M60_Oldham_12A	386867	404034	66.7	25.2	1.10 [a]	24.4
M60_Oldham_12B	386867	404034	66.7	25.3	1.10 [a]	24.5
M60_Oldham_12C	386867	404034	66.7	25.1	1.10 [a]	24.3

Note: The diffusion tubes were supplied by Staffordshire Scientific Services and prepared using 20% triethanolamine (TEA) in water.

[a] This factor was derived from an average of the ratios of measured period mean and 2018 annual mean NO_2 concentrations at four nearby AURN sites (namely Trafford Wellacre Academy (1.13), Salford Eccles (1.08), Trafford Moss Park (1.10) and Manchester Piccadilly (1.09)).

[b] This factor was derived from an average of the ratios of measured period mean and 2018 annual mean NO_2 concentrations at four nearby AURN sites (namely Trafford Wellacre Academy (1.07), Salford Eccles (1.05), Trafford Moss Park (1.07) and Manchester Piccadilly (1.06)).

[c] This factor was derived from an average of the ratios of measured period mean and 2018 annual mean NO_2 concentrations at four nearby AURN sites (namely Trafford Wellacre Academy (1.11), Salford Eccles (1.08), Trafford Moss Park (1.07) and Manchester Piccadilly (1.08)).

1.3.8 Additionally, a further set of National Highways data of three sites: Manchester_Tube 5 (1)/(2), Manchester_Tube 6 and Manchester_Tube 22, for 2019, was also annualised to 2018. The 2019 monitoring data for the sites was first bias-adjusted using a 2019 Defra national bias-adjustment factor of 0.96 (Defra, 2021c) and the Manchester_Tube 5 (1)/(2) site data was annualised for 2019 in the same process as the first set due to a low data capture (less than 75%).

1.3.9 The bias-adjusted and annualised 2019 annual mean data were then further annualised to 2018 in accordance with the guidance provided in LAQM TG(16). The bias-adjustment and both sets of annualisation for this second set of National Highways monitoring data is shown in Table 1.6.

Table 1.6: Annualised and bias-adjusted National Highways monitoring data (set 2)

Site ID	X (m)	Y (m)	Data capture (%)	NO_2 2019 period mean (µg/m^3)	Annualisation factor	Annualised and adjusted NO_2 2019 annual mean (µg/m^3)	Annualisation factor [c]	Annualised and adjusted NO_2 2018 annual mean (µg/m^3)
Manchester_Tube_5 (1)	386617	403937	50.0	27.3	0.97 [a]	25.4	0.96	24.4
Manchester_Tube_5 (2)	386617	403937	66.7	25.5	1.03 [b]	25.3	0.96	24.2
Manchester_Tube 6	386585	404074	75.0	29.5	N/A	28.4	0.96	27.2
Manchester_Tube 22	386527	403974	75.0	31.1	N/A	29.8	0.96	28.6

Note: The diffusion tubes were supplied by Staffordshire Scientific Services and prepared using 20% triethanolamine (TEA) in water.

[a] This factor was derived from an average of the ratios of measured period mean and 2019 annual mean NO_2 concentrations at four nearby AURN sites (namely Trafford Wellacre Academy (0.97), Salford Eccles (0.98), Trafford Moss Park (0.93) and Manchester Piccadilly (1.01)).

[b] This factor was derived from an average of the ratios of measured period mean and 2019 annual mean NO_2 concentrations at four nearby AURN sites (namely Trafford Wellacre Academy (1.02), Salford Eccles (1.05), Trafford Moss Park (1.02) and Manchester Piccadilly (1.04)).

[c] This factor was derived from an average of the ratios of measured 2018 and 2019 annual mean NO_2 concentrations at four nearby AURN sites (namely Trafford Wellacre Academy (0.94), Salford Eccles (0.99), Trafford Moss Park (0.95) and Manchester Piccadilly (0.96)).

Scheme-specific monitoring

1.3.10 National Highways undertook a six-month air quality monitoring survey using diffusion tubes for NO_2, from 28 April 2021 to 13 October 2021, due to previously identified gaps in the existing monitoring (Jacobs, 2021). Monitoring was undertaken at locations close to the Proposed Scheme, along the M60, M62 and M66 motorway corridors, and at other key locations in Whitefield and Prestwich. This was undertaken to generate a more comprehensive baseline dataset, and to support the necessary verification of the assessment results and stakeholder engagement.

1.3.11 Scheme-specific monitoring was undertaken at 22 locations. The sites within the air quality study area and considered in this assessment are shown on Figure 6.2 of the PEIR.

1.3.12 In accordance with guidance from LAQM TG(16), a NO_2 projection factor of 1.17 was applied to the weighted 2021 period mean for all sites within the air quality study area to generate the weighted 2018 period mean (Defra, 2021d). This was done to compensate for the general trend of reducing concentrations in future years.

1.3.13 The monitoring data was then annualised from the six-month period to the 2018 base year annual mean using annualisation factors derived from the AURN monitoring data, and then bias-adjusted using a local bias-adjustment factor developed from the co-located site DT3/4/5. The final annualisation adjustment to the 2018 base year for all scheme-specific monitoring locations is shown in Table 1.7.

Table 1.7: Annualised and bias-adjusted scheme-specific monitoring data

Site ID	X (m)	Y (m)	Data capture (%)	NO_2 2021 weighted period mean (µg/m^3)	NO_2 projection factor	NO_2 2018 factored weighted period mean (µg/m^3)	2018 Annualisation factor	Annualised NO_2 2018 annual mean (µg/m^3)	Local bias adjustment factor	Annualised and adjusted NO_2 2018 annual mean (µg/m^3)
DT3	380636	406973	41.7	21.9	1.17	25.6	1.29 [a]	33.0	0.73	24.1
DT4	380636	406973	41.7	21.2	1.17	24.8	1.29 [a]	32.0	0.73	23.4
DT5	380636	406973	41.7	21.9	1.17	25.7	1.29 [a]	33.1	0.73	24.2
DT7	382322	405715	50.0	25.2	1.17	29.4	1.32 [b]	38.8	0.72	27.9
DT10	382315	405483	50.0	20.1	1.17	23.5	1.32 [b]	31.0	0.72	22.3
DT11	382925	405676	50.0	28.6	1.17	33.5	1.32 [b]	44.1	0.72	31.8
DT14	383038	405757	50.0	32.7	1.17	38.2	1.32 [b]	50.4	0.72	36.3
DT15	382974	405930	50.0	33.7	1.17	39.4	1.32 [b]	51.9	0.72	37.4
DT17	386400	408719	50.0	26.7	1.17	31.3	1.32 [b]	41.2	0.72	29.7
J_001	383806	405300	50.0	36.5	1.17	42.6	1.32 [b]	56.2	0.72	40.5
J_002	382984	405718	50.0	57.7	1.17	67.5	1.32 [b]	89.0	0.72	64.1
J_003	382425	405493	41.7	17.4	1.17	20.3	1.35 [c]	27.6	0.71	19.7
J_004	382236	407788	50.0	41.4	1.17	48.4	1.32 [b]	63.8	0.72	45.9
J_005	381976	409139	41.7	36.9	1.17	43.2	1.32 [d]	57.2	0.71	40.7
J_006	381153	408316	50.0	32.6	1.17	38.2	1.32 [b]	50.3	0.72	36.2
J_007	379788	404428	50.0	98.3	1.17	114.9	1.32 [b]	151.4	0.72	109.1
J_008	383206	403451	50.0	35.0	1.17	40.9	1.32 [b]	53.9	0.72	38.8

Site ID	X (m)	Y (m)	Data capture (%)	NO_2 2021 weighted period mean ($\mu g/m^3$)	NO_2 projection factor	NO_2 2018 factored weighted period mean ($\mu g/m^3$)	2018 Annualisation factor	Annualised NO_2 2018 annual mean ($\mu g/m^3$)	Local bias adjustment factor	Annualised and adjusted NO_2 2018 annual mean ($\mu g/m^3$)
J_009	381608	405231	50.0	31.3	1.17	36.6	1.32 [b]	48.2	0.72	34.7
J_010	381787	405302	50.0	28.1	1.17	32.9	1.32 [b]	43.3	0.72	31.2
J_011	381243	405057	50.0	35.3	1.17	41.3	1.32 [b]	54.4	0.72	39.2
J_012	381381	405155	50.0	35.4	1.17	41.4	1.32 [b]	54.6	0.72	39.3
J_013	381105	404279	50.0	31.1	1.17	36.3	1.32 [b]	47.9	0.72	34.5
J_014	380917	404892	50.0	40.6	1.17	47.5	1.32 [b]	62.6	0.72	45.1
J_015	382294	404807	50.0	18.5	1.17	21.6	1.32 [b]	28.4	0.72	20.5

Note: The diffusion tubes were supplied by Staffordshire Scientific Services and prepared using 20% triethanolamine (TEA) in water.

[a] This factor was derived from an average of the ratios of measured period mean and 2018 annual mean NO_2 concentrations at four nearby AURN sites (namely Trafford Wellacre Academy (1.44), Salford Eccles (1.17), Trafford Moss Park (1.36) and Manchester Piccadilly (1.20)).

[b] This factor was derived from an average of the ratios of measured period mean and 2018 annual mean NO_2 concentrations at four nearby AURN sites (namely Trafford Wellacre Academy (1.42), Salford Eccles (1.20), Trafford Moss Park (1.42) and Manchester Piccadilly (1.23)).

[c] This factor was derived from an average of the ratios of measured period mean and 2018 annual mean NO_2 concentrations at four nearby AURN sites (namely Trafford Wellacre Academy (1.44), Salford Eccles (1.24), Trafford Moss Park (1.48) and Manchester Piccadilly (1.26)).

[d] This factor was derived from an average of the ratios of measured period mean and 2018 annual mean NO_2 concentrations at four nearby AURN sites (namely Trafford Wellacre Academy (1.42), Salford Eccles (1.19), Trafford Moss Park (1.45) and Manchester Piccadilly (1.24)).

Air quality monitoring data

1.3.14 The air quality monitoring data collected as part of this assessment, including the now bias-adjusted and annualised data, were reviewed further to determine the suitability of each of the monitoring locations for inclusion in the model verification process. The criteria used to determine the suitability of the monitoring data for inclusion in the verification process were:

- The monitoring site was at a roadside or near road location within the air quality study area (as opposed to a background site away from major roads for example)
- The exact location of the monitoring site could be accurately identified
- The monitoring site was not influenced by substantial road or other emission sources for which data was not available in the traffic reliability area, and hence could not be included in the dispersion model
- The monitoring site was not influenced by any factors considered to have the potential to have a substantial influence on the dispersion of emissions affecting that location, and which could not be accurately accounted for within the modelling process (e.g. sections of road in cutting, or where there were walls/barriers/dense vegetation between the monitoring site and the nearest road traffic emission source) where such locations were not representative of relevant exposure)
- The monitoring site was not affected by highly localised emission sources (e.g. from a petrol station, bus station, car park or buses accelerating from a bus stop)

1.3.15 Table 1.8 details the monitoring data between 2015 and 2019 for all sites within the modelled study area for this assessment, whether they were included in verification, and if not, why they were removed. Results in bold represent exceedances of the level of the NO_2 AQO (40µg/m^3).

1.3.16 The annualised and bias-adjusted 2018 base year scheme-specific monitoring data was also compared to the 2018 data at sites where the monitoring was done at the same location (the sites were co-located). This was done to assess the accuracy of the annualisation process and suitability of the annualised data being used in verification.

1.3.17 Site J_013 is co-located with BU17 and the annualised and monitored 2018 NO_2 concentration at each of these sites were 34.5 and 35.0µg/m^3 respectively. The same applies for sites J_014, BU16 and BUR-A3 (45.1, 44.9 and 45.6µg/m^3) which too are co-located, as well as sites DT3/4/5 with the Bury Whitefield AURN (24.2/23.5/24.3 and 25.0µg/m^3). The greatest difference between the annualised and monitored 2018 NO_2 concentration at any of these co-located sites is 0.8µg/m^3 and so it can be concluded that annualised data is suitable for use in the model verification process.

Table 1.8: Monitored or estimated annual mean NO_2 concentrations (µg/m³) within the air quality study area

Site ID	Source	Monitored or Estimated Annual Mean NO_2 (µg/m³)							Included in verification?	Reason for removal, if applicable
		2015	2016	2017	2018	2019	2020	2021		
BU01	GMCA	33.7	35.2	31.9	32.3	32.4	24.4	25.3	Yes	N/A
BU15	GMCA	-	-	-	**44.7** [a]	**46.6**	34.4	37.4	No	Next to a bus stop
BU16	GMCA	-	-	-	**44.9** [a]	**46.8**	32.5	36.1	Yes	N/A
BU17	GMCA	-	-	-	34.0 [a]	35.4	25.7	28.2	Yes	N/A
BU19	GMCA	-	-	-	**40.4** [a]	**42.1**	32.7	33.1	Yes	N/A
BU04	GMCA	37.0	38.1	31.9	31.2	39.2	27.4	28.4	Yes	N/A
BU20	GMCA	-	-	-	-	-	26.1	28.4	No	Monitoring for 2020 and 2021 only
MAN98	GMCA	-	-	-	34.8 [a]	36.2	26.6	28.9	Yes	N/A
RO20A	GMCA	-	-	-	27.2 [b]	31.3	23.9	24.9 [d]	No	Next to a bus stop
RO2A	GMCA	35.8	33.3	35.0	28.9	32.7	21.7 [d]	-	No	Exact location of monitoring site could not be accurately identified
RO3A	GMCA	26.0	29.9	23.4	20.6	22.1	16.0	16.4 [d]	No	Exact location of monitoring site could not be accurately identified
RO5A	GMCA	24.3	24.7	25.9	31.5	24.5	16.5	16.4	No	Exact location of monitoring site could not be accurately identified
RO6A	GMCA	**43.2**	**44.6**	**47.2**	**41.9**	**42.5**	31.8	32.3	Yes	N/A
SA38_1	GMCA	26.7	31.0	29.0	25.8	26.6	19.6	21.6	Yes	N/A
SA38_2	SCC	26.7	31.0	29.0	26.1	-	-	-	Yes	N/A
DT7	Jacobs	-	-	-	27.9 [c]	-	-	-	Yes	N/A

Site ID	Source	Monitored or Estimated Annual Mean NO_2 ($\mu g/m^3$)							Included in verification?	Reason for removal, if applicable
		2015	2016	2017	2018	2019	2020	2021		
DT10	Jacobs	-	-	-	22.3 [c]	-	-	-	No	Influenced by roads not in the traffic model
DT11	Jacobs	-	-	-	31.8 [c]	-	-	-	Yes	N/A
DT14	Jacobs	-	-	-	36.3 [c]	-	-	-	Yes	N/A
DT15	Jacobs	-	-	-	37.4 [c]	-	-	-	Yes	N/A
DT17	Jacobs	-	-	-	29.7 [c]	-	-	-	Yes	N/A
J_001	Jacobs	-	-	-	**40.5** [c]	-	-	-	Yes	N/A
J_002	Jacobs	-	-	-	**64.1** [c]	-	-	-	Yes	N/A
J_003	Jacobs	-	-	-	19.7 [c]	-	-	-	No	School site for monitoring purposes
J_004	Jacobs	-	-	-	**45.9** [c]	-	-	-	Yes	N/A
J_005	Jacobs	-	-	-	**40.7** [c]	-	-	-	Yes	N/A
J_006	Jacobs	-	-	-	36.2 [c]	-	-	-	Yes	N/A
J_007	Jacobs	-	-	-	**109.1** [c]	-	-	-	No	Site on an elevated road section
J_009	Jacobs	-	-	-	34.7 [c]	-	-	-	Yes	N/A
J_010	Jacobs	-	-	-	31.2 [c]	-	-	-	Yes	N/A
J_011	Jacobs	-	-	-	39.2 [c]	-	-	-	Yes	N/A
J_012	Jacobs	-	-	-	39.3 [c]	-	-	-	Yes	N/A
J_013	Jacobs	-	-	-	34.5 [c]	-	-	-	Yes	N/A
J_014	Jacobs	-	-	-	**45.1** [c]	-	-	-	Yes	N/A

Site ID	Source	Monitored or Estimated Annual Mean NO_2 (µg/m^3)							Included in verification?	Reason for removal, if applicable
		2015	2016	2017	2018	2019	2020	2021		
Manchester_Tube_5	HE	-	-	-	24.3 [a]	25.3	-	-	Yes	N/A
Manchester_Tube_6	HE	-	-	-	27.2 [a]	28.4	-	-	No	Exact location of monitoring site could not be accurately identified
Manchester_Tube_22	HE	-	-	-	28.6 [a]	29.8	-	-	Yes	N/A
M60_Oldham_2	HE	-	-	-	35.6 [b]	-	-	-	Yes	N/A
M60_Oldham_18	HE	-	-	-	27.6 [b]	-	-	-	Yes	N/A
M60_Oldham_12	HE	-	-	-	24.4 [b]	-	-	-	No	Exact location of monitoring site could not be accurately identified
BUR-A1	TfGM	-	-	-	**46.6** [a]	**48.6** [b]	30.0	35.2	Yes	N/A
BUR-A2	TfGM	-	-	-	**54.2** [a]	**56.5** [b]	32.9	36.4	No	Next to carpark and drive-through
BUR-A3	TfGM	-	-	-	**45.6** [a]	**47.6** [b]	32.1	35.1	Yes	N/A
BUR-A4	TfGM	-	-	-	**57.8** [a]	**60.2** [b]	38.4	**44.4**	Yes	N/A
BUR-A5	TfGM	-	-	-	**52.0** [a]	**54.2** [b]	37.3	**41.2**	Yes	N/A
BUR-B1	TfGM	-	-	-	**58.4** [a]	**60.9** [b]	**40.2**	-	No	Influenced by roads not in the traffic model
BUR-B2	TfGM	-	-	-	**41.1** [a]	**42.9** [b]	27.5	28.5	Yes	N/A
BUR-B3	TfGM	-	-	-	34.2 [a]	35.7 [b]	24.0	-	Yes	N/A

Site ID	Source	Monitored or Estimated Annual Mean NO_2 ($\mu g/m^3$)							Included in verification?	Reason for removal, if applicable
		2015	2016	2017	2018	2019	2020	2021		
Values in bold type denote exceedances of level of annual mean NO_2 air quality objective (40µg/m^3)										
[a] Estimated from measured values in 2019.										
[b] Annualised as data capture less than 75% of the calendar year.										
[c] Estimated from measured values in 2021.										
[d] Low data capture (i.e. <75%), therefore result should be treated with caution.										

Verification methodology – NO_X/NO_2

1.3.18 The verification method followed the process detailed in LAQM TG(16). The first stage of verification was undertaken by comparing the modelled versus monitored contribution from road traffic sources (Road NO_x). Road NO_x contributions at the diffusion tube sites were calculated using the latest Defra NO_x to NO_2 Calculator (Defra, 2020b), because diffusion tubes only measure total NO_2, from which Road NO_x needs to be estimated having first subtracted background NO_2 concentrations.

1.3.19 To obtain realistic verification factors, locations of diffusion tubes were divided into three zones and one subzone:

- Zone 1: monitoring sites within 50m of the M60 between J17 and J18
- Zone 2: monitoring sites within 50m of rest of the motorway network
- Zone 3: monitoring sites >50m from the motorway network and next to major motorway junctions

1.3.20 Once the modelled Road NO_x component had been adjusted with the relevant verification factor, this value was used in the Defra NO_x to NO_2 Calculator (Defra, 2020b). This process has been repeated for each of the three zones.

1.3.21 Table 1.9 depicts the monitored and modelled concentrations before and after adjustment.

Table 1.9: Monitored and modelled NO_2 concentrations

Zone	Site ID	Monitored NO_2 (µg/m^3)	Unadjusted total NO_2 (µg/m^3)	Percentage difference (%)	Adjusted total NO_2 (µg/m^3)	Percentage difference (%)
Zone 1	BU19	**40.4**	52.9	31.0	38.8	-3.9
	BU04	31.2	**47.3**	51.4	35.1	12.4
	DT7	27.9	39.6	41.9	30.7	10.0
	J_009	34.7	**43.3**	24.7	33.2	-4.4
	J_010	31.2	33.1	6.0	27.4	-12.0
	J_011	39.2	**48.7**	24.3	36.3	-7.2
	J_012	39.3	**56.1**	42.7	**40.7**	3.6
Zone 2	BU01	32.3	37.4	15.6	35.0	8.2
	RO6A	**41.9**	45.4	8.1	**42.1**	0.3
	DT11	31.8	32.9	3.5	31.3	-1.5
	DT14	36.3	38.5	6.2	36.2	-0.2
	DT15	37.4	37.7	1.0	35.6	-4.8
	J_001	**40.5**	50.8	25.6	**47.2**	16.6
	J_002	**64.1**	**69.2**	7.9	**63.9**	-0.4

Zone	Site ID	Monitored NO_2 ($\mu g/m^3$)	Unadjusted total NO_2 ($\mu g/m^3$)	Percentage difference (%)	Adjusted total NO_2 ($\mu g/m^3$)	Percentage difference (%)
	J_004	**45.9**	**43.4**	-5.5	**40.4**	-12.0
	Manchester_Tube_5	24.3	25.7	5.8	24.8	2.0
	Manchester_Tube_22	28.6	26.0	-9.3	25.0	-12.7
	M60_Oldham_2	35.6	31.6	-11.3	30.4	-14.7
	M60_Oldham_18	27.6	26.3	-4.7	25.3	-8.3
Zone 3	BU16	**44.9**	**46.8**	4.1	**48.9**	8.8
	BU17	34.0	38.6	13.7	40.0	17.8
	MAN98	34.8	27.4	-21.3	27.9	-19.9
	SA38_1	25.8	25.6	-0.7	26.0	1.0
	SA38_2	26.1	26.5	1.5	27.0	3.4
	DT17	29.7	25.7	-13.4	26.5	-10.9
	J_005	**40.7**	31.7	-22.2	32.9	-19.2
	J_006	36.2	29.5	-18.6	30.5	-15.9
	J_013	34.5	39.0	13.0	**40.4**	17.2
	J_014	**45.1**	**47.2**	4.6	**49.3**	9.4
	BUR-A1	**46.6**	**45.6**	-2.2	**47.5**	1.9
	BUR-A3	**45.6**	**49.3**	8.1	**51.6**	13.2
	BUR-A4	**57.8**	**43.9**	-24.1	**45.8**	-20.8
	BUR-A5	**52.0**	**47.8**	-8.0	**50.0**	-3.9
	BUR-B2	**41.1**	39.0	-5.3	**40.7**	-1.2
	BUR-B3	34.2	28.7	-16.1	29.6	-13.5
Note: Exceedances of level of annual mean NO_2 AQO shown in bold type.						

Verification summary – NO_X/NO_2

1.3.22 A review was undertaken of the monitored vs modelled performance across the whole study area. The summary results and model performance statistics defined in LAQM TG(16) are provided in Table 1.10.

1.3.23 It should be noted that the application of a road NOx adjustment factor of less than 1.0 (as within Zone 1 and Zone 2) indicates that the model tends to overpredict road NOx concentrations at modelled receptors. This overprediction is thought to occur as a result of the influence of fencing and dense vegetation at the roadside influencing the dispersion of pollution and resulting in lower concentrations at receptors behind these features in the real-world than predicted by the dispersion model. As there is no standard methodology by which the influence of such features on pollution dispersion

can be accounted for directly within dispersion models, then a model adjustment factor of less than 1.0 is typically applied in such situations.

Table 1.10: Verification summary and model performance

Statistical parameter	Zone 1		Zone 2		Zone 3	
	No adjustment	With adjustment	No adjustment	With adjustment	No adjustment	With adjustment
No. of monitoring sites	7	7	12	12	16	16
Road NO_X adjustment factor	1.00	0.52	1.00	0.87	1.00	1.09
NO_2 adjustment factor	1.00	1.00	1.00	1.00	1.00	1.00
RMSE	11.95	2.72	4.18	3.33	5.64	5.39
CC	0.78	0.81	0.95	0.95	0.83	0.83
FB	-0.27	0.01	-0.04	0.02	0.06	0.02
No. within ±10%	1	5	9	8	8	7
No. within ±25%	3	7	11	12	16	16

1.3.24 The statistics support the methodology adopted. The statistics show that the RMSE, FB and CC are improved when the adjustment is applied for all three modelled zones with the RMSE closer or under the ideal of value of 4 after adjustment, and well below the required value of 10.

Verification methodology – PM_{10}

1.3.25 There were no PM_{10} analysers within the study area to enable model verification. Therefore, no adjustment has been applied to modelled PM_{10} road contributions.

Prediction of environmental concentrations including adjustment for long-term trends in NO_2

1.3.26 In July 2011, Defra published a report, Trends in NO_X and NO_2 Emissions and Ambient Measurements in the UK (Defra, 2011), examining the long-term air quality trends in NO_X and NO_2 concentrations. This identified that there has been a clear decrease in NO_2 concentrations between 1996 and 2002. Thereafter, NO_2 concentrations stabilised with little to no reduction between 2004 and 2012. The consequence of the conclusions of Defra's advice on long-term trends is that there is now a gap between current projected vehicle emission reductions and projections on the annual rate of improvements in ambient air quality, which are built into vehicle emission factors, projected background maps and the NO_X to NO_2 Calculator.

1.3.27 Highways England developed the gap analysis methodology to adjust model predictions based on the method in LAQM TG(16) to account for the long-term NO_X and NO_2 profiles. This uses the relationship between the base year vehicle emission rates and the opening year vehicle emission rates, and the measured trends in roadside air quality concentrations to uplift opening year predicted concentrations to align them better with the Long-Term Trends (LTT) of NO_X and NO_2.

1.3.28 The current trends in air quality are based on measurements of emissions from the existing vehicle fleet. Newer vehicles have needed to comply with the more stringent Euro 6/VI emissions standards from September 2014 onwards. If the Euro 6/VI fleet emissions perform as predicted, then this should lead to substantial reductions in predicted future roadside air quality concentrations.

1.3.29 However, because the likely effects of Euro 6/VI vehicles on air quality are yet to be fully understood, a conservative approach of applying Highways England's LTT has been applied to the modelling results. These LTT assume a projected rate of decrease into the future based on past monitoring trends.

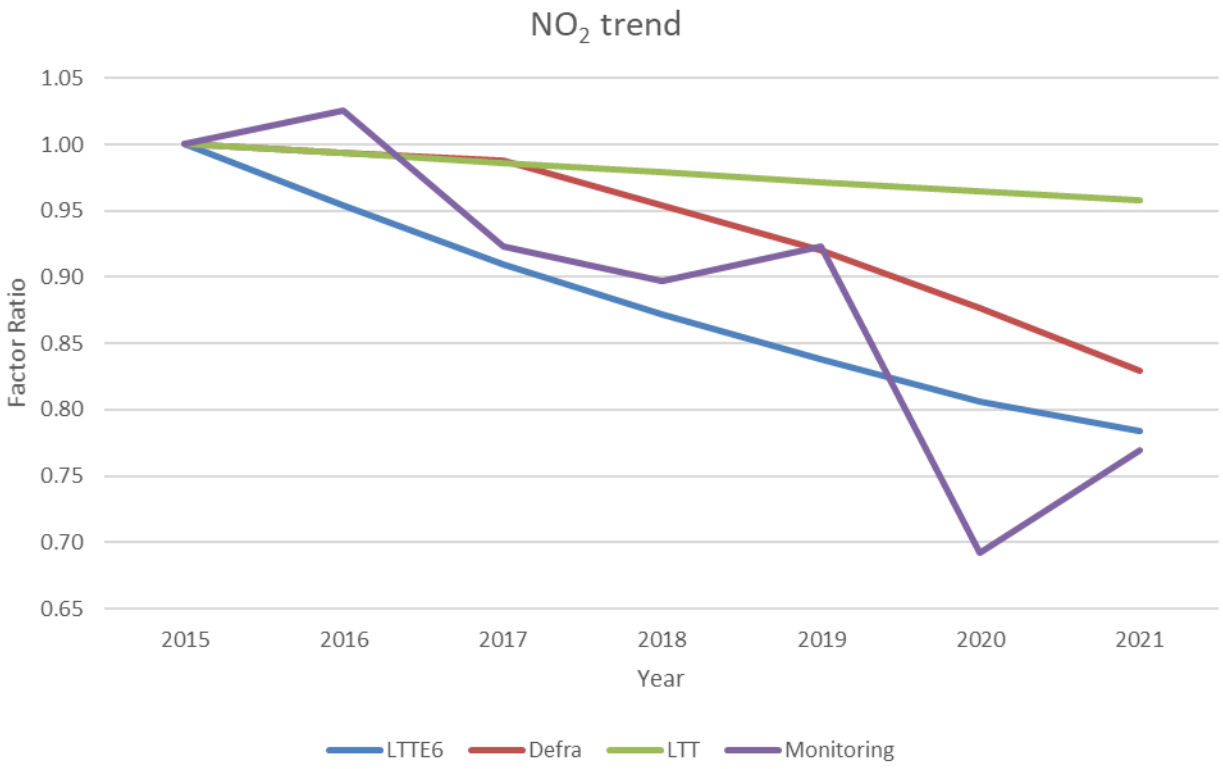
Gap factor analysis

1.3.30 The Gap Analysis methodology, as set out in DMRB LA 105, advises that an informed decision as to which set of LTTs are the most appropriate on a scheme-by-scheme basis.

1.3.31 A comparison of the LTT ratios with AURN monitoring has therefore been undertaken using the Manchester Piccadilly Urban Background site as this monitoring location was identified as being in close proximity and best representative of the modelled study area. Comparisons of the LTT ratios are below in Plate 1.3. As can be seen, the line arguably closest to the monitoring data trend is the updated 2018 LTT_{E6} version, and

therefore, the LTT_{E6} factors have been applied to the future predictions for air quality modelling.

Plate 1.3: Long-Term Trend (LTT) ratios compared to monitoring AURN data



1.3.32 As per DMRB LA 105, the gap analysis methodology was not applied to modelled compliance risk receptors, so the assessment is consistent with Defra's reporting on compliance with the European Union (EU) Limit Values.

1.3.33 The gap analysis method is also not required to be applied to PM_{10} predictions, as there is less uncertainty in future year concentrations of these pollutants, and the results based on the LAQM TG(16) method are the final predicted concentrations throughout the assessment.

1.3.34 The LTT_{E6} factors assume that the measured trends from 2004 to 2012 continue to occur for all pre-Euro 6/VI fleet. They also take a precautionary approach to account for uncertainty associated with Euro 6/VI performance and fleet mix in the future, rather than assuming full reductions in emissions occur as predicted by Euro 6/VI, which has not been observed by air quality monitoring trends associated with recent Euro standards. This is implemented into LTT_{E6} by taking the mid-point between the measured trend predictions (which assume no improvement in emissions associated with Euro 6/VI) and predicted Euro 6/VI uptake and emission improvements.

1.4 Air quality modelled receptors

Human health receptors

1.4.1 A combined total of 519 worst-case human health receptors were included in the assessment, which included a transect directly north-west of M60 J18 to represent the

possible locations of potential housing. Additionally, all receptors within 50m of either side of the M60 between J17 and J18 were modelled.

1.4.2 Building usage was determined using OS AddressBase Plus data within ArcGIS. The receptors selected were positioned to represent the façade of the property closest to the nearest affected road in order to provide an estimate of the maximum concentration or maximum change in pollutant concentrations to which that receptor would potentially be exposed. Equally, receptors were selected to indicate where air quality was considered likely to improve as a result of the Proposed Scheme.

1.4.3 The locations of all of the 519 modelled human health receptors are provided on Figure 6.3 of the PEIR. All of the modelled human health receptor results for the operational assessment are presented in Appendix 6.2.

Compliance risk receptors

1.4.4 Pollution Climate Mapping (PCM) road links with census IDs 802006053, 802017924, 802046572, 802074590 and 802099614 (Defra, 2020d) were found to correspond to the operational ARN along sections of the A56 and M60, with qualifying features identified adjacent to each of these links.

1.4.5 A total of 122 receptors were modelled as part of the compliance risk assessment, with all positioned within 15m of the three PCM road links but not within 25m of a junction, in accordance with DMRB LA 105 criteria. Of these receptors, 73 were modelled at positions 4m from the edge of the PCM road links and 49 receptors were modelled at locations representative of sensitive locations and qualifying features; all were modelled at 2m in height. The locations of the compliance risk receptors are shown on Figure 6.5 of the PEIR.

Ecological receptors

1.4.6 As well as the effect on human health, the Proposed Scheme was identified to result in potential air quality impacts upon the natural environment. Concentrations of pollutants in the air and deposition of nitrogen can damage vegetation directly or affect plant health and productivity. The pollutant of most concern for sensitive vegetation and ecosystems near roads is NO_X. Increases in concentrations of NO_X directly increase nutrient nitrogen deposition.

1.4.7 In order to assess the risk of air pollution impacts to ecosystems, critical loads are used as benchmarks. Baseline nitrogen deposition rates and critical loads were obtained from the Air Pollution Information System (APIS; UK Centre for Ecology and Hydrology, 2022) based on priority habitats sensitive to nitrogen deposition, confirmed by the project ecologist.

1.4.8 Transects up to 200m from the road (measured from the edge of the road) were modelled based on professional judgement of where the impact would be highest. Transect points were positioned from the nearest site boundary point to the road with further transect points at 10m increments up to 200m from the road.

1.4.9 A total of 336 ecological receptors were modelled across 27 ecological transects to represent 22 designated sites. The designated sites are listed in Appendix 6.2. All assessed ecological receptor locations are shown on Figure 6.4 of the PEIR.

1.4.10 In accordance with DMRB LA 105, the following conversion rates were applied to convert road increment NO_2 (in µg/m^3) to nitrogen deposition (kg N/ha/yr):

- Grassland and similar habitats: 1µg/m^3 of NO_2 = 0.14kg N/ha/yr
- Forests and similar habitats: 1µg/m^3 of NO_2 = 0.29kg N/ha/yr

Appendix 6.2. Air quality assessment results

1.1 Human health assessment results

1.1.1 The results from the PEIR human health air quality assessment of operational traffic (2027) are presented below. Results in **bold** represent exceedances of the Air Quality Objective (AQO) of 40µg/m^3.

Table 1.1: Human health assessment results (µg/m^3)

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R1	382032	405565	34.2	29.7	30.0	0.3	15.3	14.2	14.3	0.1
R2	382612	406162	29.5	24.4	25.0	0.5	14.6	13.5	13.7	0.2
R3	381504	405238	**43.0**	**41.7**	38.5	-3.2	16.9	15.7	15.7	<0.1
R4	381642	405254	34.3	29.7	29.9	0.1	15.6	14.4	14.5	0.1
R5	382958	405930	**44.7**	37.6	35.4	-2.2	17.2	16.0	15.3	-0.7
R6	384109	407438	31.2	26.5	26.6	0.1	14.9	13.8	13.8	<0.1
R7	385133	404871	28.2	23.5	23.5	<0.1	14.2	13.1	13.1	<0.1
R8	381041	404728	31.5	26.2	26.4	0.2	15.3	14.2	14.2	<0.1
R9	377742	403303	37.5	32.0	32.6	0.7	15.2	14.2	14.2	<0.1
R10	385377	408232	32.9	28.2	28.3	0.2	15.0	13.9	13.9	<0.1
R11	382296	405704	30.9	26.4	26.3	<0.1	14.9	13.9	14.0	0.1
R12	382927	405687	34.5	28.5	28.7	0.1	15.5	14.4	14.4	<0.1
R13	382251	406778	25.0	20.6	20.7	<0.1	13.8	12.8	12.8	<0.1
R14	382148	407630	25.9	21.4	21.5	0.1	14.1	13.0	13.1	0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R15	382049	408148	24.2	20.0	20.0	0.1	14.0	12.9	13.0	0.1
R16	382304	407669	26.8	22.2	22.3	0.1	14.2	13.1	13.2	0.1
R17	385435	408343	36.2	31.1	31.3	0.2	15.5	14.3	14.3	<0.1
R18	386389	408721	26.3	22.8	22.8	<0.1	14.2	13.4	13.4	<0.1
R20	386355	408977	32.7	28.5	28.5	<0.1	15.1	14.0	14.0	<0.1
R22	384375	404924	37.5	31.7	31.8	0.1	16.3	15.2	15.2	<0.1
R23	384231	404795	26.4	22.0	22.0	<0.1	14.9	13.8	13.9	0.1
R24	384599	404676	23.0	19.0	19.0	<0.1	14.3	13.3	13.3	<0.1
R25	381846	405350	29.1	24.3	24.9	0.6	15.0	13.8	13.9	0.1
R26	380914	404652	36.9	31.2	31.3	0.1	15.4	14.3	14.3	<0.1
R27	380933	404837	36.3	31.8	31.9	0.1	15.4	14.3	14.4	0.1
R28	380872	404808	**44.1**	38.0	38.1	0.1	16.5	15.4	15.4	<0.1
R29	377691	403418	**42.9**	37.0	37.5	0.5	16.3	15.3	15.3	<0.1
R30	377804	403284	38.9	33.0	33.5	0.5	15.8	14.7	14.7	<0.1
R31	381245	404910	32.8	27.4	27.5	0.1	15.6	14.5	14.5	<0.1
R32	381216	405029	38.7	35.3	33.6	-1.7	16.3	15.2	15.2	<0.1
R33	383040	405733	37.6	31.4	31.4	<0.1	15.9	14.8	14.6	-0.2
R34	383082	405809	32.4	26.9	26.9	<0.1	15.2	14.1	14.0	-0.1
R35	386390	408996	35.6	30.6	30.7	0.1	15.5	14.4	14.4	<0.1
R36	385299	408303	31.1	26.4	26.5	0.1	14.7	13.6	13.7	0.1
R37	382102	407963	26.0	21.4	21.5	0.1	14.1	13.1	13.1	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R38	382546	406820	27.2	22.5	22.6	0.1	14.1	13.0	13.1	0.1
R39	382384	405842	31.3	26.5	26.6	0.1	15.0	13.9	14.1	0.2
R40	380605	404645	**43.4**	37.8	37.7	-0.1	16.3	15.1	15.1	<0.1
R41	380679	404666	**44.0**	38.3	38.1	-0.1	16.4	15.2	15.3	0.1
R42	380855	404768	**47.7**	**41.3**	**41.3**	<0.1	17.0	15.9	15.9	<0.1
R43	380900	404844	**50.2**	**43.9**	**44.1**	0.1	17.6	16.5	16.6	0.1
R44	380924	404874	**49.6**	**45.2**	**45.3**	0.1	17.6	16.5	16.5	<0.1
R45	380890	404890	**43.2**	37.7	37.8	0.1	16.5	15.4	15.4	<0.1
R46	380893	404875	**44.6**	39.0	39.1	0.1	16.7	15.6	15.6	<0.1
R47	380897	404860	**46.2**	**40.5**	**40.6**	0.1	17.0	15.9	15.9	<0.1
R49	380896	404863	**45.8**	**40.1**	**40.2**	0.1	16.9	15.8	15.8	<0.1
R50	380899	404847	**49.1**	**42.9**	**43.1**	0.1	17.5	16.3	16.4	0.1
R51	380928	404855	**50.4**	**45.9**	**46.1**	0.1	17.7	16.6	16.6	<0.1
R52	380927	404860	**50.2**	**45.8**	**45.9**	0.1	17.7	16.6	16.6	<0.1
R53	380930	404845	35.9	31.5	31.6	0.1	15.4	14.3	14.3	<0.1
R54	380925	404870	**49.8**	**45.4**	**45.5**	0.1	17.6	16.5	16.6	0.1
R55	380980	404829	36.4	31.2	31.4	0.3	15.4	14.3	14.4	0.1
R56	381052	404894	35.0	29.7	29.8	0.1	15.8	14.7	14.7	<0.1
R57	381049	404692	28.4	23.4	23.5	0.1	14.9	13.8	13.8	<0.1
R58	381050	404667	33.3	27.8	27.9	0.1	15.6	14.4	14.4	<0.1
R59	381047	404699	28.7	23.7	23.8	0.1	14.9	13.8	13.8	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R60	381048	404681	27.9	23.0	23.1	0.1	14.8	13.7	13.7	<0.1
R61	381054	404661	32.6	27.2	27.3	0.1	15.5	14.3	14.4	0.1
R62	381044	404715	30.0	24.9	25.0	0.2	15.1	14.0	14.0	<0.1
R63	381052	404679	33.8	28.3	28.4	0.1	15.6	14.5	14.5	<0.1
R64	381044	404710	29.6	24.5	24.6	0.1	15.1	13.9	14.0	0.1
R65	381042	404720	30.5	25.3	25.5	0.2	15.2	14.0	14.1	0.1
R66	381059	404628	31.1	25.8	25.9	0.1	15.3	14.1	14.2	0.1
R67	381053	404649	32.2	26.9	26.9	0.1	15.4	14.3	14.3	<0.1
R68	381056	404647	31.8	26.5	26.6	0.1	15.4	14.2	14.2	<0.1
R69	381057	404636	31.4	26.2	26.2	0.1	15.3	14.2	14.2	<0.1
R71	381096	404782	30.9	25.7	25.9	0.2	15.2	14.1	14.1	<0.1
R72	381136	404821	31.0	25.8	26.0	0.2	15.2	14.1	14.1	<0.1
R73	381164	404845	30.7	25.6	25.7	0.1	15.2	14.0	14.1	0.1
R74	381318	405120	37.1	34.4	32.4	-2.0	16.0	14.9	14.9	<0.1
R75	381401	405076	31.1	26.9	26.7	-0.2	15.2	14.1	14.2	0.1
R76	381241	405062	35.8	32.5	30.9	-1.6	15.9	14.8	14.8	<0.1
R77	381314	405011	32.9	28.3	28.3	<0.1	15.5	14.3	14.4	0.1
R78	381436	405200	39.3	37.2	34.5	-2.6	16.3	15.2	15.2	<0.1
R79	381433	405098	30.6	26.4	26.2	-0.2	15.2	14.0	14.1	0.1
R80	381594	405222	33.7	29.3	29.2	-0.2	15.5	14.4	14.5	0.1
R81	381558	405276	**42.0**	**40.4**	37.3	-3.1	16.7	15.5	15.5	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R83	381960	405533	34.0	29.4	29.6	0.2	15.6	14.4	14.5	0.1
R84	382153	405633	31.8	27.3	27.5	0.2	15.0	13.9	14.0	0.1
R85	382245	405677	31.5	27.0	27.1	<0.1	15.0	13.9	14.0	0.1
R86	382274	405692	31.2	26.7	26.7	<0.1	15.0	13.9	14.0	0.1
R87	382335	405726	30.5	25.9	25.9	<0.1	14.9	13.8	14.0	0.2
R88	382515	405526	26.2	21.8	21.7	<0.1	14.4	13.3	13.4	0.1
R89	382654	405965	36.1	30.6	35.4	4.8	15.9	14.8	16.5	1.7
R90	383003	405972	37.0	31.2	30.7	-0.5	15.9	14.7	14.6	-0.1
R91	382999	405971	38.4	32.3	31.8	-0.6	16.1	14.9	14.7	-0.2
R92	382994	405969	35.5	29.7	29.2	-0.5	15.7	14.5	14.4	-0.1
R94	383007	405910	34.4	28.7	28.4	-0.4	15.5	14.4	14.2	-0.2
R95	382996	405927	36.7	30.6	30.1	-0.6	15.8	14.7	14.4	-0.3
R96	382987	405881	38.0	31.7	31.1	-0.6	16.0	14.9	14.6	-0.3
R97	382968	405912	**40.9**	34.2	33.0	-1.2	16.5	15.3	14.9	-0.4
R98	383001	405920	35.2	29.4	28.9	-0.5	15.6	14.5	14.3	-0.2
R99	382993	405931	37.1	31.0	30.4	-0.6	15.9	14.7	14.5	-0.2
R100	382982	405895	38.4	32.0	31.3	-0.7	16.1	14.9	14.6	-0.3
R101	383003	405917	34.9	29.1	28.7	-0.4	15.6	14.5	14.3	-0.2
R102	382977	405898	39.1	32.6	31.8	-0.8	16.2	15.1	14.7	-0.4
R103	382963	405923	**42.6**	35.7	34.1	-1.6	16.8	15.6	15.1	-0.5
R104	382974	405905	39.7	33.2	32.2	-0.9	16.3	15.2	14.7	-0.5

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R105	383011	405905	34.1	28.5	28.1	-0.3	15.5	14.4	14.2	-0.2
R106	382985	405942	38.6	32.3	31.5	-0.8	16.1	14.9	14.7	-0.2
R107	382989	405937	37.8	31.7	31.0	-0.7	16.0	14.8	14.6	-0.2
R108	383090	405994	31.1	26.0	25.9	<0.1	15.0	13.9	13.9	<0.1
R109	382997	405806	37.7	31.4	30.7	-0.8	16.1	15.0	14.5	-0.5
R110	382992	405825	**40.7**	34.1	33.2	-0.9	16.5	15.4	14.8	-0.6
R111	383005	405811	38.5	32.2	31.7	-0.6	16.2	15.1	14.6	-0.5
R112	382983	405839	**41.5**	34.7	33.5	-1.2	16.6	15.5	14.9	-0.6
R113	382988	405831	**41.0**	34.3	33.3	-1.0	16.6	15.5	14.8	-0.7
R114	382997	405818	**40.4**	33.8	33.0	-0.8	16.5	15.3	14.8	-0.5
R116	383064	405750	36.0	30.0	30.1	0.1	15.7	14.5	14.4	-0.1
R117	383043	405776	37.0	30.9	30.8	-0.1	15.9	14.8	14.6	-0.2
R118	383029	405768	39.4	33.0	32.8	-0.2	16.3	15.2	14.8	-0.4
R119	383050	405740	38.8	32.5	32.5	0.1	16.1	15.0	14.8	-0.2
R120	383048	405780	36.2	30.2	30.1	-0.1	15.8	14.7	14.5	-0.2
R121	383055	405785	35.3	29.4	29.3	<0.1	15.6	14.5	14.4	-0.1
R122	383060	405788	34.8	29.0	28.9	<0.1	15.5	14.4	14.3	-0.1
R123	383025	405765	36.6	30.5	30.3	-0.2	15.9	14.8	14.5	-0.3
R124	382904	405666	32.2	26.7	26.7	<0.1	15.2	14.1	14.1	<0.1
R125	382919	405678	33.5	27.7	27.8	0.1	15.4	14.3	14.3	<0.1
R126	382912	405673	32.8	27.2	27.2	<0.1	15.3	14.2	14.2	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R127	382945	405666	30.9	25.4	25.5	0.1	15.0	13.9	13.9	<0.1
R128	382933	405657	31.7	26.2	26.3	0.1	15.1	14.0	14.0	<0.1
R129	382733	405702	28.8	24.0	24.0	0.1	14.7	13.7	13.7	<0.1
R130	382616	405416	25.0	20.6	20.5	<0.1	14.2	13.2	13.2	<0.1
R131	384354	404946	33.6	28.4	28.5	0.1	15.7	14.6	14.6	<0.1
R132	384381	404930	36.3	30.6	30.7	0.1	16.2	15.0	15.0	<0.1
R133	384359	404954	32.5	27.3	27.4	0.1	15.6	14.5	14.5	<0.1
R134	384369	404931	35.9	30.4	30.5	0.1	16.1	15.0	15.0	<0.1
R135	384361	404940	34.5	29.2	29.2	0.1	15.9	14.7	14.7	<0.1
R136	384185	404870	25.6	21.3	21.3	0.1	14.7	13.6	13.6	<0.1
R137	384178	404883	26.3	21.9	22.0	0.1	14.8	13.7	13.7	<0.1
R138	384624	404904	28.3	23.7	23.7	<0.1	15.0	13.8	13.8	<0.1
R139	383270	406370	33.7	28.8	29.0	0.2	15.0	13.9	13.9	<0.1
R140	382161	407552	25.8	21.3	21.4	0.1	14.1	13.0	13.1	0.1
R141	382139	407689	25.9	21.4	21.5	0.1	14.1	13.0	13.1	0.1
R142	382124	407788	25.9	21.4	21.5	0.1	14.1	13.0	13.1	0.1
R143	382112	407880	25.9	21.4	21.4	0.1	14.1	13.0	13.1	0.1
R144	383992	407026	26.1	21.8	21.8	0.1	13.9	12.8	12.9	0.1
R145	384455	407792	31.9	27.2	27.3	0.1	15.0	13.9	13.9	<0.1
R146	385847	408539	**40.7**	35.1	35.8	0.7	16.0	14.8	14.8	<0.1
R147	386389	409004	34.6	29.4	29.5	0.1	15.6	14.4	14.4	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R148	386385	409043	30.5	25.3	25.3	0.1	15.0	13.7	13.7	<0.1
R149	386384	409050	30.1	24.8	24.9	0.1	15.0	13.7	13.7	<0.1
R150	386349	409042	28.7	23.9	24.0	<0.1	14.8	13.5	13.5	<0.1
R151	386352	409013	30.2	25.5	25.6	<0.1	15.0	13.8	13.8	<0.1
R152	386353	409001	31.1	26.5	26.5	<0.1	15.1	13.9	13.9	<0.1
R153	386350	409033	29.1	24.4	24.4	<0.1	14.8	13.6	13.6	<0.1
R154	386348	409051	28.4	23.6	23.6	<0.1	14.7	13.5	13.5	<0.1
R155	386351	409019	29.8	25.1	25.2	<0.1	14.9	13.7	13.7	<0.1
R156	386354	408992	31.3	26.9	27.0	<0.1	14.9	13.8	13.8	<0.1
R157	386499	409070	31.5	27.1	27.1	0.1	15.0	14.0	14.0	<0.1
R158	386472	409044	32.1	27.6	27.7	0.1	15.1	14.1	14.1	<0.1
R159	386550	409094	33.8	29.1	29.3	0.1	15.3	14.3	14.3	<0.1
R160	382644	405966	35.2	29.8	32.7	2.9	15.7	14.6	15.7	1.1
R161	382635	405967	34.5	29.2	31.2	2.0	15.6	14.5	15.3	0.8
R162	382625	405969	33.8	28.6	30.1	1.5	15.5	14.4	15.0	0.6
R163	382615	405970	33.3	28.1	29.2	1.2	15.4	14.3	14.8	0.5
R164	382605	405971	32.7	27.6	28.5	0.9	15.3	14.3	14.6	0.3
R165	382595	405972	32.3	27.2	28.0	0.8	15.3	14.2	14.5	0.3
R166	382586	405973	31.9	26.8	27.5	0.7	15.2	14.1	14.4	0.3
R167	382576	405974	31.5	26.5	27.1	0.6	15.1	14.1	14.3	0.2
R168	382566	405975	31.1	26.1	26.7	0.5	15.1	14.0	14.2	0.2

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R169	382556	405976	30.8	25.8	26.3	0.5	15.0	14.0	14.2	0.2
R170	382546	405977	30.4	25.5	26.0	0.4	15.0	13.9	14.1	0.2
R171	382537	405978	30.2	25.3	25.7	0.4	15.0	13.9	14.1	0.2
R172	382527	405979	29.9	25.1	25.4	0.3	14.9	13.8	14.0	0.2
R173	382517	405980	29.6	24.8	25.1	0.3	14.9	13.8	14.0	0.2
R174	382507	405981	29.4	24.6	24.9	0.3	14.8	13.8	13.9	0.1
R175	382497	405982	29.2	24.4	24.7	0.3	14.8	13.7	13.9	0.2
R176	382489	405982	29.0	24.3	24.5	0.2	14.8	13.7	13.9	0.2
R177	382480	405983	28.8	24.1	24.3	0.2	14.8	13.7	13.8	0.1
R178	382472	405984	28.7	24.0	24.2	0.2	14.7	13.7	13.8	0.1
R179	382464	405985	28.5	23.8	24.0	0.2	14.7	13.6	13.8	0.2
R180	382455	405986	28.4	23.7	23.9	0.2	14.7	13.6	13.7	0.1
R181	383398	405534	32.1	26.6	26.8	0.1	14.9	13.8	13.8	<0.1
R182	385783	404768	24.4	20.1	20.1	<0.1	13.8	12.7	12.7	<0.1
R183	385797	404765	24.6	20.2	20.2	<0.1	13.8	12.8	12.8	<0.1
R184	385812	404755	24.6	20.2	20.3	<0.1	13.8	12.8	12.8	<0.1
R185	386198	404147	25.2	20.7	20.7	<0.1	14.2	13.1	13.1	<0.1
R186	386230	404126	26.2	21.5	21.5	<0.1	14.3	13.2	13.2	<0.1
R187	386192	404209	25.6	21.0	21.0	<0.1	14.2	13.1	13.1	<0.1
R188	386112	404509	29.4	24.4	24.4	<0.1	14.6	13.4	13.4	<0.1
R189	386205	404185	25.7	21.1	21.1	<0.1	14.3	13.2	13.2	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R190	386142	404402	26.4	21.8	21.8	<0.1	14.3	13.2	13.2	<0.1
R191	386216	404136	25.7	21.1	21.1	<0.1	14.3	13.2	13.2	<0.1
R192	386181	404281	26.7	22.0	22.0	<0.1	14.4	13.2	13.2	<0.1
R193	386125	404434	26.3	21.7	21.7	<0.1	14.3	13.2	13.2	<0.1
R194	386204	404201	25.9	21.3	21.3	<0.1	14.3	13.2	13.2	<0.1
R196	386113	404481	27.4	22.7	22.7	<0.1	14.4	13.2	13.2	<0.1
R197	386170	404339	26.2	21.6	21.7	<0.1	14.3	13.2	13.2	<0.1
R198	386155	404376	26.4	21.8	21.8	<0.1	14.3	13.2	13.2	<0.1
R200	386244	404114	26.8	22.0	22.0	<0.1	14.4	13.3	13.3	<0.1
R201	386418	404199	37.5	31.3	31.3	<0.1	15.8	14.5	14.5	<0.1
R202	386240	404565	31.0	25.8	25.9	<0.1	14.8	13.6	13.6	<0.1
R203	386451	404172	32.2	26.8	26.9	<0.1	14.9	13.8	13.8	<0.1
R204	386249	404511	33.3	27.9	27.9	<0.1	15.1	13.9	13.9	<0.1
R206	386435	404183	33.7	28.1	28.2	<0.1	15.1	14.0	14.0	<0.1
R207	386250	404499	31.2	26.0	26.0	<0.1	14.8	13.7	13.7	<0.1
R208	386543	404091	32.9	27.6	27.6	0.1	14.9	13.7	13.7	<0.1
R209	386569	404067	35.5	29.9	30.0	0.1	15.2	14.0	14.0	<0.1
R210	386638	404050	32.5	27.2	27.3	<0.1	14.9	13.7	13.7	<0.1
R211	386480	404149	31.2	26.0	26.1	<0.1	14.8	13.6	13.6	<0.1
R213	386604	404053	35.0	29.5	29.6	0.1	15.1	13.9	13.9	<0.1
R215	386723	403908	24.7	20.3	20.3	<0.1	13.4	12.3	12.3	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R216	386698	403913	24.7	20.4	20.4	<0.1	13.4	12.3	12.3	<0.1
R217	386640	403931	25.0	20.6	20.6	<0.1	13.4	12.3	12.3	<0.1
R218	386624	403954	27.1	22.4	22.5	<0.1	13.7	12.5	12.5	<0.1
R219	386606	403945	25.3	20.9	20.9	<0.1	13.5	12.3	12.4	0.1
R220	386746	403911	25.2	20.8	20.8	<0.1	13.5	12.3	12.3	<0.1
R221	386682	403917	24.7	20.4	20.4	<0.1	13.4	12.3	12.3	<0.1
R222	386738	403910	25.0	20.6	20.6	<0.1	13.4	12.3	12.3	<0.1
R223	387210	403839	25.8	21.4	21.4	<0.1	14.3	13.2	13.2	<0.1
R224	387115	403870	26.0	21.5	21.5	<0.1	14.3	13.2	13.2	<0.1
R225	386910	403899	25.8	21.3	21.4	<0.1	13.5	12.4	12.4	<0.1
R226	387048	403889	26.5	22.0	22.0	<0.1	14.4	13.2	13.2	<0.1
R227	386949	403903	26.9	22.3	22.3	<0.1	13.6	12.5	12.5	<0.1
R228	387204	403842	25.9	21.4	21.5	<0.1	14.3	13.2	13.2	<0.1
R229	386973	403903	27.3	22.7	22.7	<0.1	13.7	12.5	12.5	<0.1
R230	387017	403898	27.2	22.6	22.6	<0.1	14.4	13.3	13.3	<0.1
R231	386928	403896	25.7	21.2	21.2	<0.1	13.5	12.4	12.4	<0.1
R232	386758	404034	30.3	25.3	25.3	<0.1	14.6	13.5	13.5	<0.1
R233	386732	404037	30.6	25.5	25.6	<0.1	14.7	13.5	13.5	<0.1
R234	386984	404008	29.8	24.9	24.9	<0.1	14.6	13.4	13.4	<0.1
R235	386793	404036	31.6	26.5	26.5	<0.1	14.8	13.6	13.6	<0.1
R236	387004	404005	30.3	25.3	25.3	<0.1	13.4	12.2	12.2	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R237	386955	404020	31.1	26.0	26.0	<0.1	14.7	13.5	13.5	<0.1
R238	386931	404029	30.3	25.3	25.4	<0.1	14.6	13.5	13.5	<0.1
R239	387016	404004	30.2	25.2	25.2	<0.1	13.4	12.2	12.2	<0.1
R240	387045	404008	31.5	26.3	26.3	<0.1	13.5	12.4	12.4	<0.1
R241	387054	404015	30.4	25.4	25.4	<0.1	13.4	12.3	12.3	<0.1
R243	388566	403382	29.1	24.0	24.0	<0.1	14.4	13.3	13.3	<0.1
R244	388662	403400	31.7	26.3	26.3	<0.1	14.7	13.5	13.5	<0.1
R246	388478	403394	31.1	25.8	25.8	<0.1	14.6	13.5	13.5	<0.1
R247	388612	403392	30.5	25.2	25.2	<0.1	14.5	13.4	13.4	<0.1
R249	388559	403382	29.2	24.1	24.1	<0.1	14.4	13.3	13.3	<0.1
R250	388512	403390	30.4	25.1	25.2	<0.1	14.5	13.4	13.4	<0.1
R251	388833	403403	29.2	24.1	24.1	<0.1	14.4	13.3	13.3	<0.1
R252	388703	403410	34.2	28.5	28.5	<0.1	14.9	13.7	13.7	<0.1
R253	388643	403387	29.5	24.3	24.4	<0.1	14.4	13.3	13.3	<0.1
R295	388510	409858	**41.0**	34.3	34.4	0.1	16.1	15.0	15.0	<0.1
R299	388396	409801	31.0	25.7	25.8	0.1	14.4	13.3	13.3	<0.1
R304	388530	409946	38.9	32.7	32.8	0.1	15.5	14.3	14.4	0.1
R305	388549	409956	36.9	31.0	31.1	0.1	15.2	14.1	14.1	<0.1
R306	388470	409950	37.6	31.5	31.6	0.1	15.4	14.3	14.3	<0.1
R307	388524	409946	38.1	32.0	32.1	0.1	15.4	14.2	14.3	0.1
R308	388502	409934	**42.0**	35.3	35.5	0.1	16.0	14.9	14.9	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R309	390264	410305	27.4	22.9	22.9	<0.1	14.3	13.2	13.2	<0.1
R330	386579	404061	35.8	30.2	30.3	0.1	15.2	14.0	14.0	<0.1
R331	386590	404056	35.7	30.1	30.2	0.1	15.2	14.0	14.0	<0.1
R332	385790	404765	24.5	20.1	20.1	<0.1	13.8	12.7	12.7	<0.1
R333	385803	404765	24.8	20.3	20.4	<0.1	13.9	12.8	12.8	<0.1
R334	386199	404205	25.7	21.2	21.2	<0.1	14.3	13.2	13.2	<0.1
R335	386962	403908	28.0	23.3	23.3	<0.1	13.7	12.6	12.6	<0.1
R336	386999	403900	27.5	22.8	22.8	<0.1	13.7	12.5	12.5	<0.1
R337	387086	403875	25.7	21.3	21.3	<0.1	14.3	13.2	13.2	<0.1
R338	387138	403866	26.2	21.8	21.8	<0.1	14.3	13.2	13.2	<0.1
R339	387158	403860	26.3	21.8	21.8	<0.1	14.3	13.2	13.2	<0.1
R340	387191	403848	26.1	21.6	21.6	<0.1	14.3	13.2	13.2	<0.1
R341	382125	407814	26.5	21.9	21.9	0.1	14.2	13.1	13.1	<0.1
R342	382145	407651	25.9	21.4	21.5	0.1	14.1	13.0	13.1	0.1
R343	382175	407178	23.8	19.6	19.7	0.1	13.9	12.9	12.9	<0.1
R344	381856	405493	31.8	27.0	27.4	0.5	15.3	14.2	14.2	<0.1
R345	380885	404642	36.1	30.5	30.5	<0.1	15.3	14.2	14.2	<0.1
R346	381067	404748	30.3	25.2	25.3	0.2	15.1	14.0	14.0	<0.1
R347	380830	404738	**45.6**	39.4	39.3	-0.2	16.7	15.6	15.6	<0.1
R348	380850	404761	**43.1**	37.1	37.1	<0.1	16.3	15.2	15.2	<0.1
R349	381115	404671	29.8	24.7	24.8	0.1	15.1	13.9	14.0	0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R350	383385	406314	30.2	25.6	25.8	0.2	14.5	13.4	13.4	<0.1
R351	386397	408653	23.3	19.3	19.4	0.1	13.8	12.8	12.8	<0.1
R352	386663	409184	32.7	27.9	28.1	0.2	15.1	14.0	14.1	0.1
R353	379914	404605	30.6	26.0	26.0	<0.1	14.8	13.7	13.7	<0.1
R354	386349	404054	34.6	28.6	28.5	<0.1	15.4	14.2	14.2	<0.1
R355	386999	404005	30.1	25.1	25.1	<0.1	14.6	13.4	13.4	<0.1
R356	380914	404928	**47.1**	**42.9**	**42.9**	<0.1	17.3	16.2	16.2	<0.1
R357	380919	404900	**48.4**	**44.2**	**44.2**	<0.1	17.5	16.4	16.4	<0.1
R358	380887	404906	**42.6**	37.2	37.2	<0.1	16.4	15.3	15.3	<0.1
R359	380883	404922	**42.0**	36.6	36.7	<0.1	16.3	15.2	15.3	0.1
R360	380911	404943	**46.9**	**42.4**	**42.4**	<0.1	17.2	16.1	16.1	<0.1
R361	380922	404885	**49.2**	**44.8**	**44.9**	<0.1	17.6	16.5	16.5	<0.1
R362	380880	404937	**41.6**	36.2	36.2	<0.1	16.3	15.2	15.2	<0.1
R363	380877	404952	**40.7**	35.3	35.3	<0.1	16.2	15.1	15.1	<0.1
R364	380916	404914	**47.9**	**43.6**	**43.7**	<0.1	17.4	16.3	16.3	<0.1
R365	380843	404758	**46.9**	**40.7**	**40.6**	-0.1	16.9	15.8	15.8	<0.1
R366	380828	404742	**43.4**	37.5	37.4	-0.1	16.3	15.2	15.2	<0.1
R367	380820	404746	**45.2**	39.2	39.1	-0.1	16.6	15.5	15.5	<0.1
R368	380841	404784	**40.8**	35.1	35.1	<0.1	15.9	14.8	14.9	0.1
R369	380656	404659	**44.0**	38.3	38.2	-0.1	16.4	15.2	15.2	<0.1
R370	380673	404706	37.9	32.6	32.6	-0.1	15.5	14.4	14.4	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R371	388304	409759	29.4	24.4	24.5	0.1	14.2	13.1	13.1	<0.1
R372	390204	410392	33.2	27.8	27.9	<0.1	15.1	14.0	14.0	<0.1
R373	377764	403241	33.4	28.1	28.5	0.3	14.9	13.8	13.8	<0.1
R374	380987	404837	35.3	30.2	30.4	0.2	15.2	14.1	14.2	0.1
R375	380983	404848	33.2	28.2	28.4	0.2	14.9	13.8	13.9	0.1
R376	381000	404880	30.7	25.9	26.0	0.1	14.5	13.5	13.5	<0.1
R377	381047	404902	33.5	28.3	28.3	0.1	15.6	14.4	14.5	0.1
R378	381068	404921	33.3	28.2	28.2	<0.1	15.6	14.4	14.5	0.1
R379	386433	404228	38.6	32.2	32.2	<0.1	15.9	14.6	14.6	<0.1
R380	386449	404255	35.6	29.6	29.6	<0.1	15.4	14.2	14.2	<0.1
R381	380837	404537	28.1	23.5	23.5	<0.1	14.2	13.1	13.1	<0.1
R382	380784	404533	28.8	24.1	24.2	<0.1	14.2	13.2	13.2	<0.1
R383	380750	404527	29.1	24.5	24.5	<0.1	14.3	13.2	13.2	<0.1
R384	388511	409853	39.1	32.6	32.7	0.1	15.8	14.7	14.7	<0.1
R385	388512	409848	37.6	31.3	31.4	0.1	15.6	14.5	14.5	<0.1
R386	388446	409764	26.0	21.4	21.5	<0.1	13.8	12.8	12.8	<0.1
R387	388510	409938	**40.5**	34.0	34.1	0.1	15.8	14.6	14.6	<0.1
R388	388516	409938	**40.9**	34.4	34.5	0.1	15.8	14.6	14.7	0.1
R389	388519	409944	38.5	32.4	32.4	0.1	15.5	14.3	14.3	<0.1
R390	388533	409947	38.5	32.3	32.5	0.1	15.4	14.3	14.3	<0.1
R391	386453	404263	35.5	29.5	29.5	<0.1	15.4	14.2	14.2	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R392	386458	404273	35.2	29.2	29.2	<0.1	15.4	14.2	14.2	<0.1
R393	386466	404289	34.9	28.9	29.0	<0.1	15.3	14.1	14.1	<0.1
R394	386461	404279	35.1	29.1	29.2	<0.1	15.4	14.1	14.1	<0.1
R395	386469	404295	34.7	28.8	28.8	<0.1	15.3	14.1	14.1	<0.1
R396	386473	404303	34.1	28.3	28.3	<0.1	15.3	14.1	14.1	<0.1
R397	386443	404318	**40.1**	33.4	33.5	<0.1	16.0	14.8	14.8	<0.1
R398	388070	409997	23.2	19.0	19.1	<0.1	13.4	12.4	12.4	<0.1
R399	380694	404530	30.9	26.1	26.1	<0.1	14.5	13.4	13.4	<0.1
R400	381253	404865	36.5	30.7	30.8	0.1	16.2	15.0	15.0	<0.1
R401	381039	404906	32.5	27.3	27.4	0.1	15.4	14.3	14.3	<0.1
R402	381035	404912	31.8	26.7	26.7	<0.1	15.3	14.2	14.2	<0.1
R403	381075	404928	33.3	28.1	28.2	<0.1	15.5	14.4	14.5	0.1
R404	381080	404936	33.0	27.9	27.9	<0.1	15.5	14.4	14.4	<0.1
R405	381086	404938	33.3	28.1	28.2	<0.1	15.6	14.4	14.5	0.1
R406	381213	405039	35.6	31.8	30.6	-1.2	15.9	14.8	14.8	<0.1
R407	381208	405051	33.1	29.0	28.2	-0.8	15.6	14.4	14.5	0.1
R408	381206	405056	32.2	28.1	27.4	-0.7	15.5	14.3	14.4	0.1
R409	381236	405072	33.3	29.6	28.5	-1.1	15.6	14.4	14.4	<0.1
R410	381236	405079	32.5	28.7	27.7	-1.0	15.5	14.3	14.3	<0.1
R411	381267	405084	35.9	32.8	31.1	-1.8	15.9	14.8	14.8	<0.1
R412	381260	405078	35.7	32.6	30.9	-1.7	15.9	14.7	14.7	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R413	381279	405093	36.1	33.1	31.3	-1.8	15.9	14.8	14.8	<0.1
R414	381274	405089	36.0	33.0	31.2	-1.8	15.9	14.8	14.8	<0.1
R415	381283	405096	36.2	33.2	31.4	-1.8	15.9	14.8	14.8	<0.1
R416	381288	405100	36.3	33.4	31.5	-1.9	15.9	14.8	14.8	<0.1
R417	381308	405114	36.8	34.0	32.1	-2.0	16.0	14.9	14.9	<0.1
R418	381303	405110	36.6	33.8	31.9	-1.9	16.0	14.8	14.8	<0.1
R419	381311	405116	36.9	34.1	32.2	-2.0	16.0	14.9	14.9	<0.1
R420	381333	405130	37.5	34.9	32.8	-2.1	16.1	14.9	15.0	0.1
R421	381326	405125	37.4	34.8	32.7	-2.1	16.1	14.9	14.9	<0.1
R422	381353	405144	37.9	35.4	33.3	-2.1	16.2	15.0	15.0	<0.1
R423	381347	405141	37.8	35.3	33.2	-2.1	16.1	15.0	15.0	<0.1
R424	381358	405147	38.2	35.8	33.6	-2.2	16.2	15.0	15.1	0.1
R425	381363	405150	38.3	35.9	33.7	-2.2	16.2	15.0	15.1	0.1
R426	381372	405157	38.4	36.0	33.8	-2.3	16.2	15.1	15.1	<0.1
R427	381377	405161	38.5	36.1	33.9	-2.3	16.2	15.1	15.1	<0.1
R428	381387	405168	38.5	36.1	33.8	-2.3	16.2	15.1	15.1	<0.1
R429	381392	405171	38.5	36.2	33.9	-2.3	16.2	15.1	15.1	<0.1
R430	381401	405177	38.7	36.4	34.0	-2.4	16.2	15.1	15.1	<0.1
R431	381410	405183	38.7	36.4	34.0	-2.4	16.3	15.1	15.1	<0.1
R432	381419	405190	38.7	36.4	33.9	-2.5	16.2	15.1	15.1	<0.1
R433	381424	405193	38.7	36.4	33.9	-2.5	16.2	15.1	15.1	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R434	381439	405208	37.2	34.6	32.5	-2.2	16.0	14.9	14.9	<0.1
R435	381437	405223	33.6	30.3	28.9	-1.4	15.6	14.4	14.4	<0.1
R436	381435	405232	32.0	28.6	27.4	-1.2	15.4	14.2	14.2	<0.1
R437	381473	405233	36.6	33.9	31.9	-1.9	16.0	14.8	14.8	<0.1
R438	381477	405241	35.2	32.2	30.5	-1.7	15.8	14.6	14.6	<0.1
R439	381470	405249	33.0	29.7	28.4	-1.3	15.5	14.4	14.4	<0.1
R440	381469	405258	31.7	28.1	27.1	-1.0	15.3	14.2	14.2	<0.1
R441	381500	405235	**43.1**	**41.8**	38.6	-3.2	16.9	15.7	15.7	<0.1
R442	381514	405285	32.0	28.5	27.4	-1.1	15.4	14.2	14.2	<0.1
R443	381518	405285	32.2	28.8	27.7	-1.1	15.4	14.3	14.3	<0.1
R444	381502	405285	31.1	27.4	26.5	-0.9	15.2	14.1	14.1	<0.1
R445	381528	405290	32.6	29.1	28.0	-1.1	15.4	14.3	14.3	<0.1
R446	381533	405294	32.4	28.9	27.8	-1.1	15.4	14.3	14.3	<0.1
R447	381531	405257	**42.5**	**41.1**	38.0	-3.1	16.8	15.6	15.6	<0.1
R448	381542	405307	31.5	28.0	27.0	-0.9	15.3	14.2	14.2	<0.1
R449	381573	405329	31.4	27.7	26.9	-0.8	15.3	14.2	14.2	<0.1
R450	381575	405324	32.1	28.5	27.5	-1.0	15.4	14.2	14.2	<0.1
R451	381586	405318	34.2	30.9	29.6	-1.3	15.6	14.5	14.5	<0.1
R452	381590	405320	34.3	31.0	29.8	-1.3	15.7	14.5	14.5	<0.1
R453	381594	405322	34.4	31.1	29.9	-1.3	15.7	14.5	14.5	<0.1
R454	381598	405324	34.6	31.2	30.0	-1.2	15.7	14.5	14.6	0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R455	381603	405326	34.7	31.3	30.1	-1.2	15.7	14.6	14.6	<0.1
R456	381607	405328	34.8	31.4	30.3	-1.2	15.7	14.6	14.6	<0.1
R457	381610	405333	34.2	30.6	29.6	-1.0	15.6	14.5	14.5	<0.1
R458	381614	405335	34.3	30.7	29.7	-0.9	15.7	14.5	14.5	<0.1
R459	381618	405335	34.9	31.2	30.3	-1.0	15.7	14.6	14.6	<0.1
R460	381622	405337	34.9	31.3	30.4	-0.9	15.7	14.6	14.6	<0.1
R461	381625	405339	35.1	31.3	30.5	-0.8	15.8	14.6	14.6	<0.1
R462	381630	405341	35.2	31.3	30.7	-0.7	15.8	14.6	14.6	<0.1
R463	381634	405343	35.3	31.3	30.8	-0.6	15.8	14.6	14.6	<0.1
R464	381639	405345	35.4	31.4	30.9	-0.5	15.8	14.6	14.7	0.1
R465	381643	405360	33.1	28.9	28.6	-0.2	15.5	14.4	14.4	<0.1
R466	381641	405364	32.3	28.0	27.8	-0.2	15.4	14.2	14.3	0.1
R467	381638	405368	31.5	27.3	27.1	-0.2	15.3	14.2	14.2	<0.1
R468	381665	405380	32.0	27.5	27.6	0.1	15.4	14.2	14.2	<0.1
R469	381667	405376	32.9	28.3	28.5	0.1	15.5	14.3	14.3	<0.1
R470	381670	405372	33.8	29.3	29.4	0.2	15.6	14.4	14.5	0.1
R471	381678	405367	35.9	31.2	31.5	0.3	15.9	14.7	14.7	<0.1
R472	381682	405370	35.6	30.9	31.3	0.4	15.8	14.7	14.7	<0.1
R473	381685	405372	35.7	30.9	31.3	0.4	15.8	14.7	14.7	<0.1
R474	381689	405374	35.7	31.0	31.4	0.4	15.8	14.7	14.7	<0.1
R475	381693	405376	35.8	31.0	31.5	0.5	15.9	14.7	14.7	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R476	381698	405395	32.8	28.1	28.4	0.4	15.5	14.3	14.3	<0.1
R477	381700	405391	33.5	28.8	29.2	0.4	15.6	14.4	14.4	<0.1
R478	381709	405386	35.8	30.9	31.5	0.6	15.8	14.7	14.7	<0.1
R479	381713	405388	35.8	30.9	31.5	0.6	15.8	14.7	14.7	<0.1
R480	381726	405393	36.4	31.5	32.2	0.7	15.9	14.8	14.8	<0.1
R481	381727	405397	35.7	30.8	31.5	0.7	15.8	14.7	14.7	<0.1
R482	381735	405401	35.8	30.8	31.6	0.7	15.8	14.7	14.7	<0.1
R483	381736	405406	34.8	29.9	30.6	0.6	15.7	14.6	14.6	<0.1
R484	381737	405420	32.4	27.6	28.1	0.5	15.4	14.3	14.3	<0.1
R485	381733	405423	31.6	26.9	27.3	0.4	15.3	14.2	14.2	<0.1
R486	381731	405427	31.1	26.4	26.8	0.4	15.2	14.1	14.1	<0.1
R487	381863	405497	31.7	26.9	27.4	0.5	15.3	14.2	14.2	<0.1
R488	381960	405540	32.8	28.2	28.3	0.2	15.4	14.3	14.3	<0.1
R489	381960	405547	31.7	27.1	27.3	0.1	15.3	14.2	14.2	<0.1
R490	382029	405572	32.4	28.0	28.2	0.2	15.1	14.0	14.1	0.1
R491	382024	405579	31.1	26.7	26.8	0.2	14.9	13.9	13.9	<0.1
R492	382054	405580	33.2	28.7	29.0	0.3	15.2	14.1	14.2	0.1
R493	382051	405587	31.7	27.2	27.4	0.2	15.0	13.9	14.0	0.1
R494	382079	405593	32.9	28.4	28.6	0.2	15.2	14.1	14.1	<0.1
R495	382075	405600	31.6	27.1	27.3	0.2	15.0	13.9	14.0	0.1
R496	382072	405606	30.6	26.1	26.3	0.1	14.9	13.8	13.8	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R497	382101	405609	31.9	27.5	27.7	0.2	15.0	14.0	14.0	<0.1
R498	382098	405615	30.8	26.4	26.5	0.2	14.9	13.8	13.9	0.1
R499	382127	405622	31.7	27.2	27.4	0.2	15.0	13.9	14.0	0.1
R500	382124	405629	30.6	26.2	26.4	0.1	14.9	13.8	13.9	0.1
R501	382148	405640	30.6	26.1	26.3	0.1	14.9	13.8	13.8	<0.1
R502	382244	405682	30.7	26.3	26.3	<0.1	14.9	13.8	13.9	0.1
R503	382271	405696	30.5	26.0	26.0	<0.1	14.9	13.8	13.9	0.1
R504	381853	405349	28.8	24.0	24.5	0.5	14.9	13.8	13.8	<0.1
R505	381832	405344	29.3	24.4	25.0	0.6	15.0	13.9	13.9	<0.1
R506	381821	405339	29.4	24.6	25.3	0.7	15.0	13.9	13.9	<0.1
R507	381816	405336	29.4	24.6	25.2	0.6	15.0	13.9	13.9	<0.1
R508	381807	405332	29.5	24.7	25.4	0.7	15.0	13.9	13.9	<0.1
R509	381802	405330	29.6	24.7	25.4	0.7	15.0	13.9	13.9	<0.1
R510	381794	405327	29.9	25.0	25.7	0.7	15.1	13.9	14.0	0.1
R511	381784	405320	29.6	24.8	25.5	0.7	15.0	13.9	14.0	0.1
R512	381775	405316	29.8	25.0	25.7	0.7	15.1	13.9	14.0	0.1
R513	381769	405308	29.3	24.5	25.1	0.6	15.0	13.9	13.9	<0.1
R514	381764	405299	28.5	23.9	24.3	0.5	14.9	13.8	13.8	<0.1
R515	381760	405291	28.0	23.4	23.8	0.4	14.8	13.7	13.8	0.1
R516	381759	405284	27.5	23.0	23.3	0.3	14.8	13.7	13.7	<0.1
R517	381704	405259	28.1	23.7	23.9	0.2	14.9	13.7	13.8	0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R518	381698	405256	28.2	23.8	23.9	0.1	14.9	13.7	13.8	0.1
R519	381690	405256	28.7	24.3	24.4	0.1	14.9	13.8	13.8	<0.1
R520	381680	405256	29.5	25.0	25.1	0.1	15.0	13.9	13.9	<0.1
R521	381672	405259	30.7	26.2	26.4	0.2	15.2	14.0	14.1	0.1
R522	381662	405256	31.3	26.9	27.0	0.1	15.2	14.1	14.2	0.1
R523	381654	405257	32.8	28.3	28.4	0.2	15.4	14.3	14.3	<0.1
R524	381615	405199	27.9	23.6	23.4	-0.2	14.8	13.7	13.7	<0.1
R525	381639	405224	28.7	24.5	24.3	-0.2	14.9	13.8	13.8	<0.1
R526	381633	405225	29.3	25.0	24.9	-0.2	15.0	13.9	13.9	<0.1
R527	381624	405225	30.1	25.8	25.6	-0.2	15.1	14.0	14.0	<0.1
R528	381612	405224	31.2	26.9	26.7	-0.2	15.2	14.1	14.1	<0.1
R529	381603	405223	32.4	28.0	27.8	-0.2	15.4	14.2	14.3	0.1
R530	381607	405196	28.1	23.9	23.6	-0.2	14.9	13.7	13.8	0.1
R531	381597	405190	28.1	23.9	23.7	-0.2	14.9	13.7	13.8	0.1
R532	381590	405191	28.6	24.4	24.1	-0.2	14.9	13.8	13.8	<0.1
R533	381582	405183	28.4	24.2	23.9	-0.2	14.9	13.8	13.8	<0.1
R534	381574	405178	28.4	24.2	23.9	-0.3	14.9	13.8	13.8	<0.1
R535	381567	405174	28.5	24.2	24.0	-0.2	14.9	13.8	13.8	<0.1
R536	381558	405168	28.5	24.3	24.0	-0.3	14.9	13.8	13.8	<0.1
R537	381555	405161	28.1	23.9	23.6	-0.2	14.9	13.7	13.8	0.1
R538	381543	405158	28.4	24.3	24.0	-0.2	14.9	13.8	13.8	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R539	381537	405157	28.8	24.6	24.4	-0.3	14.9	13.8	13.9	0.1
R540	381500	405116	27.5	23.3	23.1	-0.2	14.8	13.7	13.7	<0.1
R541	381520	405138	28.1	23.9	23.7	-0.2	14.9	13.7	13.8	0.1
R542	381513	405147	29.5	25.3	25.1	-0.2	15.0	13.9	14.0	0.1
R543	381509	405152	30.6	26.4	26.2	-0.2	15.2	14.0	14.1	0.1
R545	381470	405124	30.5	26.3	26.1	-0.2	15.2	14.0	14.1	0.1
R546	381493	405116	27.8	23.7	23.4	-0.2	14.8	13.7	13.8	0.1
R547	381455	405105	29.5	25.3	25.0	-0.2	15.0	13.9	14.0	0.1
R548	381450	405102	29.4	25.2	25.0	-0.2	15.0	13.9	13.9	<0.1
R549	381439	405097	29.9	25.7	25.5	-0.2	15.1	14.0	14.0	<0.1
R550	381402	405071	30.2	25.9	25.7	-0.2	15.1	14.0	14.1	0.1
R551	381389	405060	30.1	25.8	25.6	-0.2	15.1	14.0	14.0	<0.1
R552	381383	405059	30.7	26.4	26.3	-0.2	15.2	14.0	14.1	0.1
R553	381375	405051	30.4	26.1	26.0	-0.2	15.2	14.0	14.1	0.1
R554	381369	405051	31.3	26.9	26.8	-0.1	15.3	14.1	14.2	0.1
R555	381361	405042	30.8	26.5	26.4	-0.1	15.2	14.1	14.1	<0.1
R556	381355	405038	31.0	26.7	26.6	-0.1	15.2	14.1	14.2	0.1
R557	381347	405033	31.3	27.0	26.9	-0.1	15.3	14.1	14.2	0.1
R558	381341	405031	32.0	27.6	27.6	<0.1	15.4	14.2	14.3	0.1
R559	381334	405024	31.9	27.4	27.4	<0.1	15.3	14.2	14.3	0.1
R560	381327	405019	32.2	27.7	27.7	<0.1	15.4	14.2	14.3	0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R561	381319	405014	32.6	28.0	28.0	<0.1	15.4	14.3	14.4	0.1
R562	381335	404987	28.8	24.2	24.1	-0.1	14.9	13.8	13.8	<0.1
R563	381326	404981	29.0	24.4	24.3	-0.1	14.9	13.8	13.8	<0.1
R564	381321	404978	29.1	24.5	24.4	-0.1	15.0	13.8	13.9	0.1
R565	381313	404972	29.3	24.6	24.6	-0.1	15.0	13.8	13.9	0.1
R566	381308	404968	29.5	24.8	24.7	-0.1	15.0	13.9	13.9	<0.1
R567	381299	404963	29.7	24.9	24.9	<0.1	15.0	13.9	13.9	<0.1
R568	381293	404960	30.0	25.2	25.2	<0.1	15.1	13.9	14.0	0.1
R569	381285	404953	30.2	25.3	25.3	<0.1	15.1	14.0	14.0	<0.1
R570	381280	404950	30.4	25.5	25.5	<0.1	15.1	14.0	14.0	<0.1
R571	381275	404945	30.5	25.5	25.5	<0.1	15.2	14.0	14.1	0.1
R572	381271	404940	30.6	25.6	25.6	<0.1	15.2	14.0	14.1	0.1
R573	381257	404924	31.1	26.0	26.0	0.1	15.3	14.1	14.2	0.1
R574	381260	404928	30.9	25.8	25.9	<0.1	15.3	14.1	14.2	0.1
R575	381252	404910	31.7	26.5	26.5	0.1	15.4	14.3	14.3	<0.1
R576	381164	404839	30.1	25.0	25.2	0.1	15.1	13.9	14.0	0.1
R577	381164	404830	29.3	24.3	24.4	0.1	15.0	13.9	13.9	<0.1
R578	381165	404824	28.9	23.9	24.0	0.1	14.9	13.8	13.8	<0.1
R579	381165	404815	28.3	23.4	23.5	0.1	14.9	13.7	13.8	0.1
R580	381165	404809	28.0	23.2	23.2	0.1	14.8	13.7	13.7	<0.1
R581	381133	404811	30.2	25.1	25.3	0.1	15.1	14.0	14.0	<0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R582	381133	404799	29.2	24.2	24.3	0.1	15.0	13.8	13.9	0.1
R583	381137	404795	28.7	23.8	23.9	0.1	14.9	13.8	13.8	<0.1
R584	381139	404779	27.8	22.9	23.0	0.1	14.8	13.7	13.7	<0.1
R585	381133	404779	28.0	23.2	23.3	0.1	14.8	13.7	13.7	<0.1
R586	381123	404780	28.6	23.7	23.8	0.1	14.9	13.8	13.8	<0.1
R587	381117	404784	29.2	24.2	24.3	0.1	15.0	13.8	13.9	0.1
R588	381107	404784	30.1	25.0	25.1	0.1	15.1	13.9	14.0	0.1
R589	381068	404743	29.8	24.7	24.9	0.1	15.1	13.9	14.0	0.1
R590	381069	404735	29.2	24.2	24.3	0.1	15.0	13.9	13.9	<0.1
R591	381070	404731	28.9	23.9	24.0	0.1	14.9	13.8	13.8	<0.1
R592	381071	404723	28.4	23.4	23.5	0.1	14.9	13.8	13.8	<0.1
R593	381072	404718	28.1	23.2	23.3	0.1	14.8	13.7	13.7	<0.1
R594	381374	405197	31.2	27.6	26.7	-1.0	15.3	14.1	14.2	0.1
R595	381383	405200	31.5	27.9	26.9	-1.0	15.3	14.2	14.2	<0.1
R596	381388	405203	31.6	28.0	27.0	-1.0	15.3	14.2	14.2	<0.1
R597	381395	405208	31.6	28.0	27.0	-1.0	15.3	14.2	14.2	<0.1
R598	381401	405214	31.4	27.8	26.8	-1.0	15.3	14.2	14.2	<0.1
R599	381500	405236	**42.8**	**41.4**	38.3	-3.2	16.8	15.6	15.7	0.1
R600	381527	405254	**42.3**	**40.9**	37.8	-3.1	16.8	15.6	15.6	<0.1
R601	381554	405273	**41.9**	**40.3**	37.2	-3.1	16.7	15.5	15.5	<0.1
R602	380999	404886	30.2	25.5	25.6	0.1	14.5	13.4	13.5	0.1

Receptor ID	Location (m)		NO_2 (µg/m^3)				PM_{10} (µg/m^3)			
	X	Y	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027	Base 2018	DM 2027	DS 2027	Change in concentration (DS-DM) 2027
R603	381094	404967	31.8	26.7	26.7	<0.1	15.3	14.2	14.3	0.1

1.2 Ecological assessment results

1.2.1 The results from the PEIR ecological air quality assessment (nitrogen deposition (N-dep) calculations) for operational traffic are presented below. The results are divided between two tables: Table 1.2 and Table 1.3, the first featuring the worst-case habitats at each receptor location as identified by the project ecologists (with the lowest Critical Load (CL)) and the second other habitats identified at each receptor location. Baseline nitrogen deposition rates and critical loads were obtained from the Air Pollution Information System website (APIS; UK Centre for Ecology and Hydrology, 2022).

1.2.2 As stated in DMRB LA 105 (Highways England, 2019), water course habitats are not evaluated in air quality assessments due to not being considered sensitive to nitrogen deposition impacts. However, for the purpose of this assessment, and following advice from Natural England and the project ecologists, a worst-case critical load of 3kg N/ha/yr was assigned to the Rochdale Canal Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) receptor points, representing the *Luronium natans* - Floating water-plantain (S1831) habitat.

1.2.3 The following is the key for Table 1.2 and Table 1.3 where the beginning of the receptor ID designates the ecological site type as Ancient Woodland (AW), Local Nature Reserve (LNR), Local Wildlife Site (LWS), SAC and/or SSSI:

- ‘AW_CW’ relates to Clifton Wood
- ‘AW_MC’ relates to Mere Clough
- ‘AW_NW’ relates to North Wood
- ‘AW_PW’ relates to Phillips Wood
- ‘LNR_AW’ relates to Alkrington Woods
- ‘LNR_CCP’ relates to Clifton Country Park
- ‘LNR_HV’ relates to Hollins Vale
- ‘LNR_MC’ relates to Mere Clough
- ‘LNR_PP1’ relates to Philip’s Park (1)

- ‘LNR_PP2’ relates to Philip’s Park (2)
- ‘LWS_AWRL’ relates to Alkrington Woods and Rhodes Lodges
- ‘LWS_BB’ relates to Boardman Brook
- ‘LWS_CCP’ relates to Clifton Country Park
- ‘LWS_CMS’ relates to Clifton Moss (South)
- ‘LWS_HL’ relates to Hollins Vale
- ‘LWS_HP’ relates to Hollins Plantation
- ‘LWS_HW’ relates to Hazlitt Wood
- ‘LWS_PPNW1’ relates to Philips Park and North Wood (1)
- ‘LWS_PPNW2’ relates to Philips Park and North Wood (2)
- ‘LWS_PPNW3’ relates to Phillip’s Park and North Wood (3)
- ‘LWS_RC1’ relates to Rochdale Canal (Scowcroft to Warland) (1)
- ‘LWS_RC1’ relates to Rochdale Canal (Scowcroft to Warland) (2)
- ‘LWS_RFSW1’ relates to Rhodes Farm Sewage Works (1)
- ‘LWS_RFSW2’ relates to Rhodes Farm Sewage Works (2)
- ‘LWS_RWE’ relates to Ringley Woods (East)
- ‘SAC_SSSI_RC2’ relates to Rochdale Canal (1)
- ‘SAC_SSSI_RC2’ relates to Rochdale Canal (2)

Table 1.2: Ecological assessment results – worst-case habitats

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_CMS_0	4	376767	403218	Broadleaved, mixed and yew woodland	Forest	10	38.78	45.55	45.74	0.20	2.0	Not significant
LWS_CMS_10	14	376767	403228	Broadleaved, mixed and yew woodland	Forest	10	38.78	43.72	43.87	0.15	1.5	Not significant
LWS_CMS_20	24	376767	403238	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.67	42.79	0.12	1.2	Not significant
LWS_CMS_30	34	376767	403248	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.99	42.09	0.10	1.0	Not significant
LWS_CMS_40	44	376767	403258	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.51	41.59	0.09	0.9	Not significant
LWS_CMS_50	54	376767	403268	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.81	41.90	0.10	1.0	Not significant
LWS_CMS_60	64	376767	403278	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.46	41.54	0.09	0.9	Not significant
LWS_CMS_70	74	376767	403288	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.18	41.26	0.08	0.8	Not significant
LWS_CMS_80	84	376767	403298	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.96	41.03	0.07	0.7	Not significant
LWS_CMS_90	94	376767	403308	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.77	40.83	0.06	0.6	Not significant
LWS_CMS_100	104	376767	403318	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.61	40.67	0.06	0.6	Not significant
LWS_CMS_110	114	376767	403328	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.48	40.53	0.05	0.5	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_CMS_120	124	376767	403338	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.37	40.42	0.05	0.5	Not significant
LWS_CMS_130	134	376767	403348	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.27	40.31	0.05	0.5	Not significant
LWS_CMS_140	144	376767	403358	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.18	40.22	0.04	0.4	Not significant
LWS_CMS_150	154	376767	403368	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.11	40.15	0.04	0.4	Not significant
LWS_CMS_160	164	376767	403378	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.04	40.08	0.04	0.4	Not significant
LWS_CMS_170	174	376767	403388	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.97	40.01	0.04	0.4	Not significant
LWS_CMS_180	184	376767	403398	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.92	39.95	0.03	0.3	Not significant
LWS_CMS_190	194	376767	403408	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.87	39.90	0.03	0.3	Not significant
LWS_CMS_194	198	376767	403411	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.85	39.88	0.03	0.3	Not significant
LWS_CCP_0	13	377761	403418	Broadleaved, mixed and yew woodland	Forest	10	38.78	43.59	43.81	0.22	2.2	Not significant
LWS_CCP_10	23	377758	403428	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.86	43.04	0.18	1.8	Not significant
LWS_CCP_20	33	377755	403437	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.34	42.50	0.16	1.6	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_CCP_30	43	377752	403447	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.95	42.09	0.14	1.4	Not significant
LWS_CCP_40	53	377750	403457	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.64	41.76	0.12	1.2	Not significant
LWS_CCP_50	63	377747	403466	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.39	41.50	0.11	1.1	Not significant
LWS_CCP_60	73	377744	403476	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.18	41.28	0.10	1.0	Not significant
LWS_CCP_70	83	377741	403485	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.99	41.09	0.09	0.9	Not significant
LWS_CCP_80	93	377739	403495	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.84	40.93	0.08	0.8	Not significant
LWS_CCP_90	103	377736	403505	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.71	40.79	0.08	0.8	Not significant
LWS_CCP_100	113	377733	403514	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.59	40.66	0.08	0.8	Not significant
LWS_CCP_110	123	377730	403524	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.49	40.56	0.07	0.7	Not significant
LWS_CCP_120	133	377728	403533	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.39	40.46	0.07	0.7	Not significant
LWS_CCP_130	143	377725	403543	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.31	40.38	0.07	0.7	Not significant
LWS_CCP_140	153	377722	403553	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.24	40.30	0.06	0.6	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_CCP_150	163	377719	403562	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.17	40.23	0.06	0.6	Not significant
LWS_CCP_160	173	377717	403572	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.11	40.17	0.05	0.5	Not significant
LWS_CCP_170	183	377714	403582	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.05	40.11	0.05	0.5	Not significant
LWS_CCP_180	193	377711	403591	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.01	40.05	0.05	0.5	Not significant
LWS_CCP_188	200	377709	403599	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.97	40.01	0.05	0.5	Not significant
AW_CW_0	23	377760	403427	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.90	43.09	0.18	1.8	Not significant
AW_CW_10	33	377757	403437	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.38	42.53	0.16	1.6	Not significant
AW_CW_20	43	377754	403447	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.98	42.11	0.14	1.4	Not significant
AW_CW_30	53	377752	403456	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.66	41.78	0.12	1.2	Not significant
AW_CW_40	63	377749	403466	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.40	41.51	0.11	1.1	Not significant
AW_CW_50	73	377746	403475	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.19	41.29	0.10	1.0	Not significant
AW_CW_60	83	377743	403485	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.01	41.10	0.09	0.9	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
AW_CW_70	93	377741	403495	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.85	40.94	0.09	0.9	Not significant
AW_CW_80	103	377738	403504	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.71	40.80	0.08	0.8	Not significant
AW_CW_90	113	377735	403514	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.60	40.67	0.08	0.8	Not significant
AW_CW_100	123	377732	403524	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.49	40.57	0.07	0.7	Not significant
AW_CW_110	133	377730	403533	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.40	40.47	0.07	0.7	Not significant
AW_CW_120	143	377727	403543	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.32	40.38	0.07	0.7	Not significant
AW_CW_130	153	377724	403552	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.24	40.31	0.06	0.6	Not significant
AW_CW_140	163	377721	403562	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.18	40.23	0.06	0.6	Not significant
AW_CW_150	173	377719	403572	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.12	40.17	0.05	0.5	Not significant
AW_CW_160	183	377716	403581	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.06	40.11	0.05	0.5	Not significant
AW_CW_170	193	377713	403591	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.01	40.06	0.05	0.5	Not significant
AW_CW_179	200	377711	403599	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.97	40.01	0.05	0.5	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LNR_CCP_0	6	378395	403595	Broadleaved, mixed and yew woodland	Forest	10	38.78	51.27	51.91	0.65	6.5	Potentially Affected
LNR_CCP_10	16	378392	403605	Broadleaved, mixed and yew woodland	Forest	10	38.78	47.03	47.45	0.42	4.2	Potentially Affected
LNR_CCP_20	26	378388	403614	Broadleaved, mixed and yew woodland	Forest	10	38.78	44.96	45.27	0.32	3.2	Not significant
LNR_CCP_30	36	378385	403623	Broadleaved, mixed and yew woodland	Forest	10	38.78	43.72	43.96	0.25	2.5	Not significant
LNR_CCP_40	46	378381	403633	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.88	43.09	0.21	2.1	Not significant
LNR_CCP_50	56	378378	403642	Broadleaved, mixed and yew woodland	Forest	10	38.78	43.25	43.47	0.22	2.2	Not significant
LNR_CCP_60	66	378374	403651	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.69	42.88	0.19	1.9	Not significant
LNR_CCP_67	73	378372	403658	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.37	42.54	0.17	1.7	Not significant
LWS_RFSW1_0	6	378445	403613	Lowland fens	Grassland	10	24.08	30.19	30.51	0.31	3.1	Not significant
LWS_RFSW1_10	16	378442	403623	Broadleaved, mixed and yew woodland	Forest	10	38.78	46.93	47.34	0.41	4.1	Potentially Affected
LWS_RFSW1_20	26	378439	403632	Broadleaved, mixed and yew woodland	Forest	10	38.78	44.91	45.22	0.31	3.1	Not significant
LWS_RFSW1_30	36	378435	403641	Broadleaved, mixed and yew woodland	Forest	10	38.78	43.69	43.92	0.24	2.4	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_RFSW1_40	46	378432	403651	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.87	43.06	0.20	2.0	Not significant
LWS_RFSW1_50	56	378429	403660	Broadleaved, mixed and yew woodland	Forest	10	38.78	43.24	43.45	0.21	2.1	Not significant
LWS_RFSW1_60	66	378425	403670	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.68	42.86	0.18	1.8	Not significant
LWS_RFSW1_70	76	378422	403679	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.24	42.40	0.16	1.6	Not significant
LWS_RFSW1_80	86	378419	403689	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.89	42.03	0.14	1.4	Not significant
LWS_RFSW1_90	96	378415	403698	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.60	41.73	0.13	1.3	Not significant
LWS_RFSW1_100	106	378412	403707	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.36	41.48	0.12	1.2	Not significant
LWS_RFSW1_110	116	378409	403717	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.16	41.27	0.11	1.1	Not significant
LWS_RFSW1_120	126	378405	403726	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.99	41.08	0.10	1.0	Not significant
LWS_RFSW1_130	136	378402	403736	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.84	40.93	0.09	0.9	Not significant
LWS_RFSW1_140	146	378399	403745	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.71	40.79	0.08	0.8	Not significant
LWS_RFSW1_150	156	378395	403755	Fen marsh swamp	Grassland	10	24.08	24.99	25.02	0.04	0.4	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_RFS W1_160	166	378 392	403 764	Fen marsh swamp	Grassland	10	24.08	24.94	24.97	0.04	0.4	Not significant
LWS_RFS W1_170	176	378 389	403 773	Fen marsh swamp	Grassland	10	24.08	24.89	24.92	0.03	0.3	Not significant
LWS_RFS W1_180	186	378 385	403 783	Fen marsh swamp	Grassland	10	24.08	24.85	24.88	0.03	0.3	Not significant
LWS_RFS W1_190	196	378 382	403 792	Fen marsh swamp	Grassland	10	24.08	24.81	24.84	0.03	0.3	Not significant
LWS_RFS W1_193	199	378 381	403 795	Fen marsh swamp	Grassland	10	24.08	24.80	24.83	0.03	0.3	Not significant
LWS_RFS W2_0	2	378 486	403 576	Broadleaved, mixed and yew woodland	Forest	10	38.78	47.41	47.67	0.26	2.6	Not significant
LWS_RFS W2_10	12	378 489	403 567	Broadleaved, mixed and yew woodland	Forest	10	38.78	43.79	43.99	0.20	2.0	Not significant
LWS_RFS W2_20	22	378 493	403 558	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.37	42.53	0.16	1.6	Not significant
LWS_RFS W2_30	32	378 496	403 548	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.59	41.71	0.13	1.3	Not significant
LWS_RFS W2_40	42	378 500	403 539	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.08	41.19	0.11	1.1	Not significant
LWS_RFS W2_50	51	378 503	403 530	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.28	41.40	0.12	1.2	Not significant
LWS_RW E_0	12	379 006	403 843	Broadleaved, mixed and yew woodland	Forest	10	38.78	46.35	46.39	0.04	0.4	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_RWE_10	22	379002	403852	Broadleaved, mixed and yew woodland	Forest	10	38.78	44.33	44.36	0.03	0.3	Not significant
LWS_RWE_20	32	378997	403862	Broadleaved, mixed and yew woodland	Forest	10	38.78	43.27	43.30	0.02	0.2	Not significant
LWS_RWE_30	42	378993	403871	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.51	42.53	0.02	0.2	Not significant
LWS_RWE_40	52	378989	403880	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.85	42.88	0.03	0.3	Not significant
LWS_RWE_50	62	378985	403889	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.34	42.37	0.02	0.2	Not significant
LWS_RWE_60	72	378981	403898	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.95	41.97	0.02	0.2	Not significant
LWS_RWE_70	82	378977	403907	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.63	41.65	0.02	0.2	Not significant
LWS_RWE_80	92	378972	403916	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.38	41.40	0.02	0.2	Not significant
LWS_RWE_90	102	378968	403925	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.16	41.18	0.02	0.2	Not significant
LWS_RWE_100	112	378964	403934	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.98	41.00	0.02	0.2	Not significant
LWS_RWE_110	122	378960	403943	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.83	40.85	0.02	0.2	Not significant
LWS_RWE_120	132	378956	403952	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.70	40.72	0.02	0.2	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_RWE_130	142	378951	403961	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.58	40.60	0.02	0.2	Not significant
LWS_RWE_140	152	378947	403970	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.48	40.50	0.02	0.2	Not significant
LWS_RWE_150	162	378943	403980	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.39	40.41	0.02	0.2	Not significant
LWS_RWE_160	172	378939	403989	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.31	40.32	0.01	0.1	Not significant
LWS_RWE_170	182	378935	403998	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.24	40.25	0.01	0.1	Not significant
LWS_RWE_180	192	378930	404007	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.15	40.17	0.02	0.2	Not significant
LWS_RWE_188	200	378927	404014	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.10	40.12	0.02	0.2	Not significant
LNR_PP1_0	13	379071	403806	Semi-improved grassland	Grassland	20	24.08	26.20	26.22	0.02	0.1	Not significant
LNR_PP1_10	23	379076	403797	Semi-improved grassland	Grassland	20	24.08	25.60	25.61	0.01	0.1	Not significant
LNR_PP1_20	33	379081	403789	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.15	41.17	0.02	0.2	Not significant
LNR_PP1_30	43	379086	403780	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.72	40.74	0.02	0.2	Not significant
LNR_PP1_40	53	379092	403772	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.89	40.91	0.02	0.2	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LNR_PP1_50	63	379097	403763	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.61	40.63	0.02	0.2	Not significant
LNR_PP1_60	73	379102	403754	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.39	40.41	0.02	0.2	Not significant
LNR_PP1_70	83	379107	403746	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.22	40.24	0.02	0.2	Not significant
LNR_PP1_80	93	379112	403737	Broadleaved, mixed and yew woodland	Forest	10	38.78	40.09	40.10	0.02	0.2	Not significant
LNR_PP1_90	103	379117	403729	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.98	39.99	0.02	0.2	Not significant
LNR_PP1_100	113	379123	403720	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.88	39.90	0.02	0.2	Not significant
LNR_PP1_110	123	379128	403712	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.80	39.82	0.02	0.2	Not significant
LNR_PP1_120	133	379133	403703	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.73	39.74	0.01	0.1	Not significant
LNR_PP1_130	143	379138	403695	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.67	39.69	0.02	0.2	Not significant
LNR_PP1_140	153	379143	403686	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.62	39.63	0.01	0.1	Not significant
LNR_PP1_150	163	379149	403677	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.57	39.59	0.01	0.1	Not significant
LNR_PP1_160	173	379154	403669	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.53	39.55	0.01	0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LNR_PP1_170	183	379159	403660	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.49	39.51	0.01	0.1	Not significant
LNR_PP1_176	191	379163	403654	Broadleaved, mixed and yew woodland	Forest	10	38.78	39.47	39.48	0.01	0.1	Not significant
LWS_PPNW3_0	11	379527	404262	Lowland fens	Grassland	10	24.08	27.88	27.90	0.01	0.1	Not significant
LWS_PPNW3_10	21	379521	404270	Lowland fens	Grassland	10	24.08	26.85	26.86	0.01	0.1	Not significant
LWS_PPNW3_20	31	379514	404277	Lowland fens	Grassland	10	24.08	26.26	26.26	0.01	0.1	Not significant
LWS_PPNW3_30	41	379508	404285	Lowland fens	Grassland	10	24.08	25.87	25.88	0.01	0.1	Not significant
LWS_PPNW3_40	51	379501	404292	Lowland fens	Grassland	10	24.08	26.03	26.04	0.01	0.1	Not significant
LWS_PPNW3_50	61	379495	404300	Lowland fens	Grassland	10	24.08	25.78	25.78	0.01	0.1	Not significant
LWS_PPNW3_60	71	379488	404308	Lowland fens	Grassland	10	24.08	25.58	25.59	0.01	0.1	Not significant
LWS_PPNW3_70	81	379482	404315	Lowland fens	Grassland	10	24.08	25.43	25.43	0.01	0.1	Not significant
LWS_PPNW3_80	91	379475	404323	Lowland fens	Grassland	10	24.08	25.30	25.31	<0.01	<0.1	Not significant
LWS_PPNW3_90	101	379469	404330	Lowland fens	Grassland	10	24.08	25.20	25.20	0.01	0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_PPNW3_100	111	379462	404338	Lowland fens	Grassland	10	24.08	25.11	25.11	<0.01	<0.1	Not significant
LWS_PPNW3_110	121	379455	404346	Lowland fens	Grassland	10	24.08	25.04	25.04	<0.01	<0.1	Not significant
LWS_PPNW3_120	131	379449	404353	Lowland fens	Grassland	10	24.08	24.97	24.97	<0.01	<0.1	Not significant
LWS_PPNW3_130	141	379442	404361	Lowland fens	Grassland	10	24.08	24.91	24.92	<0.01	<0.1	Not significant
LWS_PPNW3_140	151	379436	404368	Lowland fens	Grassland	10	24.08	24.86	24.87	<0.01	<0.1	Not significant
LWS_PPNW3_150	161	379429	404376	Lowland fens	Grassland	10	24.08	24.82	24.83	<0.01	<0.1	Not significant
LWS_PPNW3_160	172	379423	404384	Lowland fens	Grassland	10	24.08	24.78	24.79	<0.01	<0.1	Not significant
AW_NW_0	16	379553	404288	Broadleaved, mixed and yew woodland	Forest	10	38.78	45.42	45.44	0.02	0.2	Not significant
AW_NW_10	26	379547	404296	Broadleaved, mixed and yew woodland	Forest	10	38.78	43.80	43.82	0.02	0.2	Not significant
AW_NW_20	36	379541	404304	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.82	42.83	0.02	0.2	Not significant
AW_NW_30	46	379535	404312	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.15	42.17	0.01	0.1	Not significant
AW_NW_40	56	379529	404320	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.48	42.50	0.02	0.2	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
AW_NW_50	66	379523	404328	Broadleaved, mixed and yew woodland	Forest	10	38.78	42.03	42.04	0.01	0.1	Not significant
AW_NW_60	76	379517	404336	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.67	41.68	0.01	0.1	Not significant
AW_NW_70	86	379511	404344	Broadleaved, mixed and yew woodland	Forest	10	38.78	41.39	41.40	0.01	0.1	Not significant
AW_NW_80	96	379506	404352	Lowland fens	Grassland	10	24.08	25.27	25.27	<0.01	<0.1	Not significant
AW_NW_90	106	379500	404360	Lowland fens	Grassland	10	24.08	25.17	25.17	<0.01	<0.1	Not significant
AW_NW_100	116	379494	404369	Lowland fens	Grassland	10	24.08	25.08	25.09	0.01	0.1	Not significant
AW_NW_110	126	379488	404377	Lowland fens	Grassland	10	24.08	25.01	25.02	<0.01	<0.1	Not significant
AW_NW_120	136	379482	404385	Lowland fens	Grassland	10	24.08	24.95	24.96	<0.01	<0.1	Not significant
AW_NW_130	146	379476	404393	Lowland fens	Grassland	10	24.08	24.90	24.90	<0.01	<0.1	Not significant
AW_NW_140	156	379470	404401	Lowland fens	Grassland	10	24.08	24.85	24.86	<0.01	<0.1	Not significant
AW_NW_144	160	379468	404404	Lowland fens	Grassland	10	24.08	24.83	24.84	<0.01	<0.1	Not significant
AW_PW_0	55	380233	404467	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.89	37.90	0.01	0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
AW_PW_10	65	380235	404457	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.62	37.63	0.01	0.1	Not significant
AW_PW_20	75	380237	404447	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.42	37.42	0.01	0.1	Not significant
AW_PW_30	85	380238	404437	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.25	37.26	0.01	0.1	Not significant
AW_PW_40	95	380240	404427	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.12	37.12	0.01	0.1	Not significant
AW_PW_50	105	380241	404418	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.01	37.01	<0.01	<0.1	Not significant
AW_PW_60	115	380243	404408	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.91	36.92	<0.01	<0.1	Not significant
AW_PW_69	124	380244	404399	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.84	36.84	<0.01	<0.1	Not significant
LWS_PPNW1_0	7	380234	404516	Broadleaved, mixed and yew woodland	Forest	10	35.70	41.48	41.50	0.03	0.3	Not significant
LWS_PPNW1_10	17	380236	404506	Broadleaved, mixed and yew woodland	Forest	10	35.70	39.51	39.53	0.02	0.2	Not significant
LWS_PPNW1_20	27	380237	404497	Broadleaved, mixed and yew woodland	Forest	10	35.70	38.57	38.59	0.01	0.1	Not significant
LWS_PPNW1_30	37	380239	404487	Broadleaved, mixed and yew woodland	Forest	10	35.70	38.02	38.03	0.01	0.1	Not significant
LWS_PPNW1_40	47	380241	404477	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.65	37.66	0.01	0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_PPNW1_50	57	380242	404467	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.85	37.86	0.01	0.1	Not significant
LWS_PPNW1_60	67	380244	404457	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.60	37.60	0.01	0.1	Not significant
LWS_PPNW1_70	77	380246	404447	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.40	37.40	0.01	0.1	Not significant
LWS_PPNW1_80	87	380247	404437	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.24	37.24	0.01	0.1	Not significant
LWS_PPNW1_90	97	380249	404427	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.10	37.11	0.01	0.1	Not significant
LWS_PPNW1_100	107	380250	404418	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.99	37.00	<0.01	<0.1	Not significant
LWS_PPNW1_110	117	380252	404408	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.90	36.91	0.01	0.1	Not significant
LWS_PPNW1_120	127	380254	404398	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.82	36.83	<0.01	<0.1	Not significant
LWS_PPNW1_130	137	380255	404388	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.75	36.76	<0.01	<0.1	Not significant
LWS_PPNW1_140	147	380257	404378	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.69	36.70	<0.01	<0.1	Not significant
LWS_PPNW1_150	157	380259	404368	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.64	36.64	<0.01	<0.1	Not significant
LWS_PPNW1_160	167	380260	404358	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.59	36.59	<0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_PPNW1_170	176	380262	404349	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.55	36.55	<0.01	<0.1	Not significant
LWS_PPNW1_180	186	380263	404339	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.51	36.51	<0.01	<0.1	Not significant
LWS_PPNW1_190	196	380265	404329	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.47	36.48	<0.01	<0.1	Not significant
LWS_PPNW1_194	200	380266	404324	Broadleaved, mixed and yew woodland	Forest	10	35.70	36.46	36.46	<0.01	<0.1	Not significant
AW_MC_0	52	380591	404516	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.97	37.97	<0.01	<0.1	Not significant
AW_MC_10	62	380594	404506	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.67	37.67	<0.01	<0.1	Not significant
AW_MC_20	72	380596	404497	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.44	37.45	<0.01	<0.1	Not significant
AW_MC_30	82	380598	404487	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.27	37.27	<0.01	<0.1	Not significant
LNR_PP2_0	11	380600	404561	Broadleaved, mixed and yew woodland	Forest	10	35.70	40.61	40.60	-0.01	-0.1	Not significant
LNR_PP2_10	21	380602	404551	Broadleaved, mixed and yew woodland	Forest	10	35.70	39.11	39.11	<0.01	<0.1	Not significant
LNR_PP2_20	31	380604	404541	Broadleaved, mixed and yew woodland	Forest	10	35.70	38.33	38.33	<0.01	<0.1	Not significant
LNR_PP2_30	41	380606	404531	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.84	37.84	<0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LNR_PP2_37	48	380608	404524	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.59	37.59	<0.01	<0.1	Not significant
LNR_MC_0	64	380612	404509	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.62	37.62	<0.01	<0.1	Not significant
LNR_MC_10	74	380614	404499	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.40	37.40	<0.01	<0.1	Not significant
LNR_MC_13	77	380615	404496	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.35	37.35	<0.01	<0.1	Not significant
LWS_PPNW2_0	11	380603	404561	Broadleaved, mixed and yew woodland	Forest	10	35.70	40.57	40.56	-0.01	-0.1	Not significant
LWS_PPNW2_10	21	380605	404551	Broadleaved, mixed and yew woodland	Forest	10	35.70	39.09	39.09	<0.01	<0.1	Not significant
LWS_PPNW2_20	31	380607	404541	Broadleaved, mixed and yew woodland	Forest	10	35.70	38.32	38.31	<0.01	<0.1	Not significant
LWS_PPNW2_30	41	380609	404532	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.83	37.83	<0.01	<0.1	Not significant
LWS_PPNW2_40	51	380611	404522	Broadleaved, mixed and yew woodland	Forest	10	35.70	38.01	38.01	<0.01	<0.1	Not significant
LWS_PPNW2_50	61	380613	404512	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.70	37.70	<0.01	<0.1	Not significant
LWS_PPNW2_60	71	380615	404502	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.47	37.47	<0.01	<0.1	Not significant
LWS_PPNW2_66	77	380616	404497	Broadleaved, mixed and yew woodland	Forest	10	35.70	37.36	37.36	<0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LNR_HV_0	14	382123	408068	Broadleaved, mixed and yew woodland	Forest	10	41.72	44.57	44.63	0.06	0.6	Not significant
LNR_HV_10	24	382113	408068	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.82	43.86	0.04	0.4	Not significant
LNR_HV_20	34	382103	408067	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.39	43.43	0.03	0.3	Not significant
LNR_HV_30	44	382093	408066	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.12	43.15	0.03	0.3	Not significant
LNR_HV_40	54	382083	408066	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.27	43.30	0.03	0.3	Not significant
LNR_HV_50	64	382073	408065	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.10	43.12	0.02	0.2	Not significant
LNR_HV_60	74	382063	408065	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.95	42.97	0.02	0.2	Not significant
LNR_HV_70	84	382053	408064	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.84	42.86	0.02	0.2	Not significant
LNR_HV_80	94	382043	408064	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.75	42.77	0.02	0.2	Not significant
LNR_HV_90	104	382033	408063	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.68	42.70	0.02	0.2	Not significant
LNR_HV_100	114	382023	408063	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.61	42.63	0.02	0.2	Not significant
LNR_HV_110	124	382013	408062	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.56	42.57	0.01	0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LNR_HV_114	128	382009	408062	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.54	42.55	0.01	0.1	Not significant
LWS_HP_0	14	382123	408069	Broadleaved, mixed and yew woodland	Forest	10	41.72	44.57	44.62	0.06	0.6	Not significant
LWS_HP_10	24	382113	408069	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.82	43.86	0.04	0.4	Not significant
LWS_HP_20	34	382103	408068	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.39	43.43	0.03	0.3	Not significant
LWS_HP_30	44	382093	408068	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.12	43.14	0.02	0.2	Not significant
LWS_HP_40	54	382083	408067	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.27	43.30	0.03	0.3	Not significant
LWS_HP_50	64	382073	408067	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.09	43.11	0.02	0.2	Not significant
LWS_HP_60	74	382063	408066	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.95	42.97	0.02	0.2	Not significant
LWS_HP_70	84	382053	408066	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.84	42.86	0.02	0.2	Not significant
LWS_HP_80	94	382043	408065	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.75	42.77	0.02	0.2	Not significant
LWS_HP_90	104	382033	408065	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.68	42.69	0.02	0.2	Not significant
LWS_HP_100	114	382023	408064	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.61	42.63	0.02	0.2	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_HP_110	124	382013	408064	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.56	42.57	0.01	0.1	Not significant
LWS_HP_113	127	382010	408064	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.54	42.56	0.01	0.1	Not significant
LWS_HL_0	59	382053	408399	lowland dry acid grassland	Grassland	10	25.32	26.06	26.07	0.01	0.1	Not significant
LWS_HL_10	69	382043	408399	lowland dry acid grassland	Grassland	10	25.32	25.98	25.99	0.01	0.1	Not significant
LWS_HL_20	79	382033	408398	lowland dry acid grassland	Grassland	10	25.32	25.91	25.92	0.01	0.1	Not significant
LWS_HL_30	89	382023	408398	lowland dry acid grassland	Grassland	10	25.32	25.86	25.87	0.01	0.1	Not significant
LWS_HL_40	100	382013	408397	lowland dry acid grassland	Grassland	10	25.32	25.82	25.83	0.01	0.1	Not significant
LWS_HW_0	10	383594	405327	Broadleaved, mixed and yew woodland	Forest	10	41.72	44.59	44.65	0.06	0.6	Not significant
LWS_HW_10	20	383590	405318	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.73	43.77	0.04	0.4	Not significant
LWS_HW_20	30	383587	405308	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.31	43.33	0.03	0.3	Not significant
LWS_HW_30	40	383584	405299	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.04	43.06	0.02	0.2	Not significant
LWS_HW_40	50	383580	405289	Broadleaved, mixed and yew woodland	Forest	10	41.72	42.86	42.88	0.02	0.2	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_HW_46	55	383578	405284	Broadleaved, mixed and yew woodland	Forest	10	41.72	43.07	43.10	0.02	0.2	Not significant
LWS_BB_0	34	385626	405015	Broadleaved, mixed and yew woodland	Forest	10	36.26	38.74	38.75	0.02	0.2	Not significant
LWS_BB_10	44	385629	405025	Broadleaved, mixed and yew woodland	Forest	10	36.26	38.35	38.36	0.01	0.1	Not significant
LWS_BB_20	54	385631	405035	Broadleaved, mixed and yew woodland	Forest	10	36.26	38.58	38.59	0.02	0.2	Not significant
LWS_BB_30	64	385634	405044	Broadleaved, mixed and yew woodland	Forest	10	36.26	38.31	38.32	0.01	0.1	Not significant
LWS_BB_40	74	385636	405054	Broadleaved, mixed and yew woodland	Forest	10	36.26	38.09	38.11	0.01	0.1	Not significant
LWS_BB_50	84	385638	405064	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.92	37.94	0.01	0.1	Not significant
LWS_BB_60	94	385641	405073	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.79	37.79	0.01	0.1	Not significant
LWS_BB_70	104	385643	405083	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.67	37.68	0.01	0.1	Not significant
LWS_BB_80	114	385646	405093	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.57	37.58	0.01	0.1	Not significant
LWS_BB_90	124	385648	405102	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.48	37.49	0.01	0.1	Not significant
LWS_BB_100	134	385651	405112	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.41	37.42	0.01	0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_BB_110	144	385653	405122	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.35	37.35	0.01	0.1	Not significant
LWS_BB_120	154	385655	405132	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.29	37.30	0.01	0.1	Not significant
LWS_BB_130	164	385658	405141	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.24	37.25	0.01	0.1	Not significant
LWS_BB_140	174	385660	405151	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.19	37.20	0.01	0.1	Not significant
LWS_BB_150	184	385663	405161	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.15	37.16	0.01	0.1	Not significant
LWS_BB_160	194	385665	405170	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.11	37.12	0.01	0.1	Not significant
LWS_BB_166	200	385667	405176	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.10	37.10	<0.01	<0.1	Not significant
LWS_AWRL_0	127	385700	405091	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.47	37.48	0.01	0.1	Not significant
LWS_AWRL_10	137	385703	405101	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.40	37.41	0.01	0.1	Not significant
LWS_AWRL_20	147	385706	405110	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.34	37.35	0.01	0.1	Not significant
LWS_AWRL_30	157	385708	405120	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.28	37.29	0.01	0.1	Not significant
LWS_AWRL_40	167	385711	405129	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.23	37.24	<0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_AWRL_50	177	385714	405139	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.19	37.20	0.01	0.1	Not significant
LWS_AWRL_60	187	385716	405149	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.15	37.16	0.01	0.1	Not significant
LWS_AWRL_70	197	385719	405158	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.11	37.12	0.01	0.1	Not significant
LWS_AWRL_73	200	385720	405161	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.10	37.11	<0.01	<0.1	Not significant
LNR_AW_0	122	385707	405084	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.51	37.52	0.01	0.1	Not significant
LNR_AW_10	132	385710	405093	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.44	37.44	0.01	0.1	Not significant
LNR_AW_20	142	385713	405103	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.37	37.38	0.01	0.1	Not significant
LNR_AW_30	152	385716	405113	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.31	37.32	0.01	0.1	Not significant
LNR_AW_40	162	385718	405122	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.26	37.26	0.01	0.1	Not significant
LNR_AW_50	172	385721	405132	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.21	37.22	0.01	0.1	Not significant
LNR_AW_60	182	385724	405141	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.17	37.17	<0.01	<0.1	Not significant
LNR_AW_70	192	385727	405151	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.13	37.13	<0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LNR_AW_78	200	385729	405159	Broadleaved, mixed and yew woodland	Forest	10	36.26	37.10	37.11	<0.01	<0.1	Not significant
SAC_SSSI_RC1_0	32	388277	409851	Luronium natans - Floating water-plantain (S1831)	Grassland	3	22.26	23.86	23.88	0.01	0.5	Not significant
SAC_SSSI_RC1_10	42	388274	409861	Luronium natans - Floating water-plantain (S1831)	Grassland	3	22.26	23.58	23.59	0.01	0.4	Not significant
SAC_SSSI_RC1_20	52	388271	409870	Luronium natans - Floating water-plantain (S1831)	Grassland	3	22.26	23.70	23.71	0.01	0.4	Not significant
SAC_SSSI_RC1_26	58	388269	409876	Luronium natans - Floating water-plantain (S1831)	Grassland	3	22.26	23.58	23.60	0.01	0.4	Not significant
SAC_SSSI_RC2_0	42	388296	409740	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	24.10	24.11	0.01	0.3	Not significant
SAC_SSSI_RC2_10	52	388299	409731	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	24.16	24.17	0.01	0.3	Not significant
SAC_SSSI_RC2_20	62	388302	409721	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	24.06	24.07	0.01	0.3	Not significant
SAC_SSSI_RC2_30	72	388306	409712	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.98	23.99	0.01	0.3	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
SAC_SSSI_RC2_40	82	388309	409703	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.92	23.93	0.01	0.2	Not significant
SAC_SSSI_RC2_50	92	388313	409693	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.87	23.88	0.01	0.2	Not significant
SAC_SSSI_RC2_60	102	388316	409684	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.84	23.84	<0.01	0.1	Not significant
SAC_SSSI_RC2_70	112	388320	409675	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.80	23.81	0.01	0.2	Not significant
SAC_SSSI_RC2_80	122	388323	409665	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.77	23.78	<0.01	0.1	Not significant
SAC_SSSI_RC2_90	132	388327	409656	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.75	23.75	0.01	0.2	Not significant
SAC_SSSI_RC2_100	142	388330	409646	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.73	23.73	<0.01	0.1	Not significant
SAC_SSSI_RC2_110	152	388333	409637	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.71	23.71	<0.01	0.1	Not significant
SAC_SSSI_RC2_120	162	388337	409628	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.69	23.70	<0.01	0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
SAC_SSSI_RC2_130	172	388340	409618	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.68	23.68	<0.01	0.1	Not significant
SAC_SSSI_RC2_140	182	388344	409609	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.66	23.67	<0.01	0.1	Not significant
SAC_SSSI_RC2_150	192	388347	409599	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.65	23.66	<0.01	0.1	Not significant
SAC_SSSI_RC2_158	200	388350	409592	Luronium natans - Floating water-plantain (S1831)	Grassland	3	23.38	23.65	23.65	<0.01	0.1	Not significant
LWS_RC2_0	0	388375	409817	Neutral grassland	Grassland	20	23.38	27.17	27.22	0.06	0.3	Not significant
LWS_RC2_10	10	388379	409808	Neutral grassland	Grassland	20	23.38	25.18	25.20	0.02	0.1	Not significant
LWS_RC2_20	20	388382	409799	Neutral grassland	Grassland	20	23.38	24.62	24.63	0.02	0.1	Not significant
LWS_RC2_30	30	388386	409789	Neutral grassland	Grassland	20	23.38	24.33	24.34	0.01	0.1	Not significant
LWS_RC2_35	35	388388	409785	Neutral grassland	Grassland	20	23.38	24.24	24.25	0.01	0.1	Not significant
LWS_RC1_0	0	388362	409850	Broadleaved, mixed and yew woodland	Forest	10	36.26	48.66	48.74	0.08	0.8	Not significant
LWS_RC1_10	9	388359	409859	Broadleaved, mixed and yew woodland	Forest	10	36.26	42.77	42.82	0.05	0.5	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_RC1_20	19	388355	409868	Broadleaved, mixed and yew woodland	Forest	10	36.26	40.75	40.79	0.04	0.4	Not significant
LWS_RC1_30	29	388351	409877	Broadleaved, mixed and yew woodland	Forest	10	36.26	39.70	39.73	0.03	0.3	Not significant
LWS_RC1_40	39	388347	409887	Neutral grassland	Grassland	20	23.38	24.78	24.79	0.01	0.1	Not significant
LWS_RC1_50	49	388343	409896	Neutral grassland	Grassland	20	23.38	24.56	24.57	0.01	0.1	Not significant
LWS_RC1_60	59	388339	409905	Neutral grassland	Grassland	20	23.38	24.69	24.70	0.01	0.1	Not significant
LWS_RC1_70	69	388335	409914	Neutral grassland	Grassland	20	23.38	24.53	24.55	0.01	0.1	Not significant
LWS_RC1_80	79	388331	409923	Neutral grassland	Grassland	20	23.38	24.41	24.42	0.01	0.1	Not significant
LWS_RC1_90	89	388327	409933	Neutral grassland	Grassland	20	23.38	24.32	24.33	0.01	0.1	Not significant
LWS_RC1_100	99	388323	409942	Neutral grassland	Grassland	20	23.38	24.24	24.25	0.01	<0.1	Not significant
LWS_RC1_110	109	388319	409951	Neutral grassland	Grassland	20	23.38	24.17	24.18	0.01	<0.1	Not significant
LWS_RC1_120	119	388316	409960	Neutral grassland	Grassland	20	23.38	24.11	24.12	0.01	<0.1	Not significant
LWS_RC1_130	129	388312	409969	Neutral grassland	Grassland	20	23.38	24.06	24.07	0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DS-DM)		
LWS_RC1_140	139	388308	409979	Lowland fens	Grassland	10	23.38	24.02	24.03	0.01	0.1	Not significant
LWS_RC1_150	149	388304	409988	Lowland fens	Grassland	10	23.38	23.99	23.99	0.01	0.1	Not significant
LWS_RC1_160	159	388300	409997	Lowland fens	Grassland	10	23.38	23.95	23.96	0.01	0.1	Not significant
LWS_RC1_170	169	388296	410006	Lowland fens	Grassland	10	23.38	23.90	23.90	0.01	0.1	Not significant
LWS_RC1_180	179	388292	410016	Lowland fens	Grassland	10	23.38	23.87	23.88	0.01	0.1	Not significant
LWS_RC1_190	189	388288	410025	Lowland fens	Grassland	10	23.38	23.85	23.86	<0.01	<0.1	Not significant
LWS_RC1_200	199	388284	410034	Lowland fens	Grassland	10	23.38	23.83	23.84	0.01	0.1	Not significant

Table 1.3: Ecological assessment results – additional habitats

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_CMS_0	4	376767	403218	Lowland fen	Grassland	10	24.08	27.46	27.56	0.10	1.0	Not significant
LWS_CMS_10	14	376767	403228	Lowland fen	Grassland	10	24.08	26.55	26.63	0.08	0.8	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_CMS_20	24	376767	403238	Lowland fen	Grassland	10	24.08	26.03	26.09	0.06	0.6	Not significant
LWS_CMS_30	34	376767	403248	Lowland fen	Grassland	10	24.08	25.68	25.73	0.05	0.5	Not significant
LWS_CMS_40	44	376767	403258	Lowland fen	Grassland	10	24.08	25.44	25.49	0.04	0.4	Not significant
LWS_CMS_50	54	376767	403268	Lowland fen	Grassland	10	24.08	25.59	25.64	0.05	0.5	Not significant
LWS_CMS_110	114	376767	403328	Lowland fen	Grassland	10	24.08	24.93	24.96	0.03	0.3	Not significant
LWS_CMS_120	124	376767	403338	Lowland fen	Grassland	10	24.08	24.87	24.90	0.02	0.2	Not significant
LWS_CMS_130	134	376767	403348	Lowland fen	Grassland	10	24.08	24.82	24.85	0.02	0.2	Not significant
LWS_CMS_140	144	376767	403358	Lowland fen	Grassland	10	24.08	24.78	24.80	0.02	0.2	Not significant
LWS_CMS_150	154	376767	403368	Lowland fen	Grassland	10	24.08	24.74	24.76	0.02	0.2	Not significant
LWS_CMS_160	164	376767	403378	Lowland fen	Grassland	10	24.08	24.71	24.73	0.02	0.2	Not significant
LWS_CMS_170	174	376767	403388	Lowland fen	Grassland	10	24.08	24.68	24.69	0.02	0.2	Not significant
LWS_CMS_180	184	376767	403398	Lowland fen	Grassland	10	24.08	24.65	24.67	0.02	0.2	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_CMS_190	194	376767	403408	Lowland fen	Grassland	10	24.08	24.62	24.64	0.02	0.2	Not significant
LWS_CMS_194	198	376767	403411	Lowland fen	Grassland	10	24.08	24.62	24.63	0.02	0.2	Not significant
LWS_CCP_0	13	377761	403418	Lowland Fen	Grassland	10	24.08	26.49	26.60	0.11	1.1	Not significant
LWS_CCP_10	23	377758	403428	Lowland Fen	Grassland	10	24.08	26.12	26.21	0.09	0.9	Not significant
LWS_CCP_20	33	377755	403437	Lowland Fen	Grassland	10	24.08	25.86	25.94	0.08	0.8	Not significant
LWS_CCP_30	43	377752	403447	Lowland Fen	Grassland	10	24.08	25.67	25.73	0.07	0.7	Not significant
LWS_CCP_40	53	377750	403457	Lowland Fen	Grassland	10	24.08	25.51	25.57	0.06	0.6	Not significant
LWS_CCP_50	63	377747	403466	Lowland Fen	Grassland	10	24.08	25.38	25.44	0.05	0.5	Not significant
LWS_CCP_60	73	377744	403476	Lowland Fen	Grassland	10	24.08	25.28	25.33	0.05	0.5	Not significant
LWS_CCP_70	83	377741	403485	Lowland Fen	Grassland	10	24.08	25.19	25.23	0.05	0.5	Not significant
LWS_CCP_80	93	377739	403495	Lowland Fen	Grassland	10	24.08	25.11	25.15	0.04	0.4	Not significant
LWS_CCP_90	103	377736	403505	Lowland Fen	Grassland	10	24.08	25.05	25.09	0.04	0.4	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_CCP_100	113	377733	403514	Lowland Fen	Grassland	10	24.08	24.98	25.02	0.04	0.4	Not significant
LWS_CCP_110	123	377730	403524	Lowland Fen	Grassland	10	24.08	24.93	24.97	0.04	0.4	Not significant
LWS_CCP_120	133	377728	403533	Lowland Fen	Grassland	10	24.08	24.89	24.92	0.03	0.3	Not significant
LWS_CCP_130	143	377725	403543	Lowland Fen	Grassland	10	24.08	24.85	24.88	0.03	0.3	Not significant
LWS_CCP_140	153	377722	403553	Lowland Fen	Grassland	10	24.08	24.81	24.84	0.03	0.3	Not significant
LWS_CCP_150	163	377719	403562	Lowland Fen	Grassland	10	24.08	24.78	24.80	0.03	0.3	Not significant
LWS_CCP_160	173	377717	403572	Lowland Fen	Grassland	10	24.08	24.75	24.77	0.03	0.3	Not significant
LWS_CCP_170	183	377714	403582	Lowland Fen	Grassland	10	24.08	24.72	24.74	0.03	0.3	Not significant
LWS_CCP_180	193	377711	403591	Lowland Fen	Grassland	10	24.08	24.69	24.72	0.02	0.2	Not significant
LWS_CCP_188	200	377709	403599	Lowland Fen	Grassland	10	24.08	24.67	24.70	0.02	0.2	Not significant
AW_CW_0	23	377760	403427	Lowland fen	Grassland	10	24.08	26.14	26.23	0.09	0.9	Not significant
AW_CW_10	33	377757	403437	Lowland fen	Grassland	10	24.08	25.88	25.96	0.08	0.8	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
AW_CW_20	43	377754	403447	Lowland fen	Grassland	10	24.08	25.68	25.75	0.07	0.7	Not significant
AW_CW_30	53	377752	403456	Lowland fen	Grassland	10	24.08	25.52	25.58	0.06	0.6	Not significant
AW_CW_40	63	377749	403466	Lowland fen	Grassland	10	24.08	25.39	25.45	0.05	0.5	Not significant
AW_CW_50	73	377746	403475	Lowland fen	Grassland	10	24.08	25.29	25.34	0.05	0.5	Not significant
AW_CW_60	83	377743	403485	Lowland fen	Grassland	10	24.08	25.19	25.24	0.05	0.5	Not significant
AW_CW_70	93	377741	403495	Lowland fen	Grassland	10	24.08	25.12	25.16	0.04	0.4	Not significant
AW_CW_80	103	377738	403504	Lowland fen	Grassland	10	24.08	25.05	25.09	0.04	0.4	Not significant
AW_CW_90	113	377735	403514	Lowland fen	Grassland	10	24.08	24.99	25.03	0.04	0.4	Not significant
AW_CW_100	123	377732	403524	Lowland fen	Grassland	10	24.08	24.94	24.97	0.04	0.4	Not significant
AW_CW_110	133	377730	403533	Lowland fen	Grassland	10	24.08	24.89	24.92	0.03	0.3	Not significant
AW_CW_120	143	377727	403543	Lowland fen	Grassland	10	24.08	24.85	24.88	0.03	0.3	Not significant
AW_CW_130	153	377724	403552	Lowland fen	Grassland	10	24.08	24.81	24.84	0.03	0.3	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
AW_CW_140	163	377721	403562	Lowland fen	Grassland	10	24.08	24.78	24.81	0.03	0.3	Not significant
AW_CW_150	173	377719	403572	Lowland fen	Grassland	10	24.08	24.75	24.78	0.03	0.3	Not significant
AW_CW_160	183	377716	403581	Lowland fen	Grassland	10	24.08	24.72	24.75	0.03	0.3	Not significant
AW_CW_170	193	377713	403591	Lowland fen	Grassland	10	24.08	24.69	24.72	0.03	0.3	Not significant
LWS_RFSW1_0	6	378445	403613	Semi-improved grassland	Grassland	20	24.08	30.19	30.51	0.31	1.6	Not significant
LWS_RFSW1_10	16	378442	403623	Fen marsh swamp	Grassland	10	24.08	28.15	28.36	0.21	2.1	Not significant
LWS_RFSW1_20	26	378439	403632	Fen marsh swamp	Grassland	10	24.08	27.14	27.30	0.15	1.5	Not significant
LWS_RFSW1_30	36	378435	403641	Fen marsh swamp	Grassland	10	24.08	26.53	26.65	0.12	1.2	Not significant
LWS_RFSW1_40	46	378432	403651	Fen marsh swamp	Grassland	10	24.08	26.12	26.22	0.10	1.0	Not significant
LWS_RFSW1_50	56	378429	403660	Fen marsh swamp	Grassland	10	24.08	26.31	26.41	0.10	1.0	Not significant
LWS_RFSW1_60	66	378425	403670	Fen marsh swamp	Grassland	10	24.08	26.03	26.12	0.09	0.9	Not significant
LWS_RFSW1_70	76	378422	403679	Fen marsh swamp	Grassland	10	24.08	25.81	25.89	0.08	0.8	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_RFS W1_80	86	378419	403689	Fen marsh swamp	Grassland	10	24.08	25.64	25.71	0.07	0.7	Not significant
LWS_RFS W1_90	96	378415	403698	Fen marsh swamp	Grassland	10	24.08	25.49	25.55	0.06	0.6	Not significant
LWS_RFS W1_100	106	378412	403707	Fen marsh swamp	Grassland	10	24.08	25.37	25.43	0.06	0.6	Not significant
LWS_RFS W1_110	116	378409	403717	Fen marsh swamp	Grassland	10	24.08	25.27	25.32	0.05	0.5	Not significant
LWS_RFS W1_120	126	378405	403726	Fen marsh swamp	Grassland	10	24.08	25.18	25.23	0.05	0.5	Not significant
LWS_RFS W1_130	136	378402	403736	Fen marsh swamp	Grassland	10	24.08	25.11	25.15	0.04	0.4	Not significant
LWS_RFS W1_140	146	378399	403745	Fen marsh swamp	Grassland	10	24.08	25.04	25.08	0.04	0.4	Not significant
LWS_RFS W2_0	2	378486	403576	Semi-improved grassland	Grassland	20	24.08	28.39	28.52	0.13	0.6	Not significant
LWS_RFS W2_10	12	378489	403567	Semi-improved grassland	Grassland	20	24.08	26.58	26.68	0.10	0.5	Not significant
LWS_RFS W2_20	22	378493	403558	Lowland fen	Grassland	10	25.08	26.88	26.96	0.08	0.8	Not significant
LWS_RFS W2_20	22	378493	403558	Lowland fen	Grassland	10	25.08	26.88	26.96	0.08	0.8	Not significant
LWS_RFS W2_30	32	378496	403548	Lowland fen	Grassland	10	26.08	27.48	27.55	0.06	0.6	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_RFSW2_30	32	378496	403548	Lowland fen	Grassland	10	26.08	27.48	27.55	0.06	0.6	Not significant
LWS_RFSW2_40	42	378500	403539	Lowland fen	Grassland	10	24.08	25.23	25.28	0.05	0.5	Not significant
LWS_RFSW2_50	51	378503	403530	Lowland fen	Grassland	10	24.08	25.33	25.39	0.06	0.6	Not significant
LWS_RWE_20	32	378997	403862	Lowland fen	Grassland	10	24.08	26.33	26.34	0.01	0.1	Not significant
LWS_RWE_30	42	378993	403871	Lowland fen	Grassland	10	24.08	25.95	25.95	0.01	0.1	Not significant
LWS_RWE_40	52	378989	403880	Lowland fen	Grassland	10	24.08	26.11	26.13	0.01	0.1	Not significant
LWS_RWE_50	62	378985	403889	Lowland fen	Grassland	10	24.08	25.86	25.87	0.01	0.1	Not significant
LWS_RWE_60	72	378981	403898	Lowland fen	Grassland	10	24.08	25.66	25.67	0.01	0.1	Not significant
LWS_RWE_70	82	378977	403907	Lowland fen	Grassland	10	24.08	25.51	25.52	0.01	0.1	Not significant
LWS_RWE_80	92	378972	403916	Lowland fen	Grassland	10	24.08	25.38	25.39	0.01	0.1	Not significant
LWS_RWE_90	102	378968	403925	Lowland fen	Grassland	10	24.08	25.27	25.28	0.01	0.1	Not significant
LWS_RWE_100	112	378964	403934	Lowland fen	Grassland	10	24.08	25.18	25.19	0.01	0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_RWE_110	122	378960	403943	Lowland fen	Grassland	10	24.08	25.11	25.11	0.01	0.1	Not significant
LWS_RWE_140	152	378947	403970	Semi-improved grassland	Grassland	20	24.08	24.93	24.94	0.01	<0.1	Not significant
LWS_RWE_150	162	378943	403980	Semi-improved grassland	Grassland	20	24.08	24.88	24.89	0.01	<0.1	Not significant
LWS_RWE_160	172	378939	403989	Semi-improved grassland	Grassland	20	24.08	24.85	24.85	0.01	<0.1	Not significant
LWS_RWE_170	182	378935	403998	Semi-improved grassland	Grassland	20	24.08	24.81	24.82	0.01	<0.1	Not significant
LWS_RWE_180	192	378930	404007	Semi-improved grassland	Grassland	20	24.08	24.76	24.77	0.01	<0.1	Not significant
LWS_RWE_188	200	378927	404014	Semi-improved grassland	Grassland	20	24.08	24.74	24.75	0.01	<0.1	Not significant
LNR_PP1_30	43	379086	403780	Other neutral grassland	Grassland	20	24.08	25.05	25.06	0.01	0.1	Not significant
LNR_PP1_40	53	379092	403772	Other neutral grassland	Grassland	20	24.08	25.13	25.14	0.01	0.1	Not significant
LNR_PP1_50	63	379097	403763	Other neutral grassland	Grassland	20	24.08	24.99	25.00	0.01	0.1	Not significant
LNR_PP1_60	73	379102	403754	Other neutral grassland	Grassland	20	24.08	24.89	24.90	0.01	0.1	Not significant
LNR_PP1_70	83	379107	403746	Other neutral grassland	Grassland	20	24.08	24.80	24.81	0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LNR_PP1_80	93	379112	403737	Other neutral grassland	Grassland	20	24.08	24.73	24.74	0.01	<0.1	Not significant
LNR_PP1_90	103	379117	403729	Other neutral grassland	Grassland	20	24.08	24.68	24.69	0.01	<0.1	Not significant
LNR_PP1_100	113	379123	403720	Other neutral grassland	Grassland	20	24.08	24.63	24.64	0.01	<0.1	Not significant
LNR_PP1_110	123	379128	403712	Other neutral grassland	Grassland	20	24.08	24.59	24.60	0.01	<0.1	Not significant
LNR_PP1_120	133	379133	403703	Other neutral grassland	Grassland	20	24.08	24.56	24.56	0.01	<0.1	Not significant
LNR_PP1_130	143	379138	403695	Other neutral grassland	Grassland	20	24.08	24.53	24.53	0.01	<0.1	Not significant
LNR_PP1_140	153	379143	403686	Other neutral grassland	Grassland	20	24.08	24.50	24.51	0.01	<0.1	Not significant
LNR_PP1_150	163	379149	403677	Other neutral grassland	Grassland	20	24.08	24.48	24.48	0.01	<0.1	Not significant
LNR_PP1_160	173	379154	403669	Other neutral grassland	Grassland	20	24.08	24.46	24.46	0.01	<0.1	Not significant
LNR_PP1_170	183	379159	403660	Other neutral grassland	Grassland	20	24.08	24.44	24.44	0.01	<0.1	Not significant
LNR_PP1_176	191	379163	403654	Other neutral grassland	Grassland	20	24.08	24.42	24.43	0.01	<0.1	Not significant
LWS_PPNW3_80	91	379475	404323	Improved grassland	Grassland	20	24.08	25.30	25.31	<0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_PPNW3_90	101	379469	404330	Improved grassland	Grassland	20	24.08	25.20	25.20	0.01	<0.1	Not significant
LWS_PPNW3_100	111	379462	404338	Improved grassland	Grassland	20	24.08	25.11	25.11	<0.01	<0.1	Not significant
LWS_PPNW3_110	121	379455	404346	Improved grassland	Grassland	20	24.08	25.04	25.04	<0.01	<0.1	Not significant
LWS_PPNW3_120	131	379449	404353	Improved grassland	Grassland	20	24.08	24.97	24.97	<0.01	<0.1	Not significant
LWS_PPNW3_130	141	379442	404361	Improved grassland	Grassland	20	24.08	24.91	24.92	<0.01	<0.1	Not significant
LWS_PPNW3_140	151	379436	404368	Improved grassland	Grassland	20	24.08	24.86	24.87	<0.01	<0.1	Not significant
LWS_PPNW3_150	161	379429	404376	Improved grassland	Grassland	20	24.08	24.82	24.83	<0.01	<0.1	Not significant
LWS_PPNW3_160	172	379423	404384	Improved grassland	Grassland	20	24.08	24.78	24.79	<0.01	<0.1	Not significant
AW_NW_30	46	379535	404312	Lowland fens	Grassland	10	24.08	25.77	25.77	0.01	0.1	Not significant
AW_NW_40	56	379529	404320	Lowland fens	Grassland	10	24.08	25.93	25.94	0.01	0.1	Not significant
AW_NW_50	66	379523	404328	Lowland fens	Grassland	10	24.08	25.71	25.71	0.01	0.1	Not significant
AW_NW_60	76	379517	404336	Lowland fens	Grassland	10	24.08	25.52	25.53	0.01	0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
AW_NW_70	86	379511	404344	Lowland fens	Grassland	10	24.08	25.38	25.39	<0.01	<0.1	Not significant
AW_PW_0	55	380233	404467	Other neutral grassland	Grassland	20	24.08	25.17	25.18	<0.01	<0.1	Not significant
AW_PW_10	65	380235	404457	Other neutral grassland	Grassland	20	24.08	25.04	25.05	<0.01	<0.1	Not significant
AW_PW_20	75	380237	404447	Other neutral grassland	Grassland	20	24.08	24.94	24.94	<0.01	<0.1	Not significant
AW_PW_30	85	380238	404437	Other neutral grassland	Grassland	20	24.08	24.86	24.86	<0.01	<0.1	Not significant
AW_PW_40	95	380240	404427	Other neutral grassland	Grassland	20	24.08	24.79	24.79	<0.01	<0.1	Not significant
AW_PW_50	105	380241	404418	Other neutral grassland	Grassland	20	24.08	24.73	24.74	<0.01	<0.1	Not significant
AW_PW_60	115	380243	404408	Other neutral grassland	Grassland	20	24.08	24.69	24.69	<0.01	<0.1	Not significant
AW_PW_69	124	380244	404399	Other neutral grassland	Grassland	20	24.08	24.65	24.65	<0.01	<0.1	Not significant
LWS_PPNW1_10	17	380236	404506	Other neutral grassland	Grassland	20	24.08	25.99	26.00	0.01	<0.1	Not significant
LWS_PPNW1_20	27	380237	404497	Other neutral grassland	Grassland	20	24.08	25.52	25.52	0.01	<0.1	Not significant
LWS_PPNW1_30	37	380239	404487	Other neutral grassland	Grassland	20	24.08	25.24	25.24	0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_PPNW1_40	47	380241	404477	Other neutral grassland	Grassland	20	24.08	25.05	25.06	<0.01	<0.1	Not significant
LWS_PPNW1_50	57	380242	404467	Other neutral grassland	Grassland	20	24.08	25.16	25.16	<0.01	<0.1	Not significant
LWS_PPNW1_60	67	380244	404457	Other neutral grassland	Grassland	20	24.08	25.03	25.03	<0.01	<0.1	Not significant
LWS_PPNW1_70	77	380246	404447	Other neutral grassland	Grassland	20	24.08	24.93	24.93	<0.01	<0.1	Not significant
LWS_PPNW1_80	87	380247	404437	Other neutral grassland	Grassland	20	24.08	24.85	24.85	<0.01	<0.1	Not significant
LWS_PPNW1_90	97	380249	404427	Other neutral grassland	Grassland	20	24.08	24.78	24.79	<0.01	<0.1	Not significant
LWS_PPNW1_100	107	380250	404418	Other neutral grassland	Grassland	20	24.08	24.73	24.73	<0.01	<0.1	Not significant
LWS_PPNW1_110	117	380252	404408	Other neutral grassland	Grassland	20	24.08	24.68	24.68	<0.01	<0.1	Not significant
LWS_PPNW1_120	127	380254	404398	Other neutral grassland	Grassland	20	24.08	24.64	24.64	<0.01	<0.1	Not significant
LWS_PPNW1_130	137	380255	404388	Other neutral grassland	Grassland	20	24.08	24.61	24.61	<0.01	<0.1	Not significant
LWS_PPNW1_140	147	380257	404378	Other neutral grassland	Grassland	20	24.08	24.58	24.58	<0.01	<0.1	Not significant
LWS_PPNW1_150	157	380259	404368	Other neutral grassland	Grassland	20	24.08	24.55	24.55	<0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_PPNW1_160	167	380260	404358	Other neutral grassland	Grassland	20	24.08	24.52	24.53	<0.01	<0.1	Not significant
LWS_PPNW1_170	176	380262	404349	Other neutral grassland	Grassland	20	24.08	24.50	24.51	<0.01	<0.1	Not significant
LNR_PP2_0	11	380600	404561	Other neutral grassland	Grassland	20	24.08	26.54	26.53	<0.01	<0.1	Not significant
LNR_PP2_10	21	380602	404551	Other neutral grassland	Grassland	20	24.08	25.79	25.78	<0.01	<0.1	Not significant
LNR_PP2_20	31	380604	404541	Other neutral grassland	Grassland	20	24.08	25.40	25.39	<0.01	<0.1	Not significant
LNR_PP2_30	41	380606	404531	Other neutral grassland	Grassland	20	24.08	25.15	25.15	<0.01	<0.1	Not significant
LNR_PP2_37	48	380608	404524	Other neutral grassland	Grassland	20	24.08	25.03	25.03	<0.01	<0.1	Not significant
LWS_HL_0	59	382053	408399	Other neutral grassland	Grassland	20	24.08	24.82	24.83	0.01	0.1	Not significant
LWS_HL_10	69	382043	408399	Other neutral grassland	Grassland	20	24.08	24.74	24.75	0.01	0.1	Not significant
LWS_HL_20	79	382033	408398	Other neutral grassland	Grassland	20	24.08	24.67	24.68	0.01	<0.1	Not significant
LWS_HL_30	89	382023	408398	Other neutral grassland	Grassland	20	24.08	24.62	24.63	0.01	<0.1	Not significant
LWS_HW_40	50	383580	405289	Improved grassland	Grassland	20	24.08	24.65	24.66	0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_HW_46	55	383578	405284	Improved grassland	Grassland	20	24.08	24.76	24.77	0.01	0.1	Not significant
SAC_SSSI_RC1_0	32	388277	409851	Neutral grassland	Grassland	20	22.26	23.86	23.88	0.01	0.1	Not significant
SAC_SSSI_RC1_0	32	388277	409851	Neutral grassland	Grassland	20	22.26	23.86	23.88	0.01	0.1	Not significant
SAC_SSSI_RC1_10	42	388274	409861	Neutral grassland	Grassland	20	22.26	23.58	23.59	0.01	0.1	Not significant
SAC_SSSI_RC1_10	42	388274	409861	Neutral grassland	Grassland	20	22.26	23.58	23.59	0.01	0.1	Not significant
SAC_SSSI_RC1_20	52	388271	409870	Neutral grassland	Grassland	20	22.26	23.70	23.71	0.01	0.1	Not significant
SAC_SSSI_RC1_20	52	388271	409870	Neutral grassland	Grassland	20	22.26	23.70	23.71	0.01	0.1	Not significant
SAC_SSSI_RC1_26	58	388269	409876	Neutral grassland	Grassland	20	22.26	23.58	23.60	0.01	0.1	Not significant
SAC_SSSI_RC1_26	58	388269	409876	Neutral grassland	Grassland	20	22.26	23.58	23.60	0.01	0.1	Not significant
SAC_SSSI_RC2_0	42	388296	409740	Neutral grassland	Grassland	20	23.38	24.10	24.11	0.01	<0.1	Not significant
SAC_SSSI_RC2_0	42	388296	409740	Neutral grassland	Grassland	20	23.38	24.10	24.11	0.01	<0.1	Not significant
SAC_SSSI_RC2_10	52	388299	409731	Neutral grassland	Grassland	20	23.38	24.16	24.17	0.01	0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
SAC_SSSI_RC2_10	52	388299	409731	Neutral grassland	Grassland	20	23.38	24.16	24.17	0.01	0.1	Not significant
SAC_SSSI_RC2_20	62	388302	409721	Neutral grassland	Grassland	20	23.38	24.06	24.07	0.01	<0.1	Not significant
SAC_SSSI_RC2_20	62	388302	409721	Neutral grassland	Grassland	20	23.38	24.06	24.07	0.01	<0.1	Not significant
SAC_SSSI_RC2_30	72	388306	409712	Neutral grassland	Grassland	20	23.38	23.98	23.99	0.01	<0.1	Not significant
SAC_SSSI_RC2_30	72	388306	409712	Neutral grassland	Grassland	20	23.38	23.98	23.99	0.01	<0.1	Not significant
SAC_SSSI_RC2_40	82	388309	409703	Neutral grassland	Grassland	20	23.38	23.92	23.93	0.01	<0.1	Not significant
SAC_SSSI_RC2_40	82	388309	409703	Neutral grassland	Grassland	20	23.38	23.92	23.93	0.01	<0.1	Not significant
SAC_SSSI_RC2_50	92	388313	409693	Neutral grassland	Grassland	20	23.38	23.87	23.88	0.01	<0.1	Not significant
SAC_SSSI_RC2_50	92	388313	409693	Neutral grassland	Grassland	20	23.38	23.87	23.88	0.01	<0.1	Not significant
LWS_RC1_140	139	388308	409979	Neutral grasslands	Grassland	20	23.38	24.02	24.03	0.01	<0.1	Not significant
LWS_RC1_150	149	388304	409988	Neutral grasslands	Grassland	20	23.38	23.99	23.99	0.01	<0.1	Not significant
LWS_RC1_160	159	388300	409997	Neutral grasslands	Grassland	20	23.38	23.95	23.96	0.01	<0.1	Not significant

Receptor ID	Distance to ARN (m)	Location (m)		Priority Habitat	Vegetation Type (Deposition Velocity)	Minimum CL (kg N/ha/yr)	Baseline N-Dep Rate (kg N/ha/yr)	Total N-Dep Rate 2027 (kg N/ha/yr)			Change (DS-DM)/CL (%)	Impact
		X	Y					DM	DS	Change (DM-DS)		
LWS_RC1_170	169	388296	410006	Neutral grasslands	Grassland	20	23.38	23.90	23.90	0.01	<0.1	Not significant
LWS_RC1_180	179	388292	410016	Neutral grasslands	Grassland	20	23.38	23.87	23.88	0.01	<0.1	Not significant
LWS_RC1_190	189	388288	410025	Neutral grasslands	Grassland	20	23.38	23.85	23.86	<0.01	<0.1	Not significant
LWS_RC1_200	199	388284	410034	Neutral grasslands	Grassland	20	23.38	23.83	23.84	0.01	<0.1	Not significant

1.3 PCM compliance results

1.3.1 The PEIR compliance risk assessment results are presented below, along with operational traffic (2027) Pollution Climate Mapping (PCM) model NO_2 concentrations and the difference in modelled concentrations for the corresponding PCM link.

Table 1.4: Compliance risk assessment results

Receptor ID	Location (m)		PCM Link census ID	Modelled 2027 Annual Mean Roadside NO_2 Concentration (µg/m^3)			Difference (PEIR Model vs. PCM Model) (µg/m^3)		Modelled 2027 Annual Mean Roadside PM_{10} Concentration (µg/m^3)	
				PCM Model	**PEIR** Model					
	X	Y			DM	DS	DM	DS	DM	DS
PCM_4m_1	381587	405229	802006053	18.8	22.5	22.6	3.8	3.8	14.9	15.1
PCM_4m_2	381595	405234	802006053	18.8	22.5	22.6	3.8	3.8	14.9	15.1
PCM_4m_3	381603	405239	802006053	18.8	22.5	22.6	3.7	3.8	14.9	15.1

Receptor ID	Location (m)		PCM Link census ID	Modelled 2027 Annual Mean Roadside NO_2 Concentration (µg/m^3)			Difference (PEIR Model vs. PCM Model) (µg/m^3)		Modelled 2027 Annual Mean Roadside PM_{10} Concentration (µg/m^3)	
				PCM Model	PEIR Model					
	X	Y			DM	DS	DM	DS	DM	DS
PCM_4m_4	381637	405261	802006053	18.8	22.4	22.8	3.6	4.0	14.9	15.1
PCM_4m_5	381301	405085	802006053	18.8	29.0	26.2	10.2	7.4	16.2	16.1
PCM_4m_6	381308	405091	802006053	18.8	29.0	26.3	10.2	7.5	16.2	16.2
PCM_4m_7	381316	405098	802006053	18.8	29.0	26.3	10.3	7.6	16.2	16.2
PCM_4m_8	381324	405104	802006053	18.8	29.0	26.3	10.2	7.6	16.2	16.2
PCM_4m_9	381332	405110	802006053	18.8	29.0	26.3	10.2	7.6	16.2	16.2
PCM_4m_10	381340	405116	802006053	18.8	29.1	26.5	10.3	7.7	16.2	16.2
PCM_4m_11	381348	405122	802006053	18.8	29.1	26.6	10.4	7.8	16.2	16.2
PCM_4m_12	381356	405128	802006053	18.8	29.2	26.6	10.4	7.9	16.2	16.2
PCM_4m_13	381364	405134	802006053	18.8	29.1	26.6	10.4	7.9	16.2	16.2
PCM_4m_14	381372	405140	802006053	18.8	29.1	26.6	10.4	7.9	16.2	16.2
PCM_4m_15	381380	405146	802006053	18.8	29.2	26.6	10.4	7.9	16.2	16.2
PCM_4m_16	381388	405152	802006053	18.8	29.2	26.6	10.4	7.9	16.2	16.2
PCM_4m_17	381396	405158	802006053	18.8	29.2	26.6	10.4	7.8	16.2	16.2
PCM_4m_18	381404	405163	802006053	18.8	29.2	26.6	10.4	7.8	16.2	16.2
PCM_4m_19	381412	405169	802006053	18.8	29.2	26.5	10.4	7.7	16.2	16.2
PCM_4m_20	381421	405175	802006053	18.8	29.1	26.4	10.4	7.6	16.2	16.2
PCM_4m_21	381429	405181	802006053	18.8	29.1	26.3	10.3	7.5	16.2	16.1
PCM_4m_22	381437	405187	802006053	18.8	29.1	26.3	10.4	7.5	16.2	16.1
PCM_4m_23	381445	405192	802006053	18.8	29.2	26.3	10.4	7.6	16.2	16.2

Receptor ID	Location (m)		PCM Link census ID	Modelled 2027 Annual Mean Roadside NO_2 Concentration (µg/m^3)			Difference (PEIR Model vs. PCM Model) (µg/m^3)		Modelled 2027 Annual Mean Roadside PM_{10} Concentration (µg/m^3)	
				PCM Model	PEIR Model					
	X	Y			DM	DS	DM	DS	DM	DS
PCM_4m_24	381454	405198	802006053	18.8	29.2	26.4	10.4	7.6	16.2	16.2
PCM_4m_25	381458	405201	802006053	18.8	29.2	26.4	10.5	7.7	16.2	16.2
PCM_4m_26	381466	405206	802006053	18.8	29.2	26.5	10.4	7.7	16.2	16.2
PCM_4m_27	381482	405217	802006053	18.8	29.2	26.6	10.4	7.8	16.2	16.2
PCM_4m_28	381487	405220	802006053	18.8	29.2	26.6	10.4	7.9	16.2	16.2
PCM_4m_29	381495	405225	802006053	18.8	29.2	26.7	10.4	7.9	16.2	16.3
PCM_4m_30	381503	405231	802006053	18.8	29.2	26.7	10.4	7.9	16.2	16.2
PCM_4m_31	381512	405237	802006053	18.8	29.1	26.6	10.4	7.9	16.2	16.2
PCM_4m_32	381520	405242	802006053	18.8	29.1	26.6	10.4	7.8	16.2	16.2
PCM_4m_33	381528	405248	802006053	18.8	29.1	26.6	10.4	7.8	16.2	16.2
PCM_4m_34	381536	405254	802006053	18.8	29.1	26.5	10.3	7.7	16.2	16.2
PCM_4m_35	381545	405259	802006053	18.8	29.0	26.4	10.3	7.7	16.1	16.2
PCM_4m_36	381553	405265	802006053	18.8	29.0	26.3	10.2	7.6	16.1	16.1
PCM_4m_37	381561	405270	802006053	18.8	28.9	26.3	10.2	7.5	16.1	16.1
PCM_4m_38	381570	405276	802006053	18.8	29.0	26.3	10.2	7.5	16.1	16.1
PCM_4m_39	381578	405281	802006053	18.8	29.0	26.3	10.2	7.6	16.1	16.1
PCM_4m_40	381583	405284	802006053	18.8	28.9	26.3	10.2	7.5	16.1	16.1
PCM_4m_41	381233	405026	802006053	18.8	28.5	25.7	9.7	7.0	16.2	16.1
PCM_4m_42	386545	404000	802074590	25.7	19.0	19.1	-6.7	-6.6	13.0	13.0
PCM_4m_43	386553	403996	802074590	25.7	19.0	19.1	-6.7	-6.7	13.0	13.0

Receptor ID	Location (m)		PCM Link census ID	Modelled 2027 Annual Mean Roadside NO_2 Concentration (µg/m^3)			Difference (PEIR Model vs. PCM Model) (µg/m^3)		Modelled 2027 Annual Mean Roadside PM_{10} Concentration (µg/m^3)	
				PCM Model	**PEIR** Model					
	X	Y			DM	DS	DM	DS	DM	DS
PCM_4m_44	386563	403992	802074590	25.7	19.0	19.0	-6.7	-6.7	13.0	13.0
PCM_4m_45	386572	403989	802074590	25.7	19.1	19.1	-6.6	-6.6	13.0	13.0
PCM_4m_46	386582	403986	802074590	25.7	19.2	19.2	-6.6	-6.5	13.0	13.0
PCM_4m_47	386591	403983	802074590	25.7	19.2	19.2	-6.5	-6.5	13.0	13.0
PCM_4m_48	386601	403980	802074590	25.7	19.2	19.3	-6.5	-6.5	13.0	13.0
PCM_4m_49	386610	403976	802074590	25.7	19.2	19.3	-6.5	-6.5	13.0	13.0
PCM_4m_50	386620	403973	802074590	25.7	19.2	19.3	-6.5	-6.5	13.0	13.0
PCM_4m_51	386629	403970	802074590	25.7	19.2	19.2	-6.5	-6.5	13.0	13.0
PCM_4m_52	386639	403967	802074590	25.7	19.2	19.2	-6.6	-6.5	13.0	13.0
PCM_4m_53	386648	403965	802074590	25.7	19.2	19.3	-6.5	-6.4	13.0	13.0
PCM_4m_54	386654	403963	802074590	25.7	19.3	19.3	-6.5	-6.4	13.0	13.0
PCM_4m_55	388677	403417	802099614	27.2	23.4	23.4	-3.9	-3.8	14.2	14.2
PCM_4m_56	388686	403417	802099614	27.2	23.4	23.5	-3.8	-3.8	14.2	14.2
PCM_4m_57	381226	405020	802006053	18.8	28.3	25.7	9.5	6.9	16.2	16.1
PCM_4m_58	387898	403574	802099614	27.2	24.9	25.0	-2.3	-2.2	15.1	15.1
PCM_4m_59	387889	403577	802099614	27.2	24.9	25.0	-2.3	-2.2	15.1	15.1
PCM_4m_60	387879	403581	802099614	27.2	24.9	25.0	-2.3	-2.2	15.1	15.1
PCM_4m_61	387870	403585	802099614	27.2	24.9	25.0	-2.3	-2.2	15.1	15.1
PCM_4m_62	387861	403588	802099614	27.2	24.9	25.0	-2.3	-2.2	15.1	15.1
PCM_4m_63	387851	403592	802099614	27.2	24.9	25.0	-2.3	-2.3	15.1	15.1

Receptor ID	Location (m)		PCM Link census ID	Modelled 2027 Annual Mean Roadside NO_2 Concentration (µg/m^3)			Difference (PEIR Model vs. PCM Model) (µg/m^3)		Modelled 2027 Annual Mean Roadside PM_{10} Concentration (µg/m^3)	
				PCM Model	PEIR Model					
	X	Y			DM	DS	DM	DS	DM	DS
PCM_4m_64	387842	403595	802099614	27.2	24.9	25.0	-2.3	-2.3	15.1	15.1
PCM_4m_65	387833	403599	802099614	27.2	24.9	25.0	-2.3	-2.3	15.1	15.1
PCM_4m_66	387823	403602	802099614	27.2	24.9	25.0	-2.3	-2.3	15.1	15.1
PCM_4m_67	387814	403606	802099614	27.2	24.9	25.0	-2.3	-2.2	15.1	15.1
PCM_4m_68	387805	403610	802099614	27.2	24.9	25.0	-2.3	-2.2	15.1	15.1
PCM_4m_69	387795	403614	802099614	27.2	25.0	25.1	-2.2	-2.2	15.1	15.1
PCM_4m_70	387786	403617	802099614	27.2	25.0	25.1	-2.2	-2.2	15.1	15.1
PCM_4m_71	388455	403457	802099614	27.2	29.2	29.3	2.0	2.1	15.6	15.6
PCM_4m_72	388464	403457	802099614	27.2	29.1	29.2	1.8	1.9	15.5	15.5
PCM_4m_73	388474	403456	802099614	27.2	29.0	29.1	1.8	1.8	15.5	15.5
PCM_Q_1	381587	405228	802006053	18.8	22.5	22.5	3.7	3.8	14.9	15.1
PCM_Q_2	381597	405230	802006053	18.8	21.2	21.1	2.4	2.3	14.6	14.7
PCM_Q_3	381609	405231	802006053	18.8	20.1	20.0	1.4	1.3	14.3	14.4
PCM_Q_5	381294	405093	802006053	18.8	24.3	22.6	5.5	3.9	15.2	15.2
PCM_Q_6	381302	405099	802006053	18.8	24.4	22.7	5.6	4.0	15.2	15.2
PCM_Q_7	381310	405105	802006053	18.8	24.7	23.0	5.9	4.2	15.2	15.2
PCM_Q_8	381319	405111	802006053	18.8	24.9	23.2	6.2	4.4	15.3	15.3
PCM_Q_9	381327	405116	802006053	18.8	25.2	23.4	6.4	4.6	15.3	15.4
PCM_Q_10	381335	405122	802006053	18.8	25.4	23.6	6.6	4.8	15.4	15.4
PCM_Q_11	381343	405128	802006053	18.8	25.5	23.7	6.8	5.0	15.4	15.4

Receptor ID	Location (m)		PCM Link census ID	Modelled 2027 Annual Mean Roadside NO_2 Concentration (µg/m^3)			Difference (PEIR Model vs. PCM Model) (µg/m^3)		Modelled 2027 Annual Mean Roadside PM_{10} Concentration (µg/m^3)	
				PCM Model	PEIR Model					
	X	Y			DM	DS	DM	DS	DM	DS
PCM_Q_12	381352	405133	802006053	18.8	25.8	23.9	7.0	5.1	15.5	15.5
PCM_Q_13	381360	405139	802006053	18.8	25.9	24.0	7.1	5.2	15.5	15.5
PCM_Q_14	381368	405145	802006053	18.8	26.0	24.1	7.3	5.4	15.5	15.5
PCM_Q_15	381377	405150	802006053	18.8	26.2	24.2	7.4	5.5	15.5	15.6
PCM_Q_16	381385	405156	802006053	18.8	26.3	24.3	7.5	5.5	15.6	15.6
PCM_Q_17	381393	405162	802006053	18.8	26.3	24.3	7.6	5.6	15.6	15.6
PCM_Q_18	381401	405168	802006053	18.8	26.4	24.4	7.6	5.6	15.6	15.6
PCM_Q_19	381409	405173	802006053	18.8	26.4	24.4	7.7	5.6	15.6	15.6
PCM_Q_20	381418	405179	802006053	18.8	26.5	24.4	7.8	5.6	15.6	15.6
PCM_Q_21	381426	405185	802006053	18.8	26.6	24.4	7.8	5.6	15.6	15.6
PCM_Q_22	381434	405190	802006053	18.8	26.6	24.4	7.8	5.6	15.6	15.6
PCM_Q_23	381442	405196	802006053	18.8	26.6	24.4	7.8	5.6	15.6	15.6
PCM_Q_24	381451	405202	802006053	18.8	26.3	24.2	7.6	5.5	15.6	15.6
PCM_Q_25	381454	405208	802006053	18.8	25.3	23.4	6.6	4.7	15.3	15.4
PCM_Q_26	381463	405211	802006053	18.8	26.0	24.0	7.2	5.2	15.5	15.5
PCM_Q_41	381227	405033	802006053	18.8	24.4	22.9	5.7	4.1	15.4	15.3
PCM_Q_42	386540	403990	802074590	25.7	17.3	17.3	-8.5	-8.4	12.6	12.6
PCM_Q_43	386551	403990	802074590	25.7	17.8	17.8	-7.9	-7.9	12.7	12.7
PCM_Q_44	386562	403991	802074590	25.7	18.8	18.8	-6.9	-6.9	12.9	12.9
PCM_Q_52	386638	403964	802074590	25.7	18.4	18.4	-7.3	-7.3	12.8	12.8

Receptor ID	Location (m)		PCM Link census ID	Modelled 2027 Annual Mean Roadside NO_2 Concentration (µg/m^3)			Difference (PEIR Model vs. PCM Model) (µg/m^3)		Modelled 2027 Annual Mean Roadside PM_{10} Concentration (µg/m^3)	
				PCM Model	PEIR Model					
	X	Y			DM	DS	DM	DS	DM	DS
PCM_Q_53	386647	403958	802074590	25.7	17.9	17.9	-7.8	-7.8	12.7	12.7
PCM_Q_54	386652	403953	802074590	25.7	17.4	17.4	-8.3	-8.3	12.6	12.6
PCM_Q_57	381220	405027	802006053	18.8	24.2	22.8	5.4	4.1	15.4	15.3
PCM_Q_58	387901	403581	802099614	27.2	22.1	22.1	-5.2	-5.1	14.4	14.4
PCM_Q_59	387891	403585	802099614	27.2	21.9	22.0	-5.3	-5.2	14.4	14.4
PCM_Q_60	387882	403588	802099614	27.2	22.0	22.0	-5.2	-5.2	14.4	14.4
PCM_Q_61	387873	403592	802099614	27.2	22.0	22.1	-5.2	-5.1	14.4	14.4
PCM_Q_62	387863	403595	802099614	27.2	22.1	22.1	-5.2	-5.1	14.4	14.4
PCM_Q_63	387854	403598	802099614	27.2	22.1	22.2	-5.1	-5.0	14.5	14.5
PCM_Q_64	387844	403602	802099614	27.2	22.2	22.3	-5.0	-4.9	14.5	14.5
PCM_Q_65	387835	403605	802099614	27.2	22.3	22.3	-5.0	-4.9	14.5	14.5
PCM_Q_66	387826	403610	802099614	27.2	21.8	21.8	-5.5	-5.4	14.4	14.4
PCM_Q_67	387817	403614	802099614	27.2	21.8	21.9	-5.4	-5.3	14.4	14.4
PCM_Q_68	387808	403617	802099614	27.2	21.9	22.0	-5.3	-5.2	14.4	14.4
PCM_Q_69	387798	403621	802099614	27.2	22.0	22.1	-5.2	-5.2	14.4	14.4
PCM_Q_70	387790	403628	802099614	27.2	21.3	21.3	-6.0	-5.9	14.2	14.3
PCM_Q_71	388455	403459	802099614	27.2	28.6	28.7	1.4	1.4	15.5	15.5
PCM_Q_72	388464	403458	802099614	27.2	28.5	28.6	1.3	1.3	15.4	15.4
PCM_Q_73	388474	403457	802099614	27.2	28.4	28.4	1.1	1.2	15.3	15.4

Appendix 12.1. Baseline Noise Survey Results

1.1 Introduction

1.1.1 This appendix describes the baseline noise surveys that have been undertaken to inform the noise assessments.

1.1.2 Proposals regarding the baseline noise survey methodology were described within the Environmental Scoping Report (Highways England, 2021), identifying five noise monitoring locations. Permission to access four of these were obtained in time for the planned surveys in the autumn of 2021, with permission for the fifth location obtained after the initial survey period, leading to the fifth location being surveyed in winter 2021. PEIR Figure 12.1 indicates the noise measurement locations.

1.2 Methodology

1.2.1 A number of constraints influenced the choice of measurement locations, including acoustic suitability, ease of access and equipment security. The final locations are detailed in Table 1.1 and presented in Figure 12.1.

Table 1.1: Noise measurement locations

ID	Name	Survey Dates	Observations
N1	9 Droughts Lane	05/10/2021 to 12/10/2021	Constant road traffic noise, water feature in garden and barking dogs. There are approximately 10 dogs at the location.
N2	Eastview, Corday Lane	05/10/2021 to 12/10/2021	Constant road traffic noise, horses in adjacent field.
N3	9 Conisborough Place	05/10/2021 to 12/10/2021	Constant road traffic noise, some birdsong and leaf rustle.
N4	37 Marston Close	05/10/2021 to 12/10/2021	Low level traffic noise, some birdsong and local traffic.
N5	Cowlgate Farm	29/11/2021 to 07/12/2021	Constant road traffic noise. Farm activities including goats, horses, chickens and dogs. Some birdsong.

1.2.2 The rationale for the selection of each survey location is given in Table 1.2. The rationale behind choosing some locations was based upon potential uses of the data during the assessment.

Table 1.2: Rationale for selection of noise measurement locations

ID	Name	Rationale for selection
N1	9 Droughts Lane	Chosen to be representative of dwellings closest to M60 J18.
N2	Eastview, Corday Lane	Chosen to be representative of dwellings in the area of M60 J18 that are close to both the M60 and M62.
N3	9 Conisborough Place	Chosen to be representative of dwellings that are close to the M60 between J17 and J18.

ID	Name	Rationale for selection
N4	37 Marston Close	Chosen to be representative of the closest dwellings to M60 J18 and the proposed new dedicated left turn lane.
N5	Cowlgate Farm	Chosen to represent this single isolated dwelling that is close to the M66 and proposed Northern Loop road links.

1.2.3 Ambient noise levels were measured at each location using integrating-averaging Sound Level Meters (SLMs) or equivalent systems conforming to Class 1 as defined by BS EN 61672-1:2013 (British Standards Institution, 2013). Each SLM was field calibrated before the start of each survey by applying an acoustic calibrator conforming to BS EN 60942:2018 (British Standards Institution, 2018) to the microphone to check the sensitivity of the measuring equipment. Calibration checks were also performed at the end of each survey. No significant drift over the survey period was noted at any location.

1.2.4 The equipment used for the noise measurements was subject to more extensive performance tests, traceable to primary standards, at accredited independent laboratories within a period of one year prior to use.

1.2.5 The microphone height at each survey location was between 1.2m and 1.5m above ground level. To reduce the influence of reflections the microphone positions were at least 3.5m from any reflecting surface other than the ground for free-field measurements.

1.2.6 A suitable foam windshield, conforming to Class 1 of BS 61672-1:2013 (British Standards Institution, 2013) was fitted to each microphone. At each location, the SLM was set to measure using the logging facility with the A-weighting filter.

1.2.7 Table 1.3 presents a summary of the noise measurement equipment used at each survey location. A single SLM calibrator was used at each location.

Table 1.3: Noise measurement equipment

ID	Equipment make and model	Serial number	Date of previous calibration
N1	Rion NL-52 Sound Level Meter	732094	28/04/2021
	Rion NC-74 Field Calibrator	34494274	23/04/2021
N2	Rion NL-52 Sound Level Meter	976221	28/04/2021
	Rion NC-74 Field Calibrator	34494274	23/04/2021
N3	Rion NL-52 Sound Level Meter	1087405	13/05/2021
	Rion NC-74 Field Calibrator	34494274	23/04/2021
N4	Rion NL-52 Sound Level Meter	586907	20/07/2021
	Rion NC-74 Field Calibrator	34494274	23/04/2021
N5	Rion NL-52 Sound Level Meter	976220	27/07/2021
	Rion NC-74 Field Calibrator	34825715	07/01/2021

1.2.8 The equipment was installed by persons competent in acoustics who hold either the Institute of Acoustics Certificate of Competence in Environmental Noise Monitoring or the Diploma in Acoustics and Noise Control.

Weather station instrumentation and set-up

1.2.9 A weather station was co-located at measurement location N2 during the October 2021 measurement period that logged rainfall and windspeed. The anemometer and rainfall collector were installed at approximately 1.5m above local ground level. During the second survey period at N5 local weather observations were used to identify periods of rainfall and wind.

1.2.10 During the noise survey period there was unavoidably some periods of rainfall and high winds. In these situations the measured noise levels can be unreliable, unrepresentative, or not repeatable. Therefore some periods from the measured noise data have been removed from the analysis, and these are shown in Table 1.4.

Table 1.4: Periods of excluded data due to adverse weather

Date	Time of excluded data
Tuesday 05/10/2021	16:45 to 19:40
Wednesday 06/10/2021	17:10 to 17:15, 19:00 to 20:35
Saturday 09/10/2021	13:00 to 13:55, 17:30 to 23:50
Sunday 10/10/2021	00:35 to 00:55
Tuesday 30/11/2021	19:30 to 00:00
Wednesday 01/12/2021	00:00 to 10:05, 14:00 to 18:05
Thursday 02/12/2021	23:30 to 00:00
Friday 03/12/2021	00:00 to 07:05
Saturday 04/12/2021	02:10 to 00:00
Sunday 05/12/2021	00:00 to 12:25
Monday 06/12/2021	08:40 to 14:45, 19:50 to 23:05
Tuesday 07/12/2021	04:20 to 11:05

1.2.11 The time periods where data has been excluded are due to either rainfall exceeding 1mm in a one-hour period, an average wind exceeding 5m/s, or gusts above 10m/s. The noise data within periods of rainfall of less than 1mm were not excluded as it was considered that on busy roads, such as the M60/M62/M66, even at night, this amount of rainfall is unlikely to cause a noticeable change to road traffic noise. This decision was based on professional judgement.

Data processing methodology

1.2.12 At some locations particular noise sources were identified that would not be representative of baseline conditions. As such the following periods of data have also been disregarded from the following locations;

- L1, periods of dogs barking on all days during survey period

1.2.13 The remaining data have been used to derive the baseline statistical noise parameters needed by the guidance and standards which have been used to assess the potential noise effects of the Proposed Scheme. These guidance and standards documents are:

- Calculation of Road Traffic Noise: 1988 (HMSO)
- BS 5228-1:2009+A1:2014: Code of practice for noise and vibration control on construction and open sites - Noise (British Standards Institution, 2014a)

1.2.14 Following the sift for weather and extraneous noise sources, all remaining data points have been used to calculate noise levels for various daytime and night-time periods. The logarithmic $L_{Aeq,T}$ and statistical average $L_{A10,T}$ dB is reported in each period.

1.2.15 Some of the values are based on data from the full measurement period, while others will be based on reduced datasets because of excluded data.

1.3 Measurement results

Location N1, 9 Droughts Lane

1.3.1 Measurement location N1 was in the garden of 9 Droughts Lane in Simister. Observations of noise sources included constant traffic noise from the nearby motorways, a water feature in the garden and barking from multiple dogs that reside at the dwelling. This location is indicated in Plate 1.1.

Plate 1.1: Measurement location N1

1.3.2 The free-field measurement results for N1 are presented in Tables 1.5 to 1.8. The measurements were carried out for a seven-day period from 5 October 2021 to 12 October 2021. Measurement results are also presented in graphs in Annex A.

Table 1.5: Measured daytime $L_{Aeq,T}$ free-field – N1 Droughts Lane

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	16:45-19:00	Day	-	61.2
06/07/2021	Wednesday	07:00-19:00	Day	62.3	
07/10/2021	Thursday	07:00-19:00	Day	60.9	
08/10/2021	Friday	07:00-19:00	Day	60.2	
09/10/2021	Saturday	07:00-13:00	Day	59.3	
11/10/2021	Monday	07:00-19:00	Day	62.7	
12/10/2021	Tuesday	07:00-14:20	Day	62.1	

Table 1.6: Measured night-time $L_{Aeq,T}$ free-field – N1 Droughts Lane

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	23:00-07:00	Night	59.5	56.1
06/07/2021	Wednesday	23:00-07:00	Night	55.1	
07/10/2021	Thursday	23:00-07:00	Night	55.1	
08/10/2021	Friday	23:00-07:00	Night	52.7	
09/10/2021	Saturday	23:00-07:00	Night	55.1	
10/10/2021	Sunday	23:00-07:00	Night	57.5	
11/10/2021	Monday	23:00-07:00	Night	58.0	

Table 1.7: Measured other period $L_{Aeq,T}$ free-field – N1 Droughts Lane

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	19:00-23:00	Evening	61.7	59.1
06/07/2021	Wednesday	19:00-23:00	Evening	56.9	
07/10/2021	Thursday	19:00-23:00	Evening	58.1	
08/10/2021	Friday	19:00-23:00	Evening	56.7	
09/10/2021	Saturday	13:00-23:00	Weekend	59.1	
10/10/2021	Sunday	07:00-23:00	Weekend	61.8	
11/10/2021	Monday	19:00-23:00	Evening	59.8	

Table 1.8: Measured weekday $L_{A10,18h}$ free-field – N1 Droughts Lane

Date	Day	Time	$L_{A10,18h}$ dB	
			Daily	Period Average
05/10/2021	Tuesday	16:45-00:00	62.8	62.8
06/07/2021	Wednesday	06:00-00:00	61.3	60.8
07/10/2021	Thursday	06:00-00:00	60.4	
08/10/2021	Friday	06:00-00:00	59.3	
11/10/2021	Monday	06:00-00:00	62.1	
12/10/2021	Tuesday	06:00-14:20	61.5	61.5

Location N2, Eastview

1.3.3 Measurement location N2 was in the garden of Eastview, Corday Lane in the south-west quadrant of the M60 J18. The weather station was co-located with the sound level meter in this location. Observations of noise sources included constant traffic noise from the nearby motorways, and horses were observed in the adjacent field. The location is indicated in Plate 1.2.

Plate 1.2: Measurement location N2

1.3.4 The free-field measurement results for N2 are presented in Tables 1.9 to 1.12. The measurements were carried out for a seven-day period from 5 October 2021 to 12 October 2021. Measurement results are also presented in graphs in Annex A.

Table 1.9: Measured daytime $L_{Aeq,T}$ free-field – N2 Eastview

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	14:10-19:00	Day	-	63.8
06/07/2021	Wednesday	07:00-19:00	Day	65.7	
07/10/2021	Thursday	07:00-19:00	Day	61.6	
08/10/2021	Friday	07:00-19:00	Day	61.6	
09/10/2021	Saturday	07:00-13:00	Day	62.6	
11/10/2021	Monday	07:00-19:00	Day	65.6	
12/10/2021	Tuesday	07:00-13:05	Day	65.6	

Table 1.10: Measured night-time $L_{Aeq,T}$ free-field – N2 Eastview

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	23:00-07:00	Night	63.7	59.9
06/07/2021	Wednesday	23:00-07:00	Night	58.3	
07/10/2021	Thursday	23:00-07:00	Night	58.8	
08/10/2021	Friday	23:00-07:00	Night	56.1	
09/10/2021	Saturday	23:00-07:00	Night	59.3	
10/10/2021	Sunday	23:00-07:00	Night	61.3	
11/10/2021	Monday	23:00-07:00	Night	61.5	

Table 1.11: Measured other period $L_{Aeq,T}$ free-field – N2 Eastview

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	19:00-23:00	Evening	65.5	62.6
06/07/2021	Wednesday	19:00-23:00	Evening	59.7	
07/10/2021	Thursday	19:00-23:00	Evening	60.8	
08/10/2021	Friday	19:00-23:00	Evening	59.9	
09/10/2021	Saturday	13:00-23:00	Weekend	63.0	
10/10/2021	Sunday	07:00-23:00	Weekend	66.2	
11/10/2021	Monday	19:00-23:00	Evening	62.8	

Table 1.12: Measured weekday $L_{A10,18h}$ free-field – N2 Eastview

Date	Day	Time	$L_{A10,18h}$ dB	
			Daily	Period Average
05/10/2021	Tuesday	14:10-00:00	66.3	66.3
06/07/2021	Wednesday	06:00-00:00	64.6	63.2
07/10/2021	Thursday	06:00-00:00	61.6	
08/10/2021	Friday	06:00-00:00	61.4	
11/10/2021	Monday	06:00-00:00	65.1	
12/10/2021	Tuesday	06:00-13:05	66.0	66.0

Location N3, 9 Conisborough Place

1.3.5 Measurement location N3 was in the garden of 9 Conisborough Place, alongside the eastbound carriageway of the M60 between J17 and J18. Observations of noise sources confirmed constant road traffic noise from the nearby motorway, as well as birdsong and movement of trees. The location is indicated in Plate 1.3.

Plate 1.3: Measurement location N3

1.3.6 The free-field measurement results for N3 are presented in Tables 1.13 to 1.16. The measurements were carried out for a seven-day period from 5 October 2021 to 12 October 2021. Measurement results are also presented in graphs in Annex A.

Table 1.13: Measured daytime $L_{Aeq,T}$ free-field – N3 9 Conisborough Place

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	13:30-19:00	Day	-	65.4
06/07/2021	Wednesday	07:00-19:00	Day	65.3	
07/10/2021	Thursday	07:00-19:00	Day	65.8	
08/10/2021	Friday	07:00-19:00	Day	65.7	
09/10/2021	Saturday	07:00-13:00	Day	65.5	
11/10/2021	Monday	07:00-19:00	Day	65.3	
12/10/2021	Tuesday	07:00-12:10	Day	64.9	

Table 1.14: Measured night-time $L_{Aeq,T}$ free-field – N3 9 Conisborough Place

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	23:00-07:00	Night	62.5	61.3
06/07/2021	Wednesday	23:00-07:00	Night	61.8	
07/10/2021	Thursday	23:00-07:00	Night	61.8	
08/10/2021	Friday	23:00-07:00	Night	60.5	
09/10/2021	Saturday	23:00-07:00	Night	59.7	
10/10/2021	Sunday	23:00-07:00	Night	61.6	
11/10/2021	Monday	23:00-07:00	Night	61.4	

Table 1.15: Measured other period $L_{Aeq,T}$ free-field – N3 9 Conisborough Place

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	19:00-23:00	Evening	64.4	64.3
06/07/2021	Wednesday	19:00-23:00	Evening	64.0	
07/10/2021	Thursday	19:00-23:00	Evening	64.2	
08/10/2021	Friday	19:00-23:00	Evening	64.0	
09/10/2021	Saturday	13:00-23:00	Weekend	65.0	
10/10/2021	Sunday	07:00-23:00	Weekend	65.1	
11/10/2021	Monday	19:00-23:00	Evening	63.2	

Table 1.16: Measured weekday $L_{A10,18h}$ free-field – N3 9 Conisborough Place

Date	Day	Time	$L_{A10,18h}$ dB	
			Daily	Period Average
05/10/2021	Tuesday	14:10-00:00	65.2	65.2
06/07/2021	Wednesday	06:00-00:00	65.8	66.0
07/10/2021	Thursday	06:00-00:00	66.2	
08/10/2021	Friday	06:00-00:00	66.3	
11/10/2021	Monday	06:00-00:00	65.8	
12/10/2021	Tuesday	06:00-13:05	66.0	66.0

Location N4, 37 Marston Close

1.3.7 Measurement location N4 was in the garden of 37 Marston Close, in the north-west quadrant of the M60 J18. Observations of noise sources included constant traffic noise from the nearby motorways, subjectively quieter than at the other survey locations, local traffic and some bird song. The location is indicated in Plate 1.4.

Plate 1.4: Measurement location N4

1.3.8 The free-field measurement results for N4 are presented in Tables 1.17 to 1.20. The measurements were carried out for a seven day period from 5 October to 12 October 2021. Measurement results are also presented in graphs in Annex A.

Table 1.17: Measured daytime $L_{Aeq,T}$ free-field – N4 37 Marston Close

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	14:55-19:00	Day	-	58.3
06/07/2021	Wednesday	07:00-19:00	Day	56.7	
07/10/2021	Thursday	07:00-19:00	Day	62.1	
08/10/2021	Friday	07:00-19:00	Day	60.9	
09/10/2021	Saturday	07:00-13:00	Day	57.8	
11/10/2021	Monday	07:00-19:00	Day	57.7	
12/10/2021	Tuesday	07:00-13:55	Day	54.7	

Table 1.18: Measured night-time $L_{Aeq,T}$ free-field – N4 37 Marston Close

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	23:00-07:00	Night	53.9	54.6
06/07/2021	Wednesday	23:00-07:00	Night	56.9	
07/10/2021	Thursday	23:00-07:00	Night	56.6	
08/10/2021	Friday	23:00-07:00	Night	55.5	
09/10/2021	Saturday	23:00-07:00	Night	49.3	
10/10/2021	Sunday	23:00-07:00	Night	56.9	
11/10/2021	Monday	23:00-07:00	Night	52.9	

Table 1.19: Measured other period $L_{Aeq,T}$ free-field – N4 37 Marston Close

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
05/10/2021	Tuesday	19:00-23:00	Evening	53.6	55.8
06/07/2021	Wednesday	19:00-23:00	Evening	57.9	
07/10/2021	Thursday	19:00-23:00	Evening	58.6	
08/10/2021	Friday	19:00-23:00	Evening	57.6	
09/10/2021	Saturday	13:00-23:00	Weekend	54.9	
10/10/2021	Sunday	07:00-23:00	Weekend	53.7	
11/10/2021	Monday	19:00-23:00	Evening	54.2	

Table 1.20: Measured weekday $L_{A10,18h}$ free-field – N4 37 Marston Close

Date	Day	Time	$L_{A10,18h}$ dB	
			Daily	Period Average
05/10/2021	Tuesday	14:55-00:00	54.1	54.1
06/07/2021	Wednesday	06:00-00:00	57.8	59.4
07/10/2021	Thursday	06:00-00:00	61.8	
08/10/2021	Friday	06:00-00:00	60.7	
11/10/2021	Monday	06:00-00:00	57.4	
12/10/2021	Tuesday	06:00-13:55	56.2	56.2

Location N5, Cowlgate Farm

1.3.9 Measurement location N5 was in the garden of Cowlgate Farm, located to the west of the northbound M66. Observations of noise sources included constant traffic noise from the nearby motorways, some human activities on the farm, animal sounds (chickens, horses and dogs) and bird song. The location is indicated in Plate 1.5.

Plate 1.5: Measurement location N5

1.3.10 The free-field measurement results for N5 are presented in Tables 1.21 to 1.25. The measurements were carried out for a seven-day period from 20 November to 7 December 2021. Measurement results are also presented in graphs in Annex A.

Table 1.21: Measured daytime $L_{Aeq,T}$ free-field – N5 Cowlgate Farm

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
30/11/2021	Tuesday	13:55-19:00	Day	70.8	72.6
01/12/2021	Wednesday	07:00-19:00	Day	73.1	
02/12/2021	Thursday	07:00-19:00	Day	72.6	
03/12/2021	Friday	07:00-19:00	Day	71.8	
04/12/2021	Saturday	07:00-13:00	Day	-	
06/12/2021	Monday	07:00-19:00	Day	71.7	
07/12/2021	Tuesday	07:00-11:05	Day	73.8	

Table 1.22: Measured night-time $L_{Aeq,T}$ free-field – N5 Cowlgate Farm

Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
30/11/2021	Tuesday	23:00-07:00	Night	-	66.5
01/12/2021	Wednesday	23:00-07:00	Night	66.6	
02/12/2021	Thursday	23:00-07:00	Night	67.3	
03/12/2021	Friday	23:00-07:00	Night	65.8	
04/12/2021	Saturday	23:00-07:00	Night	-	
05/12/2021	Sunday	23:00-07:00	Night	66.4	
06/12/2021	Monday	23:00-07:00	Night	66.6	

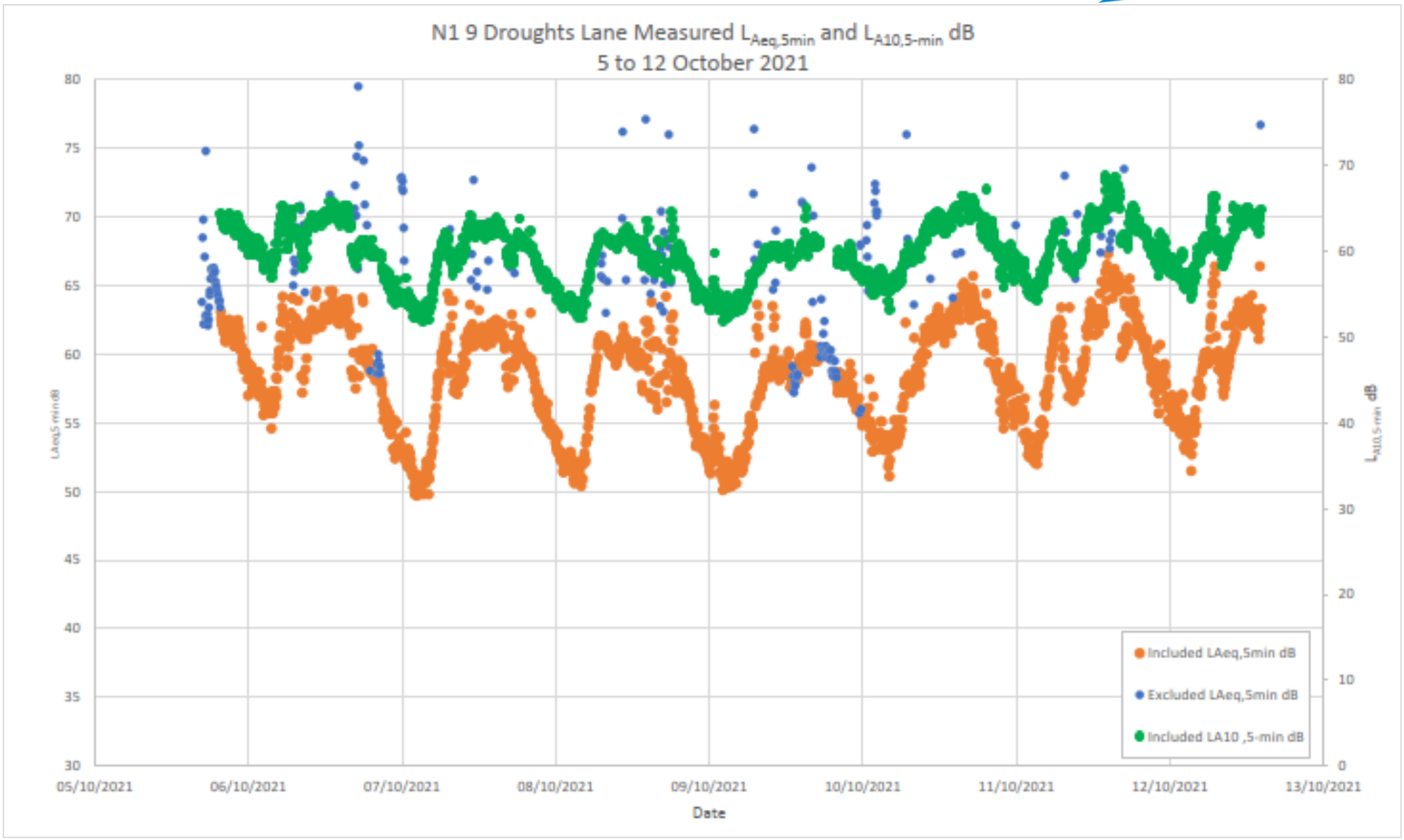
Table 1.23: Measured other period $L_{Aeq,T}$ free-field – N5 Cowlgate Farm

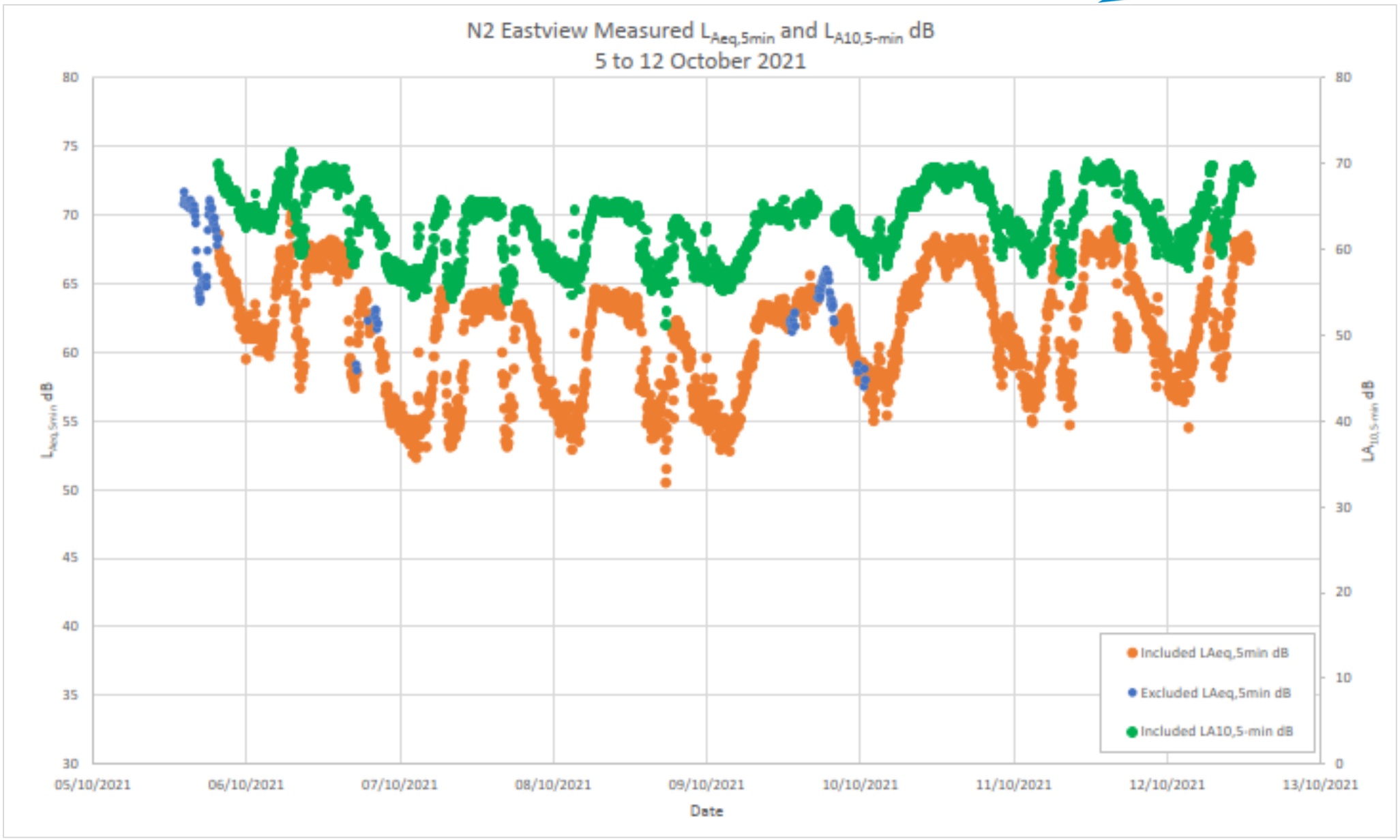
Date	Day	Time	Period	$L_{Aeq,T}$ dB	
				Daily	Period Average
30/11/2021	Tuesday	19:00-23:00	Evening	70.3	70.0
01/12/2021	Wednesday	19:00-23:00	Evening	70.7	
02/12/2021	Thursday	19:00-23:00	Evening	69.1	
03/12/2021	Friday	19:00-23:00	Evening	69.1	
04/12/2021	Saturday	13:00-23:00	Weekend	-	
05/12/2021	Sunday	07:00-23:00	Weekend	71.9	
06/12/2021	Monday	19:00-23:00	Evening	69.2	

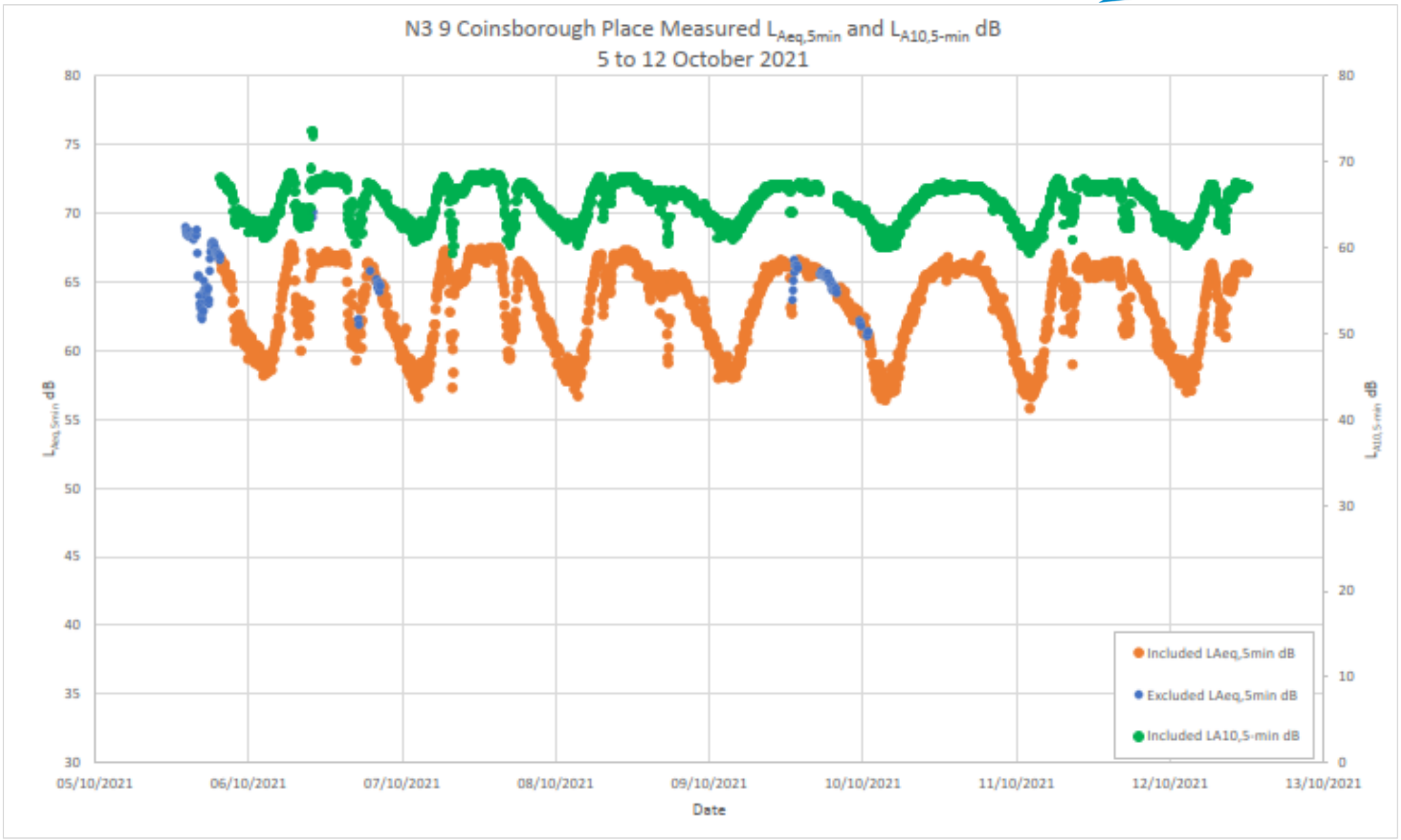
Table 1.24: Measured weekday $L_{A10,18h}$ free-field – N5 Cowlgate Farm

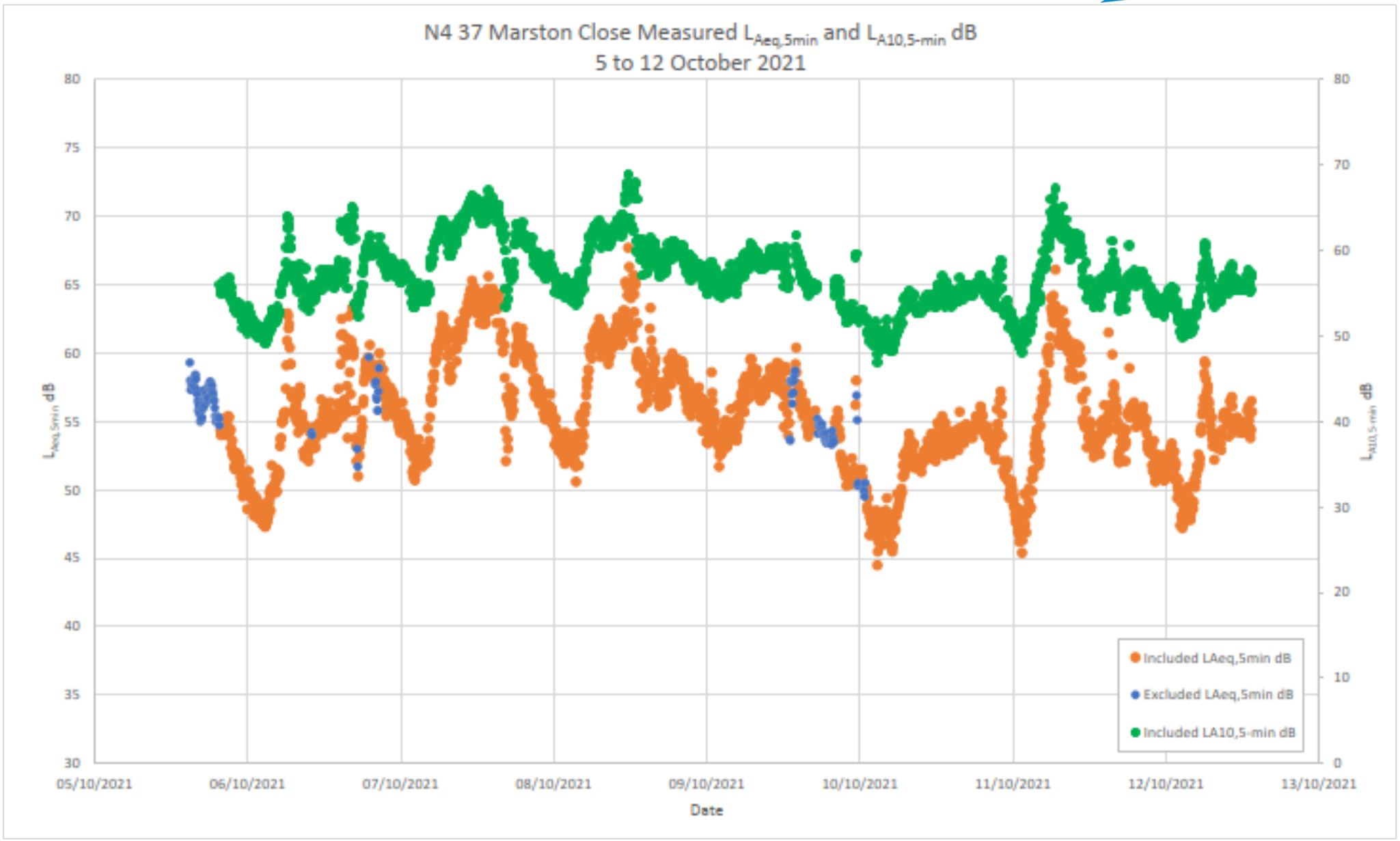
Date	Day	Time	$L_{A10,18h}$ dB	
			Daily	Period Average
30/11/2021	Tuesday	13:55-00:00	72.2	72.2
01/12/2021	Wednesday	06:00-00:00	73.3	72.8
02/12/2021	Thursday	06:00-00:00	73.2	
03/12/2021	Friday	06:00-00:00	72.5	
06/12/2021	Monday	06:00-00:00	72.0	
07/12/2021	Tuesday	06:00-11:05	74.6	74.6

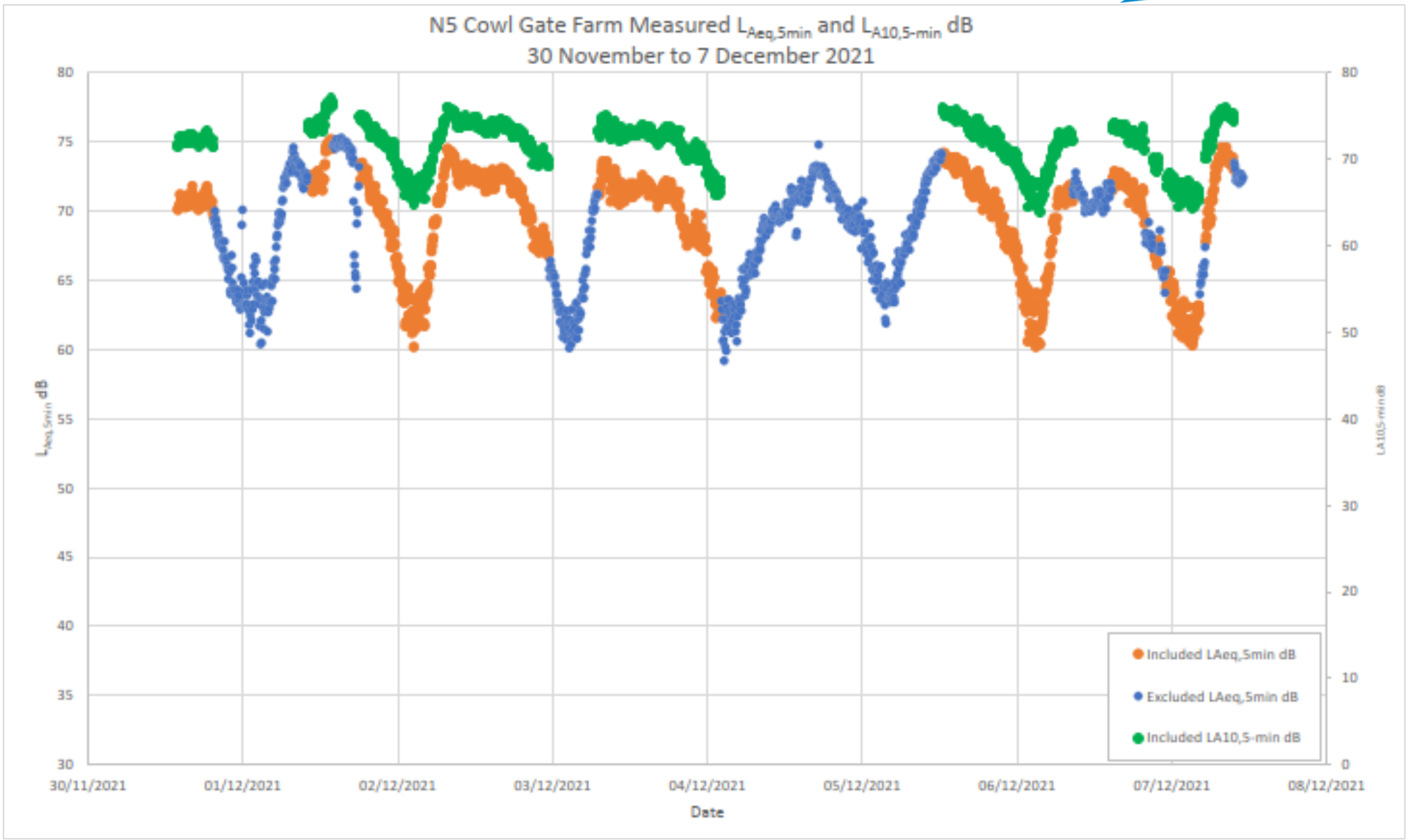
Annex A. Graphs


N1 9 Droughts Lane Measured $L_{Aeq,5min}$ and $L_{A10,5-min}$ dB
5 to 12 October 2021
LAeq,5 min dB
$L_{A10,5-min}$ dB
Date
05/10/2021
06/10/2021
07/10/2021
08/10/2021
09/10/2021
10/10/2021
11/10/2021
12/10/2021
13/10/2021
Included LAeq,5min dB
Excluded LAeq,5min dB
Included LA10 ,5-min dB


N2 Eastview Measured $L_{Aeq,5min}$ and $L_{A10,5-min}$ dB
5 to 12 October 2021
$L_{Aeq,5min}$ dB
$LA_{10,5-min}$ dB
80
75
70
65
60
55
50
45
40
35
30
80
70
60
50
40
30
20
10
0
05/10/2021
06/10/2021
07/10/2021
08/10/2021
09/10/2021
10/10/2021
11/10/2021
12/10/2021
13/10/2021
Date
Included LAeq,5min dB
Excluded LAeq,5min dB
Included LA10,5-min dB


N3 9 Coinsborough Place Measured $L_{Aeq,5min}$ and $L_{A10,5-min}$ dB
5 to 12 October 2021
$L_{Aeq,5min}$ dB
$L_{A10,5-min}$ dB
80
75
70
65
60
55
50
45
40
35
30
80
70
60
50
40
30
20
10
0
05/10/2021
06/10/2021
07/10/2021
08/10/2021
09/10/2021
10/10/2021
11/10/2021
12/10/2021
13/10/2021
Date
Included LAeq,5min dB
Excluded LAeq,5min dB
Included LA10,5-min dB


N4 37 Marston Close Measured $L_{Aeq,5min}$ and $L_{A10,5-min}$ dB
5 to 12 October 2021
$L_{Aeq,5min}$ dB
$L_{A10,5-min}$ dB
80
75
70
65
60
55
50
45
40
35
30
80
70
60
50
40
30
20
10
0
05/10/2021
06/10/2021
07/10/2021
08/10/2021
09/10/2021
10/10/2021
11/10/2021
12/10/2021
13/10/2021
Date
Included LAeq,5min dB
Excluded LAeq,5min dB
Included LA10,5-min dB


N5 Cowl Gate Farm Measured $L_{Aeq,5min}$ and $L_{A10,5-min}$ dB
30 November to 7 December 2021
$L_{Aeq,5min}$ dB
$L_{A10,5-min}$ dB
80
75
70
65
60
55
50
45
40
35
30
80
70
60
50
40
30
20
10
0
30/11/2021
01/12/2021
02/12/2021
03/12/2021
04/12/2021
05/12/2021
06/12/2021
07/12/2021
08/12/2021
Date
Included LAeq,5min dB
Excluded LAeq,5min dB
Included LA10,5-min dB

Appendix 12.2. Construction Noise and Vibration

1.1 Introduction

1.1.1 This appendix summarises the information used to inform the construction noise assessment. Section 1.2 of this appendix presents the construction baseline, and impact threshold levels used in the assessment. The tables in Section 1.3 list the expected construction activities within each area of the Proposed Scheme. It also lists the expected time of the day when these activities may take place, together with the predicted noise level at a horizontal distance of 10m from the works. The assessment presents a conservative approach, as it assumes that all plant to be used within each phase of activity will be operating continuously through a working day or night, at the closest point to each receptor. In practice plant will be spread out within the working area, and there will be parts of each shift when some plant are not in operation.

1.1.2 The tables within Section 1.4 of this appendix then list the expected plant that will be used for used for each activity, together with the sound power level and the percentage on-time. These terms are described at the start of Section 1.4.

1.2 Construction baseline

1.2.1 The measured noise levels have been used to determine Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL) levels for the construction assessment. The results from a fifth noise measurement location (N5 Cowlgate Farm) have not been used as weather conditions were not ideal for environmental noise surveys, with rainfall during a high proportion of the survey period. Tables 1.1 and 1.2 summarise the applicable LOAEL and SOAEL levels at each location.

Table 1.1: Daytime baseline at construction assessment locations

Receptor ID	Location	Representative Areas	Daytime measured $L_{Aeq,T}$ dB	LOAEL	SOAEL
N1	9 Droughts Lane, Simister	South-east quadrant of M60 J18	61	61	65
N2	Eastview, Corday Lane	South-west quadrant of M60 J18	64	64	70
N3	9 Conisborough Place	Alongside M60 J17 to J18	65	65	70
N4	37 Marston Close	North-west quadrant of M60 J18	58	58	65
N5	Cowlgate Farm	Cowlgate Farm	73	73	75

Table 1.2: Night-time baseline at construction assessment locations

Receptor ID	Location	Representative Areas	Night-time measured $L_{Aeq,T}$ dB	LOAEL	SOAEL
N1	9 Droughts Lane, Simister	South-east quadrant of M60 J18	56	56	59
N2	Eastview, Courday Lane	South-west quadrant of M60 J18	60	60	63
N3	9 Conisborough Place	Alongside M60 J17 to J18	61	61	64
N4	37 Marston Close	North-west quadrant of M60 J18	55	55	55
N5	Cowlgate Farm	Cowlgate Farm	67	67	70

1.2.2 A simplified approach to applying these results across the study area has been taken where the LOAEL and SOAEL for locations N2 and N3 have been applied for receptors within 100m of the construction activities, and locations N1 and N4 for receptors at a greater distance than 100m from construction works. In both cases, the lowest available LOAEL has been applied. The results from the fifth noise measurement location (N5 Cowlgate Farm) have not been used as weather conditions were not ideal for environmental noise surveys, with rainfall during a high proportion of the survey period. Table 1.3 summarises these levels.

Table 1.3: Summary construction LOAEL and SOAEL

Receptor IDs	Representative Areas	Daytime		Night-time	
		LOAEL	SOAEL	LOAEL	SOAEL
N2 & N3	Receptors within 100m of motorway roads	64	70	60	63
N1 & N4	Receptors greater than 100m from motorway roads	58	65	55	55

1.3 Construction activities by location

1.3.1 The tables in this section list the assumed construction activities to be undertaken in different working areas of the Proposed Scheme together with the calculated noise level at a reference distance of 10m. The column indicating the likely timing of the works is based on best estimates and is subject to change. An activity marked as being undertaken during the day and night will not necessarily have an equal split of working time in these two periods.

Table 1.4: Construction activities and calculated noise levels during mobilisation

Activity	Likely timing for works	L_{Aeq} at 10m, dB
Establish temporary working compounds	Day	78
Traffic management for enabling works	Night	78
Site clearance	Night	78
Earthworks	Day	83
Access road paving	Day	84

Activity	Likely timing for works	L_{Aeq} at 10m, dB
Accommodation units	Day	82

Table 1.5: Construction activities and calculated noise levels - online works

Activity	Likely timing for works	L_{Aeq} at 10m, dB
Traffic management	Night	78
Site clearance	Both	82
Earthworks	Both	79
Drainage works	Both	80
Roadworks	Night	79
Vehicle restraint system	Both	83
Central reserve barrier	Both	80
Pavement and white lining	Both	88
Gantry works	Both	81
Retaining wall	Both	82
Sheet piling for piers	Night	86

Table 1.6: Construction activities and calculated noise levels - offline works

Activity	Likely timing for works	L_{Aeq} at 10m, dB
Earthworks	Day	84
Drainage	Day	82
Piling	Day	81
Fiber reinforced concrete (FRC) to abutment pile caps and walls	Day	83
Beam installation	Day	84
Diaphragm walls	Day	79
Bridge deck construction	Day	84
Roadworks	Day	82
Landscaping (finishing)	Day	84

Table 1.7: Construction activities and calculated noise levels - pond construction

Activity	Likely timing for works	L_{Aeq} at 10m, dB
Site establishment	Both	82
Earthworks	Day	81
Drainage	Day	81

Activity	Likely timing for works	L_{Aeq} at 10m, dB
Landscaping	Both	82

1.4 Construction plant

1.4.1 The tables in this section list the assumed plant for each activity listed in Section 1.3 of this appendix. The calculations undertaken have used the method contained in BS 5228-1:2009+A1:2014 (British Standards Institution, 2014a).

1.4.2 The 'Plant Description' in the second column are the descriptors given in BS 5228-1:2009+A1:2014 (British Standards Institution, 2014a). Where no reference is provided in the tables the information is from a source other than BS 5228 (e.g. manufacturer's data, measured levels). Some minor works, both in terms of duration and noise level produced, are excluded from the lists and subsequent assessment. The tables contain those items of plant likely to be in close proximity to a receptor and can therefore be considered for the noise calculations to be a largely single homogenous source for the type of works described.

1.4.3 The percentage on-time for the activities within these calculations is defined as the period at which the equipment is operating within 3 dB of the maximum – in layman's terms this can be considered to be the percentage of the time operating that the equipment is running and on full power.

1.4.4 Ground cover has been assumed to be acoustically hard at all locations, which is likely to overestimate noise levels where there are areas of soft ground between construction works and receptors. As most of the surrounding area is urban, this is considered to be representative of most receptors. Screening between construction activities and receptors has been considered within the assessment for receptors either side of the M60 between J17 and J18 where there are existing barriers either side of the road. A correction of -5dB has been applied, based on these barriers providing partial screening to all plant working in the online sections.

Table 1.8: Plant assumed during mobilisation – compound works

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C4.10	Wheeled excavator	94	1	30%
C5.27	Vibratory roller	95	1	30%
C4.6	Dumper	107	1	25%
C8.20	Tipper lorry	107	1	25%
C2.34	Site van	108	1	25%

Table 1.9: Plant assumed during mobilisation – traffic management

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C2.34	Site van	108	2	25%
C2.34	Impact protection vehicle	108	1	10%

Table 1.10: Plant assumed during mobilisation – site clearance

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C4.67	Mini excavator	102	1	30%
C4.53	HIAB (Truck with crane)	105	1	25%
C8.20	Tipper lorry	107	1	25%
C2.34	Site van	108	1	25%

Table 1.11: Plant assumed during mobilisation – earthworks

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C2.20	Tracked excavator	96	1	30%
C6.28	Dozer	113	1	25%
C8.16	Dump truck	109	2	30%
C2.38	Roller	101	1	30%
C2.34	Site van	108	2	25%

Table 1.12: Plant assumed during mobilisation – access road paving

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C5.31	Asphalt paver	105	1	35%
C5.21	Vibratory roller	108	2	30%
C2.14	Tracked excavator	107	1	30%
C4.6	Dumper	107	1	25%
C2.34	14t white liner	108	1	20%
C4.82		84	1	20%
C2.34	Site van	108	4	25%

Table 1.13: Plant assumed during mobilisation – accommodation units

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C3.30	Wheeled mobile crane	99	1	40%
C2.34	Site van	108	2	25%
C8.20	Tipper lorry	107	1	25%
C4.59	MEWP (Scissor lift)	106	1	25%

Table 1.14: Plant assumed during online works – traffic management

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C8.20	Tipper lorry	107	1	40%
C2.34	Site van	108	1	40%

Table 1.15: Plant assumed during online works – site clearance

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
Manufacturer's data	Post rammer	113	1	25%
C8.20	Tipper lorry	107	2	25%
C2.34	Site van	108	1	25%
C4.67	Mini tracked excavator	102	1	30%

Table 1.16: Plant assumed during online works – earthworks

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C4.6	Dumper	107	1	25%
C5.25	Roller	103	1	30%
C2.34	Site van	108	1	25%
C8.20	Tipper lorry	107	1	25%

Table 1.17: Plant assumed during online works – drainage works

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C2.7	Tracked excavator	98	1	30%
C4.6	Dumper	107	2	25%
C5.27	Roller	95	1	30%
C2.34	Site van	108	1	25%
C8.20	Tipper lorry	107	2	25%

Table 1.18: Plant assumed during online works – roadworks

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C8.20	Tipper lorry	107	1	25%
C4.67	Mini tracked excavator	102	1	30%
C4.6	Dumper	107	1	30%
C2.34	Site van	108	1	25%

Table 1.19: Plant assumed during online works – vehicle restraint system

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C8.20	Tipper lorry	107	3	25%
C2.34	Lorry	108	1	25%
Manufacturer's data	Post rammer	113	1	25%
C4.67	Mini tracked excavator	102	1	30%
C4.6	Dumper	107	1	25%

Table 1.20: Plant assumed during online works – central reserve barrier

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
Manufacturer's data	Slipformer	92	1	45%
C2.34	Site van	108	2	25%
C8.20	Tipper lorry	107	2	25%

Table 1.21: Plant assumed during online works – pavement and white lining

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C5.30	Paver	103	1	35%
C2.14	Tracked excavator	107	1	30%
C5.21	Vibratory roller	108	2	30%
C2.34	Lorry	108	1	20%
C4.82	14t white liner	84	1	20%
C2.34		108	4	25%
C8.20	Tipper lorry	107	3	25%
Manufacturer's data	Floor saw	118.2	1	40%

Table 1.22: Plant assumed during online works – gantry works

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C3.17	Small piling rig	104	1	35%
C4.10	Excavator	94	1	30%
C4.6	Dumper	107	1	25%
C4.59	MEWP	106	1	30%
C8.20	Tipper lorry	107	2	25%
C2.34	Site van	108	1	25%

Table 1.23: Plant assumed during online works – retaining wall

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C4.10	Wheeled excavator	94	1	30%
C5.25	Roller	103	1	30%
C4.6	Dumper	107	1	25%
C2.41	Vibratory plate	108	1	20%
C4.82	Sheet piling rig	84	1	50%
C3.7		98	1	50%
C4.43	Small crane	98	1	40%
C8.20	Tipper lorry	107	2	25%
C2.34	Site van	108	2	25%

Table 1.24: Plant assumed during online works – sheet piling for piers

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C3.8	Piling Rig	116	1	50%
C2.7	Excavator	98	1	30%
C4.6	Dumper	107	1	25%
C8.20	Tipper lorry	107	1	25%
C2.34	Site van	108	1	25%

Table 1.25: Plant assumed during offline works – earthworks

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C2.20	Tracked excavator	96	1	30%
C6.28	Dozer	113	1	25%
C4.67	Mini tracked excavator	102	3	25%
C2.38	13t Roller	101	1	30%
C5.25	6t Roller	103	1	30%
C2.34	Site van	108	1	25%
C6.38	Tractor and bowser	111	1	40%
C8.20	Tipper lorry	107	1	25%

Table 1.26: Plant assumed during offline works – drainage

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C2.7	Tracked excavator	98	1	30%
C2.20	Tracked excavator	96	1	30%
C4.6	Dumper	107	2	25%
C5.25	6t Roller	103	1	30%
C2.41	Vibratory plate	108	1	40%
C2.34	Site van	108	1	25%
C8.20	Tipper lorry	107	2	25%

Table 1.27: Plant assumed during offline works – piling

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C3.21	Piling rig	107	1	35%
C4.46	Crane	95	1	40%
C4.10	Excavator	94	1	30%
C4.6	Dumper	107	1	25%
C8.20	Tipper lorry	107	1	25%
C2.34	Site van	108	2	25%

Table 1.28: Plant assumed during offline works – fiber reinforced concrete (FRC) to abutment pile cap and walls

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C3.29	Crane	98	1	40%
C4.59	MEWP	106	2	30%
C8.20	Tipper lorry	107	3	25%
C2.34	Site van	108	3	25%
C4.24	Concrete wagon	95	1	25%

Table 1.29: Plant assumed during offline works – beam installation

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C4.50	Crane	99	1	40%
C3.30	Crane	98	1	40%
C4.59	MEWP	106	2	25%
C8.20	Tipper lorry	107	3	25%
C2.34	Site van	108	5	25%
C2.35	Telescopic handler	99	1	25%

Table 1.30: Plant assumed during offline works – diaphragm walls

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C4.24	Concrete wagon	95	1	25%
C2.39	Roller	102	1	40%
C2.7	Excavator	98	1	30%
C8.20	Tipper lorry	107	2	25%
C2.34	Site van	108	1	25%

Table 1.31: Plant assumed during offline works – bridge deck construction

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C4.46	Crane	95	1	40%
C4.59	MEWP	106	2	25%
C4.24	Concrete wagon	95	1	25%
C8.20	Tipper lorry	107	3	25%
C2.34	Site van	108	5	25%
C2.35	Telescopic handler	99	1	25%

Table 1.32: Plant assumed during offline works – roadworks

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C8.20	Tipper lorry	107	2	25%

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C4.6	Dumper	107	2	25%
C4.67	Mini tracked excavator	102	2	30%
C2.34	Site van	108	2	25%
C4.53	HIAB	105	1	25%

Table 1.33: Plant assumed during offline works – landscaping (finishing)

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C4.74	Tractor (rotavator)	108	1	15%
C4.88	Water pump (hydroseeding)	96	1	30%
C8.20	Tipper van	107	2	25%
C2.34	Site van	108	1	25%
C4.67	Mini tracked excavator	102	1	30%
C6.38	Tractor and bowser	111	1	40%

Table 1.34: Plant assumed during pond works – site establishment

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C2.20	Tracked excavator	96	1	30%
C6.28	Dozer	113	1	25%
C4.67	Mini tracked excavator	102	2	25%
C2.39	Roller	102	1	30%
C2.34	Site van	108	1	25%
C8.20	Tipper lorry	107	1	25%

Table 1.35: Plant assumed during pond works – earthworks

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C2.20	Tracked excavator	96	1	30%
C6.28	Dozer	113	1	25%
C4.67	Mini tracked excavator	102	2	25%
C2.34	Site van	108	1	25%
C8.20	Tipper lorry	107	1	25%

Table 1.36: Plant assumed during pond works – drainage

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C2.7	Tracked excavator	98	1	30%
C4.6	Dumper	107	2	25%
C5.25	Roller	103	1	30%
C2.41	Vibratory plate	108	1	40%
C8.20	Tipper lorry	107	2	25%
C2.34	Site van	108	1	25%

Table 1.37: Plant assumed during pond works – landscaping

BS 5228-1 ref	Plant description	Single plant L_{WA} dB	Quantity	Percentage on-time
C4.74	Tractor (rotavator)	108	1	15%
C4.88	Water pump (hydroseeding)	96	1	30%
C8.20	Tipper van	107	2	25%
C2.34	Site van	108	1	25%
C4.67	Mini tracked excavator	102	1	30%
C6.38	Tractor and bowser	111	1	40%

Appendix 14.1. Water Framework Directive (WFD) Regulations Assessment

1.1 Purpose of the Report

1.1.1 This compliance assessment has been prepared for the M60/M62/M66 Simister Island Interchange Scheme to comply with the requirements of the Water Framework Directive (WFD) Regulations.

1.1.2 Compliance with the provisions of the legislation needs to be taken into account in the planning of all new activities in the water environment. The Environment Agency, as competent authority in England, must exercise its relevant functions so as to secure compliance with the legislation, and so as best to secure the achievement of the following environmental objectives:

a) measures should be put in place to prevent deterioration of the surface water status or groundwater status of a body of water, and

b) measures should otherwise support the achievement of the environmental objectives set for a body of water.

1.2 Background

Preventing deterioration in Ecological Status or Potential

1.2.1 All water bodies should meet good ecological status (GES) (or good ecological potential (GEP) if an artificial or heavily modified water body) by a set timeframe. Overall ecological status (or potential) is made up of a number of biological, hydromorphological and chemical quality characteristics called elements. The overall status is determined by the lowest element status.

1.2.2 Any activity which has the potential to have an impact on ecology will need consideration in terms of whether it could cause deterioration in the ecological status or potential of a water body. It is, therefore, necessary to consider the possible changes associated with the Proposed Scheme.

1.2.3 Where there are sites protected under transposed and adopted regulations, WFD Regulations aims for compliance with any relevant standards or objectives for these sites, including Conservation of Habitats and Species Regulations (2017).

1.2.4 For those water bodies that are not already in ‘good’ condition, specific mitigation measures have been set for each River Basin District (RBD) to achieve the environmental objectives of the WFD Regulations. These measures are to mitigate impacts that have been or are being caused by human activity and to enhance and restore the quality of the existing environment. These mitigation measures will be delivered through the River Basin Management Plan (RBMP) which also identifies the different organisations responsible for their delivery.

1.3 The Proposed Scheme

1.3.1 The Proposed Scheme aims to ease congestion by improving Simister Island at the interchange of the M60, M62 and M66, Manchester. Figure 2.1 of the main report

shows the location of the different elements of the Proposed Scheme that are described below:

- New two-lane free flow link from M60 northbound to M60 westbound.
- New loop providing free flow link from M60 eastbound to M60 southbound.
- Realigned southbound off slip from M66 to M60 J18 and M62 eastbound.
- New bridge connecting M60 eastbound off slip with new loop, leading to M60 southbound.
- M60 between J17 and J18 converted to 5-lane motorway with intermittent hard shoulder.

1.4 Methodology

Assessment stages

1.4.1 The methodology for this is based on Environment Agency guidance (internal guidance 488), whilst the Planning Inspectorate Note 18 (PINS18) also provides guidance on methodology. The following discrete stages need to be followed to complete the assessment of the Proposed Scheme for its compliance with the WFD Regulations

- **Data collection:** identification of relevant water bodies potentially affected by the Proposed Scheme
- **Screening:** Screening provides an initial overview of the Proposed Scheme, outlining the activities (as they are known in WFD Regulations) in both construction and operation phases.
- **Scoping:** identifies the receptors and water body elements that are potentially at risk from the Proposed Scheme and need impact assessment
- **Impact Assessment:** considers the potential impacts of the Proposed Scheme, identifies ways to avoid or minimise impacts, and indicates if the Proposed Scheme may cause deterioration or jeopardise the water body achieving GES or GEP.

Data collection

1.4.2 Data from the Catchment Data Explorer (Environment Agency, 2022) website have been used to support the compliance assessment.

1.4.3 Regarding Groundwater Dependent Terrestrial Ecosystems (GWDTE), ecological datasets and information have also been obtained, including:

- Statutory and non-statutory designated site boundaries, such as Local Nature Reserves (LNR) and Habitats of Priority Importance (HPI) boundaries, available on Defra's MagicMap application (Defra, 2022)
- Sites of Biological Importance (SBI) register (GMEU, 2017)

1.4.4 This report should be read in conjunction with Appendix 14.3: GWDTE Assessment, which identifies, prioritises, and assesses the impacts of the Proposed Scheme on GWDTE located within a 250m buffer of the provisional Order Limits.

1.4.5 This WFD Regulations Assessment is based on a desk-based assessment only, no field surveys have been undertaken.

1.5 Water Body Existing Status

1.5.1 The WFD Regulations water body parameters for the relevant water bodies are shown in Table 1.1. The Proposed Scheme does not directly interact with the designated main channels of any WFD Regulations surface water bodies. However, the Proposed Scheme could indirectly impact the following WFD Regulations water bodies through interactions with non-designated hydrological pathways (tributaries):

- Roch (Spodden to Irwell)
- Whittle Brook (Irwell)
- Irk (Wince to Irwell)
- Irwell (Croal to Irk)

1.5.2 The Proposed Scheme is within the Northern Manchester Carboniferous Aquifers and Manchester and East Cheshire Permo-Triassic Sandstone Aquifers groundwater bodies. The water body parameters for the relevant groundwater bodies are shown in Table 1.2. Figure 1 shows the location of the WFD Regulations water bodies (both groundwater and surface water) and the tributaries to the WFD Regulations surface water bodies which interact with the Proposed Scheme.

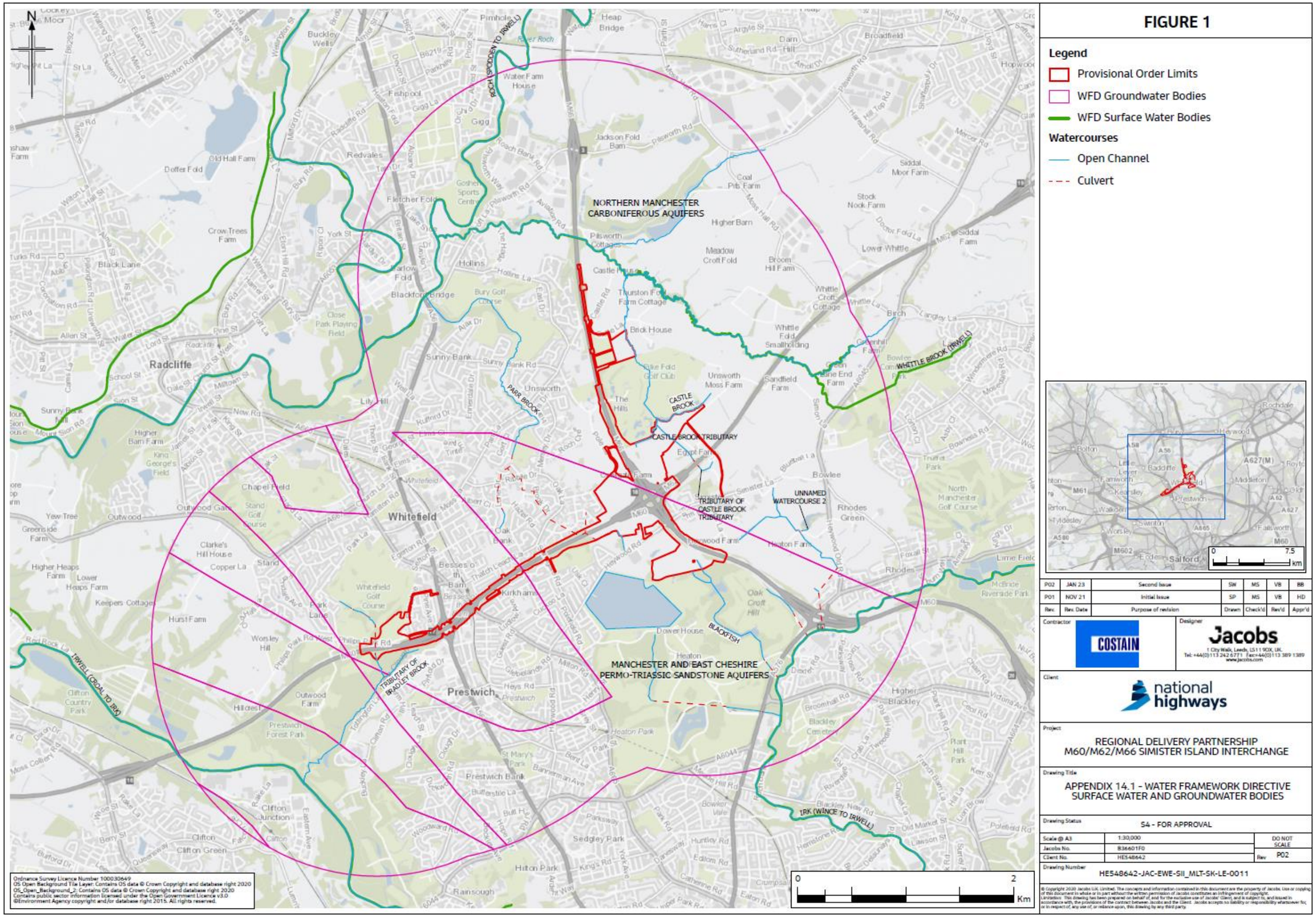


FIGURE 1

Legend

- Provisional Order Limits
- WFD Groundwater Bodies
- WFD Surface Water Bodies

Watercourses

- Open Channel
- Culvert

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	JAN 23	Second Issue	SW	MS	VB	BB
P01	NOV 21	Initial Issue	SP	MS	VB	HD

Contractor: COSTAIN

Designer: Jacobs
1 City Walk, Leeds, LS11 9DX, UK
Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
www.jacobs.com

Client: national highways

Project: REGIONAL DELIVERY PARTNERSHIP
M60/M62/M66 SIMISTER ISLAND INTERCHANGE

Drawing Title: APPENDIX 14.1 - WATER FRAMEWORK DIRECTIVE SURFACE WATER AND GROUNDWATER BODIES

Drawing Status: S4 - FOR APPROVAL

Scale @ A3	1:30,000	DO NOT SCALE
Jacobs No.	B36601F0	
Client No.	HE548642	Rev P02

Drawing Number: HE548642-JAC-EWE-SII_MLT-SK-LE-0011

Table 1.1: Water body parameters for surface water bodies. Source: Environment Agency Catchment Data Explorer – cycle 2 2019 data (Environment Agency, 2022)

Water body name	Roch (Spodden to Irwell)	Whittle Brook (Irwell)	Irk (Wince to Irwell)	Irwell (Croal to Irk)
Water body ID	GB112069064600	GB112069061250	GB112069061131	GB112069061451
Centroid National Grid Reference (NGR)	SD8611011308	SD8500506952	SD8388703156	SD7500605734
Catchment area (km^2)	42.57	15.77	30.98	41.92
Length (km)	21.66	8.25	17.85	25.21
Type	River	River	River	River
Hydromorphological designation	Heavily modified	Not designated artificial or heavily modified	Heavily modified	Heavily modified
Current Ecological status	Moderate	Moderate	Moderate	Moderate
Status objective (Ecological)	Moderate by 2015	Good by 2027	Moderate by 2015	Moderate by 2015
Reasons for not achieving good status (Water management issue. Activity. Sector. Impacted quality elements).	• Diffuse source: Urbanisation - urban development (Urban and transport) impacting Invertebrates, Macrophytes and Phytobenthos Combined and Phosphate). • Physical modification: Other (not in list, must add details in comments). Sector under investigation but considered to be affecting Mitigation Measures Assessment. • Point source: Sewage discharge (continuous) (Water Industry) impacting Macrophytes and Phytobenthos Combined, Ammonia (Physico-Chemical) and Phosphate.	• Diffuse source: Poor soil, Livestock and nutrient management (Agriculture and rural land management) impacting Phosphate and Macrophytes and Phytobenthos Combined. • Diffuse source: Urbanisation - urban development (Urban and transport) impacting Phosphate and Macrophytes and Phytobenthos Combined. • Diffuse source: Riparian/in-river activities (inc. bankside erosion) (Agriculture and rural land management) impacting Phosphate and Macrophytes and Phytobenthos Combined. • Unknown (pending investigation). Sector under investigation but considered to be affecting Invertebrates.	• Point source: Misconnections (Domestic General Public) impacting Invertebrates. • Point source: Sewage discharge (continuous) (Water Industry) impacting Phosphate, Invertebrates and Ammonia (Physico-Chemical). • Diffuse source: Urbanisation - urban development (Urban and transport) impacting Phosphate, Ammonia (Phys-Chem) and Invertebrates. • Diffuse source: Poor Livestock Management (Agriculture and rural land management) impacting Ammonia (Physico-Chemical). • Diffuse source: Contaminated land (Urban and transport) impacting Ammonia (Physico-Chemical). • Diffuse source: Transport Drainage (Urban and transport) impacting Ammonia (Physico-Chemical). • Point source: Sewage discharge (intermittent) (Water Industry) impacting Invertebrates and Ammonia (Physico-Chemical. • Diffuse source: Riparian/in-river activities (inc. bankside erosion) (Agriculture and rural land management) impacting Ammonia (Physico-Chemical). • Point source: Landfill leaching (Urban and transport) impacting Invertebrates. • Diffuse source: Poor nutrient management (Agriculture and rural land management) impacting Ammonia (Physico-Chemical).	• Point source: Sewage discharge (intermittent)(Water Industry) impacting Invertebrates and Biochemical Oxygen Demand (BOD). • Point source: Sewage discharge (continuous) (Water Industry) impacting Ammonia (Physico-Chemical), Phosphate and Invertebrates. • Point source: Misconnections (Domestic General Public) impacting Phosphate. • Diffuse source: Urbanisation - urban development (Urban and transport) Impacting Phosphate and Invertebrates. • Physical modification: Flood protection - structures (Local and Central Government) impacting Invertebrates. • Point source: Trade/Industry discharge (Industry) impacting Invertebrates and Ammonia (Physico-Chemical). • Diffuse source: Contaminated land (Urban and transport) impacting Ammonia (Physico-Chemical).

Water body name	Roch (Spodden to Irwell)	Whittle Brook (Irwell)	Irk (Wince to Irwell)	Irwell (Croal to Irk)
			• Diffuse source: Poor soil management (Agriculture and rural land management) impacting Ammonia (Physico-Chemical).	
Protected area designation and list of protected areas	Nitrate Vulnerable Zones: • Irwell / Man. Ship Canal (Kearsley to Irlam Locks) S643 • River Irk (Moston Brook to River Irwell) S638	Nitrate Vulnerable Zone: • River Irk (Moston Brook to River Irwell) S638	Nitrate Vulnerable Zones: • Irwell / Man. Ship Canal (Kearsley to Irlam Locks) S643 • River Irk (Moston Brook to River Irwell) S638	Nitrate Vulnerable Zones: • Irwell / Man. Ship Canal (Kearsley to Irlam Locks) S643 • River Irk (Moston Brook to River Irwell) S638 • River Glaze S641 • Urban Waste Water Treatment Regulations: • River Irwell (UKENRI94)
Hydromorphological supporting elements (status objective)	No data	Supports Good (Supports Good by 2015)	Not assessed	Supports Good (supports Good by 2015)
Biological quality elements (status objective)	Moderate (Good by 2027) • Invertebrates: Moderate (Good by 2027)	Moderate (Good by 2027) • Macrophytes and Phytobenthos Combined: Moderate (Good by 2027) • Invertebrates: Moderate (Good by 2027)	Poor (Moderate by 2021) • Invertebrates: Poor (Moderate by 2021)	Moderate (Moderate by 2021) • Invertebrates: Moderate (Moderate by 2021)
Physico-chemical quality elements (status objective)	Moderate (Moderate by 2015) • Acid Neutralising Capacity: High • Ammonia (Phys-Chem): Moderate (Good by 2015) • Dissolved oxygen: High • Phosphate: Poor (Poor by 2015) • Temperature: High • pH: High	Moderate (Good by 2027) • Ammonia (Phys-Chem): Good (Good by 2015) • Dissolved oxygen: High • pH: High • Phosphate: Moderate (Good by 2027) • Temperature: High	Moderate (Moderate by 2015) • Acid Neutralising Capacity: High • Ammonia (Phys-Chem): Good (Good by 2015) • Biochemical Oxygen Demand (BOD): High • Dissolved oxygen: High • pH: High • Phosphate: Moderate (Poor by 2015) • Temperature: High	Moderate (Moderate by 2015) • Acid Neutralising Capacity: High • Ammonia (Phys-Chem): Moderate (Good by 2015) • Biochemical Oxygen Demand (BOD): Good (no data) • Dissolved oxygen: High • pH: High • Phosphate: Moderate (Poor by 2015) • Temperature: High
Chemical quality elements (status objective)	Fail (Good by 2015) • Priority substances: Fail (Does not require assessment by 2015) • Other Pollutants: Does not require assessment (Does not require assessment by 2015) • Priority hazardous substances: Fail (Does not require assessment by 2015)	Fail (Good by 2015) • Priority substances: Good (Does not require assessment by 2015) • Other Pollutants: Does not require assessment (Does not require assessment by 2015) • Priority hazardous substances: Fail (Does not require assessment by 2015)	Fail (Good by 2015) • Priority substances: Fail (Good by 2015) • Other Pollutants: Does not require assessment (Does not require assessment by 2015) • Priority hazardous substances: Fail (Good by 2015)	Fail (Good by 2027) • Priority substances: Fail (Good by 2015) • Other Pollutants: Good (Good by 2027) • Priority hazardous substances: Fail (Good by 2015)

Table 1.2: Water body parameters for groundwater bodies. Source: Environment Agency Catchment Data Explorer – cycle 2 2019 data (Environment Agency, 2022)

Water body name	Northern Manchester Carboniferous Aquifers	Manchester and East Cheshire Permo-Triassic Sandstone Aquifers
Water body ID	GB41202G101800	GB41201G101100
NGR	SD8194613828	SD7965206300
Catchment area (km^2)	629.20	367.30
Overall status	Poor	Poor
Quantitative status elements	Good (Good by 2015) • Quantitative dependent surface water body status: Good (Good by 2015) • Quantitative GWDTEs test: Good (Good by 2015) • Quantitative saline intrusion: Good (Good by 2015) • Quantitative water balance: Good (Good by 2015)	Poor (Good by 2027) • Quantitative dependent surface water body status: Good (Good by 2027) • Quantitative GWDTEs test: Good • Quantitative saline intrusion: Poor (Good by 2015) • Quantitative water balance: Good (Good by 2015)
Chemical status elements	Poor (Good by 2027) • Chemical dependent surface water body status: Poor (Good by 2027) • Chemical drinking water protected area: Good (Good by 2015) • Chemical GWDTEs test: Good (Good by 2015) • Chemical saline intrusion: Good (Good by 2015) • General chemical test: Good (Good by 2015)	Poor • Chemical dependent surface water body status: Good • Chemical drinking water protected area: Good • Chemical GWDTEs test: Good • Chemical saline intrusion: Poor • General chemical test: Good
Reasons for not achieving good status	Point source pollution from mining and quarrying (abandoned mine), and an activity that is yet to be identified by the Environment Agency but impacting the chemical status.	Not achieved good chemical status or quantitative status due to confirmed saline or other intrusion (no sector responsible), and an activity that is yet to be identified by the Environment Agency but impacting the chemical and quantitative statuses
Other	Two GWDTEs have been identified within the Northern Manchester Carboniferous Aquifers groundwater body (Hazlitt Wood SBI and parts of Philips Park and North Wood LNR and SBI)	Two GWDTE have been identified within the Manchester and East Cheshire Permo-Triassic Sandstone Aquifers groundwater body (Hollins Vale LNR, SBI, and Hollins Plantation SBI and parts of Philips Park and North Wood LNR and SBI)

1.6 Screening of Proposed Scheme Components

1.6.1 The main activities of the Proposed Scheme are presented in Table 1.3, alongside a screening assessment as to whether further assessment would be required of the activity.

Table 1.3: Screening of Proposed Scheme components

Project stage	Activity	WFD water body type	Screened in or out?	Justification
Construction	Compounds / haul roads	Surface water	In	Potential for release of fine sediment, physical modifications to watercourses, spread of invasive species.
		Groundwater	In	Potential impacts from excavations (including soil stripping)/soil compaction and groundwater flow disturbance. Potential groundwater contamination impacts from accidental spills/leaks of fuels and chemicals, and/or suspended solids release.
	Embankments	Surface water	In	Potential for release of fine sediment, physical modifications to watercourses, spread of invasive species.
		Groundwater		Potential impacts from excavations (including soil stripping)/soil compaction and groundwater flow disturbance. Potential groundwater contamination impacts from accidental spills/leaks of fuels and chemicals, and/or suspended solids release.
	Cuttings	Surface water	In	Potential for release of fine sediment, physical modifications to watercourses, spread of invasive species. Dewatering for cuttings affecting baseflow in watercourses.
		Groundwater		Potential impacts from dewatering, groundwater flow disturbance, creation of vertical pathways for contaminated groundwater, and/or mixing of different aquifer chemistries.
	Excavations required for gantries, foundations for bridge abutments, etc.	Surface water	In	Potential for release of fine sediment, physical modifications to watercourses, spread of invasive species.
		Groundwater		Potential impacts from dewatering, groundwater flow disturbance, creation of vertical pathways for contaminated groundwater, and/or mixing of different aquifer chemistries.
	Piling	Surface water	In	Potential for groundwater flows to be altered, impacting on surface water baseflows.
		Groundwater	In	Potential impacts from groundwater flow disturbance, creation of vertical pathways for contaminated groundwater, and/or mixing of different aquifer chemistries.
	Outfall construction	Surface water	In	Potential for release of fine sediment, physical modifications to watercourses, spread of invasive species.

Project stage	Activity	WFD water body type	Screened in or out?	Justification
		Groundwater	Out	Limited/no below ground works expected and potential impacts on groundwater flows are unlikely to be significant.
	Excavations required for attenuation ponds/drainage infrastructure	Surface water	In	Potential for release of fine sediment, spread of invasive species.
		Groundwater		Potential impacts from dewatering, groundwater flow disturbance, creation of vertical pathways for contaminated groundwater, and/or mixing of different aquifer chemistries.
	Dewatering	Surface water	In	Potential for groundwater flows to be altered, impacting on surface water baseflows.
		Groundwater		Local groundwater drawdown of aquifers and potential flow/quality impacts to sensitive groundwater receptors.
Operation	Drainage (including outfalls, SuDs attenuation ponds and runoff)	Surface water	In	Change in flow regime in watercourse potentially impacting hydromorphology quality elements. Potential delivery of pollutants to watercourses.
		Groundwater		Potential impacts from permanent new (lined) attenuation ponds causing disturbance to shallow groundwater flows. Potential also for routine runoff discharged into receiving watercourses with low flows to impact groundwater quality.
	Gantries, foundations for bridge abutments etc.	Surface water	In	Potential for permanent alteration to groundwater flows, impacting on surface water baseflows.
		Groundwater	In	Potential impact due to permanent below ground structures (including piles) altering groundwater flow paths.
	Cuttings (permanent dewatering)	Surface water	In	Potential for permanent alteration to groundwater flows, impacting on surface water baseflows.
		Groundwater		Potential impacts from ongoing drawdown by drainage systems.
	Embankments	Surface water	Out	No interaction with surface waters.
		Groundwater	In	Impacts to superficial aquifers underneath embankments due to compression effects.

1.6.2 There would be no change in the direct impacts to WFD Regulations surface water bodies as a result of the Proposed Scheme. However, there would be indirect impacts to WFD Regulations surface water bodies resulting from interactions between the Proposed Scheme and tributaries or other non-designated hydrological pathways to them. Table 1.4 shows the non-designated WFD Regulation surface water bodies that would be indirectly impacted by activities associated with the Proposed Scheme.

Table 1.4: Proposed Scheme components for the non-designated hydrological pathways of WFD Regulations surface water bodies

Non-designated hydrological pathway	Proposed Scheme components		Overarching WFD Regulations surface water body
	Construction	Operation	
Tributary of Bradley Brook	Earthworks, outfall	Outfall, impermeable surfaces	Irwell (Croal to Irk)
Parr Brook	Outfall	Outfall	Roch (Spodden to Irwell)
Unnamed Watercourse 2	Earthworks, outfall	Outfall, impermeable surfaces	Roch (Spodden to Irwell)
Castle Brook	Outfall	Outfall	Whittle Brook (Irwell)
Castle Brook Tributary	Earthworks, outfall	Outfall, impermeable surfaces	Whittle Brook (Irwell)
Tributary of Castle Brook Tributary	Outfall	Outfall	Whittle Brook (Irwell)
Blackfish	Earthworks	Impermeable surfaces	Irk (Wince to Irwell)

1.7 Scoping of Water Body Elements

1.7.1 Table 1.5 summarises the quality elements scoped into further assessment for surface water bodies. Table 1.6 summarises the quality elements scoped into further assessment for groundwater bodies.

Table 1.5: Surface water body elements for further consideration

Element	Scoped in or out
Fish	In (potential impact due to change in sediment loading)
Benthic invertebrates	
Macrophytes and phytobenthos combined	
Thermal conditions	Out (scheme components unlikely to cause an impact)
Oxygenation conditions	In (potential impact due to change in sediment loading)
Acidification status	
Nutrient conditions	Out (no external environmental parameters to change nutrient conditions)
Connection to groundwater	Out (would not impact on connection to groundwater)
Quantity and Dynamics of Flow	In (Irk (Wince to Irwell) only) (due to reductions in baseflow due to dewatering)

Element	Scoped in or out
River Continuity	Out (scheme components unlikely to cause an impact)
River depth and width variation	In (potential change to channel form and sediment availability)
Structure and substrate of the river bed	
Riparian zone	Out (no impact likely due to the distance between the Proposed Scheme and the water bodies)
Chemical elements and Specific pollutants	In (due to road sources and construction)
Invasive Non-Native Species (INNS)	In (potential spread due to changes in riverine environments)
Protected areas	In (due to requirement of WFD objectives)

Table 1.6: Groundwater body elements for further consideration

Element	Scoped in or out
Quantitative status	
Saline intrusion	Out (no local coastal sources or other saline waters)
Water balance	In (potential impacts from dewatering and groundwater flow disturbance on groundwater bodies)
GWDTEs test	In (potential for groundwater flows to be altered and impact the three GWDTEs identified at PEIR stage)
Dependent surface water body status	In (potential for groundwater flows to be altered, impacting on surface water baseflows)
Chemical status	
Drinking water protected area	Out (impacts on water quality are unlikely to cause deterioration in water quality such that additional treatment is required)
General chemical test	In (potential groundwater quality impacts, such as creation of vertical pathways for contaminated groundwater, and/or mixing of different aquifer chemistries, on groundwater bodies)
GWDTEs test	In (potential for groundwater quality to be altered and impact the three GWDTEs identified at PEIR stage)
Dependent surface water body status	In (potential for groundwater quality to be altered, impacting on surface water baseflows)
Saline intrusion	Out (no local coastal sources or other saline waters)

1.8 Impact Assessment

1.8.1 The site-specific impacts of the Proposed Scheme on the biological, physico-chemical and hydromorphological quality elements of the surface water bodies are shown in Table 1.7. These apply to all scoped in water bodies. There would be no direct impacts on water bodies. However, indirect impacts on the water bodies resulting from impacts to non-designated hydrological pathways to surface water WFD Regulations water bodies have been assessed. See Table 1.4 for the non-designated tributaries or hydrological pathways relevant to each WFD Regulations surface water body. The site-specific impacts of the Proposed Scheme on groundwater quality elements are shown in Table 1.8. The general nature of the impact for each scheme element is detailed in Section **Error! Reference source not found.**.

Table 1.7: Assessment of the Proposed Scheme against status objectives and elements for all scoped in WFD Regulations surface water bodies

Key to impact:

Colour	Type of impact
	Negative
	Negligible
	Positive
	No change

Water body element	Phase	Potential impact								Possible ways to control impact
		Compounds / haul roads (all water bodies)	Embankments (all water bodies)	Cuttings (all water bodies)	Cuttings (Irk (Wince to Irwell) only)	Excavations required for gantries, foundations for bridge abutments, etc. (all water bodies)	Piling (all water bodies)	Drainage (including outfalls, SUDs, attenuation ponds and runoff) (all water bodies)	Impermeable surfaces water quantity impact (all water bodies)	
Fish	Construction	Increases in suspended sediment and noise from construction could impact on fish. However due to distance to the main water bodies, the impact is likely to be negligible.		N/A (no impact to surface water bodies).	Potential temporary dewatering for cuttings at the historic landfill site. Potential reduction to baseflows in Castle Brook Tributary and Tributary of Castle Brook Tributary. Fish are unlikely to be present in these smaller watercourses. Therefore, the impact is likely to be negligible.	Increases in suspended sediment. Impact negligible due to distance to water body.		N/A (no new outfalls).	No change likely from the existing situation.	N/A
	Operation	N/A (all impacts are during construction).		N/A (no impact to surface water bodies.	N/A (all impacts are during construction).	Potential for permanent alteration to groundwater flow impacting on baseflows at the surface. This could reduce the water levels in the watercourses and impact on fish habitats. Scale of impact currently unknown.	N/A (all impacts are during construction).	Increases in routine runoff Impacting on habitats, due to contaminants. Attenuation ponds would allow contaminates to settle out before discharging into the watercourses. Therefore, there is unlikely to be a significant impact at the water body scale.	Increases in routine runoff Impacting on habitats. At some locations there would be no change in runoff rate from existing conditions. At all locations there is unlikely to be a significant impact at the water body scale	Further assessment of groundwater alteration required.

Water body element	Phase	Potential impact								Possible ways to control impact
		Compounds / haul roads (all water bodies)	Embankments (all water bodies)	Cuttings (all water bodies)	Cuttings (Irk (Wince to Irwell) only)	Excavations required for gantries, foundations for bridge abutments, etc. (all water bodies)	Piling (all water bodies)	Drainage (including outfalls, SUDs, attenuation ponds and runoff) (all water bodies)	Impermeable surfaces water quantity impact (all water bodies)	
Benthic invertebrates	Construction	Increases in suspended sediment could smother habitats. However due to distance to the main water bodies, the impact is likely to be negligible.		N/A (no impact to surface water bodies.	Potential temporary dewatering for cuttings at the historic landfill site. Potential reduction to baseflows in Castle Brook Tributary and Tributary of Castle Brook Tributary. Large populations of benthic invertebrates are unlikely to be present in these smaller watercourses. Therefore, the impact is likely to be negligible.	Increases in suspended sediment. Impact negligible due to distance to water body.		No change likely from the existing situation.	No change likely from the existing situation.	N/A
	Operation	N/A (all impacts are during construction).		N/A (no impact to surface water bodies	N/A (all impacts are during construction).	Potential for permanent alteration to groundwater flow impacting on baseflows at the surface. This could reduce the water levels in the watercourses and impact on invertebrate habitats. Scale of impact currently unknown.	N/A (all impacts are during construction)	Increases in routine runoff Impacting on habitats, due to contaminants. Attenuation ponds would allow contaminates to settle out before discharging into the watercourses. Therefore, there is unlikely to be a significant impact at the water body scale.	Increases in routine runoff Impacting on habitats. At some locations there would be no change in runoff rate from existing conditions. At all locations there is unlikely to be a significant impact at the water body scale.	Further assessment of groundwater alteration required
Macrophytes and phytobenthos combined	Construction	Increases in suspended sediment could smother habitats. However due to distance to the main water bodies, the impact is likely to be negligible.		N/A (no impact to surface water bodies.	Potential temporary dewatering for cuttings at the historic landfill site. Potential reduction to baseflows in Castle Brook Tributary and Tributary of Castle Brook Tributary. Large populations of macrophytes and phytobenthos are unlikely to be present in these smaller watercourses.	Increases in suspended sediment. Impact negligible due to distance to water body.		No change likely from the existing situation.	No change likely from the existing situation.	N/A

Water body element	Phase	Potential impact								Possible ways to control impact
		Compounds / haul roads (all water bodies)	Embankments (all water bodies)	Cuttings (all water bodies)	Cuttings (Irk (Wince to Irwell) only)	Excavations required for gantries, foundations for bridge abutments, etc. (all water bodies)	Piling (all water bodies)	Drainage (including outfalls, SUDs, attenuation ponds and runoff) (all water bodies)	Impermeable surfaces water quantity impact (all water bodies)	
					Therefore, the impact is likely to be negligible.					
	Operation	N/A (all impacts are during construction).		N/A (no impact to surface water bodies.	N/A (all impacts are during construction.	Potential for permanent alteration to groundwater flow impacting on baseflows at the surface and therefore macrophytes and phytobenthos. Scale of impact currently unknown.	N/A (all impacts are during construction.	Increases in routine runoff Impacting on habitats, due to contaminants. Attenuation ponds would allow contaminates to settle out before discharging into the watercourses. Therefore, there is unlikely to be a significant impact at the water body scale.	Increases in routine runoff Impacting on habitats. At some locations there would be no change in runoff rate from existing conditions. At all locations there is unlikely to be a significant impact at the water body scale.	Further assessment of groundwater alteration required.
Oxygenation conditions	Construction	No change likely from the existing situation.								N/A
	Operation	No change likely from the existing situation.							Discharge of routine runoff could increase oxygenation conditions in the water bodies by creating more turbulent flow. Impact unlikely to be significant at the water body scale.	
Acidification status	Construction	No change likely from the existing situation.								N/A
	Operation	No change likely from the existing situation.							Discharge of acidic pollutants in routine runoff could change the acidification status of the water bodies. Impact unlikely to be significant at the water body scale.	
Quantity and Dynamics of Flow	Construction	No change likely from the existing situation.			Potential temporary dewatering for cuttings at the historic landfill site. Potential reduction to baseflows in Blackfish. Reduced	No change likely from the existing situation				N/A

Water body element	Phase	Potential impact								Possible ways to control impact
		Compounds / haul roads (all water bodies)	Embankments (all water bodies)	Cuttings (all water bodies)	Cuttings (Irk (Wince to Irwell) only)	Excavations required for gantries, foundations for bridge abutments, etc. (all water bodies)	Piling (all water bodies)	Drainage (including outfalls, SUDs, attenuation ponds and runoff) (all water bodies)	Impermeable surfaces water quantity impact (all water bodies)	
					baseflow in this tributary is likely to have a negligible impact on the water body.					
	Operation	No change likely from the existing situation.								
River depth and width variation	Construction	No change likely from the existing situation.								N/A
	Operation	No change likely from the existing situation.						Discharge of routine runoff could cause erosion and scour and change the river depth and width. Impact would be to non-WFD water bodies and would be unlikely to propagate downstream to the WFD water bodies.		
Structure and substrate of the river bed	Construction	No change likely from the existing situation.								N/A
	Operation	No change likely from the existing situation.						Discharge of routine runoff could cause erosion and scour and change the bed structure and substrate. Impact would be to non-WFD water bodies and would be unlikely to propagate downstream to the WFD water bodies.		
Chemical elements and specific pollutants	Construction	No change likely from the existing situation.			Dewatering flows are likely to be discharged to Blackfish. If the historic landfill site is unlined there is a potential pathway for pollutants to reach the watercourse. Further analysis would be required on the nature of the landfill material, the presence of a liner and the discharge of dewatering flows. Therefore, the impact is currently assessed to be negative.	No change likely from the existing situation.				Further analysis of impact would be required. Treatment of dewatering flows may be required.
	Operation	No change likely from the existing situation.						An assessment using Highways England Water Risk Assessment Tool (HEWRAT) showed that the release of routine runoff would be at a level that does not meet the Environmental Quality Standards (EQS) for copper and zinc in the receiving		

Water body element	Phase	Potential impact								Possible ways to control impact
		Compounds / haul roads (all water bodies)	Embankments (all water bodies)	Cuttings (all water bodies)	Cuttings (Irk (Wince to Irwell) only)	Excavations required for gantries, foundations for bridge abutments, etc. (all water bodies)	Piling (all water bodies)	Drainage (including outfalls, SUDs, attenuation ponds and runoff) (all water bodies)	Impermeable surfaces water quantity impact (all water bodies)	
								watercourses. However, further water quality assessment using the Metal-Bioavailability Assessment Tool (M-BAT) showed that, when site specific conditions are considered, the outfalls are all deemed to be within the Predicted No Effect Concentration (PNEC) limit. However, a precautionary approach has been carried out for this assessment and, until further investigation confirms the results of the M-BAT, this impact has been assumed to have a negative impact on chemical elements.		
Invasive Non-Native Species (INNS)	Construction	Himalayan balsam, Japanese knotweed, giant hogweed and creeping thistle have all been noted within the water bodies. It is not known if they are present in the non-WFD water bodies. If they are, the works could disturb seed beds and cause the spread of Invasive Non-Native Species (INNS). Impact unlikely to be significant at the water body scale.		N/A (no impact to surface water bodies.			Himalayan balsam, Japanese knotweed, giant hogweed and creeping thistle have all be noted within the water bodies. It is not known if they are present in the non-WFD water bodies. If they are, the works could disturb seed beds and cause the spread of INNS. Impact unlikely to be significant at the water body scale.			If INNS present, report to competent authority. With appropriate mitigation these can be managed to ensure no significant effects.
	Operation	No change likely from the existing situation.								N/A
Protected areas	Construction	The Proposed Scheme falls within Nitrate Pollution Prevention Regulations areas and an Urban Waste Water Treatment Regulations area. Providing any potential indirect impacts from the construction stage of the Proposed Scheme can be managed, no likely significant impacts are anticipated on the water environment.								Manage impact to protected areas through adherence to the Environmental Management Plan (EMP) and mitigation for impacts on other elements.
	Operation	No change likely from the existing situation.								N/A

Table 1.8: Assessment of the Proposed Scheme against status objectives and elements for all scoped in WFD Regulations groundwater water bodies

Key to impact:

Colour	Type of impact
	Negative
	Negligible
	Positive
	No change

Water body element	Phase	Potential impact							Possible ways to control impact
		Compounds / haul roads	Cuttings	Embankments	Excavations required for gantries, foundations for bridge abutments, etc.	Piling	Excavations required for attenuation ponds / drainage infrastructure	Dewatering	
Water balance (quantitative)	Construction Operation	Groundwater disturbances within the bedrock, caused by temporary and permanent below ground structures and/or shallow excavations that do not require dewatering, are expected to be minor and localised. Any changes to the water balance are precautionarily assessed as negligible. Dewatering may be required for the construction of cuttings. The maximum potential dewatering radius of influence is currently estimated to extend up to 90m from the edge of the provisional Order Limits, depending on the cutting location (see Chapter 14: Road Drainage and the Water Environment). Due to the scale of the aquifers, the magnitude of impact from dewatering of the cuttings, on the bedrock aquifers, would also be minor. As a result, any changes to the water balance would likely be negligible.							A piling risk assessment and dewatering risk assessment is recommended to be undertaken in line with Environment Agency guidance, to demonstrate adequate code of construction practice to meet environmental regulations (e.g., Water Resources Act 1991 and any relevant planning conditions).
GWDTEs test (quantitative)	Construction Operation	Given that the GWDTE sites do not have a statutory designation, impacts would not result in a change in quantity element status. However, it is recommended that mitigation measures are still explored to avoid GWDTE loss.							Minimise footprint of topsoil stripping and vegetation clearance wherever possible.
Dependent surface water body status (quantitative)	Construction Operation	Any earthworks/excavations in the far west of the provisional Order Limits for attenuation ponds could require dewatering. Bradley Brook is culverted under the M60 in this location, and baseflow contributions from this part of the aquifer are therefore expected to be limited along this stretch of watercourse. Potential impacts on baseflow cannot be ruled out completely, but are unlikely to be lead to measurable change in the water body element, and as such, are precautionarily assessed as negligible.							A dewatering risk assessment is recommended to be undertaken.
General chemical test	Construction Operation	Details regarding the potential presence of a landfill liner are currently unknown for the historic landfill sites referred to as ‘Land to the South of Whitehouse Farm’ and ‘Land to the west of the M60 motorway’. However, local groundwater drawdown caused by temporary cutting dewatering and potential dewatering during the construction of an attenuation pond could lead to direct impacts on the historic landfills – if lining is absent or ‘leaky’. This may result in sources of leachate being drawn into aquifer; reducing resource potential and/or affecting baseflow quality; or leading to degradation of WFD water body chemical status from indirect discharge of cutting drainage from the Proposed Scheme. The potential impact could therefore be negative. This will be assessed further at Environmental Statement stage.							A dewatering risk assessment is recommended to be undertaken.
GWDTEs test (chemical)	Construction Operation	Given that the GWDTE sites do not have a statutory designation, impacts would not result in a change in chemical element status. However, it is recommended that mitigation measures are still explored to avoid GWDTE loss.							Minimise footprint of topsoil stripping and vegetation clearance wherever possible.
Dependent surface water body status (chemical)	Construction Operation	Although precautionary negligible impacts are predicted to baseflow contributions to Bradley Brook, there are unlikely to be any groundwater quality changes of sufficient magnitude to permanently alter the chemical status of surface waters associated with the Proposed Scheme.							N/A

1.9 Conclusions

1.9.1 This WFD Regulations assessment of the works for the Proposed Scheme has demonstrated that there could be a negative impact to the Manchester and East Cheshire Permo-Triassic Sandstone Aquifers groundwater body. This would be as a result of dewatering activities potentially drawing leachate into the aquifer, if the Land to the South of Whitehouse Farm and/or Land to the west of the M60 motorway historic landfill linings are absent or leaky. Furthermore, there is potential for contaminated dewatering flows to reach the River Irk (Wince to Irwell) WFD Regulations surface water body. Additional negative impacts also include EQS failures where routine runoff could impact all WFD surface water bodies. M-BAT results suggest such failures are unlikely to cause WFD water body scale impacts, however as a precaution, a negative impact has been identified. Further analysis of the discussed impacts, as well as treatment of dewatering flows may be required as a result.

1.9.2 With standard mitigation, there are no identified adverse impacts affecting any other WFD regulations surface water or groundwater bodies.

1.9.3 Compliance with the WFD objectives against the impacts of proposed works on a water body need to be assessed. The assessment should determine whether the Proposed Scheme could cause deterioration to water body status elements for WFD Regulations surface water or groundwater bodies, or prevent other water bodies from reaching good status (Table 1.9).

Table 1.9*: Compliance with the environmental objectives of the WFD*

Environmental Objective	Conclusions for Proposed Scheme	Compliance with the WFD
No changes affecting high status sites	Not applicable – no high-status water bodies present.	Yes
No changes that will cause failure to meet surface water Good Ecological Status or Potential or result in a deterioration of surface water Ecological Status or Potential	The Proposed Scheme could cause deterioration in the status of identified WFD water bodies.	No
No changes which will permanently prevent or compromise the Environmental Objectives being met in other water bodies	The Proposed Scheme could cause a permanent exclusion or compromise achieving the objectives in other bodies of water within the same River Basin District.	No
No changes that will cause failure to meet good groundwater status or result in a deterioration to groundwater status.	The Proposed Scheme could cause a deterioration in the status of the Manchester and East Cheshire Permo-Triassic Sandstone Aquifers groundwater body.	No

1.9.4 Based on the findings of this preliminary assessment, the scheme cannot currently be concluded as being compliant as presented in Table 1.9. However, further impact assessment, coupled with specific site surveys and investigations, would be carried out during the detailed WFD assessment stage. This will include refining understanding of dewatering impacts in relation to the historic landfill site on receipt of ground investigation data and detailed excavation information, as well as refining mitigation measures (where necessary) to support the scheme in being compliant with the WFD Regulations.

Appendix 14.2. Preliminary Water Quality Assessment Report

Executive Summary

Junction improvement works are planned at and around M60 Junction 18 (M60 J18), which is located to the north of Manchester. M60 J18 is a major interchange between the M60, M62 and M66 motorways and suffers from congestion at peak times.

At PCF Stage 3 the potential for likely significant effects to the water environment have been identified relating to routine runoff and its impact upon water quality in receiving watercourses. The aim of undertaking an assessment of routine runoff is to establish the nature and severity of the impacts in order to inform the design. This will help reduce the risks to the scheme through identification of constraints on drainage design and highlight any further mitigation measures that may need to be incorporated.

An assessment of routine runoff upon water quality has been undertaken using the methods described in DMRB, Volume 11, Section 3, Part 10: DMRB LA 113 Road Drainage and the Water Environment, published by Highways England in March 2020. The assessment uses the Highways England Water Risk Assessment Tool (HEWRAT) in accordance with DMRB LA 113. HEWRAT uses copper and zinc as a proxy for other pollutants, which may be present in road runoff and considers both long-term and short-term pollution impacts. A detailed level assessment using the Metal Bioavailability Assessment Tool (M-BAT) has further been undertaken to assess site-specific conditions.

During earlier stages of the project six drainage catchments, and corresponding outfalls, were identified as potentially receiving runoff from the existing carriageway within the scheme extents. A site visit was undertaken to confirm the location of the outfalls and collect data to be used in the HEWRAT assessments. Of the six outfalls, two could not be located and one excluded from the assessments as it is no longer affected by the Proposed Scheme.

For the existing situation, Outfalls 1 and 6 fail the national Environmental Quality Standards (EQS) for dissolved copper in HEWRAT. Outfall 6 also fails the EQS for zinc. The EQS limits are based upon the bioavailable annual average concentrations in a receiving watercourse and provide an indication of long-term impacts. Ambient Background concentrations (ABC) can be considered when investigating EQS failures. The ABC for copper has not been included in the existing situation HEWRAT assessments as the background levels are greater than the EQS limit and thus all assessments would by default fail the HEWRAT assessments due to the ABCs. For the existing situation Outfalls 1 and 6 also fail for acute soluble impacts over a 6-hour and 24-hour period. Outfall 5 passes all the HEWRAT assessments for soluble pollutants. This outfall discharges to the River Irk, near junction 19 of the M60, which has a significantly larger dilution capacity than the other watercourses affected by the Proposed Scheme.

HEWRAT assessments have also been undertaken on the Proposed Scheme drainage design, pre mitigation and including the embedded mitigation at this stage. For the Proposed Scheme with embedded mitigation Outfall 4 fails the 6-hour limit for zinc and 24-hour limits for both copper and zinc. Outfalls 2, 5 and 7 pass the assessment for soluble acute impacts (24 hour and 6 hour) for copper and zinc and the EQS for copper and zinc with embedded mitigation. When assessed cumulatively Outfalls 4 and 7 pass the parameters in HEWRAT for both EQS and RSTs. Outfalls 4 and 7 fail for sediment bound pollutants when assessed individually.

For the outfalls which fail the EQS detailed level assessments have been undertaken using M-BAT. These provide a ‘site-specific EQS’ based upon a Predicted No Effect Concentration (PNEC). This can be compared to the EQS outputs from the HEWRAT results and act as a threshold for HEWRAT outputs to be measured against. These site-specific results show that all relevant outfalls with the ABC for copper included meet the required site-specific M-BAT

thresholds for copper and zinc, and as such, these can be considered to have met acceptable limits for the EQS for bioavailable copper and zinc.

The spillage risk assessment results for the Proposed Scheme show that all outfalls meet acceptable limits and potential impacts from accidental spillage risk is deemed not to be environmentally significant.

After the currently proposed embedded mitigation measures are applied, environmentally significant effects are no greater than slight as HEWRAT did not record any sediment- bound impacts and the M-BAT assessment showed compliance with the EQS when the site-specific limits are considered. Without any embedded mitigation the outfalls record no failures for sediment-bound pollutants and pass the EQS using M-BAT. Therefore, with and without the proposed embedded mitigation the significance of effect is no greater than Slight and thus not environmentally significant.

The embedded mitigation will provide a betterment in surface water quality as currently there is no mitigation for water quality provided on the existing highway network. For Outfalls 1, 2 and 6 the proposed embedded mitigation will be a slight beneficial effect. During future stages of design development options will be explored to reduce the short-term failures dependent upon feasibility and land constraints of the Proposed Scheme.

1. Introduction

1.1 Background and context

1.1.1 Junction improvement works are planned at and around M60 Junction 18 (M60 J18), which is located to the north of Manchester between Whitefield and Middleton. M60 J18 is a major interchange between the M60, M62 and M66 motorways and suffers from congestion and delays at peak times. This Preliminary Water Quality Assessment Report forms Appendix 14.2 of the M60/M62/M66 Simister Island Interchange (hereafter referred to as the Proposed Scheme) – Preliminary Environmental Information Report (PEIR). This appendix should be read in conjunction with the Road Drainage and the Water Environment (RDWE) assessment reported in Chapter 14 of the PEIR.

1.1.2 At Project Control Framework (PCF) Stage 2 the potential for likely significant effects to the surface water environment relating to routine runoff from the Proposed Scheme and its impact upon water quality in receiving watercourses was identified. A Water Quality Study Report (WQSR) (Highways England, 2020a) was produced during PCF Stage 2 to establish the nature and severity of the water quality impacts. This study included assessing the existing situation (i.e. without the Proposed Scheme) and identified existing failures for water quality and potential treatment requirements. The results from the assessment of the existing situation are presented in Section 3.2. The WQSR identified that the majority of impacts to water quality resulted from the existing situation, with the Proposed Scheme exacerbating failures.

1.1.3 To inform the Environmental Impact Assessment (EIA) reported in the PEIR it is necessary to establish the magnitude of impact upon receptors and the subsequent significance of effect of the Proposed Scheme. To achieve this an impact assessment upon water quality using the methods described in the Design Manual for Roads and Bridges (DMRB) standard LA 113 Road Drainage and the Water Environment (Highways England, 2020b); hereafter referred to as DMRB LA 113 has been undertaken. This appendix reports the outcome of these water quality assessments of the Proposed Scheme.

1.2 Purpose of assessment

1.2.1 The two main sources of pollution from roads during the operational phase of the Proposed Scheme are routine runoff and accidental spillage risk. Routine runoff consists of road deposits which can contain a range of contaminants such as suspended solids, heavy metals and hydrocarbons. When combined with rainfall, these contaminants can runoff into the highway drainage system that discharges to a watercourse, potentially polluting the surface water environment. Potential pollution effects can be classified into two groups, the first of which directly affect water quality which are typically metals which chemically impair biological functions. The second are indirect impacts that affect the aquatic habitat quality which are typically sediments which smother feeding and breeding grounds for fish and physically alter the habitat.

1.2.2 Accidental spillage risk assessments determine the level of spillage risk and whether the level of risk is acceptable or whether mitigation measures are required. The aim of undertaking assessments for routine runoff and spillage risk is to establish the nature

and severity of the impacts of road drainage and runoff from the Proposed Scheme upon surface water quality.

1.2.3 This report focuses on outlining data used to undertake the assessments and the accompanying assessment results. Where water quality failures against the DMRB standard are identified, details of additional mitigation that could be incorporated into the Proposed Scheme design are outlined. The design process is iterative and ongoing; final results will be presented in the Environmental Statement.

1.2.4 The main report for this study is supported by the following annexes:

- Annex A: Methodology
- Annex B: Data summary
- Annex C: Site visit photographs
- Annex D: PCF Stage 2 water quality sampling data
- Annex E: HR Wallingford HydroSolutions Ltd Q_{95} report

1.2.5 Routine runoff and accidental spillage risk can also pose a risk to groundwater quality. The surface water quality assessments undertaken for routine runoff have identified two watercourses where the minimum Q95 has been used. These outfalls are discharging into piped/culverted watercourses or into the existing highways drainage network and not to an open section of watercourse which may act as a soakaway. Therefore, it has not been deemed appropriate to undertaken groundwater risk assessments for these outfalls using HEWRAT.

1.2.6 At this stage due to a lack of Ground Investigation (GI) data which is required to determine if infiltration is feasible the drainage design has assumed there will be no infiltration to ground through ponds or filter drains. Dependent upon the GI and other factors such as groundwater vulnerability and Principal aquifer locations it may be appropriate to undertake HEWRAT groundwater risk assessments to determine any risk from the proposed attenuation ponds and filter drains. At present it is proposed that these features are all lined, however as the design progresses assessments will help to identify where these features could be unlined. This will be reported in the Environmental Statement.

2. Assessment methodology and approach

2.1 Introduction

2.1.1 The DMRB LA 113 standard provides a methodology for a ‘simple’ level routine runoff and spillage risk assessment using the Highways England Water Risk Assessment Tool (HEWRAT) and accompanying user guidance: the HEWRAT v2.0 Help Guide (Highways England, November 2015) for outfalls. A ‘detailed’ level assessment methodology is also provided by the Water Framework Directive – United Kingdom Technical Advisory Group (WFD-UKTAG) in the (UKTAG) Rivers and Lakes Assessment Method Specific Pollutants (Metals) Metal Bioavailability Assessment Tool (M-BAT) guidance document (UKTAG, 2014). Both a simple level, and where appropriate a detailed level of assessment, has been undertaken for outfalls which are anticipated to receive routine runoff from areas within the Proposed Scheme extents.

2.2 Routine runoff – simple level assessment

2.2.1 quantification of impacts from routine runoff is represented by a prescriptive numerical 'simple level' assessment methodology, as described in DMRB LA 113 and described in further detail in Annex A.

2.2.2 For the assessment of the long-term risks HEWRAT estimates in-river annual average concentrations for the soluble pollutants dissolved copper and dissolved zinc. These metals have been identified as priority substances occurring in road runoff, both of which are relatively eco-toxic and for which there are well defined Environmental Quality Standards (EQS). These two pollutants are assessed as a proxy for other pollutants (both dissolved and total), which may be present in road runoff.

2.2.3 The tool is also designed to make an assessment of the short-term (i.e. acute) risks related to the intermittent nature of road runoff based upon Runoff Specific Thresholds (RST) established within the HEWRAT model for a 6-hour (RST6) and 24-hour period (RST24). The RST 24 hour is designed to protect against worst case conditions whereas the RST 6 hour is designed to protect against more typical exposure conditions of aquatic organisms to soluble pollutants in highway runoff. The thresholds have been developed and agreed based upon research undertaken by National Highways (formerly Highways Agency) and the Environment Agency. The acute solubles assessment considers concentrations of copper and zinc as a proxy for other metals.

2.2.4 The RST6 allowable exceedance is 1 per year for both copper and zinc. RST6 results are indicative of the water quality within a watercourse the majority of the time. The RST24 allowable exceedance is 2 per year for both copper and zinc. The RST24 results are likely to occur on a very irregular basis but when they do are likely to have significant impacts upon water quality within the receiving watercourse and aquatic ecosystems.

2.2.5 HEWRAT also provides assessment for the impact of sediment bound pollutants (total copper, zinc, cadmium, pyrene, fluoranthene, anthracene, phenanthrene and total Polyaromatic hydrocarbons (PAH)) and identifies whether accumulation of sediments will occur. If sediment is expected to accumulate, the potential extent of sediment coverage (the deposition index (DI)) is also considered. A DI of less than 100 is required to pass the sediment-bound pollutant limit in HEWRAT. Further information on the methodology for assessing sediment-bound and soluble pollutants as well as the EQS limits used in this assessment are presented in Annex A.

2.2.6 The assessment methodology provides results which are taken as an indicator as to whether there is sufficient dispersion and dilution available within the receiving water body to limit the impacts of highway runoff to acceptable levels.

2.2.7 HEWRAT adopts a tiered consequential approach to assessment and can report the results (as a "Pass" or "Fail") at three different stages depending upon the level of assessment required for any given site. This is described further in Annex A. The stages are:

- Step 1 – the runoff quality (prior to any pre-treatment and discharge into a water body).

- Step 2 – in river impacts (after dilution and dispersion).
- Step 3 – in river impacts (post-mitigation).

2.2.8 Road drainage (subject to no treatment) can contain a wide range of pollutants. Step 1 of the HEWRAT routine runoff assessment estimates the concentration ranges of selected pollutants based on traffic volume and likely climatic conditions. As no forms of treatment (via dilution provided by a receiving watercourse) are considered at Step 1, assessments failures are almost exclusively reported. Due to this expected failure, Step 1 results have not been reported in this assessment.

2.2.9 The focus of this study has been upon the Step 2 and Step 3 assessments for dissolved metals and sediments. HEWRAT facilitates two types of assessment at the Step 2 stage, which are split into Tier 1 and Tier 2 assessments. The tiered assessments allow users to input additional data which is used specifically to inform sediment impact. Tier 2 assessments are only typically utilised where Tier 1 assessments fail for sediment-bound pollutants.

2.2.10 HEWRAT Step 3 assessments allow a % treatment efficiency to be applied, providing an indication if the proposed mitigation is sufficient for the predicted discharge of road runoff to pass the assessment for both sediment bound and soluble pollutants.

2.2.11 Treatment efficiencies used in the assessments have been taken from the DMRB standard CG501 Design of Highway Drainage Systems (Highways England, 2020), (Section 8 – Table 8.6.4N3 Pollution and flow control measures options. The treatment efficiencies are presented in Annex A.

2.2.12 In some instances, multiple SuDS treatments may be incorporated into different drainage catchments across a proposed design, i.e. SuDS treatment trains. In these instances, a total treatment efficiency value is required to be calculated which represents that specific SuDS treatment train. No explicit advice is given within DMRB standards on how to calculate the combined efficiency of multiple SuDS treatment components in a management train.

2.2.13 Through recent correspondence (February 2021) directly with Highways England, they advocated that the efficiency of each treatment component, with a SuDS treatment train, should be simply multiplied together to determine the combined efficiency. Further detail regarding this method is presented in Annex A and this approach has been taken in the assessments.

2.2.14 Outfalls are assessed individually as single discharges of routine runoff. Where discharges to the same stretch of watercourse are proposed through more than one outfall, a cumulative assessment is also undertaken using HEWRAT. For outfalls located within 100m of each other a cumulative assessment can be used to report sediment related impacts. For outfalls located between 100m and 1km of each other, a cumulative assessment can be undertaken for soluble pollutant impacts. Cumulative assessments have been undertaken where applicable based on the latest design of the Proposed Scheme.

2.3 Routine runoff – detailed level assessment

2.3.1 Where the Step 3 assessment records failures for the annual average concentrations of Copper and/ copper and/or zinc a detailed level assessment can be undertaken using M-BAT (WFD-UKTAG, 2014) as described further in Annex A.

2.3.2 The toxicity of metals is dependent on a range of water quality parameters including water hardness, pH and dissolved organic carbon (DOC). These parameters influence the amount of metal that is actually bioavailable. This bioavailability fraction of the metal is responsible for toxic effects in flora and fauna. EQS limits for a number of metals have been established based on their bioavailable concentration. They are derived to reflect concentrations of concern in conditions of high bioavailability and are referred to as $EQS_{bioavailable}$.

2.3.3 To determine the bioavailable concentration of a metal directly the M-BAT has been used. The key output of the M-BAT is an estimate of the bioavailable concentration of a metal under the conditions found at a site, which can then be compared with the $EQS_{bioavailable}$ to assess compliance.

2.3.4 As stated in the UK-TAG guidance a further output is the $PNEC_{dissolved}$. This is the Predicted No Effect Concentration. This concentration is derived from the ecotoxicological data and site-specific water quality data using M-BAT. The site specific $PNEC_{dissolved}$ can be considered a site specific EQS (expressed as dissolved concentration).

2.3.5 Background concentrations can also be taken into account for metals when assessing monitoring results against the EQS. During an investigation of an EQS failure consideration should be given to the potential influence of ambient background concentrations (ABC) at the particular site being studied. This ABC would be subtracted from the measurements of dissolved metal concentration to ‘refine’ the assessment of risk from highway runoff as a result of the the proposed scheme only.

2.3.6 The EQS (annual average) for bioavailable dissolved copper in freshwater is currently 1µg/l. For an outfall to pass the contribution of bioavailable dissolved copper from the outfall combined with the ABC of bioavailable dissolved copper must not exceed this EQS. This is discussed further in Section 3.3.

2.3.7 For zinc, an outfall passes if the contribution of bioavailable dissolved zinc is less than 10.9µg/l. The ABC for zinc is not considered and is not an input parameter in HEWRAT.

2.4 Spillage risk

2.4.1 For all roads, there is a risk that a spillage or vehicle fire may lead to an acute pollution incident. Generally, the risk on any road is proportionate to the risk of a Heavy Goods Vehicle (HGV) road traffic collision. As new or improved roads are designed to reduce the collision rate, they will also lead to fewer acute pollution impacts. Where spillages do reach a surface watercourse the pollution impact can be severe, but is usually of short duration, typical of an acute pollution impact.

2.4.2 The spillage risk assessment within DMRB LA 113 has been designed to calculate spillage risk during the operation of the Proposed Scheme by calculating the associated

probability of a serious pollution incident. The methodology is described further in Annex A and the data used in the assessments is presented in Annex B.

2.4.3 The method initially estimates the risk that there will be an incident causing the spillage of a potentially polluting substance on the length of road being assessed. It then calculates the risk, assuming a spillage has occurred, that the pollutant will reach and impact on the receiving watercourse. The risks are expressed as annual probabilities of such an event occurring. In accordance with DMRB LA 113, cumulative spillage risk assessments should be undertaken when more than one outfall / drainage catchment discharges into the same watercourse. The spillage risk undertaken at this stage only relates to potential impacts to surface waters. Spillage risk assessments associated with impacts to groundwater will be reported in the Environmental Statement.

2.4.4 The risk of a serious pollution incident is deemed within acceptable limits if the Annual Exceedance Probability (AEP) is less than 1% (i.e. a 1 in 100-year return period or greater). Where the spillage is within 1km of a sensitive area the risk of a serious pollutant incident is deemed within acceptable limits if the AEP is less than 0.5% (i.e. a 1 in 200-year return period or greater).

2.5 Assessing the need for mitigation

2.5.1 HEWRAT allows for the inclusion of mitigation measures as part of the assessment included and allow for the treatment efficiency to be added to the assessment (as a % removal), and/or a restricted discharge rate.

2.5.2 To reduce the impacts from soluble pollutants there are two broad options for mitigation: either reduce the impact of the pollutant load via dilution; or increase the levels of treatment the road runoff is subject to. Reducing the pollutant load via dilution can potentially be achieved by limiting the discharge rate (thereby increasing the available dilution in the receiving water course) and/or discharging to a watercourse with a higher base flow. Restrictions on providing a particular number of levels of SuDS treatment or limiting discharge rates is normally constrained either by land available and/or local topography.

2.5.3 The degree of flow attenuation and/or treatment required can be investigated iteratively using Step 3 of HEWRAT. A maximum discharge rate can be established, which if exceeded could result in inadequate dilution in the watercourse and an exceedance of the toxicological thresholds (the RSTs). The percentage of treatment required indicates the percentage by which the concentrations of soluble pollutants in the runoff will need to be reduced in order to achieve compliance with the toxicological thresholds. When considering mitigation options, it should be noted that flow attenuation will not reduce annual average concentrations, against which EQS compliance is measured, as all of the road runoff will eventually reach the receiving watercourse within the year.

2.5.4 The treatment percentages, taken from CG501 and used in the Step 3 assessments are very precise, however, current best practice does not provide precise, accurate or robust treatment efficiencies for the available treatment options. Therefore, a degree of pragmatism is required when designing a drainage system to meet the required treatment percentages.

2.5.5 Monitoring of any potential mitigation solution has not been considered at this stage. Once a final drainage design and mitigation has been identified any monitoring

requirements will be reported in the Environmental Statement. Monitoring could be required in terms of meeting the requirements of any EIA legislation.

2.6 Approach to assessment

Identification of outfalls

2.6.1 Based upon the existing situation, as-built drawings from the Highways England's Drainage Data Management System (DDMS) were used to identify the existing drainage network serving the existing highway arrangement at PCF Stage 1. Six existing drainage catchments were identified. These drainage catchments remained unchanged for PCF Stage 2 and were assessed as part of the Water Quality Study Report undertaken at that stage. Where appropriate it is proposed that existing outfalls structures and locations will be retained and utilised in the Proposed Scheme.

2.6.2 At PCF Stage 2, to inform the Water Quality Study (Highways England, 2020a), a walkover survey was undertaken to confirm the presence of the six outfalls. Four outfalls were identified on site at this time, these are currently numbered as 1B (previously numbered as Outfall 1), 3, 5 and 6. It should be noted that Outfall 3 (on the M60 east of J18) was identified on site at PCF Stage 2 but due to changes in the Proposed Scheme this outfall and its' entire drainage catchment now falls outside the scheme extent and has not been considered further. Numbering has been maintained to avoid confusion between PCF Stage 2 and PCF Stage 3 assessments.

2.6.3 During the site walkover the location of Outfalls 2 and 4 was ambiguous. At PCF Stage 2 HEWRAT assessments were not undertaken of these outfalls as receiving watercourses could not be confirmed. For Outfall 2 initial drainage survey data from PCF Stage 3 indicates that this outfall discharges to Castle Brook, but in a location further downstream than originally assumed. An assessment of the existing outfall has been undertaken and is included in Section 3.2. An assumption as to the location of Outfall 4 has been made for this assessment and this is discussed further in paragraph 2.6.9. An assessment of the existing situation for Outfall 4 has been undertaken and is included in Section 3.2. Further information on the outfalls and proposed drainage catchments is provided on Figure 1.1.

FIGURE 1.1

Legend

- Provisional Order Limits
- Proposed Attenuation Ponds

Watercourses

- Open Channel
- Culvert

Proposed Outfall Locations

- Outfall 1A
- Outfall 1B
- Outfall 2
- Outfall 4
- Outfall 5
- Outfall 6
- Outfall 7

Drainage Design Catchment Areas

- Proposed Catchment Area 1 (Existing)
- Proposed Catchment Area 1 (New)
- Proposed Catchment Area 2
- Proposed Catchment Area 4
- Proposed Catchment Area 5
- Proposed Catchment Area 6
- Proposed Catchment Area 7

Drainage Assets

- Outfall 1A
- Outfall 1B
- Outfall 4
- Outfall 5
- Outfall 6
- Outfall 7

Note: Drainage catchments 1A and 1B are proposed to discharge to the same pond and same outfall

P02	JAN 23	Second Issue	SW	MS	VB	BB
P01	NOV 21	Initial Issue	MS	MS	VB	HD
Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd

Contractor: COSTAIN

Designer: Jacobs, 1 City Walk, Leeds, LS11 9DX, UK. Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389 www.jacobs.com

Client: national highways

Project: REGIONAL DELIVERY PARTNERSHIP M60/M62/M66 SIMISTER ISLAND INTERCHANGE

Drawing Title: APPENDIX 14.2 - PROPOSED DRAINAGE CATCHMENTS

Drawing Status: S4 - FOR APPROVAL

Scale @ A3	1:20,000	DO NOT SCALE
Jacobs No.	B36601F0	Rev P02
Client No.	HE548642	

Drawing Number: HE548642-JAC-EWE-SII_MLT-SK-LE-0012

2.6.4 The drainage catchments for the Proposed Scheme have changed between PCF Stage 2 and PCF Stage 3. Two new additional outfalls/drainage catchments are also proposed: 1A and 7. Drainage catchment 1A will be combined with catchment 1B prior to attenuation and will discharge via a single outfall. Details of each outfall location and receiving watercourse is shown in Table 2.1.

Table 2.1: Outfall locations and receiving watercourses for PCF Stage 3

Outfall No	Easting	Northing	Receiving Watercourse
1 (1A+1B)	382879	406584	Outfalls to unnamed tributary of Castle Brook – assessed at confluence with Castle Brook.
2	382390	407156	Outfalls to Castle Brook, assessed at point of outfall.
3	No longer located within the Proposed Scheme extents.		
4	382515	405646	Headwaters of Parr Brook (the tributary is in culvert/piped in the location of Outfall 4, assessed at the point of discharge to Parr Brook).
5	383600	405332	River Irk, assessed at point of outfall.
6	380287	404470	Bradley Brook, assessed at point of outfall.
7	382232	405660	Connects to existing highways drainage network which discharges to Parr Brook headwaters. Parr Brook is culverted/piped in the location of Outfall 7.The assessment has been undertaken at the point of discharge to Parr Brook.

2.6.5 For Outfalls 2 and 5 the Proposed Scheme affects a small proportion of the total drainage catchments for these outfalls. This results in the majority of these two catchments being unaffected and located beyond the scheme boundary. However, the total catchment discharging through each outfall has been considered in the assessments as this represents the actual situation.

Assessment locations

2.6.6 For some outfalls it has been deemed appropriate to consider an assessment location which is not immediately downstream of the outfall. An alternative assessment location has been For some outfalls it has been deemed appropriate to consider an assessment location which is not immediately downstream of the outfall. An alternative assessment location has been considered for Outfall 1 located approximately 100m downstream. This assessment location is on Castle Brook downstream of the confluence with the tributary of Castle Brook upon which Outfall 1 is located. This downstream assessment location has been considered due to the likely ephemeral nature of this tributary expected at the location of Outfall 1 resulting in limited aquatic ecology. As the drainage design evolves consideration will be given during the ES stage to undertake a groundwater assessment.

2.6.7 The exact location of Parr Brook headwaters and tributaries is unknown. It is assumed that Outfalls 4 and 7 both discharge into the headwaters of Parr Brook where the watercourse is piped. This piped section and/or culvert extends for a significant length downstream under residential areas, where it is likely to receive local road runoff. Parr Brook emerges into open channel on the south side of Cunningham Drive in Unsworth approximately 1.4km downstream of Outfall 4. Although this is greater than the distance considered for the cumulative assessment for solubles the extensive culverting of Parr

Brook is likely to mean there is very limited aquatic ecology upstream of this location. For the cumulative assessment of Outfalls 4 and 7 an assessment location where Parr Brook emerges into open channel has been used in the HEWRAT assessments.

Data sources, assumptions and limitations

2.6.8 The assessments have been undertaken using a combination of data collected on site in September 2019 as reported in the PCF Stage 2 Water Quality Study Report (Jacobs, 2020) and as part of a desk-based study for the PEIR at PCF Stage 3. A summary of the data used in the assessment is presented in Annex B.

2.6.9 Where outfalls were positively identified at PCF stage 2 during the site visit, measurements of the characteristics of the receiving watercourses (i.e. channel dimensions and gradients) were taken to inform potential Step 2 Tier 2 assessment for sediment-bound pollutants. Photographs from the site visits are presented in Annex C. During the site visit one water quality sample was taken for each accessible outfall to establish the hardness of the receiving watercourses along with other water quality parameters which have been used in the M-BAT assessments. The water quality sampling data is presented in Annex D.

2.6.10 The assessment also requires the calculation of the Q_{95}, the flow exceeded 95% of the time (i.e. representative of low flow conditions and thus a worst-case). This was calculated at PCF Stage 2 for watercourses identified during the site visit using the IoH, 1992, Report No. 108 Low flow estimation in the United Kingdom approach (i.e. Outfalls 1, 5 and 6). The results of the Q_{95} calculations are summarised in the PCF Stage 2 Water Quality Study Report.

2.6.11 At PCF Stage 2 for Outfall 1 the Q_{95} calculated using IoH was less than $0.0011m^3/s$. This is the lowest Q_{95} HEWRAT accepts before it recommends the watercourse could potentially be considered a soakaway (depending upon underlying geology) and is thus a worst-case situation. DMRB LA 113 (paragraph 3.25) states that if the Q_{95} flow is estimated to be less than one litre per second (i.e. $<0.001\ m^3/s$) then a simple groundwater assessment should be undertaken. At flows lower than this it is likely that a watercourse is ephemeral and/or has a limited, if any aquatic ecology present. Site inspections confirmed the ephemeral nature of this watercourse and an assessment location downstream of the confluence with Castle Brook has been chosen to be more representative for Outfall 1. Q_{95} values have been obtained from Wallingford HydroSolutions Ltd at PCF Stage 3 for this location downstream of the confluence. The results using this downstream Q_{95} have been presented in Table 3.1 for the existing situation and Table 3.2 for the Proposed Scheme. At this stage a groundwater risk assessment has not been carried out.

2.6.12 At PCF Stage 2 Outfall 4 was identified as discharging into a piped/culverted section of a tributary of Parr Brook. Outfall 7 will also discharge into the existing highways drainage network which discharges to Parr Brook. As these outfalls do not discharge to an open section of watercourse which may act as a soakaway it has not been deemed appropriate to undertaken groundwater risk assessments for these outfalls using HEWRAT.

2.6.13 Also due to the location of the outfalls and the extensive culverted length of the headwaters of Parr Brook an assessment location has been chosen downstream where the culvert emerges into open channel based upon a Q_{95} value obtained from

Wallingford HydroSolutions Ltd. The results from this downstream location have been presented in Table 3.2 for the Proposed Scheme for Outfalls 4 and 7 cumulatively.

2.6.14 It should be noted that Parr Brook emerges from culvert into open channel approximately 1.4km downstream of Outfall 4, which is beyond the 1km distance usually considered for cumulative impacts for soluble pollutants. Assessments have also been undertaken for routine runoff for Outfalls 4 and 7 individually for the Proposed Scheme using the minimum Q_{95} and these are presented in Table 3.2. As these outfalls discharge into sections of Parr Brook which are extensively piped or culverted there is likely to be very limited aquatic ecology until the watercourses becomes an open channel.

2.6.15 The assessments have been based upon traffic data for the baseline year for the existing situation assessments undertaken at PCF Stage 2. In accordance with LA 113 the design year traffic flows have been used for the assessments of the Proposed Scheme. It should be noted that this introduces some uncertainty in the baseline environment (i.e. rainfall and Q_{95}) by the year 2042 when, due to climate change, overall rainfall is likely to decrease and the Q_{95} value is also likely to decrease, which will potentially lead to worse results than that predicted by HEWRAT. In most instances the traffic flows for each drainage catchment are more than the >100,000 band in HEWRAT for the existing situation and thus the same traffic band applies for both the existing and Proposed Scheme (i.e. Do something) assessments. The traffic data used in these assessments are presented in Annex B.

2.6.16 The following limitations have been identified:

- The assessment is dependent upon the level of design available at this stage for the proposed drainage. Scheme design is ongoing (including drainage catchment size) and are subject to change based on future iterations of the design of the Proposed Scheme.
- Due to the nature of the existing drainage network and the local environment the contributing permeable areas for each outfall are complicated to establish. For assessing the existing situation, the permeable has been assumed to be zero. Permeable areas used in the assessments of the Proposed Scheme are an approximation.. Annex B presents the permeable area data used in the assessments of the Proposed Scheme. Permeable areas typically have little influence on overall results and thus any deviation in permeable areas is unlikely to alter the outcome of the assessments.
- Paragraphs 1.2.39 to 1.2.47 outline the data sources and approach to assessment for outfalls with low flows and for the methods used to calculate Q_{95}. For Outfall 4 and for the new additional drainage network (Outfall 7) the minimum value in HEWRAT of 0.0011m^3/s has been used as well as a Q_{95} downstream where Parr Brook emerges from culvert. For the downstream assessment location of Outfalls 4 and 7, along with the location of Outfall 2 and an assessment location downstream of Outfall 1 the Q_{95} has been obtained from Wallingford HydroSolutions Ltd. This calculation is based upon a catchment area determined by a Digital Terrain Model, which does not always account for some features such as embanked motorways. The reports provided by Wallingford HydroSolutions Ltd. which includes the Q_{95} values are presented in Annex E. The Q_{95} of the other outfalls has been determined using the IoH, 1992, Report No. 108 Low flow estimation in the United Kingdom

approach. Both methods of calculating Q_{95} have their own assumptions and limitations..

2.6.17 The identification and assessment of potential mitigation solutions has not considered constraints or the presence of utilities or any other considerations which may affect feasibility.

2.6.18 This study is based upon the following assumptions:

- In the absence of a drainage survey some outfall locations and aspects of the existing and proposed drainage network have been assumed.
- The outfalls discharging from earthworks are assumed to be natural runoff (i.e. relatively unpolluted compared to highway runoff) as they will not receive runoff from the road surface and thus have not been considered in the assessment. It is also assumed that the earthworks drainage is separate from the drainage from the carriageways.

2.6.19 Where assumptions have been made in the data used in the assessments, or there are uncertainties with the data used, these have been highlighted in the relevant sections of this report.

3. Assessment results

3.1 Introduction

3.1.1 The Water Quality Study Report (Jacobs, 2020) identified significant failures using HEWRAT of both the EQS and the RSTs for several outfalls for the existing and Proposed Scheme at PCF Stage 2. In HEWRAT, at Step 2, EQS and RST failures associated with soluble acute impacts have been identified for the current Proposed Scheme. Embedded mitigation proposed within the most recent drainage design has been used in Step 3 assessments. Options for essential mitigation for any failures have also been considered at Step 3. The results of these assessments are summarised in this section.

3.1.2 In the event that the HEWRAT assessment fails to meet the generic EQS a more detailed assessment of routine runoff can be undertaken as described in Section 2.3. A detailed level assessment has been required for one outfall and the results of this are presented in Section 3.3.

3.2 Existing situation assessment results

3.2.1 D of this Appendix. Any additional data required for this stage has been collated as part of a desk-based study as outlined in Section 2.

3.2.2 Outfall 2 was not able to be located on-site during the site survey and therefore the existing situation for this outfall was not assessed at PCF Stage 2. As noted in Section 2 initial results from the drainage survey indicate this outfall is on Castle Brook and an assessment of the existing situation has now been undertaken and included below. Outfall 3 has been removed from the Proposed Scheme as described in Section 2.6. Outfall 4 could not be confirmed during the site visit as an outfall structure was not visible only a manhole and a grated opening into a pipe (as shown in photographs in Annex C). The existing situation for Outfall 4 was therefore not assessed at PCF Stage

2. It has been assumed, in the absence of the drainage survey and based upon as-built drawings that for the assessment of the Proposed Scheme this is the location of Outfall 4. To represent the existing situation for Outfall 4 the minimum Q_{95} value has been used as discussed in Section 2.

3.2.3 Table 3.1 shows the results of the existing situation for outfalls with available site data at Step 2 (Tier 1). Within the table, a traffic light system has been used to aid interpretation: green shading indicates a HEWRAT 'pass', and red shading indicates HEWRAT 'fail'. Ambient background concentrations (ABC) of copper were not included in these HEWRAT assessments at PCF Stage 2. This is discussed further in Section 3.3. The ABC for copper has not been included in the existing situation HEWRAT assessments as the background levels are greater than the EQS limit and thus all assessments would by default fail HEWRAT due to the ABCs. The assessments presented below are based on the Q_{95} from the assessment locations as detailed in Table 3.1. All data used in the assessments of the existing situation are presented in Annex B.

3.2.4 Considering the EQS for copper and zinc for the existing situation Outfall 1 fails the EQS for copper and Outfall 6 fails the EQS for both copper and zinc as shown in Table 3.1. Table 3.1 does not take into consideration ABC for copper. All other assessments pass the EQS limits for the existing situation.

3.2.5 Table 3.1 shows failures for Outfall 1 of the RST 6 for zinc and RST 24 for copper and zinc at the downstream assessment location on Castle Brook. The RST6 allowable exceedance is 1 per year and HEWRAT has predicted an exceedance of 1.6 per year for zinc which is a marginal failure. As the RST6 represents more typical conditions the results indicate that usually levels of soluble copper and zinc will be acceptable the majority of the time with only a few instances a year when levels will be unacceptable. These times are likely to coincide with the first flush of pollutants following a heavy rainfall event in summer when flows in the receiving watercourse are lowest. The RST24 allowable exceedance is 2 per year for both copper and zinc and HEWRAT has predicted an exceedance of 3.4 and 4.8 per year respectively for Outfall 1. In the worst year this is expected to increase to 6 and 7 respectively.

3.2.6 Table 3.1 shows failures of the RST 6 for zinc and RST 24 for copper and zinc for Outfall 2 on Castle Brook. HEWRAT has predicted an RST6 exceedance of 1.2 per year for zinc which is a marginal failure. HEWRAT has predicted an exceedance of the RST24 for copper and zinc of 2.3 and 3.1 per year respectively for Outfall 2.

3.2.7 Table 3.1 shows that for Outfall 4 at the location of the outfall that HEWRAT has predicted that the RST24 and RST6 for both copper and zinc will pass for the existing situation.

3.2.8 For Outfall 5 the existing situation assessment passes the EQS and all RSTs for both copper and zinc, due to the larger Q_{95} value of the River Irk, which provides a greater dilution capacity.

3.2.9 Table 3.1 shows the failures of the RST 6 and RST 24 for Outfall 6 for the existing situation. The RST6 allowable exceedance is 1 per year for both copper and zinc and HEWRAT has predicted an exceedance of 6.8 and 7.6 per year respectively which is a significant failure. In the worst year the exceedances for copper and zinc are 13 and 12 per year respectively. The RST24 allowable exceedance is 2 per year for both copper

and zinc and HEWRAT has predicted an exceedance of 21.2 and 20.4 per year respectively. In the worst year this is expected to increase to 31 and 32 respectively.

Table 3.1: HEWRAT Step 2 Tier 1 assessment results for the existing situation.

Outfall (assessment location)	Annual average concentration soluble*		Sediments (Chronic impact)	Soluble acute impacts (no. of exceedances per year)			
	Cu (ug/l) (EQS = 1)	Zn (ug/l) (EQS = 10.9)		RST 24 hours**		RST 6 hours***	
				Cu	Zn	Cu	Zn
1 (d/s confluence with Castle Brook)	1.08	5.82	Pass	3.40	4.80	0.70	1.60
2	0.82	4.42	Pass	2.30	3.10	0.30	1.20
4	0.60	2.16	Pass	0.80	0.60	0.10	0.10
5	0.10	0.57	Pass	0.00	0.10	0.00	0.00
6	3.60	18.65	Pass	21.20	20.40	6.80	7.60

* EQS values are now based upon bioavailable values for Copper of 1µg/l and 10.9µg/l for Zinc (excluding ambient background concentration). These are default values within HEWRAT.

** The RST24 allowable exceedance is 2 per year for copper and zinc.

*** The RST6 allowable exceedance is 1 per year for copper and zinc.

3.3 Proposed Scheme assessment results

Step 2 Tier 1 (pre-mitigation) HEWRAT assessment results

3.3.1 are summarised in Table 3.2. Within this table, a traffic light system has been used to aid interpretation: green shading indicates a HEWRAT ‘pass’, and red shading indicates HEWRAT ‘fail’.

3.3.2 The assessments presented below for the Proposed Scheme have included the permeable areas where appropriate and the Q_{95} values from the assessment locations as described in Section 2.6 and as listed in Table 3.2. Data used within the assessments is presented in Annex B.

3.3.3 The ABC for copper has not been included in the initial HEWRAT assessments presented in Table 3.2 as the background levels are greater than the EQS limits and thus all assessments would by default fail due to the ABCs and trigger the requirement for a detailed assessment using M-BAT. This is discussed further in Section 3.3 where assessment of the EQS with the ABC for copper are presented in Table 3.3. The EQS including the ABC for copper has been used for the M-BAT assessments which are detailed in Section 3.6.

Table 3.2: HEWRAT results from Step 2 Tier 1 (pre-mitigation) where applicable (does not include ABC for copper).

Outfall	Receiving Watercourse (assessment location)	Annual Average Concentration related to EQS Compliance: EQS Copper = 1.0µg/l and Zinc = 10.9µg/l		Sediment Bound Pollutants (Pass /Fail)	Acute Soluble Copper & Zinc number of exceedances/year (RST exceedance limits in brackets)			
					RST 24 hours (2)		RST 6 hours (1)	
		Cu (ug/l)	Zn (ug/l)		Cu	Zn	Cu	Zn
1 (1A +1B)	Castle Brook downstream of confluence	1.53	8.12	Pass	6.30	6.90	1.00	2.60
2	Castle Brook	0.86	4.61	Pass	2.40	3.20	0.30	1.20
4	Parr Brook (at outfall location)	4.42	22.65	Fail	25.90	25.40	8.40	9.20
5	River Irk	0.10	0.54	Pass	0.00	0.10	0.00	0.00
6	Bradley Brook	3.31	17.07	Pass	18.90	18.20	5.90	6.60
7	Parr Brook (at outfall location)	1.37	4.98	Fail	3.80	2.50	0.40	0.70

Outfall	Receiving Watercourse (assessment location)	Annual Average Concentration related to EQS Compliance: EQS Copper = 1.0µg/l and Zinc = 10.9µg/l		Sediment Bound Pollutants (Pass /Fail)	Acute Soluble Copper & Zinc number of exceedances/year (RST exceedance limits in brackets)			
					RST 24 hours (2)		RST 6 hours (1)	
		Cu (ug/l)	Zn (ug/l)		Cu	Zn	Cu	Zn
Cumulative Assessment								
4 + 7	Parr Brook (d/s location in open channel)	1.02	5.49	Pass	3.20	4.00	0.60	1.30

3.3.4 The results show that for the Proposed Scheme, the Step 2 Tier 1 assessment (i.e. pre-mitigation) passes the EQS for soluble copper for Outfall 2 and 5. Outfalls 1, 4, 6 and 7, along with Outfalls 4 and 7 cumulatively fail the EQS for soluble copper. The EQS for soluble zinc is achieved for Outfalls 1, 2, 5 and 7 but fails for Outfalls 4 and 6. When considered cumulatively at the downstream assessment location Outfalls 4 and 7 pass the EQS for zinc. Given the EQS failures for several outfall a detailed assessment using M-BAT has been undertaken and this is presented in Section 3.6.

3.3.5 All outfalls fail the RST24 for copper and zinc except for Outfall 5 which discharges to the River Irk. Outfalls 1, 4 and 6 fail the RST6 for both copper and zinc. Outfall 2 marginally fails the RST6 for zinc and passes for copper. Outfalls 5 and 7 pass the RST6 for both copper and zinc. Outfalls 4 and 7 cumulatively fail the RST6 for Zinc at the downstream location on Parr Brook.

3.3.6 Outfall 4 and Outfall 7 fail for sediment-bound pollutants, pre-mitigation. All other outfalls pass for sediment-bound pollutants at Step 2 Tier 1.

Ambient background concentrations of Copper

3.3.7 The M-BAT guidance (UK-TAG, 2014) states that for most metals, the local background concentration would be accounted for only if there is a failure of the EQS. The EQS (i.e. annual average concentration) for bioavailable dissolved copper in freshwater is currently 1µg/l. For an outfall to pass, the contribution of bioavailable dissolved copper from the outfall combined with the ABC of bioavailable dissolved copper, must not exceed this EQS.

3.3.8 HEWRAT allows the ABC for copper to be included in assessments. Additional assessments of the Proposed Scheme have been undertaken to include the ABC for copper using values obtained as part of the water sample analysis from the site survey in 2019 (presented in Annex D and Table 3.3). The assessment results for the EQS for copper including the ABC for copper are presented in Table 3.4). The inclusion of the ABC is only considered within HEWRAT for copper. The results from the HEWRAT assessment with the ABC for copper have been used in the M-BAT assessment as described in Section 3.6.

Table 3.3: Proposed Scheme HEWRAT EQS Copper results excluding and including ABC for copper.

Outfall (assessment location)	EQS value from HEWRAT excluding ABC for copper (ug/l)	Dissolved copper (ug/l) measurement from site sampling (2019)	Annual average concentration with ABC for Copper (ug/l) from HEWRAT
1 (Castle Brook d/s confluence)	1.53	Not sampled in 2019 (value from Outfall 1 used) (4.9)	6.23
2	0.86	4.9 (Value from Outfall 1 used -located upstream in catchment)	5.66
4 (at outfall location)	4.42	2.7	6.81
5	0.10	4.0	4.10
6	3.31	1.6	4.78

Outfall (assessment location)	EQS value from HEWRAT excluding ABC for copper (ug/l)	Dissolved copper (ug/l) measurement from site sampling (2019)	Annual average concentration with ABC for Copper (ug/l) from HEWRAT
7 (at outfall location)	1.37	2.7 (Value from Outfall 4 used).	3.89
4+7	1.02	2.7 (Value from Outfall 4 used).	3.65

3.3.9 Outfall 2 was unable to be located during the site survey in 2019, and Outfall 7 is a proposed new outfall and therefore neither have water quality sampling data relating to the background concentrations of copper. Both these outfalls have not been included in the sensitivity analysis but are expected to have the same outcome as the outfalls which have been assessed in that the background levels are anticipated to exceed the EQS limit.

3.3.10 Given one water sample was collected from accessible and confirmed sites during the 2019 site visit a comparison has been undertaken with Environment Agency data from downstream watercourses where dissolved copper has been monitored. The values obtained from the site sampling in 2019 (Outfalls 1, 4, 5 and 6) ranged from 1.6 ug/l to 4.9 ug/l for dissolved copper. Data available on the Environment Agency's water quality archives website records water quality sampling data on the River Irwell At Old Ringley Bridge. This sampling site is located upstream of the M60 crossing (and upstream of Bradley Brook entering the river). Between January 2002 until November 2002 14 samples were taken with values for dissolved copper recorded ranging from 3.6 ug/l to 5.5 ug/l.

3.4 Embedded mitigation

3.4.1 Details of the proposed mitigation associated with each drainage catchment is presented in Annex B. The current drainage design includes swales and retention ponds (which are being designed to allow them to be permanently wet). These features are proposed, in varying combinations, to provide some treatment for water quality. At this stage they have primarily been designed and sized for attenuation purposes. The embedded mitigation has been assessed at Step 3 in HEWRAT. The overall efficiency for each treatment or treatment train has been taken from or calculated, where necessary, using the values for treatment efficiencies outlined in DMRB CG 501 Design of highway drainage systems (Highways England, 2020d) as presented in Annex A.

3.4.2 For those outfalls with more than one level of treatment, an overall efficiency has been calculated. Through recent correspondence (February 2021) directly with Highways England (now National Highways), they advocated that the efficiency of each treatment component, within a SuDS treatment train, should be simply multiplied together to determine the combined efficiency.

3.4.3 This combined efficiency should be achieved by converting each individual % treatment efficiency into a factor (or decimal) and subtracting it from one (1 representing total pollutant load), representing percentage of pollutant remaining after treatment. These factors should then be multiplied together to represent a decimal of pollutants remaining after treatment. Finally, this calculated decimal should be subtracted from one (1 representing total pollutant load) before converting the value into an overall % treatment

efficiency. This method is outlined in further detail in Annex A. The overall treatment efficiencies for each outfall in the proposed design is outlined in Table 3.4.

Table 3.4: Calculated treatment efficiencies for each outfall in Proposed Scheme for the proposed embedded mitigation.

Outfall	Proposed Embedded Mitigation	Overall Treatment Efficiency (%)		
		Copper (Cu)	Zinc (Zn)	Sediment-bound pollutants
1(1A+1B)	1x Attenuation Pond + 1x Swale	70	65	92
2	1x Attenuation Pond	40	30	60
4	1x Attenuation Pond + 2x Swales	70	65	92
5	1x Attenuation Pond	40	30	60
6	3x Attenuation Ponds	78	65	93
7	1x Attenuation Pond	40	30	60
4+7	2x Swale (Outfall 4) 1x Attenuation Pond for each catchment	58	51	79

3.4.4 Table 3.5 presents the results from the Step 3 HEWRAT assessments for the proposed design including the embedded mitigation. Within this table, a traffic light system has been used to aid interpretation:- green shading indicates a HEWRAT ‘pass’, and red shading indicates HEWRAT ‘fail’.

Table 3.5: Step 3 routine runoff results for the Proposed Scheme (including embedded mitigation) (without ABC for copper)

Outfall	Receiving Watercourse/assessment location	Embedded Mitigation Proposed	Annual Average Concentration related to EQS Compliance		Sediment Bound Pollutants (Pass/Fail)	Acute Soluble Copper & Zinc number of exceedances/year (RST exceedance limits in brackets)				% Treatment required to 'Pass'
			Cu (ug/l) Limit = 1.0µg/l	Zn (ug/l) Limit = 10.9µg/l		RST 24 hours (2)		RST 6 hours (1)		
						Cu	Zn	Cu	Zn	
1 (1A+1B)	Castle Brook (d/s of confluence)	1x Attenuation Pond + 1x Swale	0.46	2.84	Pass	0.20	0.80	0.00	0.10	
2	Castle Brook	1x Attenuation Pond	0.51	3.23	Pass	0.70	1.90	0.70	0.30	
4	Parr Brook	2x Swale + 1x Attenuation Pond	1.50[25]	9.06	Fail	3.60	6.60	0.30	1.30	Copper RST = 74% Zinc RST6 = 76% Sediment-bound pollutants = 95%
5	River Irk	1x Attenuation Pond	0.08	0.47	Pass	0.00	0.00	0.00	0.00	

[25] A detailed-level M-BAT assessment has been undertaken for outfall 4, which produced a site-specific copper EQS value of 45.26 µg/l. Therefore, the annual average concentration value for copper at outfall 4 as determined by HEWRAT of 1.50 µg/l is well below the site-specific EQS threshold as determined in the detailed MBAT assessment. This is discussed further in section 3.5.

Outfall	Receiving Watercourse/assessment location	Embedded Mitigation Proposed	Annual Average Concentration related to EQS Compliance		Sediment Bound Pollutants (Pass/Fail)	Acute Soluble Copper & Zinc number of exceedances/year (RST exceedance limits in brackets)				% Treatment required to 'Pass'
			Cu (ug/l) Limit = 1.0µg/l	Zn (ug/l) Limit = 10.9µg/l		RST 24 hours (2)		RST 6 hours (1)		
						Cu	Zn	Cu	Zn	
6	Bradley Brook	3x Attenuation Ponds	0.73	5.97	Pass	0.30	3.10	0.00	0.90	Zinc = 72%
7	Parr Brook	1x Attenuation Pond	0.82	3.49	Fail	0.80	1.00	0.00	0.20	Sediment-bound pollutants = 84%
Cumulative assessment										
4+7	Parr Brook (at d/s open channel)	2x Swale (Outfall 4) + 2x Attenuation Pond (1 serving each outfall)	0.51	3.18	Pass	0.60	1.70	0.10	0.20	

3.4.5 The results presented in Table 3.5 show that the current proposed drainage design with embedded mitigation passes HEWRAT (both EQS and RSTs) at Step 3 for Outfalls 1, 2 and 5 and the cumulative assessment for Outfalls 4+7. Outfall 4 at the outfall location fails the EQS for copper and the RSTs for copper and zinc, other than a pass for RST6 copper, with the embedded mitigation. Outfall 6 passes for all parameters, other than a failure for RST24 zinc. Outfall 7 passes for all parameters apart from a failure for sediment-bound pollutants.

3.4.6 The Step 3 (i.e. with embedded mitigation) results do not all show an improvement upon the existing situation (and the pre-mitigation situation) as not all proposed drainage catchments are the same size or less as the existing drainage catchments. For Outfall 1 (1A and 1B) the total drainage catchment area has increased due to the new Northern Loop to the north-east of J18. For Outfall 4 the drainage catchment has increased in size from the existing to include a section of the mainline M60 carriageway (which also increases the AADT band used in the assessment) in an attempt to reduce the drainage catchment size for Outfall 6 and reduce impacts from this outfall.

3.5 Routine runoff: 'detailed' level assessment – M-BAT results

3.5.1 Due to EQS failures at Step 2 and Step 3 for copper and/or zinc for several outfalls a detailed level assessment has been undertaken using M-BAT. The detailed methodology for the M-BAT is presented in Annex A. The measured dissolved copper and zinc concentrations have been included in the M-BAT assessment based upon the samples collected during the PCF Stage 2 site visit.

3.5.2 The Predicted No Effect Concentration (PNEC) is derived from the ecotoxicological data and site-specific water quality data using M-BAT. The site specific $PNEC_{dissolved}$ can be considered a site specific EQS (expressed as dissolved concentration). Table 3.6 presents the results of the detailed level M-BAT analysis for copper and zinc at Step 2 (without mitigation) and Table 3.7 the results at Step 3 (with mitigation). Within these tables, a traffic light system has been used to aid interpretation: green shading indicates a 'pass', and red shading indicates 'fail' against the PNEC.

3.5.3 Outfalls 2 and 7 were unable to be assessed through the M-BAT, however, as their outfalls discharge to Castle Brook and Parr Brook respectively, data from Outfalls 1 and 4 has been used as a proxy. Full details of the data used in the detailed assessment is available in Annex B.

3.5.4 As presented in Tables 3.6 and Table 3.7 M-BAT has calculated site-specific PNECs ranging from 13.50 µg/l to 45.26 µg/l for copper. For zinc the M-BAT results have calculated site specific PNEC values ranging from 24.04 µg/l to 41.15 µg/l.

3.5.5 Those outfalls that failed the copper EQS at HEWRAT Step 2 (i.e. without any mitigation) for the Proposed Scheme recorded EQS values for copper ranging between 1.01 ug/l to 4.40 ug/l. When considering ABC copper concentrations (Table 3.3) the values range from 3.64 to 6.81 ug/l as presented in Table 3.6. As such, the copper EQS values from Step 2 (pre-mitigation) with the ABC for copper included do not exceed any of the site-specific thresholds (PNEC) for copper for any outfall assessed. Consequently, it can be concluded from the M-BAT analysis, that the copper EQS values are considered to be within the site-specific PNEC and thus achieve the EQS for copper.

3.5.6 Those outfalls that failed the zinc EQS at HEWRAT Step 2 (i.e. without any mitigation) for the Proposed Scheme recorded EQS values for zinc ranging between 17.40 ug/l and 22.60 ug/l as presented in Table 3.8. Taking into consideration the current drainage strategy for the Proposed Scheme (with embedded mitigation), at Step 3 HEWRAT EQS zinc failures do not exceed 14.24 ug/l as presented in Table 3.7. As such, the Zinc EQS values generated from HEWRAT Step 3 routine runoff assessments do not exceed the PNEC for any outfall where failures were recorded at Step 2 or Step 3.

Table 3.6: The PNEC and HEWRAT EQS results from Step 2 (pre-mitigation).

Outfall	M-BAT Site-specific PNEC Dissolved Copper (µg/l)	HEWRAT Predicted In-river EQS Copper Annual Average Concentrations (µg/l) including ABC for copper.	M-BAT Site-specific PNEC Dissolved Zinc (µg/l)	HEWRAT Predicted In-river EQS Zinc Annual Average Concentrations (µg/l)
1 (1A + 1B)	31.09	6.23	30.51	8.12
2	No data collected for this outfall. Same watercourse as Outfall 1A. (31.09)	5.66	No data collected for this outfall. Same watercourse as Outfall 1A. (30.51)	4.61
4	45.26	6.81	41.15	22.65
5	20.17	4.10	30.76	0.54
6	13.56	4.78	24.04	17.07
7	No data collected for this outfall. Same watercourse as Outfall 4 (45.26)	3.89	No data collected for this outfall. Same watercourse as Outfall 4 (41.15)	4.98
4 + 7	45.26 (based upon OF4)	3.65	41.15 (based upon OF4)	5.49

Table 3.7: The PNEC and HEWRAT EQS results from Step 3 with embedded mitigation.

Outfall	M-BAT Site-specific PNEC Dissolved Zinc (µg/l)	HEWRAT Predicted In-river EQS Zinc Annual Average Concentrations (µg/l)
1 (1A+1B)	30.51	2.84
2	No data collected for this outfall Same watercourse as Outfall 1A. (30.51)	3.23
4	41.15	9.06
5	30.76	0.47
6	24.04	5.97
7	No data collected for this outfall. Same watercourse as Outfall 4 (41.15)	3.49
4 + 7	41.15 (based upon OF4)	3.18

3.5.7 M-BAT also allows the bioavailable concentration of copper and zinc to be calculated as described in Annex A. For each outfall the bioavailable concentration for copper is

presented in Table 3.8. Within the table, a traffic light system has been used to aid interpretation: green shading indicates a 'pass', and red shading indicates 'fail' against the bioavailable limits. The M-BAT assessment shows that all outfalls are all below the 1.0 µg/l limit for bioavailable copper, with the highest at Outfall 6 being 0.37 µg/l when both the background ABC for copper and the copper annual average concentration from HEWRAT for the Proposed Scheme are considered.

Table 3.8: M-BAT detailed level assessment results.

Outfall	Site-specific PNEC Dissolved Copper (µg/l)	BioF	Bioavailable Copper Concentration (µg l^{-1})	Site-specific PNEC Dissolved Zinc (µg/l)	BioF	Bioavailable Zinc Concentration (µg l^{-1})
1 (1A+1B)	31.09	0.03	0.24	30.51	0.36	3.57
2	31.09	0.03	0.19	30.51	0.36	3.57
4	45.26	0.02	0.16	41.15	0.26	1.22
5	20.17	0.05	0.20	30.76	0.35	3.57
6	13.56	0.07	0.37	24.04	0.45	6.80
7	45.26	0.02	0.08	41.15	0.26	1.22
4 + 7	45.26	0.02	0.16	41.15	0.26	1.22

3.5.8 As both the EQS for copper and zinc can be considered to pass the PNEC using M-BAT the assessment has focused on the acute soluble impacts.

4. Spillage risk

4.1 Assessment results

4.1.1 Table 4.1 presents the results from the accidental spillage risk assessment for the Proposed Scheme. With reference to the results, an annual probability of a serious pollutant incident occurring over a return period of >200 years is deemed to have a Negligible magnitude of impact. This magnitude of impact, regardless of importance of the receptor, always results in a residual effect that is not environmentally significant (Slight or Neutral), in accordance with DMRB LA 113.

Table 4.1: Spillage Risk Assessment Results

Outfall Number	Return Period (years) of Spillage	Does it meet acceptable limits, i.e., return period >100 / >200 years / Negligible Magnitude of impact?	Overall Environmental Significance
1A + 1B	118,418	Yes	Not Significant
2	935,801	Yes	Not Significant
4	77,901	Yes	Not Significant
5	282,931	Yes	Not Significant
6	33,107	Yes	Not Significant
7	101,895	Yes	Not Significant

4.1.2 The results of the spillage risk assessment show that all outfalls assessed meet the acceptable limits and have a ‘not significant’ overall environmental impact.

5. Significance of effects

5.1 Assessment criteria

5.1.1 The criteria for identifying value of receptors and the magnitude of impacts, related to water quality impacts, are documented in DMRB LA 113 and defined in Section 14.4 of Chapter 14 of the PEIR. Table 5.1 outlines the criteria which is dependent upon the HEWRAT results for routine runoff and accidental spillage risk. The magnitude of an impact (selected from Table 5.1) and the value of a receptor are combined to produce the significance of effect (Table 5.2). The significance of effect is based upon the criteria in Table 3.8.1 of DMRB LA 104 Environmental Assessment and Monitoring (Highways England, 2020c) which is used to determine the overall environmental significance. The value of receptors is determined based upon criteria in DMRB LA 113 and this is described further Section 14.4 of Chapter 14 in the PEIR. The value of the receptors affected by routine runoff discharges are presented in Table 5.3 based upon the criteria in DMRB LA 113.

Table 5.1: Routine runoff criteria for establishing the magnitude of impact (taken from Table 3.70 in DMRB LA 113).

Magnitude of impact	Criteria for routine runoff and Spillage Risk
Major adverse	Failure of both acute-soluble **and** chronic-sediment related pollutants in HEWRAT and compliance failure with EQS values. Calculated risk of pollution from a spillage ≥2% annually (spillage assessment)
Moderate adverse	Failure of **both** acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages ≥1% annually and <2% annually.
Minor adverse	Failure of **either** acute soluble or chronic sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages ≥0.5% annually and <1% annually.
Negligible	No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5%

Table 5.2: Significance matrix (taken from DMRB LA104)

Magnitude / Value	No change	Negligible	Minor	Moderate	Major
Very High	Neutral	Slight	Moderate / Large	Large / Very Large	Very Large
High	Neutral	Slight	Slight / Moderate	Moderate / Large	Large / Very Large
Medium	Neutral	Neutral / Slight	Slight	Moderate	Moderate / Large
Low	Neutral	Neutral / Slight	Neutral / Slight	Slight	Slight / Moderate

Table 5.3: Value of receptors for receiving watercourses

Outfall Number (assessment location)	Receiving watercourse	DMRB LA 113 criteria/typical examples used to determine value	Value
1A	Un-named tributary of Castle Brook	Watercourse not having a WFD classification shown in RBMP and a Q_{95}>0.001m^3/s.	Medium
1B	Un-named tributary of Castle Brook	Watercourse not having a WFD classification shown in RBMP and a Q_{95}>0.001m^3/s.	Medium
1 (1A + 1B at d/s location on Castle Brook)	Castle Brook	Watercourse not having a WFD classification shown in RBMP and a Q_{95}>0.001m^3/s.	Medium
2	Castle Brook	Watercourse not having a WFD classification shown in RBMP and a Q_{95}>0.001m^3/s.	Medium
4 (at outfall location)	Parr Brook	Watercourse not having a WFD classification shown in RBMP and a Q_{95}≤0.001m^3/s.	Low
5	River Irk	Watercourse having a WFD classification shown in RBMP and a Q_{95}<1.0m^3/s.	High
6	Bradley Brook	Watercourse not having a WFD classification shown in RBMP and a Q_{95}>0.001m^3/s.	Medium
7 (at outfall location)	Parr Brook	Watercourse not having a WFD classification shown in RBMP and a Q_{95}≤0.001m^3/s.	Low
4 + 7 (d/s in open channel)	Parr Brook	Watercourse not having a WFD classification shown in RBMP and a Q_{95}>0.001m^3/s.	Medium

5.1.2 With reference to Table 5.2, resulting significance of effects that are considered to be “Slight” or “Neutral” are considered to be insignificant. Conversely, significant effects typically comprise residual effects that are within the “Moderate”, “Large” or “Very Large” categories. Ways of reducing these significances should focus on changes to design and/or methods of mitigation.

5.2 Significance with embedded mitigation

5.2.1 The significance of effect has been determined with the embedded mitigation for the Proposed Scheme and based upon the HEWRAT and M-BAT results presented above. All outfalls pass the spillage risk assessment (presented in Section 4), the sediment-bound pollutant assessment at Step 2 Tier 1 and pass the M-BAT assessment based upon the PNEC. The significance of effect is influenced by the RST results and this is presented in Table 5.4.

Table 5.4: Residual significance of effect of single and cumulative outfall assessments

Outfall Number	Receiving watercourse (and value)	Reason for magnitude of impact (with embedded mitigation)	Magnitude of impact	Significance of Effect with embedded mitigation
1 (d/s location on Castle Brook)	Castle Brook (Medium)	None	Negligible	Slight Adverse
2	Castle Brook (Medium)	None	Negligible	Slight Adverse

Outfall Number	Receiving watercourse (and value)	Reason for magnitude of impact (with embedded mitigation)	Magnitude of impact	Significance of Effect with embedded mitigation
4 (at outfall location)	Parr Brook (Low)	Cu RST24 Zn RST24 & 6 Sediment-bound pollutants	Minor adverse	Slight Adverse
5	River Irk (High)	None	Negligible	Slight Adverse
6	Bradley Brook (Medium)	RST24 Zinc	Minor Adverse	Slight Adverse
7 (at outfall location)	Parr Brook (Low)	Sediment-bound pollutants.	Minor Adverse	Slight Adverse
4 + 7 (at d/s location)	Parr Brook (Medium)	None	Negligible	Slight Adverse

5.2.2 After the currently proposed embedded mitigation measures are applied, environmentally significant effects are no greater than slight adverse. Without any embedded mitigation the outfalls also record no failures for sediment-bound pollutants at Step 2 Tier 1 and pass the EQS for copper and zinc using M-BAT. Therefore, without the proposed embedded mitigation the significance of effect would also be no greater than slight adverse and thus not significant.

5.2.3 LA 113 also includes criteria for establishing beneficial impacts, which can be identified when comparing the existing situation to that of the Proposed Scheme with embedded mitigation. Table 5.5 presents the assessment of beneficial impacts and the significance of effects where a betterment is anticipated.

Table 5.5: Beneficial effect as a result of the Proposed Scheme

Outfall Number	Receiving watercourse (and value)	Reason for magnitude of impact (with embedded mitigation)	Magnitude of impact	Significance of Effect with embedded mitigation
1 (1A + 1B)	Castle Brook (Medium)	HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition.	Minor beneficial	Slight Beneficial
2	Castle Brook (Medium)	HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition.	Minor beneficial	Slight Beneficial
6	Bradley Brook (Medium)	HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition.	Minor beneficial	Slight Beneficial

5.3 Essential mitigation

5.3.1 The PEIR records no significant effects upon water quality as a result of the Proposed Scheme. As the effects are not significant essential mitigation is not deemed to be required.

6. Conclusions

6.1.1 The water quality assessments have considered the impact of the Proposed Scheme in relation to pollution from routine runoff and accidental spillage risk. Simple level assessments using HEWRAT recorded failures of EQS for copper and zinc for outfalls before and after mitigation and with and without the ABC for copper. A detailed level assessment has been undertaken using M-BAT. This assessment has determined that, when site specific conditions are considered, the outfalls including the ABC for copper are all deemed to be within the PNEC limit.

6.1.2 The HEWRAT assessments have also considered the short-term (i.e. acute) impacts of soluble copper and zinc. The results show that, with embedded mitigation, Outfalls 1, 2, 5 and 7 pass HEWRAT (RSTs) at Step 3. Outfall 4 fails the RST6 for zinc and RST24 for both copper and zinc with the proposed embedded mitigation. Outfall 6 fails the RST24 for zinc at Step 3. Cumulatively Outfalls 4 and 7 pass all RST thresholds. Outfall 4 and Outfall 7 fail for sediment-bound pollutants.

6.1.3 The spillage risk assessment results for the Proposed Scheme show that all outfalls meet the acceptable limits and potential impacts from accidental spillage risk is deemed not to be environmentally significant.

6.1.4 After the currently proposed embedded mitigation measures are applied, adverse environmentally significant effects are no greater than slight as the M-BAT assessment showed compliance with the EQS when the PNEC is considered. Without any embedded mitigation the outfalls record no failures for sediment-bound pollutants at Step 2 Tier 1 and pass the EQS using M-BAT. Therefore, without the proposed embedded mitigation the significance of effect is no greater than Slight adverse and thus not significant. A slight beneficial effect is anticipated for Outfalls 1, 2 and 6 which previously failed all acute soluble assessments and with embedded mitigation passes the assessments. For all outfalls the embedded mitigation will provide a betterment in surface water quality as currently there is no mitigation for water quality provided on the existing highway network.

Annex A. Methodology

1.1 Routine runoff: 'simple' level assessment - HEWRAT

1.1.1 HEWRAT uses a three-step approach to assessing the impacts of both soluble and sediment-bound pollutants and determines whether the drainage system would 'pass' or 'fail' (or 'alert') in terms of water quality in the receiving water features during operation. The three-step approach is as follows:

- Step 1 – the runoff quality (prior to any pre-treatment and discharge into a water body)
- Step 2 – in river impacts (after dilution and dispersion)
- Step 3 – in river impacts (post-mitigation)

1.1.2 At Step 1, HEWRAT predicts the statistical distribution of key pollutant concentrations in untreated and undiluted highway runoff (the 'worst case' scenario) over a long release period. The results are assessed on a pass/fail basis against the toxicity thresholds. These represent a guideline emission standard in the absence of any pre-treatment within the drainage system or in-river dilution and dispersion.

1.1.3 At Step 2 the assessment becomes more realistic and is only applied if one or both the toxicity thresholds are predicted to fail at Step 1. HEWRAT uses details of the highway catchment draining to the outfall, the flow rate of the receiving watercourse and its physical dimensions to calculate the available dilution of soluble pollutants and potential dispersion of sediments. For the soluble pollutants that cause acute impact this involves a simple mass balance approach. For the sediment-bound pollutants that cause chronic impact, the ability of the receiving watercourse to disperse sediments is considered and, if sediment is expected to accumulate, the potential extent of sediment coverage (the deposition index) is also considered.

1.1.4 Additionally, Step 2 contains two tiers of assessment for sediment accumulation: Tier 1 is a simple assessment requiring only an estimate of the river width. If required, Tier 2 is a more detailed assessment which requires specific physical dimensions of the river. If a Tier 1 assessment indicates no risk, then a Tier 2 assessment is unnecessary.

1.1.5 Step 3 allows mitigation measures to be included in the assessment. Treatment efficiencies for a range of solutions are presented in Table 8.6.4N3 Pollution and flow control measures options of CG 501 Design of Highways Drainage systems (Highways England, 2020d). The treatment efficiencies within this table for pollution control have been reproduced below in Table A.1. "X" is recorded where the removal of pollutants is likely to occur by the measure but insufficient evidence available to quote indicative treatment efficiencies.

Table A.1: Treatment Efficiencies taken from CG501

Name of Measure	Suspended solids (% removal)	Dissolved Copper (% removal)	Dissolved Zinc (% Removal)
Baffles	0	0	0

Name of Measure	Suspended solids (% removal)	Dissolved Copper (% removal)	Dissolved Zinc (% Removal)
Combined kerb and drainage blocks	0	0	0
Combined kerb and gully	X	X	X
Combined surface and sub-surface drains/filter drain	60	0	45
Ditch (vegetated)	25	15	15
Dry/Detention Basin	5	0	0
Infiltration Basin / Soakaway	Infiltration of water facilitates the removal of dissolved metals and solids.		
Notched weir	0	0	0
Penstock/Valve	0	0	0
Piped systems	0	0	0
Ponds	60	40	30
Reservoir pavement/pervious asphalt	50	0	0
Sedimentation tank	40	0	0
Sediment trap (catchpit)	X	X	X
Surface water channel	X	X	X
Swale/Grassed channel	80	50	50
Vortex chamber	0	0	0
Vortex grit separator	40	0	15
Wetland (surface flow)	60	30	50

1.2 Mitigation – treatment train calculations

1.2.1 Through recent correspondence (February 2021) directly with Highways England, they advocated that the efficiency of each treatment component, within a SuDS treatment train, should be simply multiplied together to determine the combined efficiency.

1.2.2 This should be achieved by converting each individual % treatment efficiency into a factor (or decimal) and subtracting it from one (1 representing total pollutant load), representing percentage of pollutant remaining after treatment. These factors should then be multiplied together to represent a decimal of pollutants remaining after treatment. Finally, this calculated decimal should be subtracted from one (1 representing total pollutant load) before converting the value into an overall % treatment efficiency. A short-worked example is detailed below:

1.2.3 For example, CG 501 suggests a Filter Drain will remove 60% of Total Suspended Solids (TSS) and a Detention Basin (dry pond) will remove 50% (see Table A.1). Where a SuDS treatment train consists of a Filter Drain followed by a Detention Basin, the combined efficiency is calculated as follows:

1.2.4 The percentage treatment efficiencies, for TSS, for a Filter Drain and a Detention basin are 60% and 50% respectively. Firstly, both are converted into decimals; 60% becomes 0.6, 50% become 0.5. This decimal is subtracted from one, i.e. 1 – 0.6 = 0.4 (representing decimal of pollutant remaining) and 1 – 0.5 = 0.5 (representing decimal of pollutant remaining)

0.4 [Filter Drain factor] × 0.5 [Detention Basin factor] = 0.2 [combined factor]

1 – 0.2 [combined factor] = 0.8 (represents decimal of pollutants treated), then converting 0.8 back to a percentage, i.e. 80%

1.2.5 For a SuDS treatment train involving Filter Drains and a Detention Basin, the overall treatment efficiency, for TSS, is 80% which is to be used within HEWRAT at Step 3.

1.2.6 If a third treatment component were to be added, for example a vegetated ditch (25% suspended solids removal = 0.75), the calculation would be:

0.4 [Filter Drain factor] × 0.5 [Detention Basin factor] × 0.75 [Vegetated Ditch factor] = 0.15 [combined factor]

1.2.7 Subtracting 0.15 from 1 gives a value of 0.85 and converting this back to a percentage gives an overall treatment efficiency for TSS for use in HEWRAT of 85%.

1.3 Soluble pollution

1.3.1 HEWRAT uses Runoff Specific Thresholds (RSTs) and exceedances of the RST to protect receiving watercourses from short-term exposure (six hours and 24 hours) to those significant pollutants identified in highway runoff. The approach used to generate the RSTs is consistent with that adopted for the derivation of Environmental Quality Standards (EQSs) under the Water Environment Regulations (WER). The RSTs have been agreed with the Environment Agency and incorporated within the HEWRAT assessment tools and guidance. The RST 24 hour is designed to protect against worst case conditions whereas the RST 6 hour is designed to protect against more typical exposure conditions to soluble pollutants in highway runoff.

1.3.2 Dissolved copper (Cu) and dissolved zinc (Zn) are used as indicators of the level of impact as they can result in particularly acute toxic effects to aquatic life at certain concentrations. Table A.2 summarises the RSTs for dissolved Cu and dissolved Zn used within HEWRAT.

Table A.2: RSTs for short-term exposure (WRC, 2007 cited within Highways Agency et al., 2009a)

Threshold	Cu (µg/l)	Zn (µg/l) Hardness		
		Low (<50mg $CaCO_3$/l)	Medium (50 – 200mg $CaCO_3$/l)	High (>200mg $CaCO_3$/l)
RST 24 hour	21	60	92	385
RST 6 hour	42	120	184	770

1.3.3 A HEWRAT 'pass' or 'fail' for RSTs is determined through a calculation of the number of exceedances per year; Table A.3 shows the number of exceedances used to determine a HEWRAT 'pass'.

Table A.3: Number of exceedances per year required to achieve a HEWRAT 'pass'

Metal	Not within 1km of protected site.		Within 1km of protected site.	
	RST 24	RST 6	RST 24	RST 6
Dissolved Cu	<2	<1	<1	<0.5
Dissolved Zn	<2	<1	<1	<0.5

1.3.4 An assessment of the long-term risks (using annual average concentrations) is also required to complete the risk assessment process. HEWRAT estimates in-river annual average concentrations for soluble pollutants (dissolved copper and dissolved zinc) which include the contribution from road runoff. These concentrations can be compared with published Environmental Quality Standards (EQSs) as shown in Table A.4, to assess whether there is likely to be a long-term impact on ecology.

Table A.4: EQS for Cu and Zn required to achieve 'Good' status under WFD

Metal	Annual mean bioavailable concentration (µg/l)
Cu	1
Zn	10.9

1.3.5 HEWRAT calculates concentrations for total dissolved Cu and Zn, and in the absence of long-term water quality data, a comparison is made for exceedance against EQS for bioavailable Cu and Zn. This results in a conservative 'worst-case' assessment assuming that all dissolved Cu and Zn is bioavailable and therefore has the potential to have long-term negative environmental impacts on aquatic flora and fauna.

1.4 Sediment-bound pollution

1.4.1 HEWRAT also assesses chronic impacts associated with sediment-bound pollutants on aquatic ecology within watercourses. Two standards are used for metal and polycyclic aromatic hydrocarbon (PAH) in sediment respectively, these are:

- Threshold Effect Level (TEL) – concentration below which toxic effects are extremely rare
- Probable Effect Level (PEL) – concentration above which toxic effects are observed on most occasions

1.4.2 An alert is given for outfalls that would otherwise pass the assessment for sediment-bound pollutants, were it not for the following features being present downstream:

- A protected site within 1km of the point of discharge
- A structure, lake or pond within 100m of the point of discharge

1.4.3 In both cases, the alert indicates the need for further consideration of the proposed outfall and the agreement of appropriate settlement measures with the 'Overseeing Organisation', in this case the Environment Agency.

1.5 Routine runoff: 'detailed' level assessment - M-BAT

1.5.1 The toxicity of metals is dependent on a range of water quality parameters including water hardness, pH and dissolved organic carbon (DOC). These parameters influence the amount of metal that is actually bioavailable. This bioavailability fraction of the metal is responsible for toxic effects in flora and fauna. EQS limits for a number of metals have been established based on their bioavailable concentration. They are derived to reflect concentrations of concern in conditions of high bioavailability and are referred to as $EQS_{bioavailable}$.

1.5.2 To determine the bioavailable concentration of a metal directly the M-BAT for copper and zinc has been used. The key output of the M-BAT is an estimate of the bioavailable concentration of a metal under the conditions found at a site, which can then be compared with the $EQS_{bioavailable}$ to assess compliance.

1.5.3 A further output is the $PNEC_{dissolved.}$ This is the Predicted No Effect Concentration (PNEC). This concentration is derived from the ecotoxicological data and site-specific water quality data using M-BAT. The site specific $PNEC_{dissolved}$ can be considered a site specific EQS (expressed as dissolved concentration).

1.5.4 The M-BAT also calculates a site-specific bioavailability factor (BioF). This conversion factor can be used to convert any EQS concentrations generated by HEWRAT into a bioavailable concentration of principally Copper or Zinc. Even when EQS values are exceeded in HEWRAT routine runoff assessments, utilising a site-specific BioF can demonstrate bioavailability of that particular heavy metal is lower than EQS concentration subsequently demonstrating compliance with this parameter.

1.5.5 Background concentrations can also be taken into account for metals when assessing monitoring results against the EQS. During an investigation of an EQS failure consideration should be given to the potential influence of ambient background concentrations (ABC) at the particular site being studied. This ABC would be subtracted from the measurements of dissolved metal concentration to 'refine' the assessment of risk.

1.5.6 The EQS (i.e. annual average concentration) for bioavailable dissolved copper in freshwater is currently 1µg/l. For an outfall to pass, the contribution of bioavailable dissolved copper from the outfall combined with the ABC of bioavailable dissolved copper, must not exceed this EQS.

1.5.7 For Zinc, an outfall passes if the contribution of bioavailable dissolved zinc is less than 10.9µg/l. The assessment methodology does not consider ABC for zinc as an input parameter in HEWRAT.

1.6 Spillage risk assessment

1.6.1 For all roads, there is a risk that a spillage or vehicle fire may lead to an acute pollution incident. Generally, the risk on any road is proportionate to the risk of a Heavy Goods Vehicle (HGV) road traffic collision. As new or improved roads are designed to reduce the collision rate, they should also lead to fewer acute pollution impacts. Where spillages do reach a surface watercourse the pollution impact can be severe, but is usually of short duration, typical of an acute pollution impact.

1.6.2 The spillage risk assessment has been applied to the Proposed Scheme using the methodology set out in DMRB LA 113; this has been designed to calculate spillage risk during the operation of the Proposed Scheme and the associated probability of a serious pollution incident. The method initially estimates the risk that there will be an incident causing the spillage of a potentially polluting substance on the length of road being assessed. It then calculates the risk, assuming a spillage has occurred, that the pollutant will reach and impact on the receiving watercourse. The risks are expressed as annual probabilities of such an event occurring. In accordance with DMRB LA 113, cumulative spillage risk assessments should be undertaken when more than one outfall discharges into the same watercourse.

1.6.3 The risk of a serious pollution incident is deemed within acceptable limits if the Annual Exceedance Probability (AEP) is less than 1% (i.e. a 1 in 100-year return period or greater). Where the spillage is within 1km of a sensitive area the risk of a serious pollutant incident is deemed within acceptable limits if the AEP is less than 0.5% (i.e. a 1 in 200-year return period or greater).

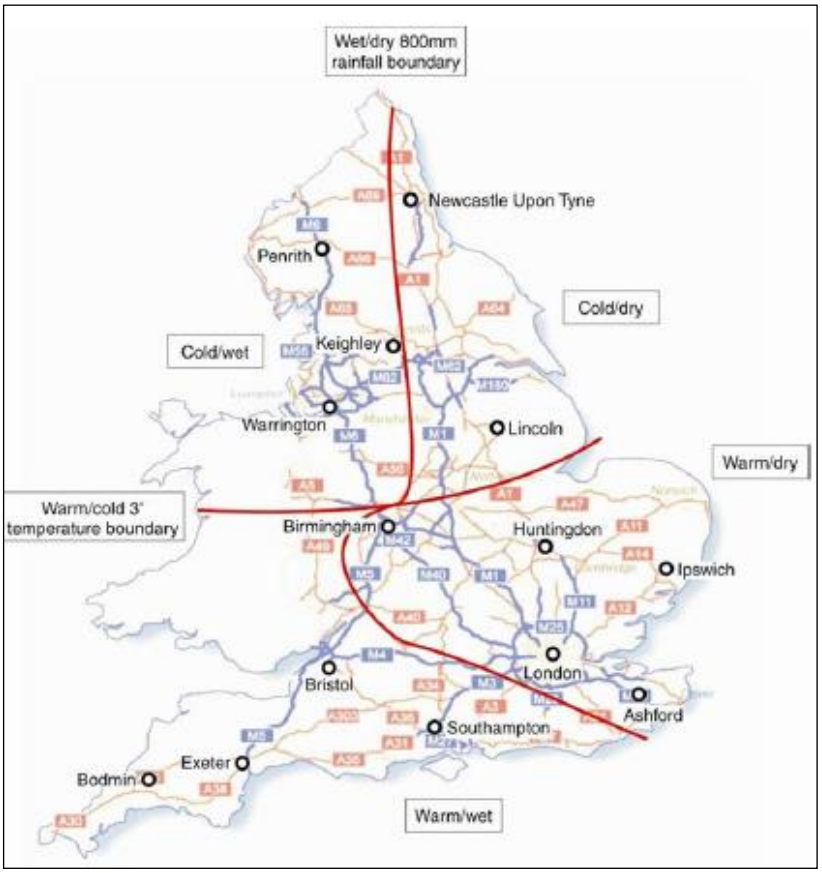
Annex B. Data summary

1.1 HEWRAT - Baseline data for Step 1 (Runoff quality) assessments

1.1.1 Baseline data, site-specific data collected during site surveys, and the most recent proposed drainage design have all been used within the routine runoff and detailed-level M-BAT.

Climatic Region

1.1.2 The scheme lies within the north west of England and the climatic region has been selected as Cold/Wet based upon the figure in the HEWRAT Help guide v2.0 reproduced below.



Rainfall Site

1.1.3 Selected as Keighley (SAAR 1000mm). Based on info on Met Office website[26] data the annual average rainfall (1981-2010) recorded at the Rochdale weather station is 1118.6mm. Using the SAAR based upon the Keighley figure is therefore considered representative of the scheme area.

[26] https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcw2ymd6s

Traffic Data

1.1.4 The assessments have been based upon the baseline year for the existing situation assessments and the design year (2042) of the Proposed Scheme. The traffic flow model has been used to identify the two-way AADT for the length of road discharging to each outfall. By using the highest AADT this provides a worst-case scenario. The methodology requires AADT to be selected based upon bands (i.e. 50,000 – 100,000 or > 100,000); given the accuracy of the traffic model where the AADT from the traffic model is within 5% of the lower limit of the next highest AADT band the higher band has been used. This adoption of a precautionary principal approach has applied to all the assessments undertaken. Table B.1 outlines the AADT bands used in the routine runoff assessment for the existing situation. Table B.2 details the AADT bands used in the routine runoff assessments for the Proposed Scheme based upon the design year.

Table B.1: AADT band used in the routine runoff assessments for existing situation (baseline year)

Drainage catchment/Outfall number	AADT band used in assessment
1	50,000 – 100,000
2	>100,000
4	10,000 – 50,000
5	>100,000
6	>100,000

Table B.2: AADT band used in the routine runoff assessments for Proposed Scheme (design year 2042)

Drainage catchment/Outfall number	AADT band used in assessment
1A	>100,000
1B	>100,000
2	>100,000
4	>100,000
5	>100,000
6	>100,000
7	50,000 – 100,000
1 (1A+1B)	>100,000
4 + 7	>100,000

1.2 HEWRAT - Baseline data for Step 2 (River impacts) assessments

Annual 95%ile river flow (Q_{95})

1.2.1 Q_{95} is the flow that is exceeded 95% of the time and is an indication of low flow. This figure is used within the calculations within HEWRAT as it provides a worst-case scenario for the flow of the receiving water at the time of discharge which influences its dilution capacity.

1.2.2 Within HEWRAT the minimum assessable Q_{95} is 0.0011m^3/s without the watercourse being considered a soakaway. In order for an assessment to be undertaken using

HEWRAT, where the Q_{95} has been calculated as being less than 0.0011m^3/s or is anticipated to be very low due to its location and nature of the discharge this value has been used.

1.2.3 Q_{95} was calculated for the PCF Stage 2 Water Quality Study Report (Highways England, 2020) using the IoH, 1992, Report No. 108 Low flow estimation in the United Kingdom approach and the results are presented in Table B.3. At PCF Stage 3 Q_{95} data has also been obtained from Wallingford HydroSolutions Ltd and this is also presented in Table B.3 and in Annex E.

Table B.3: Q_{95} for each assessment point

Catchment (Receiving watercourse)/Location of Q_{95}	Outfall	Q_{95} used in the assessment (m^3/s)	Description/Data source
Existing Situation			
Un-named tributary of Castle Brook	1	0.0011	Minimum assumed as worst case
Castle Brook	2	0.012	From Low Flow solutions
River Irk	5	0.24065	IoH methodology
Bradley Brook	6	0.00429	IoH methodology
Proposed Scheme			
Castle Brook d/s of confluence	1 (1A+1B)	0.0010	From Low Flow Solutions
Castle Brook	2	0.012	From Low Flow solutions
Parr Brook	4	0.0011	Minimum assumed as worst case
River Irk	5	0.24065	IoH methodology
Bradley Brook	6	0.00429	IoH methodology
Parr Brook	7	0.0011	Minimum assumed as worst case
Parr Brook (d/s where emerges into open channel)	4 & 7	0.014	From Low Flow solutions

Impermeable Road Area Drained

1.2.4 For the existing situation the impermeable road area drained has been provided and calculated for the Proposed Scheme from the proposed drainage design. The impermeable areas for each catchment used in the routine runoff assessments is shown in Table B.4.

Table B.4: Impermeable areas per catchment/outfall for the existing situation Proposed Scheme.

Catchment/outfall number	Impermeable area (ha)
Existing situation	
1	5.29
2	4.6
4	0.7

Catchment/outfall number	Impermeable area (ha)
5	10.39
6	12.63
Proposed Scheme	
1 (1A and 1B)	8.5
2	4.830
4	5.3
5	9.9
6	11.62
7	1.8
4 + 7	7.1

Permeable Road Area

1.2.5 For the assessments of the existing situation the permeable area was assumed to be zero. Permeable road areas have been used in the assessments of the Proposed Scheme. Table B.5 outlines the permeable road areas used in the assessments of the Proposed Scheme.

Table B.5: Permeable road areas

Outfall	Permeable Road Area (ha)
1 (1A and 1B)	6.2
2	1.1
4	3.2
5	3.845
6	3.0
7	1.5
4+7	4.7

Baseflow Index

1.2.6 The BFIHOST value from the FEH webservice obtained for the Q_{95} calculations has been used in the assessments. This is presented in Table B.6. The BFIHOST value is based upon 1km^2 and is considered representative of the assessment location.

Table B.6: Baseflow Index values

Catchment/outfall number	BFI from FEH webservice
1A	0.799
1B	0.799
2	0.799
4	0.721

Catchment/outfall number	BFI from FEH webservice
5	0.597
6	0.721
7	0.721

Protected sites

1.2.7 There are no statutory designated nature conservation sites within 1km downstream of any of the discharge points.

For dissolved zinc only – water hardness

1.2.8 Water samples were taken where possible during the site visit. These were sent for laboratory analysis to establish the hardness of the receiving watercourses. The laboratory results are presented in Annex D.

1.2.9 For Outfall 6 the hardness value was marginally within the High band on HEWRAT for hardness. A precautionary approach has been taken and the medium band has been selected for the assessments. All outfalls in the existing situation and Proposed Scheme assessments are within the 'Medium' band for water hardness.

Step 2 Tier 1 Data for sediment impact only – estimated river width and presence of downstream structures

1.2.10 To assess the impacts relating to sediments river width at Q_{95} is required. Calculating this parameter is not defined in the HEWRAT Help Guide and has been estimated from photographs (in Annex C), measurements taken on site, DDMS and google aerial photos. The data is presented in Table B.7.

1.2.11 It is also necessary to identify whether any in-channel structures have the potential to reduce velocity and thus increase the likelihood of sediments accumulating. This was checked for each identified outfall during the site visit. This data is also presented in the Table B.7 below.

Table B.7: River width and in-channel structures for Step 2 Tier 1 sediment impacts.

Catchment	Is there a structure, lake, pond or canal that reduces velocity within 100m of the point of discharge?	Estimated river width at Q_{95} (m)
Existing Situation		
1	No	0.1
4 (based upon d/s open channel assessment location)	No	0.1
5	No (however note that there is a Weir ca. 130m downstream of outfall)	1.0
6	No	0.5
Proposed Scheme		
1 (d/s on Castle Brook)	No	0.5

Catchment	Is there a structure, lake, pond or canal that reduces velocity within 100m of the point of discharge?	Estimated river width at Q_{95} (m)
2	No	0.5
4	No	0.5
5	No (however note that there is a weir approximately 130m downstream of outfall)	1
6	No	0.5
7	No	0.5
4 + 7 (based upon d/s open channel assessment location)	No	0.5

M-BAT Detailed Level Assessment Data

1.2.12 The input data used in the M-BAT is from chemical analysis of the water samples taken on site in September 2019 and presented in Annex D.

1.2.13 The parameters used in the M-BAT for each outfall are shown in Table B.8.

Table B.8: M-BAT data inputs

Outfall	Cu (ug/l)	Zn (ug/l)	pH	DOC (mg/l)	Ca (mg/l)
1	4.90	10.00	7.30	6.80	54.00
4	2.70	4.60	7.40	10.00	42.00
5	4.00	24.00	7.90	5.70	37.00
6	1.60	15.00	7.80	3.80	62.00

Annex C. Site visit photographs

Existing Outfall 1 (Note: exact location unconfirmed to date)

Plate C1: View of small un-named watercourse along Pike Fold Golf Course southern boundary, looking eastwards. Location of outfall unknown.

Existing Outfall 2

Plate C2: Castle Brook in approximate location of Outfall 2.

Existing Outfall 4

Plate C3: Assumed location of Outfall 4. Looking eastwards towards J18. Outfall assumed to be connected within manhole, with small un-named watercourse also entering manhole from the right (south).

Plate C4: View of un-named watercourse looking northwards towards M60. Manhole location behind tree.

Existing Outfall 5

Plate C5: Existing outfall into the River Irk.

Plate C6: River Irk looking downstream with outfall entering watercourse on right bank (right).

Outfall 6

Plate C7: Existing outfall 6 at top of concrete cascade structure.

Plate C8: View towards Bradley Brook culvert outlet from M60 (looking upstream). Concrete cascade feature enters from the right (left bank) behind fence line.

Plate C9: View of Bradley Brook looking upstream towards M60 culvert outlet (in distance).

Plate C10: View of Bradley Brook looking downstream from M60 culvert outlet.

Annex D. PCF Stage 2 Water Quality Sampling Data

Summary of Chemical Analysis
Water Samples

Our Ref 19-18772
Client Ref 698244CH
Contract Title

Test	Method	LOD	Units	Lab No	1567565	1567566	1567567	1567568	1567569
				Sample ID	Outfall 5	Outfall 6	Outfall 4	Outfall 1	Outfall 3
				Depth					
				Other ID					
				Sample Type	WATER	WATER	WATER	WATER	WATER
				Sampling Date	18/09/19	18/09/19	18/09/19	18/09/19	18/09/19
				Sampling Time	n/s	n/s	n/s	n/s	n/s
Metals									
Calcium, Dissolved	DETSC 2306	0.09	mg/l		37	62	42	54	45
Copper, Dissolved	DETSC 2306	0.4	ug/l		4.0	1.6	2.7	4.9	3.1
Zinc, Dissolved	DETSC 2306	1.3	ug/l		24	15	4.6	10	4.9
Inorganics									
Conductivity	DETSC 2009	1	uS/cm		581	573	504	795	449
pH	DETSC 2008		pH		7.9	7.8	7.4	7.3	7.4
Dissolved Organic Carbon	DETSC 2085	2	mg/l		5.7	3.8	10	6.8	18
Hardness	DETSC 2303	0.1	mg/l		120	202	115	178	128
Suspended Solids	DETSC 2034	5	mg/l		< 5.0	< 5.0	5.0	27	6.0

Annex E. HR Wallingford HydroSolutions Ltd Q_{95} Report (selected pages)

LowFlows Report LF809/22

November 2021

Flow estimates for Castle Brook at NGR: 382836, 406724 & NGR: 382628 407391 Parr Brook at NGR: 381549 406348

LF809/22

Flow estimates for Castle Brook at NGR: 382836, 406724 & NGR: 382628 407391 Parr Brook at NGR: 381549 406348

For and on behalf of Wallingford HydroSolutions Ltd.

Client	Jacobs
Prepared by	Clement Ehall
Approved by	Daniel Hamilton
Position	*Senior Consultant*
Invoice value	£500 (excl. VAT)

The WHS Quality & Environmental Management system is certified as meeting the requirements of ISO 9001:2015 and ISO 14001:2015 providing environmental consultancy (including monitoring and surveying), the development of hydrological software and associated training.

WHS

Registered Office Stables 4, Howbery Business Park, Wallingford, OX10 8BA
www.hydrosolutions.co.uk

Contents

1 Introduction
2 WHS Consultancy Services
3 Derivation of the LowFlows Results
3.1 Catchment Characteristics
3.2 Long Term Natural Flow Statistics
4 LowFlows Results for Castle Brook at NG
4.1 Catchment Characteristics
4.2 Long Term Natural Flow Statistics
5 LowFlows Results for Castle Brook at NG
5.1 Catchment Characteristics
5.2 Long Term Natural Flow Statistics
6 LowFlows Results for Parr Brook at NGR
6.1 Catchment Characteristics
6.2 Long Term Natural Flow Statistics
7 Assumptions
8 Model Uncertainty
9 Consideration for Use
10 Warranty and Liability
Annex 1: Copies of key correspondence with t

WHS www.hydrosolutic

1 Introduction

This report presents the annual and seasonal flow statistics for the site(s) requested using the WHS LowFlows Enterprise model. The site location(s) have been confirmed using a digital map and copies of the correspondence are contained within Annex 1.

The LowFlows software system is the standard software system used by the Environment Agency, Natural Resources Wales, the Scottish Environment Protection Agency and the Northern Ireland Environment Agency for providing estimates of river flows within ungauged catchments. The software and underpinning science have been widely published in the scientific literature. The LowFlows software system is available for purchase as two versions; LowFlows 2 and LowFlows Enterprise.

Section 2 of the report provides an overview of our consultancy services; specifically our hydrometry services for supplementing the flow statistics presented within this report with at site measurements and flood event estimation services. We also provide a range of software products including the Flood Estimation Handbook (FEH).

Section 3 presents the methods for the derivation of catchment characteristics and the annual and monthly flow estimates. Following the results for each site, Sections 5 and 8 present the assumptions and uncertainties within the flow estimates, followed by the consideration for use in section 9 and the warranty and liability in section 10.

2 WHS Consultancy Services

WHS is an independent company founded by the Centre for Ecology and Hydrology to deliver high quality consultancy services and environmental software systems to the water, energy and development sectors. WHS has a team of experienced technical staff including leading UK scientists located in three offices across the UK. We have a proven track record in provision of flood risk, water resources, environmental (including EIA) and field measurement consultancy services across the whole of the UK.

Our field measurement services, range from hydrometric (flow), topographic, ecological and geomorphological surveys through to aquatic habitat mapping. We install and operate flow measurement installations (gauging stations) support of a wide range of activities including hydropower development, water supply, flood risk and research.

WHS is committed to continuously improving company performance and customer satisfaction. We are proud of our ISO 9001 certification for the provision of environmental consultancy services, development of hydrological software and associated training. For further information on all of our services and software, please visit our website www.hydrosolutions.co.uk.

3 Derivation of the LowFlows Results

Section 3.1 presents the methods used to define the catchment characteristics, and section 3.2 provides an overview of the long term annual and monthly flow statistics provided for the site(s). The flow statistic estimates contained in this report have been produced by LowFlows Enterprise[1] using models and relationships that relate these flow statistics to the climatic and hydrological characteristics of the catchment of interest. All flow statistics provided in this report are for natural flows, thus do not contain any artificial influences such as abstractions, discharges or impounding reservoirs.

3.1 Catchment Characteristics

The following catchment characteristics are provided in the results section of this report:

- Catchment Area: The catchment boundary may be derived using either a digital terrain model or an analogue river network based method. The digital method is the default option used in preference to the analogue method but may be misleading or not possible in some areas. The estimation method used to estimate the catchment boundary is identified within the results section for the site(s).
  - The digital method uses a Digital Terrain Model (DTM) to determine the topographic boundaries of the catchment.
  - The analogue method associates grid squares (200 m resolution) to the nearest stretch of river and defines the boundary by selecting grid squares which are assigned to river reaches upstream of the ungauged point.
- Base-Flow Index (BFI): The proportion of a hydrograph occurring as base flow, hence varying between zero and unity. BFI is indicative of catchment permeability with values approaching unity associated with highly permeable systems. BFI is estimated from a revised form of the HOSTBFI multivariate linear regression equation [2].

[1] Young A. R., Grew R. and Holmes M.G.R. 2003. Low Flows 2000: A national water resources assessment and decision support. Water Science and Technology, 48 (10).
[2] Boorman, D.B., Hollis, J.M. and Lilly, A. 1994. Hydrology of Soil Types: a Hydrologically-based Classification of the Soils of the United Kingdom. IH Report 126.

3.2 Long Term Natural Flow Statistics

The following long term flow statistics are provided in the results section of this report.

- Annual Mean Flow (MF): The estimation of Mean Flow is based on a grid of long term average annual runoff developed by the Centre for Ecology and Hydrology (CEH). This was derived using the outputs from a deterministic water balance model using observed data from over 500 gauged catchments[3].
- Mean Monthly Flows (MMF): The MMF for each month are derived from the natural MF estimate by distributing the total average flow volume for the year between the months of this year. This distribution is based upon observed data from hydrologically similar gauged catchments.
- Annual Flow Duration Curve (FDC) statistics: The flow duration curve statistics are estimated using a procedure based on measured flow data from hydrologically similar gauged catchments[4]. This methodology was further updated by WHS in 2009. Flows are provided for the following exceedance percentiles: 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 99.
- Mean Monthly Flow Duration Curves (MFDC): The MFDC for each month is estimated using gauged MFDCs from hydrologically and climatologically similar catchments and the estimate of MMF for that month. The MFDC statistics are presented, by month for the following exceedence percentiles: 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 99.

If these long term natural flow statistics were calculated directly from a gauged flow record the annual statistics would be equivalent to those calculated using all of the daily flow data from all years of record and the monthly statistics for a month equivalent to those calculated from the gauged data for that month from all years.

---

[3] Holmes, M.G.R., Young, A.R., Gustard, A.G. and Grew, R. 2002. A new approach to estimating Mean Flow in the United Kingdom. Hydrology and Earth System Sciences. 6(4) 709-720.
[4] Holmes, M.G.R., Young, A.R., Gustard, A.G. and Grew, R. 2002. A Region of Influence approach to predicting Flow Duration Curves within ungauged catchments. Hydrology and Earth System Sciences. 6(4) 721-731.

4 LowFlows Results for Castle Brook at NGR: 382836, 406724

4.1 Catchment Characteristics

The catchment characteristics and map for this catchment are presented in the table and figure below. The majority of the catchment is underlain by the Pennine Middle Coal Measures Formation consisting of Mudstone, Siltstone and Sandstone, these are sedimentary bedrocks with low permeability. This is overlain by superficial deposits of Peat and Diamicton. As this catchment is below 5km in size, the guidance associated with small catchments in section 9 should be consulted.

Table 4.1 Catchment Characteristics

Basin Details	
Outlet grid reference	382836, 406724
Hydrometric area	69 (Central and South)
Catchment definition method	Digital
Basin area (km²)	1.424
Base-Flow Index	0.80

Figure 4.1 Catchment Boundary (Contains Ordnance Survey data © Crown copyright and database right 2021)

4.2 Long Term Natural Flow Statistics

This section presents the long term natural flow statistics. The table below presents both the monthly mean flows and the annual flow duration statistics. The annual flow duration curve is also presented in the figure below, followed by a table displaying the monthly flow duration statistics.

Table 4.2 Mean Flows and Annual Flow Duration Curve Statistics

Mean Flows	Flow (m³/s)
Annual	**0.023**
January	0.037
February	0.033
March	0.029
April	0.025
May	0.020
June	0.016
July	0.014
August	0.013
September	0.015
October	0.020
November	0.026
December	0.033

Percentile	Flow (m³/s)
5	0.050
10	0.040
20	0.030
30	0.025
40	0.022
50	0.019
60	0.017
70	0.015
75	0.014
80	0.014
90	0.012
95	0.010
98	0.008
99	0.008

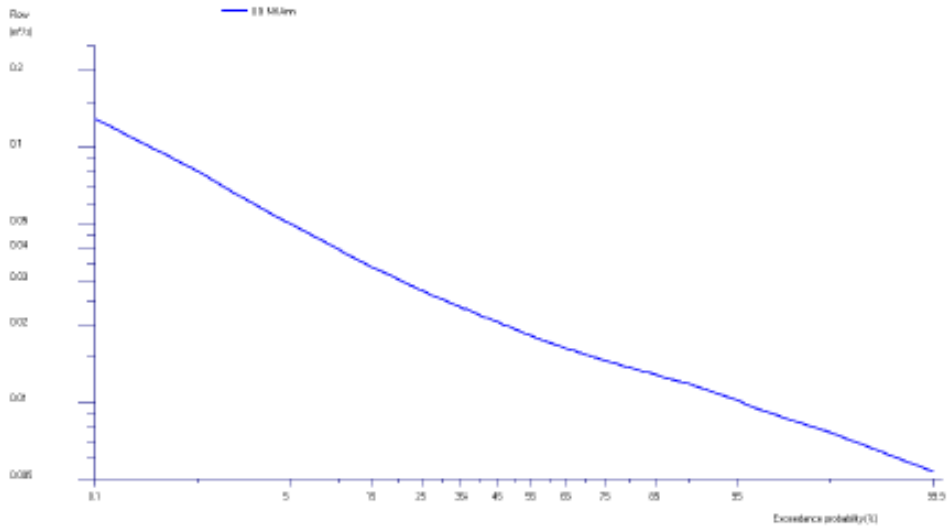


Figure 4.2 Annual Flow Duration Curve

5 LowFlows Results for Castle Brook at NGR: 382628, 407391

5.1 Catchment Characteristics

The catchment characteristics and map for this catchment are presented in the table and figure below. The majority of the catchment is underlain by the Pennine Middle Coal Measures Formation consisting of Mudstone, Siltstone and Sandstone, these are sedimentary bedrocks with low permeability. This is overlain predominantly by superficial deposits of Diamicton, with some Peat, Sand and Gravel deposits present. As this catchment is below 5km in size, the guidance associated with small catchments in section 9 should be consulted.

Table 5.1 Catchment Characteristics

Basin Details	
Outlet grid reference	382628, 407391
Hydrometric area	69 (Central and South)
Catchment definition method	Digital
Basin area (km²)	1.757
Base-Flow Index	0.75

Figure 5.1 Catchment Boundary (Contains Ordnance Survey data © Crown copyright and database right 2021)

5.2 Long Term Natural Flow Statistics

This section presents the long term natural flow statistics. The table below presents both the monthly mean flows and the annual flow duration statistics. The annual flow duration curve is also presented in the figure below, followed by a table displaying the monthly flow duration statistics.

Table 5.2 Mean Flows and Annual Flow Duration Curve Statistics

Mean Flows	Flow (m³/s)	Percentile	Flow (m³/s)
Annual	**0.029**	5	0.062
January	0.045	10	0.049
February	0.040	20	0.037
March	0.036	30	0.031
April	0.031	40	0.027
May	0.024	50	0.024
June	0.020	60	0.021
July	0.017	70	0.019
August	0.016	80	0.017
September	0.018	90	0.015
October	0.025	95	0.012
November	0.033	98	0.010
December	0.041	99	0.009

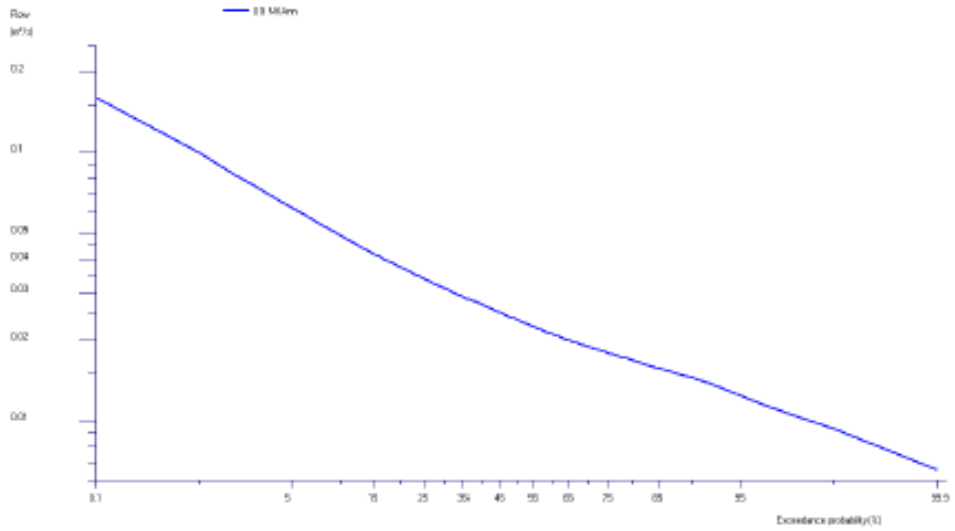


Figure 5.2 Annual Flow Duration Curve

6 LowFlows Results for Parr Brook at NGR: 381549, 406347

6.1 Catchment Characteristics

The catchment characteristics and map for this catchment are presented in the table and figure below. The majority of the catchment is underlain by Mudstone, Siltstone and Sandstone, these are sedimentary bedrocks with low permeability. This is overlain by superficial deposits of Sand, Gravel and Diamicton. As this catchment is below 5km in size, the guidance associated with small catchments in section 9 should be consulted.

Table 6.1 Catchment Characteristics

Basin Details	
Outlet grid reference	381549, 406347
Hydrometric area	69 (Central and South)
Catchment definition method	Digital
Basin area (km²)	1.892
Base-Flow Index	0.78

Figure 6.1 Catchment Boundary (Contains Ordnance Survey data © Crown copyright and database right 2021)

6.2 Long Term Natural Flow Statistics

This section presents the long term natural flow statistics. The table below presents both the monthly mean flows and the annual flow duration statistics. The annual flow duration curve is also presented in the figure below, followed by a table displaying the monthly flow duration statistics.

Table 6.2 Mean Flows and Annual Flow Duration Curve Statistics

Mean Flows	Flow (m³/s)	Percentile	Flow (m³/s)
Annual	**0.033**	5	0.070
January	0.051	10	0.055
February	0.046	20	0.042
March	0.040	30	0.035
April	0.036	40	0.030
May	0.027	50	0.027
June	0.022	60	0.024
July	0.019	70	0.021
August	0.019	80	0.019
September	0.021	90	0.016
October	0.029	95	0.014
November	0.037	98	0.012
December	0.046	99	0.011

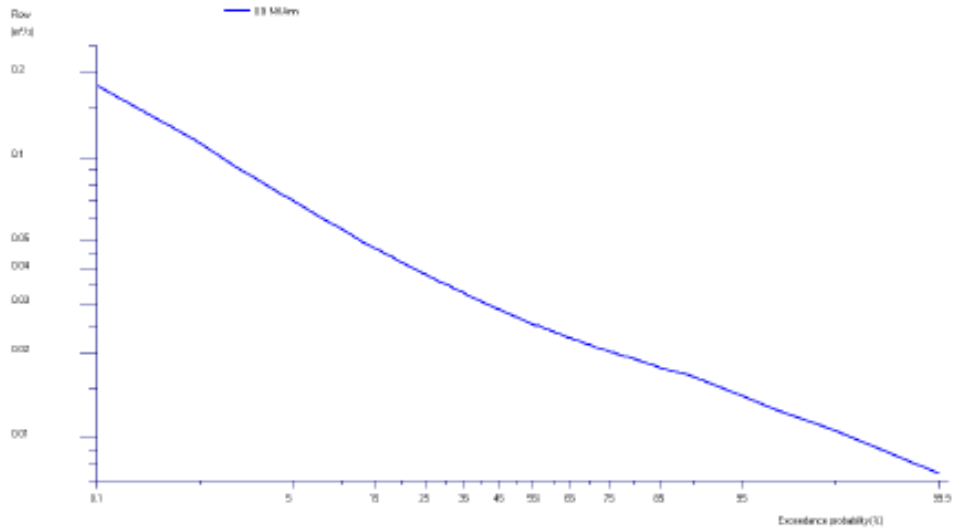


Figure 6.2 Annual Flow Duration Curve

7 Assumptions

Assumptions implicit in the estimated flow estimates are:

- Only natural flow statistics have been estimated and the impact of any artificial influences (for example abstractions, discharges or impounding reservoirs) is not included.
- The topographic catchment area identified is assumed to accurately reflect the true catchment area contributing to flows at the catchment outlet.
- The flow estimates are based on long term average records.

8 Model Uncertainty

The figures for factorial standard error of estimate for long term mean flow and Q95 are shown in Table 8.1. So, as an example the uncertainty in the estimate of mean flow in Scotland will generally be less than 11%. These standard errors are presented as a general guide only and should be considered in the context of the information presented within section 9. These errors are broadly comparable to the sampling errors that might be expected if mean flow was calculated from two to three years of error free gauged data and Q95 for in the order of five years error free gauged data.

If these estimates are to be used for high value decision making we would recommend that the estimates are corroborated through appropriate local flow measurement. For advice on flow measurement please contact us at info@hydrosolutions.co.uk.

Table 8.1 Model Factorial Standard Error (FSE)

Regions of the UK	FSE Mean Flow	FSE Q95
England and Wales	16	42
Scotland	11	35
Northern Ireland	11	30

9 Consideration for Use

The predictive performance of the Mean Flow and FDC Estimation Models may vary according to local conditions. The following is a list of significant, but not comprehensive, issues that need to be considered when estimating flows within ungauged catchments:

- Care needs to be taken when interpreting the results in smaller groundwater catchments in which river flows may be strongly influenced by point geological controls (such as spring lines and swallow holes).
- A catchment water balance is assumed within the LowFlows software; this assumption may be incorrect in smaller groundwater fed catchments where part of the regional groundwater flow bypasses the surface water catchment.
- The estimation of Mean Flow is based on a grid of long term average annual runoff developed by CEH. This was derived using the outputs from a deterministic water balance model using observed data from over 500 gauged catchments. The predictive performance of the model may therefore be reduced in areas of low rainfall gauge density.

- Care needs to be taken when interpreting the result in very small catchments as the size of the catchment approached the spatial resolution of the underlying catchment characteristic datasets within LowFlows (1 km²). For very small catchments it is recommended that the topographic contributing catchment is confirmed by a site walkover to identify any unmapped features that might modify the catchment area.
- Where available local measured flow data should be used to corroborate the LowFlows software estimates. This is good practice when using any generalised hydrological model.

10 Warranty and Liability

1. The assumptions and uncertainties associated with the flow estimation methods must be considered when making use of flow estimates produced by the system.
2. You are responsible for the interpretation of the Results presented within this report and training in the use of the estimation methods is strongly recommended.
3. Subject to 1 and 2 above, WHS do not seek to limit or exclude liability for personal injury or death arising from our negligence.
4. Except for 3 above our entire liability for any breach of our duties, whether or not attributable to our negligence, is limited to the fee that you have paid for this report.
5. Except for 3 and 4 above, in no event will WHS be liable to you for any damages, including lost profits, lost savings or other incidental or consequential damages arising on your use of the results even if we have been advised of the possibility of such damages.
6. Should any of these provisions be ruled invalid under any law or Act of Parliament, they shall be deemed modified or omitted only to the extent necessary to render them valid and the remainder of these provisions shall be upheld.

Appendix 14.3. Groundwater Dependent Terrestrial Ecosystems (GWDTE) Assessment

1.1 Introduction

1.1.1 This appendix follows the UK Technical Advisory Group (UKTAG) guidance (UKTAG, 2005), to identify, prioritise, and assess the impacts of the Proposed Scheme on groundwater dependent terrestrial ecosystems (GWDTE).

1.1.2 This appendix only discusses potential impacts on groundwater levels, flows, and quality that support GWDTE. Potential impacts on the GWDTE itself (i.e., the vegetation and habitats present), are discussed separately in Chapter 9: Biodiversity, using the outcomes of the groundwater assessment presented in this appendix.

1.1.3 Within the groundwater study area there are three types of nature conservation sites that could be impacted because of the Proposed Scheme, during both the construction and operation periods. These nature conservation sites comprise:

- Local Nature Reserves (LNR): a statutory designation in England, made under Section 21 of the National Parks and Access to the Countryside Act (1949) by principal local authorities.
- Sites of Biological Importance (SBI): one of the non-statutory designations used locally by the Greater Manchester Combined Authorities (GMCA) to protect locally valued sites of biological diversity which are described generally as Local Wildlife Sites by the UK Government.
- Habitats of Priority Importance (HPI): a term used in England to identify a list of habitats and species which are of principal importance for the conservation of biodiversity. HPIs arose under the Natural Environment and Rural Communities Act (2006) and replaces Natural England's previous UK Biodiversity Action Plan (BAP) list of priority habitats.

1.1.4 A distance of 250m was chosen as an initial screening buffer for identifying the types of nature conservation sites listed above. As shown on Figure 14.5 of Chapter 14 and summarised in Table 1.1, there are three nature conservation sites that could potentially be impacted because of the Proposed Scheme.

1.1.5 It is possible that any one of these nature conservation sites could form GWDTE. The approach for identifying GWDTE out of the sites listed in Table 1.1, and for assessing potential impacts to the GWDTE during both the construction and operational periods, is provided in Section 1.2.

Table 1.2: Nature Conservation Sites within 250m of the Proposed Scheme that could be Groundwater Dependent

Nature Conservation Site / Designation	Main Habitat (and Site Name)
1No. SBI	Woodland, reedbed, swamp, fen, ponds, and small lodges (Hazlitt Wood)
1No. LNR and 1No. SBI	Woodland, grassland, ponds, and small lodges (Philips Park and North Wood)
1No. LNR and 2No. SBI	Lowland fen, lowland meadow, purple moor grass and rush pasture, grassland, ponds, small lodges, and good quality semi-improved grassland (Hollins Vale and Hollins Plantation)

1.2 Assessment Methodology

Site Identification

1.2.1 A screening assessment has been carried out using the datasets and information listed in paragraph 1.2.6, to identify nature conservation sites that lie within 250m of the Proposed Scheme. This includes:

- Statutory designated sites of international importance, such as Special Areas of Conservation (SAC)
- Statutory designated sites of national importance, such as Sites of Special Scientific Interest (SSSI) and LNR
- Non-statutory designated sites, such as SBI
- Sites that are considered important for ecological conservation but that do not have a statutory or non-statutory designation (i.e. non-designated sites), such as HPI.

1.2.2 The distance of 250m was chosen based on Scottish Environmental Protection Agency guidance (SEPA, 2017), which recommends an initial screening distance of:

- 100m for all excavations less than 1m deep
- 250m for all excavations that are more than 1m deep.

1.2.3 For this assessment, a distance of 250m was chosen as an initial screening buffer, in the absence of any construction information and excavation requirements. It is within this distance that the greatest magnitude of impact would most likely occur, and any subsequent detailed GWDTE assessment would need to consider a wider buffer area for road cuttings that are more than 1m deep (where appropriate).

1.2.4 All ecological conservation sites have been included in the assessment to identify those which could support potential GWDTE. The potential GWDTE may, however, have boundaries that differ from the overlapping statutory/non-statutory site boundaries. But given that this is a preliminary assessment, the term ‘site boundary’ used in this appendix refers to the boundary of the designation/conservation site and not necessarily the GWDTE.

1.2.5 Sites supporting potential GWDTE identified for this assessment are shown on Figure 14.5 of Chapter 14. GWDTE have been colour-coded based on their initial (and highest) groundwater dependency classification, and cross-hatched to highlight their nature conservation designation (if designated).

Desk Study

1.2.6 For each potential GWDTE, topographic, geological, hydrogeological, hydrological, and ecological information was gathered, comprising:

- Ordnance Survey mapping and aerial imagery (Google Earth, 2022)
- Historical maps
- Light detection and ranging (LiDAR) digital terrain model
- Geological maps (1:10,000 and 1:50,000 scale), borehole logs, and permeability index/aquifer properties datasets (where required) available at the British Geological Survey's (BGS's) GeoIndex website (BGS, 2022a) or via an information request
- BGS Susceptibility to Groundwater Flooding mapping (BGS, 2022b)
- Environment Agency data obtained from their website or via an information request (Environment Agency, 2022)
- Statutory and non-statutory designated site boundaries (excluding SBIs), and HPI boundaries, available on Defra's MagicMap application (Defra, 2022)
- Sites of Biological Importance register (GMEU, 2017)
- Ecological information from nature conservation designation descriptions or from planning application documents comprising baseline ecological surveys that are freely available online
- National soils mapping (Cranfield University, 2022)
- Coal Authority data obtained from their Interactive Map Viewer (Coal Authority, 2022).

Conceptual Site Model

1.2.7 The initial groundwater dependency ratings used for the Proposed Scheme, can be split into the following categorisations:

- Not groundwater dependent
- Low groundwater dependency
- Low to moderate groundwater dependency
- Moderate groundwater dependency
- High to moderate groundwater dependency
- High groundwater dependency

1.2.8 The assessment has been based on the results of historical Phase 1 habitat surveys[27] undertaken for previous developments and provided in planning applications on local authority websites.

[27] Jacobs UK Ltd. has also carried out an extended UK Habitat Classification (UKHab) survey within 500m of the Proposed Scheme. The results from this survey have not been included in the initial identification of potential GWDTE. This is due to their absence of ecological designation and the corresponding lower receptor value. The PEIR therefore focusses on those GWDTE with a statutory or non-statutory ecological designation. The results of the UKHab survey will, however, be considered for the

1.2.9 Where no historical Phase 1 habitat survey information is available, the above initial classification has been based on the site-specific information gathered through desk study, adjusting the degree of groundwater dependency as required. Following this, all the information about each potential GWDTE has been synthesised into a conceptual site model (CSM).

1.2.10 For each site, the CSM describes conceptually the relative importance of sources of water supporting the GWDTE identified, conceptual supply mechanisms, conceptual water flows, levels and quality, and the main physical factors determining these. For larger sites, with areas of varying groundwater dependency, they have been divided into sub-zones to facilitate the assessment of the hydro-ecological functioning of the site.

1.2.11 Plates 1.1 to 1.3 in Section 1.3 show conceptualised cross-sections through each of the three potential GWDTE. The CSM diagrams highlight the indicative movement of groundwater and surface water through the site, and initial groundwater dependencies supporting vegetation and habitats present.

Defining Value

1.2.12 The prioritisation of sites is reflected in the determination of the value of each GWDTE. As per UKTAG guidance[28] (UKTAG, 2005), the value attribution is a combination of nature conservation designation and the degree of groundwater dependency determined in the CSM.

1.2.13 The value of the potential GWDTE is defined in Table 14.20 of Chapter 14: Road Drainage and Water Environment, with a summary given below:

- **Very High:** Statutory designated sites of international importance (such as SAC), that are dependent on groundwater.
- **High:** Groundwater supporting nationally designated sites (such as SSSI), or non-statutory locally designated sites of nature conservation (such as SBI), with a high or moderate groundwater dependency.
- **Medium:** Groundwater supporting nationally designated sites (such as SSSI), or non-statutory locally designated sites of nature conservation (such as SBI), with a low groundwater dependency. Or, groundwater supporting non-designated sites (such as HPI), with a moderate or high groundwater dependency.
- **Low:** Groundwater supporting non-designated sites (such as HPI), with a low groundwater dependency.

Environmental Statement, both for the designated sites discussed within this report, and generally across the Proposed Scheme, which will potentially add additional GWDTE needing to be assessed.

[28] The value classifications outlined in Chapter 14 of this PEIR and listed above for Groundwater Dependent Terrestrial Ecosystems (GWDTE), are based on the Water Framework Directive; and align with the UK Technical Advisory Group (UKTAG) guidance. The UKTAG guidance brings together the degree of groundwater dependency (low, moderate, and high), and the level of ecological designation / protection of a site, to determine the overall importance of each potential GWDTE. This deviates from the value (importance) definitions proposed in Table 3.70 of LA 113.

Assessment of Magnitude of Change to GWDTE

1.2.14 The CSM is used to assess potential changes in groundwater levels, flows, and quality, which could impact on the GWDTE because of the Proposed Scheme.

1.2.15 The assessment of potential changes was made considering the type of development (i.e., cutting, embankment, gantry etc.), and the assumption that standard practice design measures and embedded mitigation would be adopted.

1.2.16 The magnitude of change is assessed based on the criteria set out in Chapter 14 of this PEIR. The resultant potential significance of effect is based on combining the value of the GWDTE and the magnitude of change).

Assumptions, Limitations and Data Gaps

1.2.17 Specific to the GWDTE assessment, it has been assumed that only HPI classified as wetlands (i.e., those including swamp, marsh, bog, and/or fen habitats) would support potential GWDTE, and that HPI such as dry broadleaved deciduous woodlands etc. can be excluded from the assessment.

1.2.18 Whilst this appendix provides an initial assessment of GWDTE and their associated impacts, limitations and data gaps remain in the assessment, including, but not limited to the following:

- Potential GWDTE that lie outside of the 250m buffer, that could potentially be impacted by dewatering from the deepest cuttings/excavations, have not been assessed and would need to be considered as part of the Environmental Statement, subject to the outcomes of Ground Investigation (GI) data, ecology data and design development.
- No hydrogeological site walkovers have been carried out to confirm the presence of groundwater features at potential GWDTE.
- The results of the UKHab survey undertaken for the Proposed Scheme have not been included in the initial identification of potential GWDTE, nor in the ecological descriptions provided in Section 1.3. This is primarily due to the absence of ecological designation and the corresponding lower receptor value. Current habitat and vegetation information is therefore limited to descriptions provided in designation sheets, or Phase 1 habitat survey data published online, for example due to historical developments that required ecological baseline surveys to support planning applications. The results of the UKHab survey will, however, be considered for the Environmental Statement, both for the designated sites discussed within this report, and generally across the Proposed Scheme, for any potential additional GWDTE needing to be assessed.
- GI information is limited to what is published in borehole logs on the BGS GeoIndex website.
- Groundwater level information is limited to groundwater strikes and seeps recorded in borehole logs provided by the BGS, and no long-term groundwater monitoring data are available for the assessment.

1.2.19 The general assumptions, limitations and data gaps relating to the groundwater environment, and that are listed in Section 14.5 of Chapter 14: Road Drainage and the Water Environment, also apply to this appendix.

1.3 Site Specific GWDTE Assessments

Hazlitt Wood SBI

Site Setting, Topography and Hydrological Catchment

1.3.1 Hazlitt Wood SBI forms a narrow valley in the north of Heaton Park, situated immediately south-west of the existing M60 carriageway.

1.3.2 An unnamed Ordinary Watercourse issues in the north-west corner of the site. A second unnamed Ordinary Watercourse issues 100m north. Both watercourses flow south-east, in and out of culvert through the centre of the site, and merge upstream of Hazlitt Pond. The merged watercourse then outflows from Hazlitt Pond, flows southwards, and exits the site via its southern boundary, where it discharges into Blackfish Pond.

1.3.3 The elevation of the site ranges from 100m above ordnance datum (AOD) in the north-east, at the head of the valley, to around 75mAOD in the south-east corner, where the watercourse exits the site. Ground to the east and west reaches approximately 100mAOD. This marks the limit of the hydrological catchment which stretches 180m east, and 250m west. The embankment for the existing M60 carriageway likely limits the extent of the surface water catchment to the north, although the groundwater catchment could extend beyond this.

Soils and Geology

1.3.4 There are no historical borehole records located within the site itself. A series of boreholes were drilled to the north of the site for the existing M60 carriageway, one of the deepest of which was drilled approximately 25m north (SD80NW701). A single borehole was also drilled 35m east of the site (SD80NW19) (BGS, 2022a). Relevant information extracted from these two borehole records is provided in Table 1.2.

1.3.5 Soils at the site are described as freely draining slightly acid sandy soils (Cranfield University, 2022). Two distinct layers of made ground were encountered in one of the borehole records provided in Table 1.2 (SD80NW701), to depths of 1.20mbgl and 3.40mbgl, and likely associated with the existing M60 carriageway. The made ground comprised a slightly clayey gravelly sand layer overlying a sandy slightly gravelly clay.

1.3.6 The superficial geology comprises head deposits of clay, silt, sand, and gravel across most of the site (BGS, 2022a). Hummocky glacial deposits of sand and gravel are shown on geological maps located on the outskirts of the site, on high ground, mainly in the west and north.

1.3.7 This is consistent with the lithology recorded in the borehole record to the north of the site (SD80NW701), where a slightly clayey gravelly sand was found to overlie a slightly sandy slightly gravelly clay layer. The borehole record to the east of the site (SD80NW19) recorded the base of the superficial deposits as 43.56mbgl.

1.3.8 Bedrock at the site is the Chester Formation, comprising sandstone (BGS, 2022a). The borehole record 35m east of the site (SD80NW19) describes the bedrock as a soft red sandstone, with alternating units of hard red sandstone and red marl (see Table 1.2).

Table 1.2: Borehole Records for Hazlitt Wood SBI

Borehole ID	Top (mbgl)	Base (mbgl)	Lithology Description	Groundwater Strike (mbgl)
SD80NW701	0.00	1.20	Grass over dark brown slightly clayey gravelly sand (made ground)	Not recorded*
	1.20	3.40	Stiff dark brown sandy slightly gravelly clay (made ground)	
	3.40	3.80	Brown slightly clayey slightly gravelly sand	
	3.80	4.10	Stiff dark brown slightly sandy slightly gravelly clay	
SD80NW19	0.00	43.56	Alternating layers of sand, sandy clay, sand and gravel and gravelly clay	Not recorded*
	43.56	>150.00	Alternating units of soft and hard red sandstone with marl bands (tens of metres thick)	
**Not recorded refers to there being no reference to groundwater on the borehole log, not that groundwater was not encountered*				

Groundwater

1.3.9 There are no Environment Agency or BGS groundwater monitoring locations available in close proximity to the site. There are also no historical borehole records located within the site itself to provide an indication of groundwater seeps, strikes, or rest water levels.

1.3.10 Several trial pits were dug to a depth of 3.00mbgl to the north of the site for the existing M60 carriageway, which all remained dry. The nearest borehole (SD80NW245), which recorded a groundwater strike at the time of drilling, lies 25m north-east of the site, and recorded groundwater at a depth of 14.55mbgl.

1.3.11 Except for the far south-east corner of the site, the BGS susceptibility to groundwater flooding dataset classifies Hazlitt Wood SBI as having limited potential for groundwater flooding to occur (BGS, 2022b). The south-east corner of the site is classified as having either potential for groundwater flooding of property situated below ground level, or potential for groundwater flooding to occur at surface level.

1.3.12 There are no springs, sinks, sources, collects, or spreads shown within the site boundary or its immediate vicinity. However, Ordnance Survey maps show a well (referred to as ‘Hazlitt Wood West’) on Figure 14.5 and in Table 14.16 in Chapter 14: Road Drainage and the Water Environment), located 20m north-west. This could indicate the presence of a Private Water Supply (PWS), and potentially shallow groundwater levels in this location. However, this would need to be confirmed for the Environmental Statement, with a questionnaire sent to surrounding local residents and a PWS survey carried out (where appropriate).

Habitats and Vegetation

1.3.13 No habitat surveys have been carried out for the site.

1.3.14 Hazlitt Wood was designated a SBI based on the following key features; woodland, reedbed, swamp, fen, ponds and small lodges, and aquatic invertebrates (GMEU, 2017).

1.3.15 Three separate areas in the south of the site are also classified as HPI, where the main habitats comprise lowland fen (described as swamp, fen and flushes). These areas are confined to the western spur of the site, and two narrow corridors, surrounding the path of the merged unnamed Ordinary Watercourse in the south, before it discharges into Blackfish Pond.

Initial Conceptual Site Model

1.3.16 Plate 1.1 shows a conceptualised cross-section running north-west to south-east through the centre of the site. The CSM highlights the indicative movement of groundwater and surface water through the site, and initial groundwater dependencies supporting vegetation and habitats present.

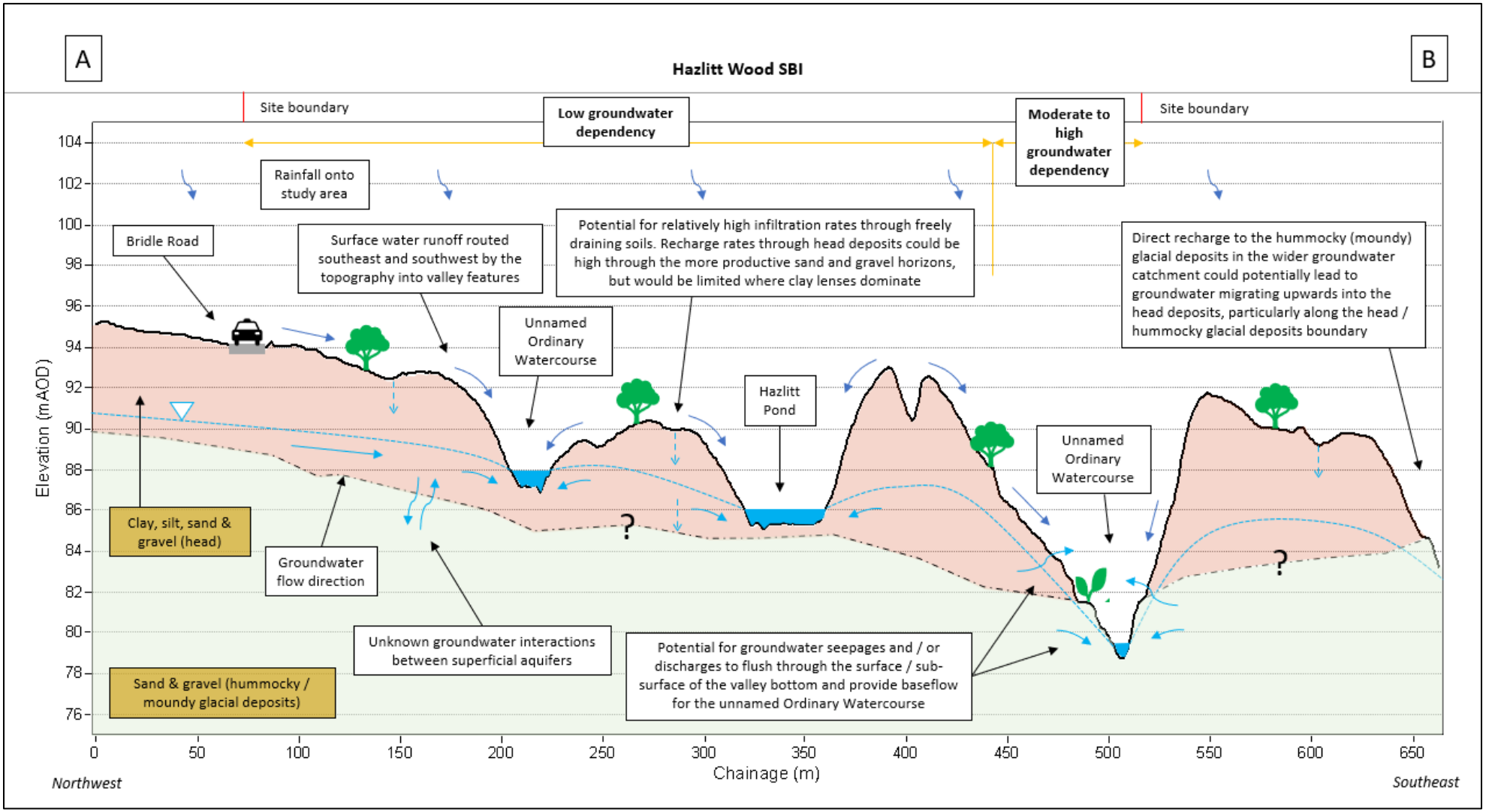
1.3.17 GWDTEs could be present within the site and would most likely be located in the areas of fen, swamp, and flushes described above. These habitats are shown to be located in the far west of the site, as well as in the south-east, the latter of which, forms a narrow, steep sided valley.

1.3.18 In these locations, the likely limited thickness of head deposits and the potential for groundwater seepages to flush through the surface / sub-surface of the valley areas surrounding the unnamed Ordinary Watercourses, correlates well with the presence of the above-mentioned wetland habitats and the areas of highest groundwater flooding susceptibility. The 'Hazlitt Wood West' well located 20m north-west could also be indicative of shallow groundwater emergence. The western spur, and the south-eastern parts of the site, are therefore classified with a **moderate to high groundwater dependency**.

1.3.19 However, as indicated by borehole records located to the north of the site, and the absence of springs, sinks, sources etc. within the site boundary, the groundwater table is generally not expected to be close to the ground surface throughout the remainder of the site. For this reason, most of the site is classified as having a **low groundwater dependency**.

1.3.20 Figure 14.5 of Chapter 14 shows the highest initial groundwater dependency classification for the GWDTE. Given the presence of the SBI designation, according to Table 14.17 of Chapter 14: Road Drainage and Water Environment, the value of the GWDTE is medium to high. The variation is due to the groundwater dependency of specific areas within the site, which will be confirmed and refined at the Environmental Statement stage.

Plate 1.1: Initial Conceptual Site Model for Hazlitt Wood SBI



Assessment of Effects

1.3.21 The northern boundary of the site lies immediately adjacent to, and downgradient of the provisional Order Limits associated with the M60 south of M60 J18 (see Figure 14.5 of Chapter 14). The nearest proposed cutting (south of M60 J18) is located more than 230m north, while the nearest embankment and gantry[29] lie 700m north/north-west. A proposed attenuation pond is, however, located 15m north of the site.

Construction

1.3.22 The site lies outside of the estimated dewatering zone of influence for the nearest proposed cutting. No cutting-related dewatering impacts on groundwater flows, levels or quality at the site are therefore predicted (see Table 1.3).

1.3.23 During construction, there could be short-term disturbances to groundwater flows at the GWDTE, because of soil stripping and vegetation clearance (assumed to take place up to a maximum of 1m depth, within the entire footprint of the provisional Order Limits), earthworks (including piling) and excavations required for the construction of the proposed attenuation pond[30], temporary haul roads, laydown areas/compounds, gantries and embankments, as well as due to changes in recharge rates from an increase in impermeable surface areas. Given that the provisional Order Limits are situated directly adjacent to the northern boundary of the site, impacts to groundwater flows and levels would be direct. This may result in effects with a potential large significance in the north of the site. Impacts with a moderate magnitude would likely propagate downgradient through the centre of the site, resulting in a potential moderate significance of effect. No impacts are expected throughout the remainder of the site. Similarly, negligible or no impacts are predicted to the GWDTE from the construction of the proposed cuttings, embankments or gantries, given their distance from the site.

1.3.24 The activities listed in paragraph 1.3.23 could also lead to changes in groundwater quality, due to mobilisation of suspended solids and associated solutes, leaks and spills of fuels and chemicals, and the creation of vertical pathways for contaminated groundwater (or mixing of different groundwater chemistries). As described in Chapter 14: Road Drainage and the Water Environment, there are several best-practice mitigation measures contained within the Environmental Mitigation Plan (EMP) for pollution prevention including managing silt pollution (for suspended solids transport). These measures only reduce the likelihood of contaminating groundwater, and do not affect the severity or consequence of an event occurring. Considering best-practice mitigation measures, and the fact that the nearest proposed works item comprises soil stripping to a maximum depth of 1m along the northern site boundary, the magnitude of change on existing groundwater quality in the north of the site is expected to be moderate. Contaminants could directly enter shallow groundwater from the works area in the north of the site, which would result in a moderate significance of effect in this location. Downgradient, and in the centre of the site, minor magnitude impacts are

[29] Only proposed new gantries or removed gantries are considered in the GWDTE impact assessment. Proposed retained gantries are scoped out, on the basis that there is no change expected to the baseline groundwater environment because of this part of the Proposed Scheme.

[30] At the time of writing, the outline drainage strategy for this PEIR stage does not include details regarding finished ground levels, because of earthworks required prior to excavating the proposed attenuation ponds. Impacts from these potential earthworks and excavations will be assessed at Environmental Statement stage following receipt of GI data and additional drainage design information.

expected, resulting in a slight significance of effect. No impacts to groundwater quality are expected throughout the remainder of the site.

Operation

1.3.25 The proposed attenuation pond has the potential to locally alter groundwater levels and flows supporting GWDTE in the north of the site. Minor magnitude impacts are expected on the basis that the proposed attenuation pond could disrupt groundwater flows from the north, but not the wider groundwater inputs from the east and west. This may result in effects with a potential slight significance in the north of the site. There are no other permanent below ground structures or embankments proposed within the vicinity of the site to impact groundwater levels and flows at the site. Any long-term changes in recharge rates as a result of increased impermeable surface areas are expected to be of negligible magnitude, and therefore potential neutral significance.

1.3.26 Considering the distance of the Proposed Scheme from the GWDTE, any accidental leaks/spills of fuels and chemicals and/or routine runoff associated with the road are also expected to be negligible, resulting in a potential neutral significance of effect.

Summary

1.3.27 A summary of the potential impacts to the site is provided in Table 1.3.

Table 1.3: Summary of Potential Effects to Hazlitt Wood SBI

Groundwater Dependency	Ecological Designation	Value	Effect	Phase	Highest Magnitude of Impact*	Highest Significance of Effect
Low to high	SBI	Medium to high	Accidental leaks / spills of fuels and chemicals (groundwater quality)	Construction	Moderate	Moderate
			Mobilisation of suspended solids (groundwater quality)	Construction	Moderate	Moderate
			Creation of vertical pathways for contaminated groundwater in short-term, or mixing of different groundwater chemistries (groundwater quality)	Construction	Negligible	Neutral
			Short-term disturbance of groundwater flows (groundwater levels / flows)	Construction	Major	Large
			Cutting dewatering (groundwater levels / flows / quality)	Construction	No impact	N/A
			Short and / or long-term changes in recharge rates (groundwater levels / flows)	Construction / Operation	Negligible	Neutral
			Groundwater contamination from routine runoff, or accidental leaks / spills (groundwater quality)	Operation	Negligible	Neutral
			Ground settlement in superficial deposits (groundwater levels / flows)	Operation	No impact	N/A
			Long-term disturbance of groundwater flows (groundwater levels / flows)	Operation	Minor	Slight
			Intercepted contaminated groundwater in long-term, or mixing of different groundwater chemistries (groundwater quality)	Operation	Negligible	Neutral

* *There is a range in potential impact magnitudes for certain effects, due to the size of the GWDTE and the proximity of areas to the works footprint. This table summarises the worst case, i.e., the highest magnitude of impact, and therefore the highest significance of effect, which will ultimately guide the need for potential additional mitigation.*

Hollins Vale LNR, SBI, and Hollins Plantation SBI

Site Setting, Topography and Hydrological Catchment

1.3.28 Most of the area shown as Hollins Vale on Ordnance Survey maps is designated a LNR. Two discrete areas within the LNR are also designated as SBIs. This includes the north of the LNR, which comprises Hollins Vale SBI, and the south-east of the LNR, which forms Hollins Plantation SBI. The largest extents of both the LNR and the two SBIs are used for this assessment and are referred to generally as "the site", unless specified otherwise.

1.3.29 The south of the LNR and Hollins Plantation SBI are situated in an area of relatively high ground to the west of the M66. The elevation in this part of the site ranges from 105mAOD in the south and south-east, to 90mAOD further north. The north of the site, which also forms Hollins Vale SBI, comprises a narrow valley through which Hollins Brook Main River flows west towards the River Roch (also designated Main River status), and the elevation drops to around 75mAOD. North of Hollins Brook lies a lodge, shown by Ordnance Survey maps to be hydrologically connected to Hollins Brook, which spans most of the width of the site. Further north, and higher up the valley side, the elevation increases to around 85mAOD along the northern boundary of Hollins Vale LNR and SBI.

1.3.30 The southern boundary of the site (Hollins Vale LNR and Hollins Plantation SBI) lies at a topographic divide. This marks the boundary between two hydrological catchments; that for Hollins Brook in the north of the site, and that for Parr Brook Main River, which flows 380m to the south. Much of the site itself therefore forms the hydrological catchment for Hollins Brook. The catchment is also likely to be limited to the east by the highway embankment for the M66.

1.3.31 A spring is shown on historical maps along the southern boundary of the LNR, north of Haweswater Crescent (referred to as 'Hollins Vale South' on Figure 14.5 and in Table 14.14 in Chapter 14: Road Drainage and the Water Environment). An unnamed Ordinary Watercourse is also shown to "issue" in the south of Hollins Plantation SBI, and flows north-east, where it enters culvert underneath the existing M66 carriageway.

Soils and Geology

1.3.32 Twelve borehole records are available for the site (BGS, 2022a) and are confined to the north and east (Hollins Vale SBI). Relevant information extracted from two of these borehole records (SD80NW217 and SD80NW453; considered representative of the geology in this location) is provided in Table 1.4.

1.3.33 A borehole was also drilled just outside of the site boundary in the north-west (SD80NW237). This borehole encountered bedrock, unlike the boreholes within the north and east of the site. Information has also been extracted from this borehole record (see Table 1.4).

1.3.34 Soils in the western half of the site are described as naturally wet, very acid sandy and loamy soils (Cranfield University, 2022). In the east, slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage dominate. The borehole record located just north-west of the site boundary (SD80NW237) encountered made ground to a depth of 5.60mbgl, comprising a soft grey sandy clay. The made ground deposits appear to be associated with the lodges situated throughout the north of the site.

1.3.35 Superficial geology across most of the site (in the south, centre, and far north) is hummocky glacial deposits (sand and gravel) (BGS, 2022a). Head deposits, overlain by

alluvium in parts, both comprising clay, silt, sand and gravel, are shown to be present in the north of the site, across a large proportion of the area designated an SBI. Table 1.4 shows that generally, alternating layers of clay and sand with varying thicknesses were recorded in boreholes in the north-west and east of the site. Given that head, alluvium, and glacial deposits typically comprise varying lithologies, it is unclear if these borehole records correlate with published geological mapping. Landslide deposits have also been recorded in the north-east of the site, to the south of Hollins Brook (BGS, 2022a).

1.3.36 Bedrock at the site can be broadly split into three regions (BGS, 2022a). Most of the site is underlain by the Pennine Lower Coal Measures Formation, comprising mudstone, siltstone and sandstone. A unit of sandstone, belonging to the Trencherbone Rock member, underlies the north-west of the site. This member forms part of the Pennine Lower Coal Measures Formation. The Pennine Lower Coal Measures and Trencherbone Rock is inferred to be fault bounded across the site (see paragraph 1.3.38). Bedrock in the far south of the site is the Pennine Middle Coal Measures Formation, comprising mudstone, siltstone and sandstone.

1.3.37 Bedrock was encountered in the borehole located just outside of the site boundary, in the north-west (SD80NW237). This was described as a highly weathered purple/grey mudstone. Published geological mapping, however, shows this area to be underlain by a sandstone unit belonging to the Trencherbone Rock member (BGS, 2022a).

1.3.38 The bedrock at the site has undergone significant structural deformation. One fault bisects the site at its centre, trending east-west, and marks the southern extent of the Trencherbone Rock sandstone member (BGS, 2021a). Further north, two north-west-south-east trending faults cut across the site. The northernmost fault marks the boundary between the Trencherbone Rock member and the Pennine Lower Coal Measures.

Table 1.4: Borehole Records for Hollins Vale LNR

Borehole ID	Top (mbgl)	Base (mbgl)	Lithology Description	Groundwater Strike (mbgl)
SD80NW217	0.00	0.30	Topsoil	Seep at 2.40. Standing water level was 5.40 after 20 minutes
	0.30	2.40	Firm brown and grey mottled very silty sandy clay with sand bands	
	2.40	3.10	Medium dense brown fine silty sand	
	3.10	5.50	Firm grey brown very silty clay with fine gravel	
	5.50	7.00	Dense brown silty sand with fine and medium gravel	
SD80NW453	0.00	0.20	Topsoil	Not encountered. Wet sand below 8.00
	0.20	2.80	Stiff dark brown clay with occasional roots and mottling to 1.00mbgl	
	2.80	12.00	Loose slightly clayey silty sand with occasional gravel and silt bands	
SD80NW237	0.00	5.60	Soft grey sandy clay (made ground)	Seep at 14.40. Standing water level was 13.90 after 15 hours
	5.60	5.80	Brown sand	
	5.80	8.40	Firm grey brown very silty clay with some laminations and sand bands	
	5.80	10.10	Stiff brown very silty friable clay with some gravel	
	10.10	14.20	Stiff grey brown sandy gravelly clay with cobbles	

Borehole ID	Top (mbgl)	Base (mbgl)	Lithology Description	Groundwater Strike (mbgl)
	14.20	19.80	Highly weathered purple/grey mudstone	

Groundwater

1.3.39 There are no Environment Agency or BGS groundwater monitoring locations available in close proximity to the site. Groundwater level information for the twelve historical borehole records located within the site, and single historical borehole record located just north-west of the site boundary, is provided in Table 1.5.

1.3.40 The BGS susceptibility to groundwater flooding dataset classifies the southern half of the site (including Hollins Plantation SBI) as having limited potential for groundwater flooding to occur (BGS, 2022b). The north of the site, however, is classified as either having potential for groundwater flooding to occur at surface level, or as having potential for groundwater flooding of property situated below ground level. The area with the highest susceptibility to groundwater flooding is in the valley bottom, where Hollins Brook is located.

1.3.41 Groundwater was encountered in seven out of the eight boreholes drilled in the north-west of the site, including the single borehole located just outside of the site boundary (SD80NW237). Groundwater seeps were encountered at depths of between 2.40mbgl (SD80NW217) and 14.40mbgl (SD80NW237). Groundwater strikes were recorded at depths ranging from 4.80mbgl (SD80NW219) to 10.00mbgl (SD80NW238). One borehole remained dry at the time of drilling, to a depth of 9.00mbgl (SD80NW239).

1.3.42 In the east and north-east of the site, groundwater was only encountered in one out of the five borehole records, but at the shallow depth of 0.50mbgl (SD80NW454). All other boreholes were dry at the time of drilling. The groundwater table was therefore more than 3.00mbgl (SD80NW450) and 12.00mbgl (SD80NW453), depending on the exact location of the borehole.

Table 1.5: Groundwater Level Information Extracted from Borehole Records for Hollins Vale LNR

Borehole ID	Groundwater Level Information	Date
SD80NW215	Seep at 5.30mbgl	02/12/1980
SD80NW216	Seep at 3.40mbgl	02/12/1980 – 03/12/1980
SD80NW217	Seep at 2.40mbgl and 5.80mbgl. Standing water level was 5.40mbgl after 20 minutes. A piezometer was installed in the borehole, which recorded a water level of 1.90mbgl on 4/12/1980	03/12/1980
SD80NW218	Strike at 5.00mbgl. Standing water level was 4.60mbgl after 20 minutes	3/12/1980
SD80NW219	Strike at 4.80mbgl. Standing water level was 2.50mbgl after 1 hour	4/12/1980
SD80NW237	Seep at 14.40mbgl. No rise after 1 hour but standing water level was 13.90mbgl after 15 hours	10/11/1980
SD80NW238	Strike at 10.00mbgl. Standing water level was 8.20mbgl after 20 minutes	7/12/1980 – 9/12/1980
SD80NW239	Not encountered (borehole terminated at 9.00mbgl)	6/10/1980
SD80NW454	Strike at 0.50mbgl with no rise after 20 minutes	1/2/1995
SD80NW453	Not encountered (borehole terminated at 12.00mbgl) – sand was wet below 8.00mbgl but no temporary standing water level present	31/1/1995

Borehole ID	Groundwater Level Information	Date
SD80NW452	Not encountered (borehole terminated at 3.50mbgl)	1/2/1995
SD80NW451	Not encountered (borehole terminated at 4.00mbgl)	2/2/1995
SD80NW450	Not encountered (borehole terminated at 3.00mbgl)	2/2/1995

1.3.43 Ordnance Survey maps show the 'Hollins Vale South' spring located along the southern site boundary, indicative of shallow groundwater levels in this location. An "issue" is also shown in the south-east of the site, along with a well in the north-west (referred to as the 'Hollins Vale North' well on Figure 14.5 and in Table 14.14 in Chapter 14: Road Drainage and the Water Environment), also potentially indicative of shallow groundwater emergence in these areas.

Habitats and Vegetation

1.3.44 Most of Hollins Vale LNR (south and central parts) is grazing land with relatively low ecological interest (Bury Metropolitan Borough Council, 2003). Other habitats, however, include marginal habitats adjacent to Hollins Brook, old woodland, old and new hedgerows, bramble and gorse scrub, and more recently planted woodland.

1.3.45 Hollins Plantation SBI, in the south-east of the site, comprises approximately 2 hectares of old woodland, with the oldest trees planted between 1848 and 1893, on the slopes of a tributary of Hollins Brook. The large willows (many of which are now dead or dying), pre-date the oaks that now characterise the plantation.

1.3.46 In the north of the site, which forms Hollins Vale SBI, the most diverse flora occurs where water springs from the steep scarp forming a boggy flush. This habitat is described in the LNR designation as a wet meadow (Natural England, 2019).

1.3.47 Approximately half of Hollins Vale SBI is also listed as an HPI, where the main habitat comprises lowland fen, swamp and flushes (Natural England, 2022), which coincides with the areas of "boggy flush" described above. There are also several canal-like lodges in this part of the site. The SBI designation in this area is primarily due to the diversity of waterside plants.

1.3.48 Whilst there is no mention of groundwater dependent vegetation in the grassland habitat that exists throughout most of the LNR, GWDTE are anticipated to be present in the north of the site. However, NVC mapping would be required to identify the exact extent of fen, swamp and flush.

Initial Conceptual Site Model

1.3.49 Plate 1.2 shows a conceptualised cross-section running south-west to north-east through the centre of the site. The CSM highlights the indicative movement of groundwater and surface water through the site, and initial groundwater dependencies supporting vegetation and habitats present.

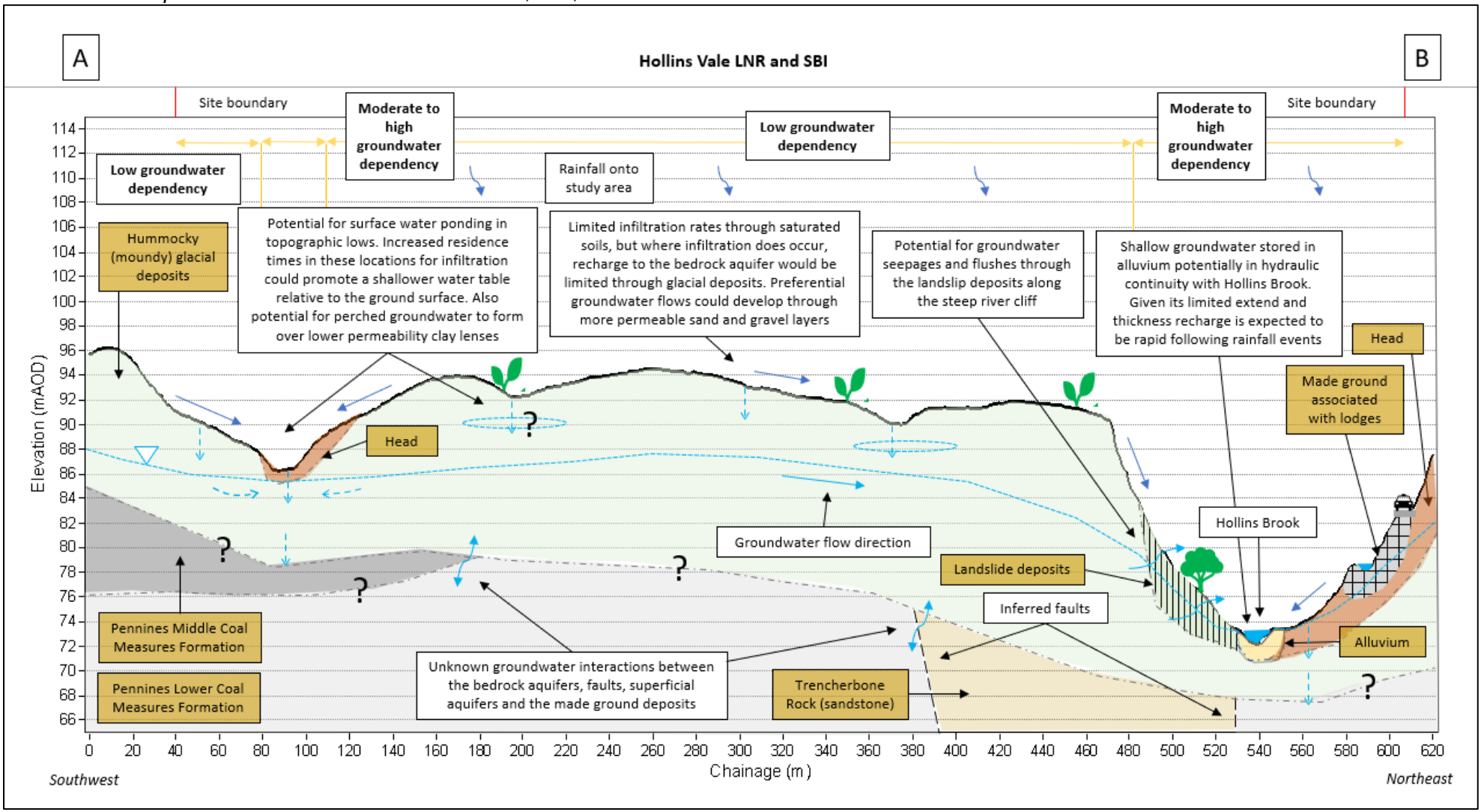
1.3.50 The area of grazing land in the south and centre of the site is classified as having a low groundwater dependency. This is based on the BGS groundwater flooding susceptibility mapping, which identifies this part of the site as having limited potential for groundwater flooding to occur, the absence of springs or issuing watercourses, generally high elevation, and the fact that the south of the site marks the head of the groundwater catchment. All of which suggest that groundwater levels are not expected to be close to the ground surface in this location. There is potential for surface water ponding to occur in topographic lows in the centre of the site, which with increased residence times for

infiltration, could lead to perched groundwater horizons (where downwards moving groundwater flows are impeded by lower permeability clay lenses in the glacial deposits).

1.3.51 The north of the site which forms Hollins Vale SBI, is described as a boggy flush, where springs and groundwater seepages emerge along the steep valley sides. Despite groundwater being encountered at the shallow depth of less than 1m in only one historical borehole record in the north of the site, groundwater levels in this area are anticipated to be high, due to the sudden drop in topography likely allowing the water table to intersect with the ground surface. With the potential for springs and groundwater seepages arising along the scarp edge, especially where higher permeability landslide deposits are located, to support groundwater dependent vegetation, the north and north-east of the site are initially attributed as having a **moderate to high groundwater dependency**. This is also the case for the south-east of the site, and its southern and western edges, due to the mapped presence of the 'Hollins Vale South' spring and issuing watercourse in these locations. However, NVC mapping would be required to confirm the presence and extent of GWDTE at the site.

1.3.52 Figure 14.5 of Chapter 14 shows the highest initial groundwater dependency classification for the GWDTE. Given the presence of the LNR and SBI designations, according to Table 14.17 of Chapter 14: Road Drainage and Water Environment, the value of the GWDTE is medium to high. The variation is due to the groundwater dependency of specific areas within the site, which will be confirmed and refined at the Environmental Statement stage.

Plate 1.2: Conceptual Site Model for Hollins Vale LNR, SBI, and Hollins Plantation SBI



Assessment of Effects

1.3.53 The south-east corner of the site lies 30m west and across-gradient of the provisional Order Limits associated with the M66 north of M60 J18 (see Figure 14.5 of Chapter 14). The site is separated from the provisional Order Limits by the northbound carriageway of the M66. The nearest proposed cutting (M66 Unsworth) is located 50m east, while the nearest gantry, embankment, and drainage assets lie 140m, 1.5km, and 750m south-east, respectively.

Construction

1.3.54 The site lies outside of the estimated dewatering zone of influence for the nearest proposed cutting. No cutting-related dewatering impacts on groundwater flows, levels or quality at the site are therefore predicted (see Table 1.6).

1.3.55 Given that the provisional Order Limits are situated adjacent to but not down-gradient of the south-east corner of the site and separated by the existing M66 northbound carriageway, impacts to groundwater flows and levels because of soil stripping and vegetation clearance would be negligible. This may result in effects with a potential neutral significance in this location. No impacts are expected throughout the remainder of the site. Similarly, negligible or no impacts are predicted to the GWDTE from the construction of the proposed cuttings, embankments, gantries, or drainage assets, given their distance from the site.

1.3.56 The magnitude of change on existing groundwater quality in the south-east of the site, due to the mobilisation of suspended solids and/or accidental spills and leaks is expected to be negligible, resulting in a neutral significance of effect. Considering the best-practice mitigation measures referred to in the EMP, the distance across-gradient from the provisional Order Limits, and the natural filtering effect of aquifer material/made ground present, contaminants within shallow groundwater would likely attenuate prior to reaching the south-eastern site boundary. No impacts to groundwater quality are expected throughout the remainder of the site.

Operation

1.3.57 There are no permanent below ground structures or embankments proposed within the vicinity of the site to locally alter groundwater levels and flows supporting GWDTE. No operational impacts to groundwater flows and levels at the site are therefore predicted.

1.3.58 Considering the distance of the Proposed Scheme from the GWDTE, and likely groundwater flow directions in the area, no impacts on groundwater quality from any accidental leaks/spills of fuels and chemicals and/or routine runoff associated with the road are expected.

Summary

1.3.59 A summary of the potential impacts to the site is provided in Table 1.6.

Table 1.6: Summary of Potential Effects to Hollins Vale LNR, SBI, and Hollins Plantation SBI

Groundwater Dependency	Ecological Designation	Value	Effect	Phase	Highest Magnitude of Impact	Highest Significance of Effect
Low to high	LNR / SBI	Medium to high	Accidental leaks / spills of fuels and chemicals (groundwater quality)	Construction	Negligible	Neutral
			Mobilisation of suspended solids (groundwater quality)	Construction	Negligible	Neutral
			Creation of vertical pathways for contaminated groundwater in short-term, or mixing of different groundwater chemistries (groundwater quality)	Construction	Negligible	Neutral
			Short-term disturbance of groundwater flows (groundwater levels / flows)	Construction	Negligible	Neutral
			Cutting dewatering (groundwater levels / flows / quality)	Construction	No impact	N/A
			Short and / or long-term changes in recharge rates (groundwater levels / flows)	Construction / Operation	No impact	N/A
			Groundwater contamination from routine runoff, or accidental leaks / spills (groundwater quality)	Operation	No impact	N/A
			Ground settlement in superficial deposits (groundwater levels / flows)	Operation	No impact	N/A
			Long-term disturbance of groundwater flows (groundwater levels / flows)	Operation	No impact	N/A
			Intercept contaminated groundwater in long-term, or mixing of different groundwater chemistries (groundwater quality)	Operation	No impact	N/A

Philips Park LNR and SBI

Site Setting, Topography and Hydrological Catchment

1.3.60 Philips Park is designated as both an LNR and an SBI, the extents of which differ slightly along the site's margins. Philips Park SBI also includes a second LNR, known as Mere Clough, which runs south-west to north-east along most of the site's eastern boundary. The largest extents of both LNRs and the SBI are used for this assessment.

1.3.61 The site is separated into two parts by the existing M60 carriageway. The smaller part, North Wood, lies to the north of the highway embankment and forms a narrow, steep sided valley. An unnamed Ordinary watercourse issues along the northern boundary of this part of the site, flows southwards through the valley bottom in the site's centre, and enters a culvert underneath the M60 carriageway, at the southernmost part of the woodland.

1.3.62 The elevation of North Wood ranges from approximately 105mAOD in the north, to around 65mAOD in the south-east, where the watercourse exits the southern boundary.

1.3.63 Most of Philips Park lies to the south of the existing M60 carriageway. The River Irwell bounds the site to the south, and Bradley Brook flows south-west, within the site, close to the entire eastern boundary of this part of the site. Several ponds (former reservoirs) are located in the south, and the watercourse which flows in a culvert beneath the M60 embankment from North Wood, discharges into the River Irwell in the south of the site.

1.3.64 The elevation of this part of the site ranges from approximately 100mAOD in the north, to around 30mAOD in the south, adjacent to the River Irwell.

1.3.65 The hydrological catchment for the site as a whole extends approximately 600m north, towards the A667 Ringley Road West, where the ground reaches around 130mAOD.

1.3.66 Two springs are shown on historical maps towards the centre of the southern part of the site (referred to as the 'Philips Park South' and 'Philips Park South-west' springs on Figure 14.5 and in Table 14.14 of Chapter 14: Road Drainage and the Water Environment), along with two "sinks" in the east, close to Bradley Brook (referred to as the 'Philips Park South' sinks). Historical maps also show two "issues" close to the eastern boundary of the southern part of the site, and three more "issues" in the smaller part of the site to the north.

Soils and Geology

1.3.67 Several historical borehole records are available for the site (BGS, 2022a). Relevant information extracted from four of these historical borehole records (considered to be representative of the geology in each part of the site) is provided in Table 1.7.

1.3.68 Soils across most of the site are described as freely draining slightly acid sandy soils (Cranfield University, 2022). Soils in the south-east of the site are described as freely draining slightly acid loamy soils, and slowly permeable seasonally wet acid loamy and clayey soils are shown to be present in the north and north-east.

1.3.69 Four areas of made ground are mapped across the site (BGS, 2022a). Two small areas lie in the west, a small strip of made ground is shown in the centre of North Wood, and the largest expanse is associated with an underpass beneath the existing route of the M60 in the west. There is no lithological information provided for any of the mapped areas of made ground, but two of the historical borehole records provided in Table 1.7 (SD70SE159 and SD70SE530) describe layers of brick, ash, clay, and sand as made ground deposits.

1.3.70 The superficial geology across most of the site is mapped as glaciofluvial sand and gravel deposits, interspersed with glacial till (BGS, 2022a). River terrace sand and gravels are mapped in the south-west of the site, and a thin, south-west-north-east trending unit of hummocky glacial deposits, also comprising sand and gravel, are mapped along most of the eastern boundary. Layers of sands, sandy gravels and clays are described in the historical borehole records provided in Table 1.7, which is broadly consistent with the mapped superficial geology.

1.3.71 Large expanses of landslide deposits are shown along most of the southern and eastern edges of the southern part of the site (through Mere Clough), along with the southern half of the northern part of the site (BGS, 2022a).

1.3.72 Bedrock at the site is complex and comprises several individual formations which trend north-west-south-east (BGS, 2022a). Individual bedrock units at the site include; the Pennine Middle Coal Measures Formation (mudstone, siltstone and sandstone) – including a unit of sandstone belonging to the Newton Heath Sandstone member, the Pennine Upper Coal Measures Formation (mudstone, siltstone and sandstone - including a unit of sandstone belonging to the Worsley Delf Rock member, the Manchester Marls Formation (mudstone), and the Chester Formation (sandstone). The mapped geology is consistent with the bedrock lithology identified in the historical borehole records, which describe alternating layers of mudstone and coal (see Table 1.7).

1.3.73 The bedrock has undergone a degree of structural deformation, with a north-west-south-east trending fault cutting across the east of the site. This fault marks the boundary of the Pennine Lower/Middle Coal Measures Formation and the Manchester Marls/Chester Formation.

Table 1.7: Borehole Records for Philips Park LNR and SBI

Borehole ID	Top (mbgl)	Base (mbgl)	Lithology Description	Groundwater Strike (mbgl)
SD70SE159	0.00	1.20	Brick and clinker (made ground)	Not encountered
	1.20	3.05	Clay and sand (made ground)	
SD70SE530	0.00	0.20	Ash (made ground)	Strike at 5.80mbgl. Standing water level rose to 4.40mbgl after 20 minutes
	0.20	4.50	Grey/black sandy clay with ash/glass (made ground)	
	4.50	5.80	Soft to firm grey slightly sandy silty clay	
	5.80	6.10	Loose grey brown sandy gravel	
	6.10	8.00	Soft clayey sand with clay bands	
SD70SE42	0.00	39.00	Alternating layers of clay and sand	Not recorded
	39.00	42.00	Grey mudstone with coal layers	
SD80SW71	0.00	33.53	-	Not recorded
	33.53	38.10	Mudstone with layers of coal, seatearth and ironstone	

Groundwater

1.3.74 There are no Environment Agency or BGS groundwater monitoring locations available in close proximity to the site.

1.3.75 The BGS susceptibility to groundwater flooding dataset classifies the south-eastern part of the site as having potential for groundwater flooding to occur either at surface level,

or to property situated below ground level (BGS, 2022b). This is also the case for the lower part of the valley in North Wood, adjacent to the watercourse that flows south. The north-east of the site, however, is classified as having limited potential for groundwater flooding to occur.

1.3.76 One of the historical borehole records located in the south of the site (SD70SE530) encountered groundwater at a depth of 5.80mbgl, with standing water recorded at 4.40mbgl. Groundwater levels could therefore be at, or close to ground level, in certain parts of the site, following periods of sustained or significant recharge.

1.3.77 The presence of the 'Philips Park South' and 'Philips Park South-west' springs, 'Philips Park South' sinks, the "issues" and wells in the south and east of the site are also indicative of shallow groundwater emergence in these locations, along with the two wells in the north-west, and the three issues shown in and around the edges of North Wood.

Habitats and Vegetation

1.3.78 The SBI designation lists the key features of Philips Park as woodland, grassland, ponds, and small lodges (GMEU, 2017). The site also includes a series of HPI, with the main habitats comprising lowland fen (Natural England, 2010).

1.3.79 The units mapped as lowland fen habitat comprise several discrete areas, dispersed across the site, and which occupy approximately one quarter of the site as a whole.

1.3.80 A Phase 1 habitat survey was carried out for Bury Metropolitan Borough Council in 2001, for the HPI unit situated in the east of the site. The HPI unit was classified as having an F1 vegetation type (Bury Metropolitan Borough Council, 2001). F1 vegetation is described as swamp vegetation (Joint Nature Conservation Committee (JNCC), 2010). That is, tall emergent vegetation, typical of the transition between open water and exposed land.

1.3.81 Lowland fen/swamp habitats have potential for GWDTE to be present, although NVC mapping would be required to confirm this and identify their exact extents.

Initial Conceptual Site Model

1.3.82 Plate 1.3 shows a conceptualised cross-section running north to south through the east of the site. The CSM highlights the indicative movement of groundwater and surface water through the site, and initial groundwater dependencies supporting vegetation and habitats present.

1.3.83 GWDTE could be present at the site and would most likely be located in the areas of fen, swamp, and flushes described above. These habitats are shown to be dispersed across the site, with the largest expanses located in the far west, and in the south and east of the site. More than half of the area located to the north of the existing M60 carriageway is also classified as lowland fen habitat.

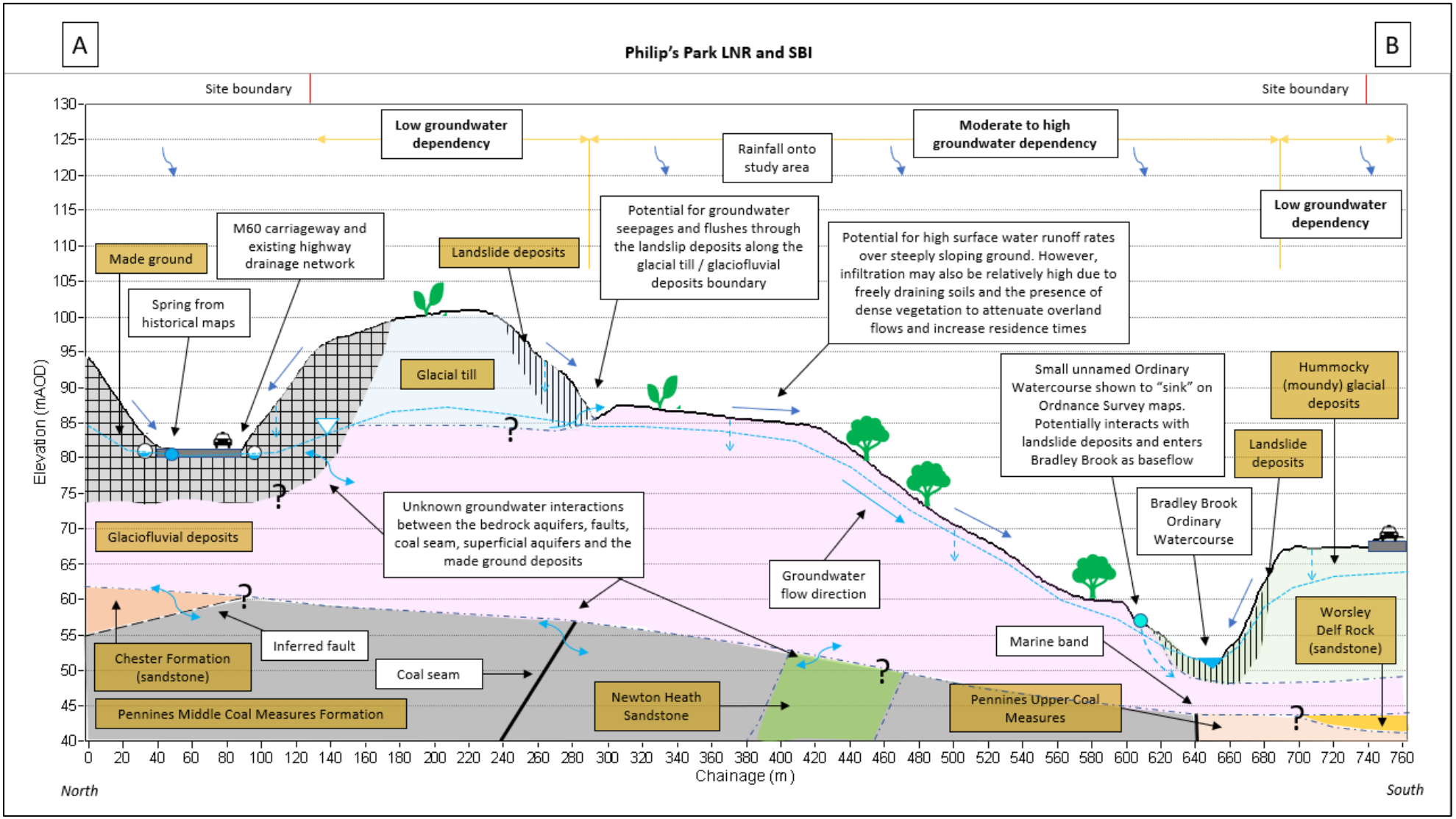
1.3.84 The identified hydrological features in the southern half of the site, and its eastern and western edges, confirms the presence of shallow groundwater levels in these locations, as does the number of issuing watercourses in North Wood and the correlation with the mapped areas of highest groundwater flooding susceptibility. For these reasons, most of the site is classified as having a **moderate to high groundwater dependency**.

1.3.85 Towards the centre of Philips Park, and in the north-east of the site (in its southern part), localised areas of high ground are expected to have deeper groundwater levels. Recharge rates through the glacial till in these areas are likely to be lower than in other

parts of the site. Groundwater stored within the glaciofluvial deposits may be confined by the overlying till in these locations, although this is not certain. With the limited hydrological catchment areas and steep slopes present in the centre and north-east of the site (southern part), likely limiting recharge potential, a **low groundwater dependency classification** has been initially attributed to these areas. This is consistent with the absence of springs and associated hydrological features in these locations.

1.3.86 Figure 14.5 of Chapter 14 shows the highest initial groundwater dependency classification for the GWDTE. Given the presence of the LNR and SBI designations, according to Table 14.17 of Chapter 14: Road Drainage and Water Environment, the value of the GWDTE is medium to high. The variation is due to the groundwater dependency of specific areas within the site, which will be confirmed and refined at the Environmental Statement stage.

Plate 1.3: Conceptual Site Model for Philips Park LNR and SBI



Assessment of Effects

1.3.87 The provisional Order Limits extend marginally into the north-east of the site (southern part only) and include Outfall 6, associated with Bradley Brook and a proposed attenuation pond located 110m north, i.e. to the north of the existing M60 (Figure 14.5 of Chapter 14). The nearest proposed cutting (M60 West of Sandgate Road) is located 1.2km east, while the nearest gantry and embankment lie 670m and 1.4km east, respectively.

Construction

1.3.88 The site lies outside of the estimated dewatering zone of influence for the nearest proposed cutting. No cutting-related dewatering impacts on groundwater flows, levels or quality at the site are therefore predicted (see Table 1.8).

1.3.89 Given that the provisional Order Limits extend into the north-east of the site, impacts to groundwater flows and levels because of soil stripping, vegetation clearance, and construction of the outfall (assumed to require shallow <1m deep excavations for foundations and associated connections) would be direct. This would result in effects with a potential large significance in this location. Impacts with a moderate magnitude would likely propagate downgradient through the east of the site, resulting in a potential moderate significance of effect. No impacts are expected throughout the remainder of the site. Similarly, negligible or no impacts are predicted to the GWDTE from the construction of the proposed cuttings, embankments, gantries, or the attenuation pond to the north, given their distance from the site.

1.3.90 The magnitude of change on existing groundwater quality in the north-east of the site, due to the mobilisation of suspended solids and/or accidental spills and leaks is expected to be moderate. Considering the best-practice mitigation measures referred to in the EMP, contaminants could directly enter shallow groundwater from the works area in the north-east of the site, which would result in a moderate significance of effect in this location. Downgradient, and in the east of the site, minor magnitude impacts are expected, resulting in a slight significance of effect. No impacts to groundwater quality are expected throughout the remainder of the site.

Operation

1.3.91 There are no permanent below ground structures or embankments proposed within the vicinity of the site to locally alter groundwater levels and flows supporting GWDTE. No operational impacts to groundwater flows and levels at the site are therefore predicted.

1.3.92 Considering the limited distance of the Proposed Scheme from the GWDTE, and likely groundwater flow directions in the area, any accidental leaks/spills of fuels and chemicals and/or routine runoff associated with the road could lead to minor impacts on groundwater quality in the north-east of the site, resulting in a potential slight significance of effect. Downgradient, and in the east of the site, negligible impacts on groundwater quality could propagate to this location. No impacts are expected throughout the remainder of the site.

Summary

1.3.93 A summary of the potential impacts to the site is provided in Table 1.8.

Table 1.8: Summary of Potential Effects to Philips Park LNR and SBI

Groundwater Dependency	Ecological Designation	Value	Effect	Phase	Highest Magnitude of Impact	Highest Significance of Effect
Low to high	LNR / SBI	Medium to high	Accidental leaks / spills of fuels and chemicals (groundwater quality)	Construction	Moderate	Moderate
			Mobilisation of suspended solids (groundwater quality)	Construction	Moderate	Moderate
			Creation of vertical pathways for contaminated groundwater in short-term, or mixing of different groundwater chemistries (groundwater quality)	Construction	Negligible	Neutral
			Short-term disturbance of groundwater flows (groundwater levels / flows)	Construction	Major	Large
			Cutting dewatering (groundwater levels / flows / quality)	Construction	No impact	N/A
			Short and / or long-term changes in recharge rates (groundwater levels / flows)	Construction / Operation	Negligible	Neutral
			Groundwater contamination from routine runoff, or accidental leaks / spills (groundwater quality)	Operation	Minor	Slight
			Ground settlement in superficial deposits (groundwater levels / flows)	Operation	No impact	N/A
			Long-term disturbance of groundwater flows (groundwater levels / flows)	Operation	No impact	N/A
			Intercept contaminated groundwater in long-term, or mixing of different groundwater chemistries (groundwater quality)	Operation	No impact	N/A

1.4 Summary of Effects

1.4.1 A summary of the initial assessment of groundwater dependency of each GWDTE, along the associated magnitude of impact to existing groundwater levels, flows, and quality, is provided in Table 1.9.

Table 1.9: Summary of Potential GWDTEs and Associated Impacts

Potential GWDTE	Initial Assessment of Groundwater Dependency	Highest Magnitude of Impact		Highest Significance of Effect	
		Construction	Operation	Construction	Operation
Hazlitt Wood SBI	Low to high	Major	Minor	Large	Slight
Hollins Vale LNR, SBI and Hollins Plantation SBI	Low to high	Negligible	No impact	Neutral	N/A
Philips Park LNR and SBI	Low to high	Major	Minor	Large	Slight

Appendix 14.4. Preliminary Flood Risk Assessment

1.1 Introduction

Background

1.1.1 This Flood Risk Assessment (FRA) supports the application for development consent for the M60/M62/M66 Simister Island Interchange Scheme (hereafter referred to as the Proposed Scheme) in accordance with the National Policy Statement for National Networks (NPS NN) (Department of Transport, 2014).

1.1.2 This document is the preliminary FRA to provide flood risk information to inform the Preliminary Environmental Information Report and will be updated to inform the Environmental Statement and support the DCO application.

Aims and Objectives

1.1.3 The Preliminary FRA has been produced in accordance with the Planning Practice Guidance to the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG), 2021) and seeks to demonstrate compliance with the requirements of the NPS NN, specifically that the Proposed Scheme will:

- Remain operational and safe for users in times of flood; and
- Not increase flood risk elsewhere

1.1.4 The Preliminary FRA seeks to demonstrate the Proposed Scheme's compliance with the NPS NN by including:

- An assessment of flood risk to the Proposed Scheme from all sources
- An assessment of change in flood risk from all sources as a result of the Proposed Scheme
- Appropriate consideration of the impacts of climate change on flood risk using the latest UK Climate Projections available
- An initial assessment of mitigation measures to prevent adverse impact on flood risk
- Details of completion of the Sequential and Exception Tests

1.1.5 The Preliminary FRA is supported by the following figures:

- Figure 1.1: Location Plan and LPA Boundaries
- Figure 2.1: Overview of the Proposed Scheme
- Figure 14.6: Flood Zones
- Figure 14.7: Areas at Risk from Surface Water Extents
- Figure 14.8: Areas Susceptible to Groundwater Flooding
- Figure 14.9: Areas at Risk of Flooding from Reservoirs

1.1.6 The flood risk design criteria and requirements for the Preliminary FRA will be agreed through consultation with the Environment Agency, Bury Metropolitan Borough Council (BMBC) as the Lead Local Flood Authority (LLFA) for the Proposed Scheme's location.

Sources of Information

1.1.7 Flood risk has been assessed based on information from the following sources:

- Bury Rochdale and Oldham Level 1 and 2 Strategic Flood Risk Assessment (JBA Consulting, 2009)
- Bury Preliminary Flood Risk Assessment (JBA Consulting, 2011)
- Greater Manchester Surface Water Management Plan (JBA Consulting, 2012)
- The Coal Authority Interactive Map Viewer (Coal Authority, 2022)
- Ordnance Survey (OS) Open Rivers dataset (Ordnance Survey, 2022)
- Environment Agency Catchment Data Explorer (Environment Agency, 2020)
- Environment Agency Risk of Flooding from Surface Water Extent: 0.1, 1 and 3.3 percent annual chance (Environment Agency, 2021) datasets
- Environment Agency Flood Map for Planning (Environment Agency, 2022a)
- Environment Agency Historic Flood Map (Environment Agency, 2022b)
- Environment Agency Long Term Flood Risk Information Mapping (Environment Agency, 2022c)
- Environment Agency Risk of Flooding from Reservoirs (Environment Agency, 2022d)
- Environment Agency Statutory Main River Map (Environment Agency, 2022e)
- Environment Agency bedrock and superficial aquifer designations from Defra's MAGIC map application (Defra, 2022)
- British Geological Survey (BGS) Groundwater Flooding Susceptibility data (BGS, 2021)
- BGS mapping at 1:10,000 scale and 1:50,000 scale, historical borehole records and permeability index/aquifer properties datasets (where required) (BGS, 2022)
- Ordnance Survey mapping for identifying the locations of springs, sinks, sources, spreads, collects, issues, wells (Ordnance Survey, 2022)

1.2 Scheme and Location

Context

1.2.1 The Proposed Scheme comprises improvements to the M60 Junction (J)18 interchange (also known as Simister Island), north of Manchester.

1.2.2 The Proposed Scheme would involve improvement of a highway which is wholly in England and where National Highways (formerly Highways England) is the highway authority. The improvement could potentially have a significant effect on the environment. The Proposed Scheme is therefore classed as a Nationally Significant Infrastructure Project (NSIP) under the Planning Act (2018), triggering the need to apply for a Development Consent Order (DCO).

1.2.3 The Proposed Scheme falls under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations'). It falls under Schedule 2, Section 10f, infrastructure projects, construction of roads unless included in Schedule 1. The selection criteria in Schedule 3 of the EIA regulations have been used to screen the

Proposed Scheme and have identified the potential for significant effects. The Proposed Scheme therefore requires a statutory EIA to support the DCO application.

Location

1.2.4 The Proposed Scheme includes junction improvement works and widening to five lanes of the M60 between J17 and J18 located at M60 J18 (Simister Island), north of Manchester (National Grid Reference (NGR) SD 8283 0594). The project location is shown in Figure 1.1: Location Plan and LPA Boundaries. The Proposed Scheme extent falls within the administrative boundary of Bury Metropolitan Borough Council (BMBC) and is close to Rochdale Borough Council (RBC), Salford City Council (SCC) and Manchester City Council (MCC). Local Planning Authority boundaries are shown in Figure 1.1 of the main report.

1.2.5 It should be noted that the junction is situated on more than one motorway and as a result has two junction numbers: M60 J18 and M66 J4. For the purpose of this project and therefore this report, the junction is referred to as M60 J18.

1.2.6 M60 J18 provides the interchange between the M60, M62 and M66 motorways. The environmental study area of the Proposed Scheme encompasses the following motorways and slip roads:

- M60 between J17 – J18, in both directions
- M60 between J18 – J19, in both directions, partly
- M60 J17, including the eastbound and westbound entry and exit slip roads
- M60 J18, including all entry and exit slip roads to and from the M60, M62 and M66 motorways
- M66 motorway from the M60 J18 (M66 J4) to M66 J3, partly
- M62 motorway between J18 of the M60 and the M62 Birch Services, partly
- M60/M62/M66 Simister Island Interchange

1.2.7 The Proposed Scheme is situated between several urban areas and settlements including Whitefield, Prestwich, Simister and Middleton. The Proposed Scheme is situated in an urban fringe landscape, with urban settlements to the west, north and south of the Proposed Scheme and predominantly low-lying Grade 3/4 agricultural land to the east. The majority of the Proposed Scheme location falls within the Green Belt boundary.

1.3 Methodology

1.3.1 The Preliminary FRA has been undertaken in accordance with DMRB LA 113 Road Drainage and the Water Environment (Highways England, 2020a). The document provides an initial assessment method for determining and managing the effects of the Proposed Scheme on the water environment.

1.3.2 Where this Preliminary FRA has identified potential flood risk impacts, flood mitigation measures (either embedded in design or standalone) will be considered to minimise the overall impact on flood risk. At locations where the Proposed Scheme may have an impact, a range of measures will be explored with the aim of achieving no significant detrimental effect on overall flood risk.

1.3.3 It is anticipated that this Preliminary FRA will be updated to reflect design changes and feedback from statutory consultation to then inform the Environmental Statement in support of the DCO application.

Assessment Assumptions and Limitations

1.3.4 The assessment is based on the Proposed Scheme design as described in Chapter 2: The Scheme. The specific location of construction activities is currently uncertain at the time of writing, where referenced, a high-level understanding of the potential flood risk impacts and mitigation is considered for further refinement at FRA stage.

1.3.5 The Preliminary FRA has been based on readily available web-based data sources and organisational experience. No detailed hydraulic modelling of flood risk has been undertaken. If appropriate, further data collection will be undertaken at FRA stage.

1.3.6 The Preliminary FRA has been produced prior to undertaking a site-specific Ground Investigation (GI). BGS groundwater flooding susceptibility mapping has, however, been used to gain an initial understanding of the potential for shallow groundwater emergence within the provisional Order Limits, along with a high-level review of groundwater strike data provided in BGS borehole records. GI data will be included in the assessment of groundwater flood risk (where available) for the FRA stage.

1.3.7 The following are assumed based on current knowledge of the design.

Surface Water Drainage

1.3.8 The aim for the Proposed Scheme is to mainly reuse the existing drainage network and outfalls, which would discharge routine runoff at a rate attenuated to existing discharge rates. The discharge is to an existing outfall and will be limited to existing rates or lower. This is summarised at a high level in this report and can be found in the Drainage Strategy for the Proposed Scheme (National Highways, 2022).

Surface Water Features

1.3.9 The watercourses crossed by the Proposed Scheme are classified into two categories:

- Main River: Defined under Water Resources Act 1991 as being regulated by the Environment Agency. These rivers are generally larger than ordinary watercourse and have bigger floodplains and greater potential impact on the local area. Construction work on or surrounding a main river is controlled by Section 109 of the Water Resources Act 1991 and the Environment Agency Anglian Regional by-laws.
- Ordinary watercourses: BMBC defines an ordinary watercourse as ‘small rivers, streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991) and passages through which water flows’ (BMBC, 2012). is responsible for regulating activities affecting an ordinary watercourse.

1.3.10 A detailed summary of the surface water features within the provisional Order Limits is presented in PEIR Chapter 14: Road Drainage and Water Environment and shown in Figure 14.1.

Geology

1.3.11 The geology and aquifers for the Proposed Scheme are described in the PEIR Chapter 14: Road Drainage and the Water Environment (Section 14.7) and shown in PEIR

Figure 14.4: Potential Groundwater Receptors. A detailed summary of the geology beneath the Proposed Scheme is also provided in Chapter 10: Geology and Soils.

1.3.12 A summary of the bedrock and superficial geology pertinent to the FRA is provided here to provide context to the groundwater and surface water interactions likely across the provisional Order Limits.

1.3.13 Extensive made ground deposits are expected within most of the provisional Order Limits, largely associated with the existing motorways and their junctions. The superficial geology is complex, and comprises glacial till, hummocky (moundy) glacial deposits, glaciofluvial/ice contact deposits, head, peat and small areas of glaciolacustrine clay and silt.

1.3.14 The bedrock geology underlying the provisional Order Limits primarily includes the Coal Measures Group, along with the Permo-Triassic sandstone units such as the Chester Formation. The bedrock has generally undergone significant structural deformation, with multiple faults shown to be present cutting across the bedrock at depth beneath the Proposed Scheme.

1.4 Flood Risk Policy and Guidance

1.4.1 The sections below summarise the planning policy and regulatory framework that has a direct influence on the structure and content of this Preliminary FRA and the subsequent FRA.

National Policy Statement for National Networks

1.4.2 The NPS NN (Department for Transport, 2014) is a requirement of the 2008 Planning Act. It sets out the need for, and Government's policies to deliver, development of nationally significant infrastructure projects on the national road and rail networks in England. It provides planning guidance for promoters of nationally significant infrastructure projects on the road and rail networks, and the basis for the examination by the Examining Authority and decisions by the Secretary of State (SoS). NPS NN is used as the primary basis for making decisions on development consent applications for national networks nationally significant infrastructure projects in England.

1.4.3 Key policy from the NPS NN relevant to the assessment of flood risk is set out below:

- Paragraphs 5.91 to 5.97 state that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk although essential transport infrastructure is permissible in areas of high flood risk subject to the Exception Test. But where development is necessary, it should be made safe without increasing flood risk elsewhere. The Environmental Statement will need to be accompanied by a FRA, which will identify and assess the risks of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account.
- Paragraph 5.93 states that the assessment of impact should take climate change into account.
- Paragraph 5.99 states that when determining an application, the SoS should be satisfied that flood risk would not be increased elsewhere, that the most vulnerable development is located in the areas of lowest risk, and that it is appropriately flood resilient and resistant.

- Paragraph 5.109 states that the Proposed Scheme should be designed and constructed to remain operational and safe for users in times of flood.
- Paragraph 5.230 states that projects are required to adhere to National Standards for Sustainable Drainage Systems (SuDS), which promotes the most sustainable approach but recognises feasibility, and use of conventional drainage systems as part of a sustainable solution for any given site given its constraints. For example, Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems (Defra, 2015).

1.4.4 In addition to the national policy set out in the NPS NN, the Proposed Scheme must also have regard to relevant legislation and local plans and policy.

National Planning Policy Framework

1.4.5 The NPPF (MHCLG, 2021) and associated NPPG are the relevant guidance documents that local authorities use in reviewing proposals for development with respect to flood risk. If a site was to be developed, the NPPF sets out policies for planning authorities to:

- Ensure flood risk is properly considered at all stages of the planning process
- Prevent inappropriate development in areas at high risk of flooding
- Direct development away from areas at highest risk
- Ensure that new developments take climate change into account and do not increase flood risk elsewhere

1.4.6 The NPPF provides guidance on the assessment of flood risk and how it may be addressed or mitigated. The guidance advises, among others, planning authorities in their planning decisions to use a risk-based approach to avoid flood risk wherever possible and manage flood risk elsewhere.

Assessment of Flood Risk

1.4.7 The assessment of flood risk is used to steer development at the planning stage. The flood risk from main rivers and the sea is initially assessed using the Environment Agency Flood Map for Planning (FMfP) (Environment Agency, 2022a). This map has delineated three zones of flood risk: 1, 2 and 3a defined in Table 1.1. In addition to main rivers, risk from all other sources of flooding have been considered in determining the whether the proposed development would be in an appropriate location with regard to flood risk.

Table 1.1: Flood risk vulnerability and flood zone 'compatibility'

Flood Zone	Definition
Flood Zone 1	'Low probability of flooding' – This zone comprises land assessed as having a less than 1 in 1,000 annual probabilities of river or sea flooding (<0.1%).
Flood Zone 2	'Medium probability of flooding' – This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.
Flood Zone 3a	'High probability of flooding' – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Flood Zone	Definition
Flood Zone 3b (Functional Floodplain)	A sub-part of Zone 3, this zone comprises land where water has to flow or be stored in times of flood. This zone is not normally included within the national FMfP and is calculated where necessary using detailed hydraulic modelling. This flood zone is identified as being likely to flood with annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in extreme scenarios.

The Sequential Test

1.4.8 The NPPF requires a risk based sequential approach to determine the suitability of land for development in flood risk areas which should be applied at all stages of the planning process.

1.4.9 The Sequential Test should be applied to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development proposed.

1.4.10 The Published Flood Zones are the starting point for the Sequential Test and refer to the probability of sea and river flooding. They are defined on a 'worst case' basis, ignoring the presence of existing defences. The overall aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding.

1.4.11 The Proposed Scheme is wholly located within Flood Zone 1, therefore passes the Sequential Test based on being located in the area of lowest flood risk.

Assessment of development vulnerability

1.4.12 The NPPF defines what development is suitable for construction within each flood risk zone based upon the level of vulnerability of the development, as set out in Table 1.2.

Table 1.2: Flood risk vulnerability and flood zone 'compatibility'

Flood Risk Vulnerability	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test Required	✓	✓
Zone 3a	Exception Test Required	✓	x	Exception Test Required	✓
Zone 3b	Exception Test Required	✓	x	x	x

1.4.13 The Proposed Scheme has to be assigned a Flood Risk Vulnerability Classification in accordance with NPPF of '**Essential Infrastructure'**. As the Proposed Scheme is wholly located in Flood Zone 1 it is deemed compliant with national planning policy and application of the Exception Test is not required.

Other National Policy

1.4.14 The Department of the Environment, Food and Rural Affairs (Defra) is responsible for all aspects of water policy in England. Key legislation and policies relating to flood risk are detailed in Table 1.3.

Table 1.3: Key national legislation and policy relating to the water environment

Legislation / Policy	Relevance to the Proposed Scheme
Reservoirs Act 1975	The Reservoir Act 1975 states further provision against escapes of water from large reservoirs or from lakes or lochs artificially created or enlarged.
Environmental Protection Act 1990	The Environmental Protection Act (1990) defines the structure and authority of waste management and control of emissions into the environment within England, Wales and Scotland.
Water Resources Act 1991	The Water Resources Act (1991) defines the duties of the Environment Agency on flood defences and other areas relating to water management and quality.
Land Drainage Act 1991 and 1994	The Land Drainage Act outlines the responsibilities of various bodies that deal with local (land) drainage including local authorities, internal drainage boards and riparian owners.
Environment Act 2021	The Environment Act (2021) created a number of new agencies (including the Environment Agency) and requires the Environment Agency to supervise all matters relating to flood risk management in England and Wales.
Floods Directive (2007/60/EC)	The objective of the Floods Directive is to establish a framework for the assessment and management of flood risk to reduce the negative consequences of flooding on human health, economic activities, the environment and cultural heritage. The Directive which applies to all kinds of floods (river, lakes, flash floods, urban floods, coastal floods, including storm surges and tsunamis), on all of the European Union (EU) territory requires Member States to approach flood risk management in a three-stage process, including preliminary flood risk assessment; develop flood risk maps and produce flood risk management plans. The Environment Agency has delivered the requirements of the Floods Directive through its flood hazard and risk maps, and Flood Risk Management Plans.
Flood and Water Management Act 2010	The Flood and Water Management Act (2010) defines the responsibilities of various flood risk management authorities. The Act gives the Environment Agency strategic overview for national flood risk management in England and gives unitary and county council responsibility for local flood risk management.
Flood Risk (England and Wales) Regulations 2016	The Flood Risk Regulations transposed the EU Floods Directive into law in England and Wales. The EU Floods Detective aims to provide a consistent approach to flood risk management across Europe.

Sustainable Drainage Systems guidance

1.4.15 The DMRB CG 501 Design of highway drainage systems (National Highways, 2022a) standard includes:

- ‘The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30-year rainfall event’
- ‘The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100-year rainfall event are managed in exceedance routes that minimise the risks to people and property’

Local Flood Risk Policy and Guidance

1.4.16 The Proposed Scheme is within an area administered by BMBC, as the LLFA and five Local Planning Authorities (LPA): Rochdale Borough Council (RBC), Salford City

Council (SCC), Manchester City Council (MCC), Oldham Metropolitan Borough Council (OMBC) and Greater Manchester Combined Authority (GMCA).

Local Plans

1.4.17 The Local Plans are prepared by the LPA and provide guidance for future growth and development within the local area including Core Strategies and Development Policies. The key flood risk management policies and objectives identified relevant to the Proposed Scheme are summarised in Table 1.4.

Table 1.4: Local planning policies and objectives

Document	Flood Risk Policy / Objective	Key Requirements
Adopted Bury Unitary Development Plan (1997)	EN5: Flood Protection and Defence	The Council will not permit new development, including the raising of land and the intensification of development, where such development would be at risk from flooding, would be likely to increase the risk of flooding elsewhere, or would adversely affected river flood defences.
Oldham Local Development Framework (2011)	Policy 19: Water and Flooding	Ensure the development does not result in unacceptable flood risk or drainage problem by directing away from areas at risk of flooding, and protecting and improving existing flood defences, water resources and quality. Minimise the impact of development on surface water runoff, which must where possible be achieved through the implementation of sustainable drainage systems (SUDS). Ensure that culverting or channelization of watercourses are avoided, unless limited access is required over the watercourse. Developments must remove existing culverts and artificial channels and restore the watercourse to a more natural state or open up and enhance existing culverted or channelization of watercourses where appropriate.
Manchester's Local Development Framework (2012)	Policy EN 14: Flood Risk	Follow sequential approach contained within PPS25 New developments to minimise surface water runoff, including through SuDS
Salford City Council Revised Draft Local Plan (2019)	Policy WA2: Delivering the North West River Basin Management Plan	Minimise the discharge of surface water to the sewerage network and intercepting any associated pollutants, particularly through the use of green infrastructure and SuDS
	Policy WA4: Flood related infrastructure	Proposed developments should follow the sequential approach
	Policy WA6: Surface water and sustainable drainage	Ensure surface water across the whole site is managed in a sustainable way, helping to minimise flood risk and water pollution, promote diversity and secure compliance with the North West River Basin Management Plan
Greater Manchester Joint Development Plan Document (2021)	JP-S 5: Flood Risk and the Water Environment	Locate and design developments to minimize the impacts of current and future flood risk. Development to manage surface water runoff through sustainable drainage system and as close to source as possible (unless demonstrably inappropriate) so as to not exceed greenfield run-off rates or alternative rates specified in district local plans, such as those identified for areas with critical drainage issues.

Bury Council Preliminary Flood Risk Assessment

1.4.18 A Preliminary Flood Risk Assessment (PFRA) provides a high-level overview of the flood risk from local sources and more specifically surface water, groundwater and ordinary watercourses. As BMBC is the LLFA for the Proposed Scheme area, the BMBC PFRA (JBA Consulting, 2011) has been consulted and has informed the assessment of baseline flood risk. The document identifies areas at high flood risk with potential consequences on the local population. The LLFA investigates the high-risk areas by producing Strategic Flood Risk Assessments (SFRAs) and Surface Water Management Plans (SWMPs). According to the BMBC PFRA the Proposed Scheme lies predominantly within an area of medium to low risk of surface water flooding.

1.4.19 The BMBC PFRA expands on the risk from the flood sources included in Section 1.4.6 that could have 'significant harmful consequences. The Proposed Scheme does not cross any areas identified as having potential significant harmful consequences.

Strategic Flood Risk Assessment

1.4.20 A SFRA is a document produced by LPAs that helps developers consider flood risk within planning decisions and demonstrate application of the Sequential Test to inform the Local Plan. It provides an overall understanding of the flood risk within its scope area considering all potential sources. As stated in Section Annex B this preliminary FRA has been informed by the Bury, Rochdale and Oldham Level 1 and 2 Strategic Flood Risk Assessments.

Surface Water Management Plan

1.4.21 A SWMP is produced by the LLFA and investigates the flood risk from local sources and determines a long-term plan of flood risk management. The flood sources commonly include surface water, groundwater and ordinary watercourses. As stated in Section Annex B this preliminary FRA has been informed by the Greater Manchester SWMP.

1.5 Climate Change

1.5.1 The Environment Agency latest available published guidance on climate change allowances (Environment Agency, 2022f) has been incorporated into this assessment to demonstrate compliance with national planning policy. This guidance is predominantly based on United Kingdom Climate Change Projections 2018 (UKCP18).

1.5.2 The guidance provides allowances to be applied to incorporate the predicted impact of climate change into the assessment of flood risk for new developments. The allowance to be applied is dependent on the location, design life and vulnerability classification of the development (as detailed in Table 2 of the National Planning Practice Guidance, NPPG (MHCLG, 2021). The Proposed Scheme is located wholly within Flood Zone 1 and is therefore classified as 'essential infrastructure'. Of relevance to this development is peak river flow and rainfall intensity.

1.5.3 The Proposed Scheme is located within the Irwell Management Catchment in the North West river basin district. The Proposed Scheme is intended to have an overall design life of 100 years. Given its purpose as major highway infrastructure it is considered appropriate to classify the Proposed Scheme as essential infrastructure.

1.5.4 Due to the inland nature of the Proposed Scheme Sea Level Rise has been scoped out. This is expanded upon in Section 1.6.

Peak River Flow

1.5.5 The allowance to be applied to assess the predicted impact of climate change on peak river flow is set out in Table 1.5. The guidance requires that the Higher Central allowances should be adopted for development classified as Essential Infrastructure for peak river flow. Assuming a 100-year design life for the Proposed Scheme a climate change allowance of 46% for peak river flow is obtained using the Higher Central allowance.

Table 1.5: Climate change allowance for Peak River Flow for the River Irwell

Management Catchment	Allowance Category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Irwell	Upper End	24%	43%	75%
	Higher Central	15%	26%	46%
	Central	12%	19%	35%

Peak Rainfall Intensity

1.5.6 The guidance also states that the potential increase in rainfall intensity due to climate change should be considered within an FRA for the central and upper end allowances. Assuming a 100-year design life for the Proposed Scheme a climate change allowance of 30% for rainfall intensity using the central allowance and 45% for rainfall intensity using the upper end allowance in the 1% AEP event, as per Table 1.6 should be considered in assessment. For a 3.3% AEP event, this corresponds to a climate change allowance of 30% using the central allowance and 40% using the upper end allowance.

1.5.7 At the time of writing the guidance for rainfall intensity relies upon UKCP18.

Table 1.6: Climate change allowance for Peak Rainfall Intensity in small and urban catchments

Management Catchment	Allowance Category	1% Annual Exceedance Rainfall Event		3.3% Annual Exceedance Rainfall Event	
		Total potential change anticipated for '2050s' (Present to 2060)	Total potential change anticipated for '2070s' (2061 to 2125)	Total potential change anticipated for '2050s' (Present to 2060)	Total potential change anticipated for '2070s' (2061 to 2125)
Irwell	Upper End	40%	45%	35%	40%
	Central	25%	30%	25%	30%

1.6 Assessment of Flood Risk to the Proposed Scheme

1.6.1 This section includes the assessment of all potential sources of flood risk to the Proposed Scheme.

1.6.2 This FRA considers flood risk from all sources:

- Tidal and coastal – flooding from the sea
- Fluvial - flooding from watercourses including Main Rivers, Ordinary Watercourses and land drainage
- Surface water – flooding from runoff and overland flow as a result of rainfall events

- Groundwater – flooding due to the rising of the water table below ground
- Failure of artificial drainage systems and infrastructure – flooding that occurs as a direct result of infrastructure failure or overflow; including canals and reservoirs
- Water supply and wastewater infrastructure failure
- Failure of flood risk management assets

Assessment Criteria

1.6.3 Table 1.7 describes these sources of flooding and outlines the methodology used to assess flood risk for this Preliminary FRA. If the risk is considered moderate or high, then mitigation measures may be required.

Table 1.7: Sources of flood risk considered and assessment methodology for this Preliminary FRA

Flood Source	Flood Source Detail	Assessment Methodology
Coastal/Tidal	Coastal/tidal flooding is flooding originating from the sea where water levels exceed the normal tidal range and flood onto the low-lying areas that define the coastline. Coastal/tidal flooding results in the inundation of low-lying areas and areas where sea defences have been breached or overtopped and is generally caused by seasonal high tides and where stormy weather conditions results in strong wave action that increase water levels above the norm. The Proposed Scheme does not traverse areas considered to be at risk of coastal flooding and would not increase the risk of coastal flooding. Therefore, this FRA has not considered this source of flooding further	N/A
Fluvial (main rivers)	Fluvial flooding occurs when rives (main rivers or ordinary watercourses) are unable to cope with the volume of water draining from the surrounding land as a result of sustained or intense rainfall. The increase in water causes the rivers to rise above its banks and/or retaining structures and flow across land.	Review of the FMfP to understand risk from fluvial flooding associated with main rivers within the provisional Order Limits.
Fluvial (ordinary watercourses)		Review of the Environment Agency Risk of Flooding from Surface Water (RoFSW) (Environment Agency, 2021) mapping to identify ordinary watercourses. However, the RoFSW mapping may not include all these watercourses or ditches or include all structures on them.
Surface Water	Surface water (pluvial) flooding results from rainfall-generated overland flow before the runoff enters any watercourse, drainage system or sewer or when the infiltration capacity of the ground surface is exceeded during extreme rainfall events. Excessive surface water runoff can pose a flood hazard especially if flowing at high velocity. Localised depressions in the ground topography can result in the ponding of water, sometimes to a significant depth. The antecedent conditions, permeability of the soil type or geology can affect the volume of runoff, whilst the capacity and condition of the drainage network can affect how much water remains on the surface. The topography of the land and location of urban features such as road networks also influence surface water flood risk.	Review of the Environment Agency RoFSW mapping to determine areas of high, medium and low surface water flood risk within the provisional Order Limits.

Flood Source	Flood Source Detail	Assessment Methodology
Groundwater	Groundwater flooding occurs when groundwater levels rise above the ground surface. In some instances, groundwater can emerge at surface level following heavy or prolonged rainfall events and contribute to existing flooding from other sources. A greater risk can be presented if construction works or long term, large developments, such as road schemes, intersect areas with shallow groundwater levels, or create pathways for deeper confined artesian groundwater to be released at ground level causing widespread flooding. The presence of linear below ground structures can also increase the risk of flooding as they can impede groundwater flow leading to a rise in the water table up hydraulic gradient of the structures.	Review of the local PFRA, SFRA and SWMP for groundwater flood risk information pertinent to the provisional Order Limits. BGS groundwater flooding susceptibility data will be reviewed to determine areas of high, medium and low likelihood of groundwater emergence. A high-level review will also be undertaken of groundwater levels reported in BGS borehole records within the Order Limits, bedrock and superficial aquifer properties information, and potential indicators of shallow groundwater emergence (such as springs). This will be compared with the BGS groundwater flooding susceptibility data, alongside design considerations for the Proposed Scheme, to identify areas of potential high, medium and low groundwater flood risk within the provisional Order Limits.
Failure of water retaining infrastructure	Flooding due to the collapse and/or failure of man-made water retaining features such hydropower-dams, water supply reservoirs, canals, flood defences structures, underground conduits, and water treatment tanks or pumping stations. Reservoir flooding can occur as a result of the failure of artificially created ponds/lakes and is detailed in the NPPG to be residual risk. The Reservoir Act 1975 defines a 'large, raised reservoir' as 'a reservoir that is capable of holding more than 25,000 m^3 of water above the topographical level of any adjoining land'. The failure of a reservoir can result in a large volume of water escaping, potentially at high velocity and flooding land within its flow path. This can lead to significant consequences in the surrounding area. Flooding due to the failure and or collapse flood defence infrastructures is considered to be a residual risk. Failure could potentially result in a release of large volumes of water at high velocity.	The assessment will be based on the FMfP that indicates areas at flood risk due to reservoir areas benefitting from flood defence structures within the provisional Order Limits. Local SFRAs will also be also reviewed to understand the condition and nature of the water retaining structures.

Flood Source	Flood Source Detail	Assessment Methodology
Failure of sewers and water mains infrastructure	Sewer or water supply infrastructure flooding occurs when there is a failure, collapse, or blockage of the network. The probability of sewer or water supply infrastructure flooding is dependent on the combined effect of several factors such as infrastructure condition, existing maintenance regimes and other outside influences. However, failure could potentially result in a release of large volume of water.	Local SFRAs will be consulted regarding the sewer and water main infrastructure flood risk. Review will be undertaken of mapping showing the existing water supply and sewer infrastructure to determine the impact to and from the Proposed Scheme.
Land drainage and artificial drainage	Failure of land drainage infrastructure such as drains, channels and outflow pipes, which is most commonly the result of obstructions, poor maintenance and/or blockages. For the Proposed Scheme, a like for like replacement would be undertaken where this infrastructure is affected. Therefore, the risk of flooding is unlikely to change and consequently this FRA has not considered this source of flooding further.	N/A

Tidal/Coastal Flood Risk

1.6.4 Due to its inland location with ground levels ranging between 82 - 102 mAOD, flooding from the sea is not considered to be a risk to the Proposed Scheme and has therefore been scoped out.

Fluvial Flood Risk from Main Rivers

1.6.5 Based on the FMfP reproduced as Figure 14.6, the Proposed Scheme is located wholly within Flood Zone 1. The nearest mapped area of Flood Zones 2 and 3 is associated with the Hollins Brook approximately 0.2km northwest of the Proposed Scheme Order Limits.

1.6.6 The overall flood risk from main rivers to the Proposed Scheme is considered to be **Low**.

Fluvial Flood Risk from Ordinary Watercourses

1.6.7 A review of the RoFSW map indicates a risk of flooding from smaller watercourses interacting with the Proposed Scheme as presented in Figure 14.7 of the PEIR. A number of these surface water flood extents can be attributed to fluvial flooding from watercourses with catchments less than 3km^2 not mapped on the FMfP. However, due to the way in which the RoFSW map is produced, areas identified as being at RoFSW often overlap with areas identified as being at risk of fluvial flooding. Thus, in locations where no fluvial flood risk mapping exists, the RoFSW map may provide an additional indication of potential fluvial flood risk associated with smaller watercourses. Table 1.8 summarises these risks.

Table 1.8: Summary of Ordinary Watercourse Flood Risk to the Proposed Scheme

Watercourse	Description of flood risk
Ordinary Watercourse 1 (Tributary of Parr Brook)	This watercourse rises to the north of the M60 in Whitefield and flows northwards through Thatch Leach Lane park to join the Parr Brook. There is no surface water flow path evident from the RoFSW (2021) mapping in the vicinity of the Proposed Scheme attributable to this watercourse.
Ordinary Watercourse 2 (Tributary of Castle Brook)	This watercourse rises to the north of M60 J18 and flows eastwards away from the M66 to join Ordinary Watercourse 3 and then the Castle Brook approximately 450m east of the motorway. The watercourse forms the boundary of the provisional Order Limits and therefore it is not anticipated to impact the Proposed Scheme during operation.
Ordinary Watercourse 3 (Tributary of Castle Brook)	This watercourse rises south of the M62 and flows northwards crossing the motorway approximately 530m north-east of the M60 J18 and flows north-westwards parallel to the M66 to join ordinary watercourse 2 and then the Castle Brook approximately 450m east of the M66. Flood extents based on the RoFSW (2021) are within the river channel except for an area south of Egypt Lane, although that is outside the provisional Order Limits.
Ordinary Watercourse 4 (Tributary of Castle Brook)	This watercourse rises approximately 330m north-west of the M62 and flows south-westwards to join the Castle Brook at the same point as ordinary watercourses 2 and 3. It flows parallel and approximately 40m north-west of Egypt Lane. Based on the RoFSW (2021) flooding is retained in the river channel except for an area at the head of the watercourses approximately 1km north-east of M60 J18 and outside the provisional Order Limits.
Ordinary Watercourses 5, 6 & 7 (Tributaries of the River Irk)	These three ordinary watercourses rise within the study area to the east of the M60 south-east of M60 J18 and join to flow through farmland south-eastwards away from the Proposed Scheme to their confluence with the River Irk approximately 500m east of M60

Watercourse	Description of flood risk
	J19. Based on the RoFSW (2021) there are areas of flood risk attributed to these watercourses but not that intersect the provisional Order Limits.
Ordinary Watercourse 8 (tributary of the Bradley Brook)	This watercourse rises to the north of the M60 in Whitefield Golf Club at the western end of the Proposed Scheme. It flows southwards crossing under the motorway approximately 700m to the west of M60 J17. Continuing southwards it joins the Bradley Brook 250m south of the M60. The RoFSW (2021f) indicates areas of flood risk to the north of the M60 in the golf course which are outside the provisional Order Limits. There are also areas of low risk across the eastbound M60 carriageway south of Philip's Park Road associated with a flow path that originates on the M60 carriageway rather than the watercourse..
Ordinary Watercourse 9 (tributary of the Bradley Brook)	This watercourse rises to the north of the M60 in Park Lane at the western end of the Proposed Scheme. It flows southwards crossing under the motorway approximately 1.5km to the west of M60 J17. Continuing southwards it joins the Bradley Brook 500m south of the M60.
Ordinary Watercourse 1 (Tributary of Parr Brook)	This watercourse rises to the north of the M60 in Whitefield and flows northwards through Thatch Leach Lane park to join the Parr Brook. There is no surface water flow path evident from the RoFSW (2021) mapping in the vicinity of the Proposed Scheme attributable to this watercourse.

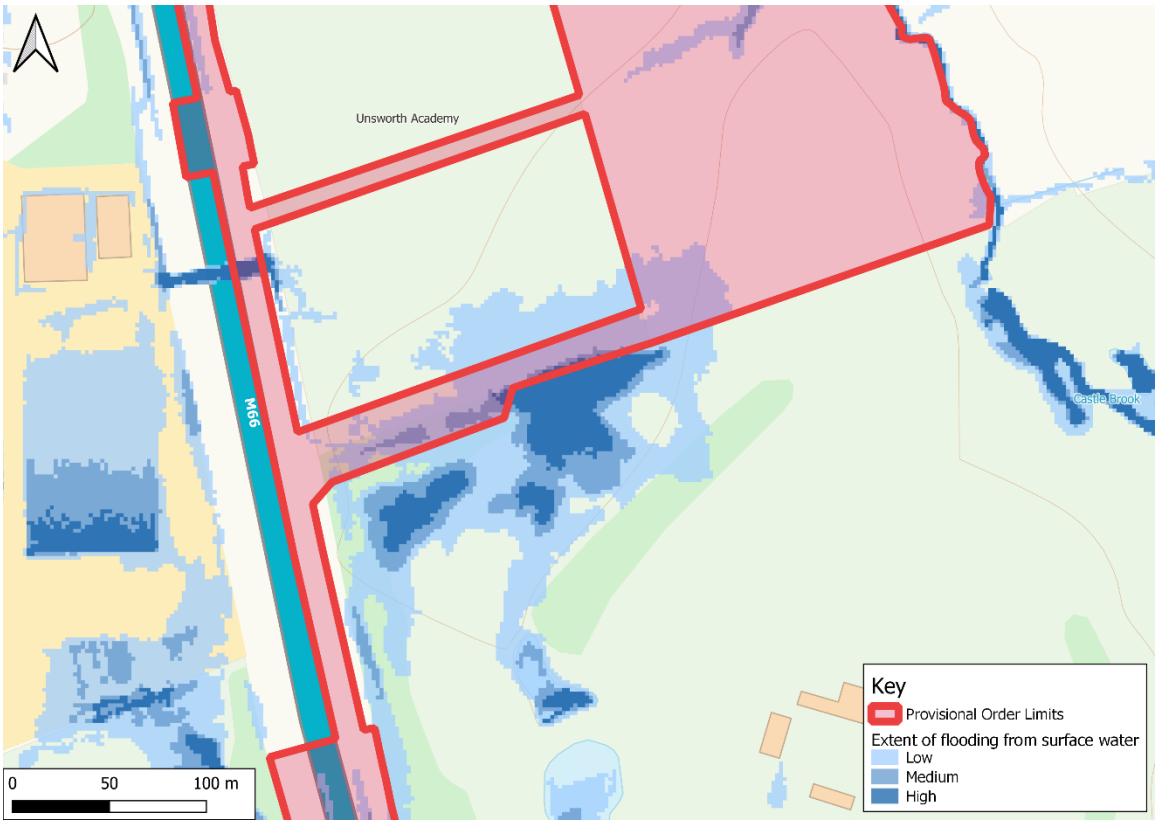
1.6.8 The overall flood risk from watercourses to the Proposed Scheme is considered to be **Moderate** due to the areas of surface water flood risk shown on RoFSW map. As stated in section 1.6.10, it is believed that these areas at risk of flooding are either areas at risk of fluvial flooding associated with minor watercourses or depressions in local topography where surface water ponds (as summarised in Table 1.8). Embedded mitigation measures, such as the avoidance of development in areas at risk of flooding and the design of appropriate drainage systems, should ensure that there is no risk of flooding to the Proposed Scheme and no impact from the Proposed Scheme on flood risk elsewhere for the Proposed Scheme's lifetime (100 years).

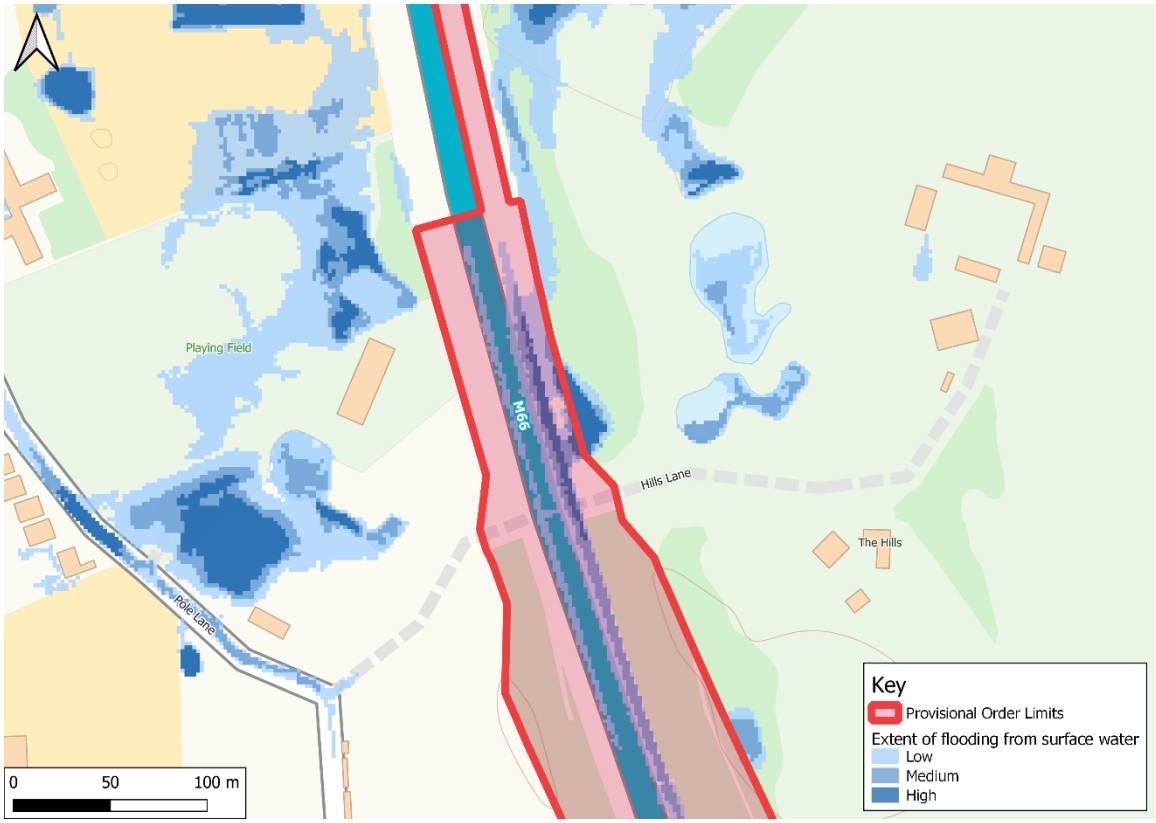
Surface Water Flood Risk

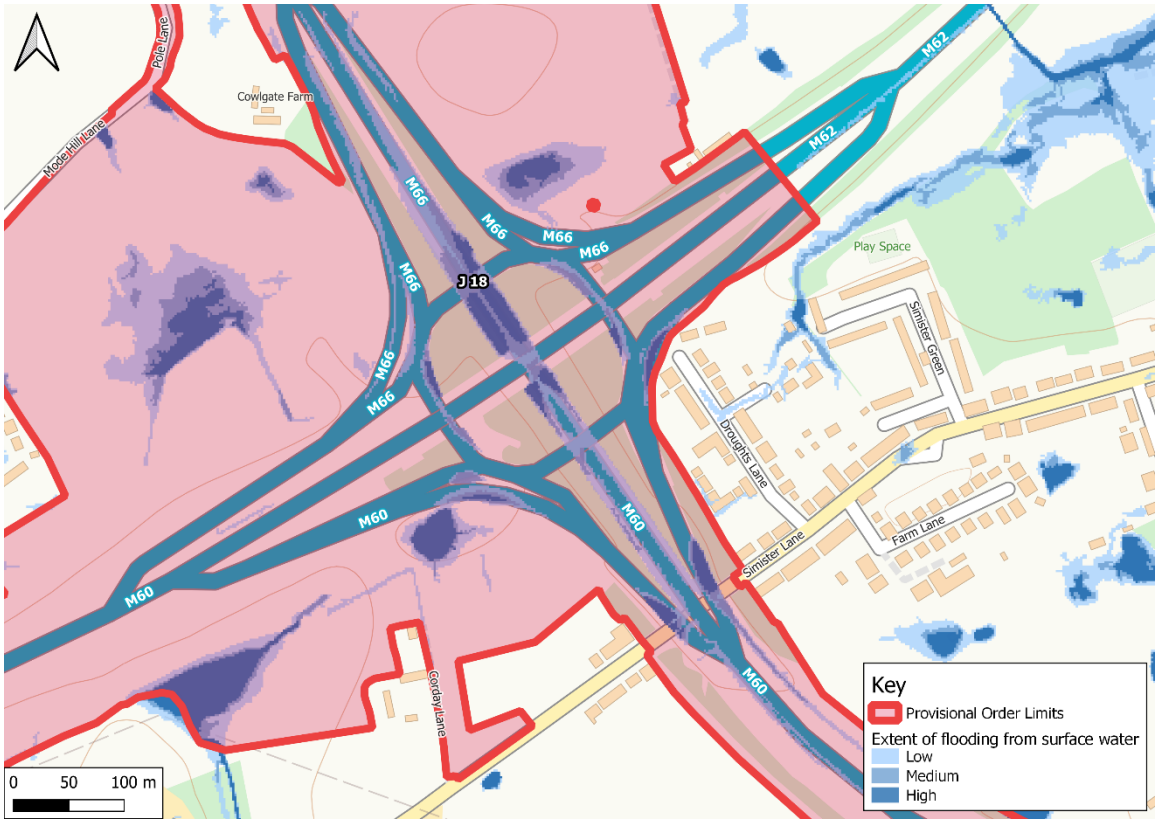
1.6.9 The RoFSW map also indicates areas which show surface water flood extents where in the incident rainfall intensities exceed the grounds infiltration capacity such that water collects on the ground surface. Therefore, there is a greater risk of flooding from this source within urbanised areas, where there is a higher proportion of impermeable surfacing. This is summarised in Table 1.9.

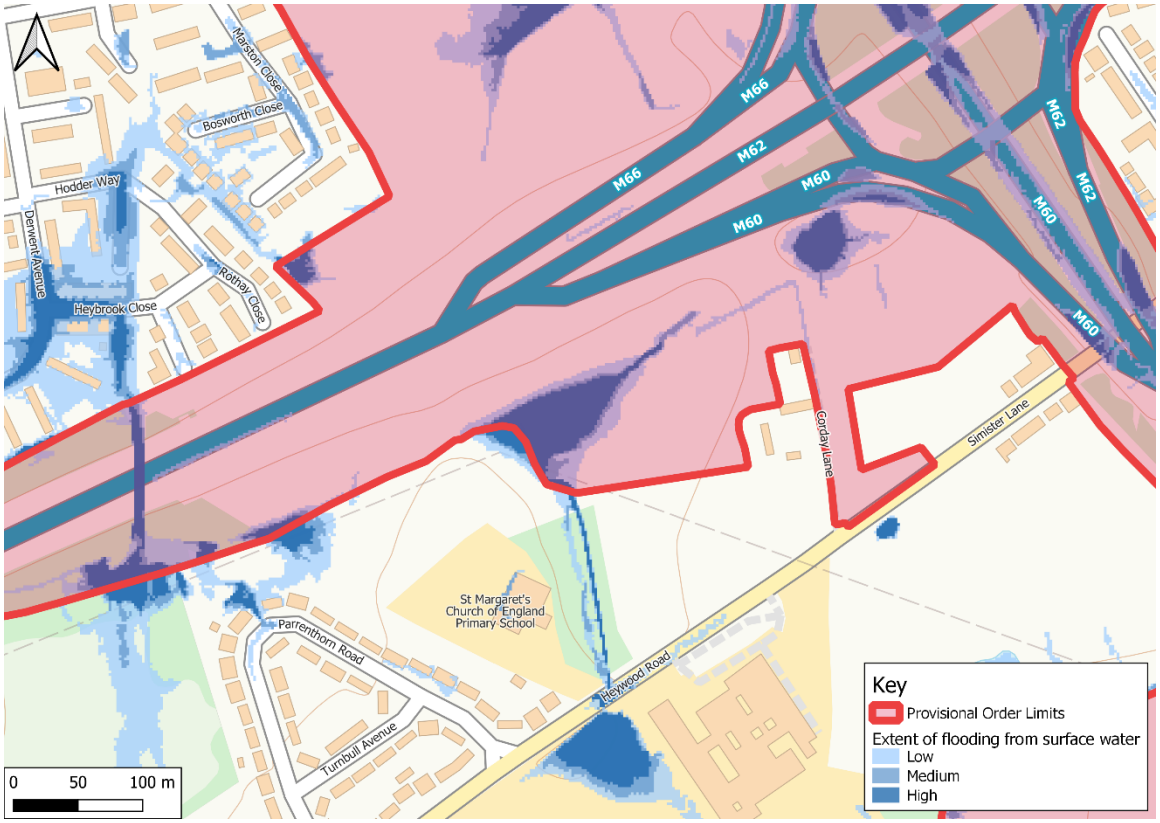
1.6.10 Other areas of surface water flood risk are located mainly within localised topographic depressions or against existing road embankments, these locations of high surface water risk are summarised in Table 1.9. It should be noted that the high-level models often used for large-scale surface water mapping may not take full account of the influence of existing drainage and culverts and may therefore overestimate flood risk in some areas.

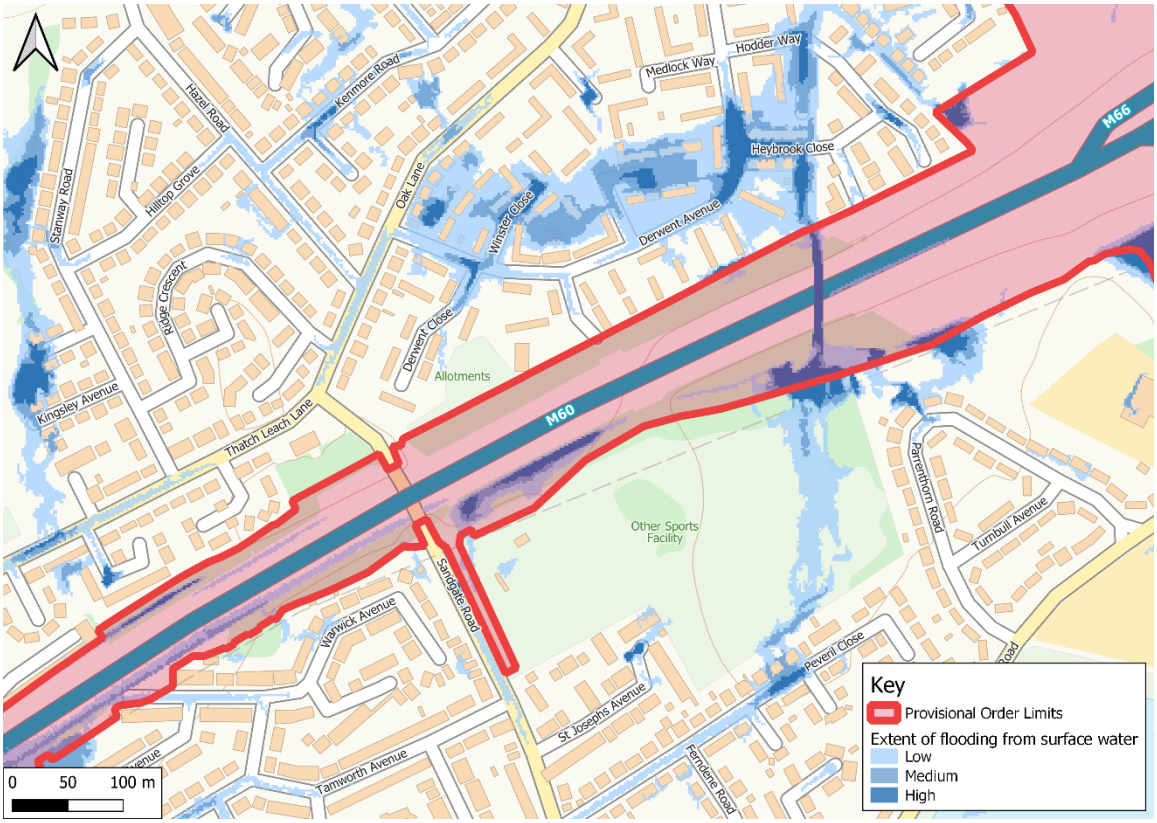
Table 1.9: Summary of High Surface Water Risk Areas

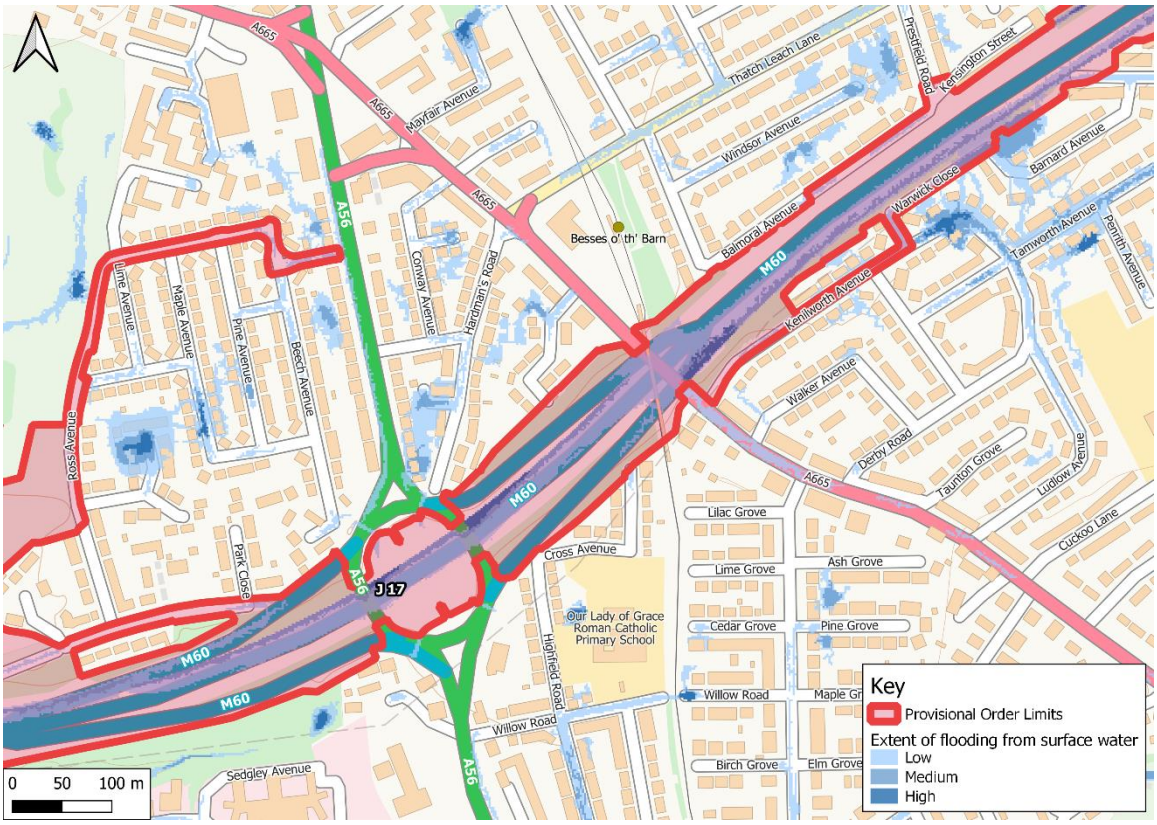
Location	Description of flood risk
NGR: SD82460717, Land north of Pike Fold Golf Club and M60 carriageway	A high surface water flood risk flow path is shown to be originating from flows retained by the existing M60 embankment resulting in ponding along the boundary of the Pike Fold Golf Club and southern boundary of Unsworth Academy. The ponding occurs in a local topographic depression associated with a network of recreational ponds present on the Golf Club. The average flood depth is 300 - 600 mm and the flood velocity is predominantly over 0.25 m/s. A historical flood event of medium severity has been recorded on Highways England Drainage Data Management System (HADDMS) at this location. The description of the event recorded standing water on the M60 main carriageway. 

Location	Description of flood risk
NGR: SD82410682, Land north of Hills Lane	A high surface water flood risk flow path is shown along the land north of Hills Lane against the existing M60 embankment. The flow path runs down to a network of ponds presents on the Pike Fold Golf Club. The surface water ponding interacts with the M60 provisional Order Limits. The average flood depth is between 300mm to 600mm and the flood velocity mainly under 0.25m/s. A historical flood event of medium severity has been recorded on Highways England Drainage Data Management System (HADDMS) at this location. The description of the event detailed standing water on the M60 main carriageway. 

Location	Description of flood risk
NGR: SD82820594, M60 J18 Roundabout	The M60 J18 includes areas of surface water high risk associated with the underpass and ponding accumulating at the low points of slip roads. Based on Environment Agency RoFSW mapping the flood depth is described as between 300 and 600 mm and the flood velocity is predicted to be predominantly under 0.25m/s. Historical flood event of low and medium severity has been recorded on HADDMS at this location. The description of the event detailed standing water on the M60 main carriageway resulting in flooding of the central reserve. 

Location	Description of flood risk
NGR: SD82500570, Land north of St Margret's CofE Primary School	High surface water flood risk is associated with overland flows originating from Parrenthorn High School, crossing Heywood Road collecting at a local topographic depression that ponds against the existing M60 embankment. Based on the RoFSW the predicted flood depth is between 600-900 mm and the velocity predominantly over 0.25m/s. A historical flood event of low and medium severity has been recorded on HADDMS at this location. The description of the event detailed standing water on the M60 main carriageway resulting in flooding of the central reserve. 

Location	Description of flood risk
NGR: SD82180554, Land associated with the Prestwich Heys Football Club	High surface water flood risk is associated with overland flows originating from the Prestwich Heys Football Club, crossing the existing M60 carriageway. Based on the RoFSW the flood depth is predicted to be between 300-600 mm and the velocity predominantly under 0.25m/s. A historical flood event of low and medium severity has been recorded on HADDMS at this location. The description of the event detailed standing water on the M60 main carriageway resulting in flooding of the central reserve. 

Location	Description of flood risk
NGR: SD81220496, Land north of Hills Lane	High surface water flood risk is associated with overland flow routes originating from Derby Road, Beeston Grove and Tamworth Avenue ponding against the existing M60 embankment and running along the existing M60 carriageway. Based on the RoFSW the predicted flood depth is between 300-600 mm and the velocity predominantly under 0.25m/s. Historical flood event of low and medium severity has been recorded on HADDMS at this location. The description of the event detailed standing water on the M60 main carriageway resulting in flooding of the central reserve. 

1.6.11 The overall surface water flood risk from ponding and overland flow routes to the Proposed Scheme is considered to be **High** due to there being areas of “high” risk and a past flood history.

Groundwater Flood Risk

1.6.12 BGS data shows that there are three main areas within the provisional Order Limits with potential for groundwater flooding to occur at surface level, or to property or infrastructure situated below ground level (BGS, 2021) (see Figure 14.8):

- Most of the area in and around M60 J18, extending north to Unsworth along the M66
- Between M60 J17 and J18 around Oak Bank and north of Parrenthorn Road
- In the far west, to the west of M60 J17

1.6.13 The remainder of the area within the provisional Order Limits is considered to have limited potential for groundwater flooding to occur.

1.6.14 A review of groundwater level information within the provisional Order Limits (obtained from historical borehole records), has been undertaken. There were 132 borehole

records located within the provisional Order Limits (BGS, 2022), with 56 of them noting a presence of groundwater strikes encountered during drilling or noted that the borehole was dry and 76 being inconclusive.

1.6.15 Where encountered, BGS borehole records show that groundwater was primarily struck within the sand and gravel dominated made ground deposits, with some groundwater strikes recorded in the underlying glaciofluvial deposits (where made ground was less than 1.2m deep). In the majority (18 of 20 boreholes), groundwater was encountered at less than 3m below ground level (bgl), i.e., at a relatively shallow depth. As shown in Table 1.10, four boreholes had groundwater recorded at a depth of less than 1mbgl.

Table 1.10: Summary of Potential Groundwater Flooding Mechanisms in the provisional Order Limits

Borehole ID	Relation to the Proposed Scheme	Groundwater Level Information	Date
SD80SW1025	Located immediately west of J17 and less than 20m south of the M60	Strike at 0.7mbgl. No rise after 20 minutes	27/07/07
SD80SW1017	Located adjacent to J17 and the M60 eastbound slip road to the A56	Strike at 0.8mbgl. No rise after 20 minutes	25/07/07
SD80NW263	Located east of J17 and less than 20m north of the M60	Seep at 0.8mbgl	05/12/88
SD80NW177	Located south of M60 J18 along the route of the M60 carriageway	Seep at 0.35	02/10/90

1.6.16 As shown in Figure 14.8, Ordnance Survey and historic maps show a spring and a well located along the route of the M66, to the north of J18. An “issue” is shown along the northern boundary of the Northern Loop in the east of the provisional Order Limits, and two further wells are mapped along the eastern flank of M60 J18. These indicate the potential for shallow groundwater emergence in these locations.

1.6.17 The mapped locations of the springs, wells, “issues”, and the four historic borehole records listed in Table 1.10 (with groundwater levels of less than 1mbgl), broadly correlate with the areas of highest susceptibility to groundwater flooding. Based on this correlation, the generally shallow groundwater strike data recorded throughout the provisional Order Limits (i.e., less than 3mbgl), and the potential for superficial deposits such as peat, and the more permeable horizons within the glacial deposits and made ground to store significant quantities of groundwater, the Proposed Scheme is conservatively considered (at this PEIR stage) to be at ‘**High’** risk of groundwater flooding. A summary of these flooding mechanisms is presented in Table 1.11. This will be reviewed, and refined (where appropriate), for the Environmental Statement, following the receipt of GI data.

1.6.18 Further to the above, a shallow water table can act as a direct source of groundwater flooding, but it can also indirectly affect other flooding sources and mechanisms present. Table 1.11 summarises the potential groundwater flooding mechanisms operating within the provisional Order Limits at this stage of scheme development.

Table 1.11: Summary of Potential Groundwater Flooding Mechanisms in the provisional Order Limits

Primary Flood Source	Flooding Mechanism(s)	Scoped In / Out (✓ or ✗)	Comments
Groundwater	Naturally shallow groundwater levels in superficial and / or bedrock aquifers	✓	Likely due to evidence of shallow groundwater levels obtained from historical borehole records and

Primary Flood Source	Flooding Mechanism(s)	Scoped In / Out (✓ or ✗)	Comments
			mapped presence of springs, issues and wells
	Groundwater rebound / mine water rebound from ceasing abstraction(s)	✓	Possible as there is potential for underground coal mining to have taken place in and around M60 J17 (Coal Authority, 2022)
	Sub-surface barriers to groundwater flow e.g., building foundations / basements, sheet piles, linear flood defences etc.	✓	Likely due to the degree of urbanisation and number of buildings present throughout the provisional Order Limits
	Tidal locking which drives groundwater heads in adjacent aquifers and causes groundwater levels to rise (even if the watercourse remains in-bank)	✗	Unlikely due to the distance of the Proposed Scheme from the coast
	Artificially elevated groundwater levels caused by leaking assets (water transmission infrastructure, drainage / sewerage infrastructure, canals etc.)	✓	Possible due to the degree of urbanisation and likely number of water mains, sewers, etc. within the provisional Order Limits. Leakage from any water transmission infrastructure and assets could elevate groundwater levels locally in the aquifers that they pass through
Fluvial	Shallow groundwater levels which increase baseflow inputs to watercourses	✓	Possible in areas with shallow groundwater levels. Further assessment on groundwater contribution as baseflow to the main rivers needed at Environmental Statement stage
Surface water	Shallow groundwater levels which limit infiltration and enhances runoff response	✓	Likely in areas with shallow groundwater levels where superficial deposits have low permeabilities
Drainage / sewerage infrastructure	Groundwater ingress into drainage and sewerage systems which could reduce their efficiency and cause them to surcharge at an earlier onset	✓	Likely in areas with shallow groundwater levels and in the neighbouring urban areas

1.6.19 It should be noted that the PFRA, SFRA and SWMP listed in Section 1.4 were reviewed in relation to groundwater flood risk. However, they were primarily based on superseded versions of the BGS groundwater flooding susceptibility dataset. Hence, they do not form part of the groundwater flood risk assessment.

Reservoir Flood Risk

1.6.20 The Environment Agency's Risk of Flooding from Reservoirs mapping (Environment Agency, 2022d) indicates that the M60 at J18 and its northern and southern slip roads are at risk of flooding due to the failure of a large, raised reservoir, as defined under the Reservoir Act 1975. The potential extent of reservoir flooding also reaches residential areas in Whitefield by crossing the M60 west of J18. The source of the risk is not stated

but it may be Heaton Park Reservoir to the south-west of M60 J18. The flow path flows north-westwards and then following the course of the Parr Brook.

1.6.21 All large, raised reservoirs, as defined by the Reservoirs Act 1975, are regularly inspected and maintenance is supervised by reservoir engineers. Therefore, the likelihood of failure is considered to be very low due to their monitoring and inspection.

1.6.22 Heaton Park Reservoir lies approximately 750m directly south of M60 J18 and covers an area of some 33 hectares (ha). The reservoir is not hydrologically connected to the watercourses within the provisional Order Limits.

1.6.23 Therefore, the likelihood of failure to the Proposed Scheme is considered to be 'Very Low' however the consequences could be severe with a potential risk to life, therefore the risk is considered to be '**Low'**.

Risk of Flood Defence Failure

1.6.24 According to the FMfP there are no flood defences within 1km of the Proposed Scheme.

Other Sources of Flooding

1.6.25 The Proposed Scheme is not near to any other artificial sources of flood risk such as canals or wetland areas. As such, the Proposed Scheme is considered not to be at risk from any other artificial sources of flood risk.

1.6.26 A review of the local SWMPs provide information regarding the sewer flood risk. The information states that the data is not sufficient to determine the magnitude of sewer flood risk but is considered to be **'Low'**. This will be investigated further in the next stage.

Historic Flooding

1.6.27 The Environment Agency's Historic Flood Map (Environment Agency, 2022) identifies the maximum extent of recorded flood outlines from the rivers, sea and groundwater springs. A review of the map indicates there are no recorded incidents of fluvial flooding identified within 1km of the Proposed Scheme.

1.6.28 A further request will be made to BMBC as LLFA to identify any recorded flood incidents related to surface water flooding.

Summary of existing flood risk to the development

1.6.29 A summary of the estimated level of flood risk for each source, based on a review of available information, can be found in Table 1.12 below.

Table 1.12: Summary table of the flood risk to the Proposed Scheme

Source of flood risk	Assessed Risk Level
Fluvial	Low
Fluvial (ordinary watercourses)	Moderate
Surface Water (Existing Drainage Systems)	High
Sewers	Low
Groundwater	High
Reservoir	Very Low

1.7 Flood Risk from the Development

Assessment Criteria

1.7.1 This section assesses the potential impact that the Proposed Scheme may have on the risk of flooding elsewhere.

Fluvial Flood Risk (from Main Rivers)

1.7.2 As discussed in Section 1.6, the Proposed Scheme is entirely located within Flood Zone 1, therefore the Proposed Scheme does not impact on river or floodplain storage and fluvial flood risk elsewhere remains unchanged.

Fluvial Flood Risk (from Ordinary Watercourses)

1.7.3 A review of the RoFSW map indicates a risk of flooding from surface water attributed to ordinary watercourses within the study area as presented in Figure 14.7 and summarised in Table 1.8. There is potential for the Proposed Scheme to have an adverse impact on flood risk associated with ordinary watercourses. For example, changing culvert geometry and encroachment into the floodplain associated with ordinary watercourses could increase water levels upstream or downstream of the Proposed Scheme, reduce floodplain storage volume or pass additional flood flow downstream, increasing the risk of flooding.

1.7.4 There are also areas which show surface water flood extents where in the incident rainfall intensities exceed the grounds infiltration capacity such that water collects on the ground surface. This is summarised in Table 1.9.

1.7.5 At this stage, it is considered that the provision of culverts of an adequate size, maintenance of flood flow conveyance and drainage storage and flow attenuation embedded in the design of the Proposed Scheme will not have an adverse impact on flood risk from the Proposed Scheme.

Surface Water Drainage Flood Risk

1.7.6 Drainage of highway runoff will follow existing arrangements and will only be adjusted to suit the new pavement locations. The surface water drainage strategy is evolving but will be designed to incorporate storage and attenuation of additional runoff to ensure no increase in flood risk to receiving watercourses, including an allowance for climate change.

1.7.7 The change in impermeable area within each surface water drainage catchment is presented in the Table 1.13.

Table 1.13: Schedule of Drainage Catchments

Proposed Catchment	Gross Area (ha)	Impermeable Area (ha)	Permeable Area (ha)
Outfall 1 (1A and 1B)	14.7	8.5	6.2
Outfall 2	3.011	1.839	1.172
Outfall 4	8.593	5.343	3.250
Outfall 5	8.429	4.621	3.808
Outfall 6	14.696	11.681	3.015
Outfall 7	3.398	1.816	1.582

Groundwater Flood Risk

1.7.8 Where embankments are proposed, long-term changes to groundwater levels could occur in the superficial deposits, both underneath proposed embankments and in their vicinity due to embankment surcharge causing consolidation of the materials underneath the embankment, which may cause the ground beneath the structure to compress affecting groundwater storage and pore-water pressure distribution. This may locally increase groundwater flood risk if emergence is possible.

1.7.9 Potential ongoing dewatering for cuttings may cause the water table to fall, reducing localised groundwater flood risk. This will be confirmed with an assessment of the long-term dewatering requirements (where appropriate) for the Environmental Statement once GI data (including groundwater levels) have been obtained.

1.7.10 Permanent below ground structures, such as foundations for bridge abutments and sheet piles at gantry locations could form a sub-surface barrier to groundwater flow, thereby locally increasing groundwater flood risk on the up-gradient side and decreasing groundwater flood risk on the downgradient side of these structures (see Figure 14.8).

1.7.11 In addition, permanent below ground structures may require new pathways for groundwater migration to form around these features, which may locally increase groundwater flood risk elsewhere. This is also the case for backfilled excavations, such as those associated with temporary works areas (e.g., haul roads, construction compounds etc.) and drainage assets. This will be developed further at FRA stage.

Impact on Flood Risk from Reservoirs

1.7.12 The Proposed Scheme would not involve works that would impact on the risk of flooding from reservoirs.

Impact on Flood Risk from Sewers and Artificial Drainage Systems

1.7.13 The Proposed Scheme, through the widening of new carriageway, will result in an increase in impermeable area. Without mitigation this will increase the rate of surface water runoff and could exacerbate downstream flood risk

1.7.14 As identified in Section 5.3 the Proposed Scheme would result in an increase in impermeable area drained by the drainage system, and as a result the volume of surface water runoff would increase. Embedded mitigation through the storage and attenuation of additional runoff would ensure there would be no increased risk on receiving drainage networks and no additional mitigation is required.

1.7.15 The local SWMPs provide information regarding the sewer flood risk. The information states that the data not sufficient to determine the magnitude of sewer flood risk but is considered to be **‘Low’**. This will be investigated further in the next stage.

Table 1.14: Summary table of the flood risk to the Proposed Scheme

Source of flood risk	Risk Level	Mitigation required?
Fluvial	Low	x
Fluvial (ordinary watercourses)	Moderate	✓
Surface Water (Existing Drainage Systems)	High	✓
Sewers	Low	x

Source of flood risk	Risk Level	Mitigation required?
Groundwater	High	✓
Reservoir	Very Low	x

1.8 Residual Risks

1.8.1 The residual flood risks from minor watercourses include:

- Blockages of existing and proposed culverts by large debris that reduce flow capacity. According to the design standards, the blockage risk will be assessed to inform the updated FRA for the Environmental Statement, and appropriate mitigation in the form of trash screens may be provided depending on the risk level to reduce residual risk. However, flooding may occur due to blockage in excess of standard blockage assessment calculations.
- Flood risk associated with the likelihood of reservoir flooding.
- Severe flood events which exceed the design capacity of the culverts.

1.8.2 There is a residual surface water flood risk to the Proposed Scheme as a result of an extreme rainfall event that would exceed the design capacity of the surface water drainage system. The blockage risk of culverts will be assessed, and mitigation in the form of trash screens may be provided depending on the risk level to reduce residual risk. Potential blockages of the drainage system (such as gullies, pipes, etc) can result in a reduced drainage capacity that could result in flooding. The risk will be mitigated through suitable operation and maintenance of such drainage systems.

1.8.3 The residual risk could lead to overtopping of the proposed drainage basins and high flows or ponding along the M60 carriageway. It is recommended that the design of any drainage basins is built to appropriate climate change allowances with freeboard and includes consideration of exceedance events.

1.8.4 The production of an operational and maintenance plan for the surface water drainage system is also recommended, that will ensure the orderly operation of the system and contribute to the mitigation of the residual risks. This will be investigated further in the FRA for Planning.

1.9 Summary and Conclusion

Summary of Flood Risk

1.9.1 The development of the M60 J18 interchange (also known as Simister Island) project has been classified as essential infrastructure, in accordance with Table 3 of the NPPF. The Proposed Scheme is wholly located within Flood Zone 1 and therefore is considered to be at **'Low'** risk of flooding from fluvial sources associated with main rivers. This is considered to be appropriate in terms of flood risk.

1.9.2 The fluvial; flood risk from ordinary watercourses to the Proposed Scheme is considered to be '**Moderate'** due to the areas of surface water flood risk shown on the RoFSW map.

1.9.3 The Proposed Scheme is identified to be mainly at '**High**' surface water flood risk. Surface water flood risk areas were identified due to overland flows on the main carriageway. The addition of impermeable areas can lead to increased runoff rates that will lead to increased surface water flood risk. The Proposed Scheme would include

new surface water drainage features (e.g., road drainage and SuDS) to manage the risk of surface water flooding along the Proposed Scheme carriageway.

1.9.4 The Proposed Scheme will result in an increase in impermeable area and consequently an increase in runoff volume. The proposed surface water drainage strategy will ensure that the increase will be managed through attenuation facilities and there will be no increase in peak flow (including an allowance for climate change) to ensure no increase in flood risk.

1.9.5 The risk of flooding to the existing M60 from failure of reservoirs, sewers, water supply infrastructure and flood defence infrastructure is considered to be low, therefore no additional mitigation measures are proposed.

1.9.6 As the Proposed Scheme is located in Flood Zone 1 the Environment Agency's climate change guidance suggests that the Higher Central allowance must be assessed for essential infrastructure, indicating that peak flows could increase by 46%. Climate change has the potential to increase peak flows, and therefore flood extents, for existing main rivers. However, since the Proposed Scheme is located within Flood Zone 1 it is not considered that it would become inappropriate development as it is at low risk of fluvial flooding associated with 'main rivers.

1.9.7 The fluvial; flood risk from ordinary watercourses to the Proposed Scheme is considered to be **'Moderate'** due to the areas of surface water flood risk shown on the RoFSW map Climate change has the potential to increase peak flows, and therefore flood extents, for the ordinary watercourses located in the vicinity of the Proposed Scheme. There is a likelihood the risk of fluvial flooding from ordinary watercourses may increase in line with projected climate change allowances,

1.9.8 At this PEIR stage, the Proposed Scheme is conservatively considered to be at generally **'High'** risk of groundwater flooding. As a result of several elements of the Proposed Scheme expected to interact with the water table, e.g., cuttings, excavations required for bridge foundations, sheet piling at gantry locations etc., there is also potential for the Proposed Scheme to increase groundwater flood risk, both to the development and elsewhere.

1.9.9 Best-practice mitigation outlined in the EMP would be adhered to and a dewatering risk assessment and piling risk assessment would need to be carried out where appropriate. It is recommended that a more detailed review of groundwater levels within the provisional Order Limits is undertaken at the Environmental Statement stage, upon receipt of GI data, to refine the baseline understanding of groundwater flood risk to the development and its subsequent impacts on groundwater flood risk elsewhere.

1.9.10 Reservoir and Sewer flood risk has been assessed to be **'Very Low'** and **'Low'**, respectively, to the Proposed Scheme.

Conclusion

1.9.11 The Preliminary Flood Risk Assessment has demonstrated that further assessment and data collection is required to manage flood risks to and from the Proposed Scheme in compliance with the NPPF and NPS NN. Further scheme design development, surveys and assessment will continue during the Environmental Statement stage. Stakeholders will continue to be consulted on the likely significant effects and proposed mitigation. This preliminary FRA will be updated to reflect ongoing design development to support the Environmental Statement.

Appendix 16.1. Long list of other developments

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
Nationally Significant Infrastructure Projects within 2km of the Proposed Scheme										
There are no Nationally Significant Infrastructure Projects within 2km of the Proposed Scheme. The nearest Nationally Significant Infrastructure Projects is the A57 Link Roads project, located approximately 17.7km from the Proposed Scheme.										
Planning applications within 2km of the Proposed Scheme										
Bury Metropolitan Borough Council										
BMBC-APP-001	Mr Kiely	58918	Land adjacent to 15 Prestfield Road, Whitefield, Manchester, M45 6BD	Erection of 33 apartments with associated parking and a detached dwellinghouse.	0.00	Approved	29/02/2016	Tier 1	All topics	Yes, due to the distance from the project.
BMBC-APP-002	Mr Smith	63003	85 Bury Old Road, Whitefield, Manchester, M45 7AY	Erection of new four storey office building (Class B1) and new four storey building comprising of 11 residential apartments (Class C3) together with dedicated parking.	0.05	Approved	11/06/2019	Tier 1	All topics	Yes, due to the distance from the project.
BMBC-APP-003	Galliford Try Building - North West	63378	Castlebrook High School, Parr Lane, Bury, BL9 8LP	Variation of condition of planning permission 61515 for erection of new main school building: Revised site layout plan to show amendments to the habitat zone and parking layout. Ref 61515: Demolition of existing main school building and erection of new (relocated replacement) main school building, relocated hard surface games areas, car parking and landscaping and new substation.	0.05	Approved	15/01/2019	Tier 1	All topics	Yes, due to the distance from the project.
BMBC-APP-004	Mr Smallman	65379	Lord Clive Pub, 92 Mersey Drive, Whitefield, Manchester, M45 8LF	Demolition of existing building and construction of a three-storey block of apartments consisting of 27 units.	0.40	Approved	16/07/2020	Tier 1	Air quality (construction dust); Geology and soils; Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development and distance from the project.

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
BMBC-APP-005	Mr Parks	62751	34-36 Fountain Place & Aldi Foodstore Ltd, Higher Lane, Whitefield, Manchester, M45 7EA	Demolition of 34-36 Fountain Place and the extension of existing car park.	0.50	Approved	20/06/2018	Tier 1	Geology and soils; Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-006	Mr Baldwin	68691	Land off Victoria Avenue, Whitefield, Manchester, M45 6DP	Redevelopment and change of use of the site to provide 30 new residential dwellings along with associated works including landscaping and provision of access from Victoria Avenue, including highway works to Victoria Avenue.	0.50	Registered	30/08/2022	Tier 1	Geology and soils; Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development and distance from the project.
BMBC-APP-007	Mr Dowse	67431	Land off Poppythorn Lane, Prestwich	Residential development comprising six single storey apartments and 12 duplex apartments in part-two and three storey linked buildings with landscaped grounds, car parking and a new access road from Poppythorn Lane serving the development.	0.70	Approved	10/08/2022	Tier 1	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-008	Mr Mclean	68066	Unsworth Primary School, Blackley Close, Bury, BL9 8LY	Proposed additional staff car parking (seven additional spaces).	0.75	Approved	14/07/2022	Tier 1	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
BMBC-APP-009	Peveril Securities Ltd	60998	Park 66, Pilsworth Road, Bury, BL9 8RS	Mixed use development B1c, B2, B8, A1, D2, A3/A5.	0.80	Approved	23/11/2017	Tier 1	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-010	JD Sports Fashion plc	68530	Land at the junction of Hollins Brook Way and Pilsworth Road, Bury, BL9 8RR	Hybrid application - Full application: Zone 1 development of Commercial building No1 (Creche, Use Class E), car parking and internal site roads, a new site access junction to Pilsworth Road, highway improvements to Hollins Brook Way and Pilsworth Road, and continued use of an existing car park exit to Aviation Road. Outline application: Zone 2 development of Commercial building No.2 (Hub building, Use Class E) car parking and internal site roads and a multi-purpose all-weather sports pitch (Including reserved matters of means of access, layout and scale included for determination).	0.80	Awaiting decision	06/06/2022	Tier 1	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development.
BMBC-APP-011	Mr Barnes	62220	Elizabethan Public House, Ribble Drive, Whitefield, Manchester, M45 8WJ	Demolition of public house and erection of 15 dwellings.	1.00	Approved	09/01/2019	Tier 1	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-012	N/A	68744	Land adjacent to junction of Pilsworth Road and Pilsworth Way, Pilsworth Industrial Estate, Bury, BL9 8RE	Extensions to 13 existing units; Erection of three new build units; External alterations (including comprehensive recladding) and associated access, parking, servicing, security treatment and landscaping arrangements.	1.00	Awaiting decision	02/082022	Tier 1	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
BMBC-APP-013	Mr Adair	68705	Nightfreight, Roach Bank Road, Bury, BL9 8RQ	Extend the existing car park for 35 new car park spaces into the south of the site with new 1.2m retaining wall.	1.10	Awaiting decision	31/08/2022	Tier 1	Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-014	Star UK PAS I Propco Limited (UK)	68897	Unit 3, Roach Bank Road, Bury, BL9 8RY	Proposed extension to existing warehouse with external alterations to the existing building and use of the building for Class E(g) and / or Class B2 and / or Class B8 purposes with associated works.	1.18	Awaiting decision	16/09/2022	Tier 1	Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-015	Miss Steadman	60556	Land off Roach Bank Road, Bury, BL9 8RQ	Industrial unit for a food production facility with ancillary offices, associated parking, service yards and landscaping.	1.40	Approved	26/10/2016	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-016	Mr Yazdanpanah	66674	Former nursery building and land to rear of Earl Street, Prestwich, Manchester, M25 1GQ	Change of use and part demolition of former nursery building to form three dwellings; Demolition of existing garage units and construction of 12 dwellings with associated external works (15 units in total).	1.50	Refused	18/05/2022		Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Application refused (to be reviewed again for potentially successful appeals).
BMBC-APP-017	Mr Salim	63376	The Old School, 1 Walker Street, Radcliffe, Manchester, M26 1FH	Conversion of antiques centre/dwelling to 13 residential apartments.	1.70	Approved	31/01/2019	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-018	Mr Salim	67008	The Old School, 1 Walker Street, Radcliffe, Manchester, M26 1FH	Variation of condition no. 2 of planning permission 63376 for Conversion of antiques centre/dwelling to 13 residential apartments; change to window type to UPVC windows.	1.70	Approved	26/08/2021		Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID BMBC-APP-017 (application ref 63376)**.
BMBC-APP-019	Mr Boys	65877	Connect 56 Business Park, Former Derby Works, Manchester Road, Bury, BL9 9NX	Demolition of a number of existing industrial buildings on an existing industrial site, over-cladding of existing elevations and roofs, new door openings and the sub-division of a number of existing buildings to create self-contained industrial starter units.	1.90	Approved	11/11/2020		Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-020	Environment Agency	63559	Land to south of Morris Street and land within Close Park, Radcliffe	A series of sheet piled walls and embankments, on land within Close Park and land to the south of Morris Street, which form part of a wider scheme to improve flood protection along the River Irwell.	2.00	Approved	28/03/2019	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
BMBC-APP-021	The Averill Group	65015	Land at Morris Street, Radcliffe	Construction of 25 dwellings with associated access, landscaping and ancillary works.	2.00	Approved	24/03/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-022	Dumers Lane Ltd	68738	Cellnet Building, Dumers Lane, Bury, BL9 9QL	Change of use of from call centre office (Class E) to a flexible use comprising of a warehouse distribution centre (Class B2/B8) with ancillary offices (Class E(g)); Creation of new site access/entrance with sliding security gates, service yard and vehicle/cycle parking; External alterations including new loading/delivery doors to north elevation.	2.00	Awaiting decision	01/08/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-023	Weidenbaum	67839	The Pilot Mill, Alfred Street, Bury, BL9 9EF	Non material amendment following approval of planning permission 66752- Alterations to the elevation to remove the previously proposed roller shutter doors and retain the existing window opening (albeit replaced with new UPVC units to match others in this elevation) and a door for each of the units. Internal alterations to reposition proposed WCs resulting in a reduction of 1no. unit and an increase in size of unit No. 4.	2.00	Approved	15/12/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID BMBC-APP-024 (application ref 66752)**.
BMBC-APP-024	Weidenbaum	66752	Pilot Mill, Alfred Street, Bury, BL9 7EJ	Subdivision of a portion of the ground floor of the existing building to create seven business units (Use Class E Part G i, ii, iii, B2, B8) and external alterations including replacement windows and the installation of roller shutters to the northern elevation.	2.00	Approved	06/08/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-025	Mr Van	66231	Land to west of Metrolink line at Warth Road; Land to west of Bury Road; Land to east of Whitefield Road; Land to west of Hardy's Gate Bridge and Land to north of York Street, Bury	Variation of condition 2 (approved plans) for the realignment of the flood defence adjacent to Hardy's Gate Bridge.	2.00	Approved	21/01/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
BMBC-APP-026	Mr Van	66570	Land near Hardy's Gate Bridge, Bury	Non-material amendment following grant of planning permission 65171: Minor re-alignment of the sheet piles forming the flood defence wall and relocation of the access ramp.	2.00	Approved	12/03/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.

Development description								Cumulative Effects Assessment Stage 1		
ID	**Applicant or proponent**	**Application reference**	**Location**	**Description**	**Distance from project (km)**	**Application status**	**Submission / Decision date**	**Tier**	**Within ZOI?**	**Progress to Stage 2?**
Manchester City Council										
MCC-APP-001	Mr Broadbent	133818/LO/2022	Heaton Park, Horticultural Centre Middleton Road Manchester M25 2SW	City Council Listed Building Consent for the erection of temporary fencing in association with construction works, together with removal of existing boundary wall to the western and southern elevation to allow its reconstruction and excavation works to allow new foundations.	0.90	Awaiting decision	19/05/2022	Tier 1	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
MCC-APP-002	Premier Inn Hotels Limited	118800/FO/2018	Premier Inn, Heaton Park, Middleton Road, Manchester, M8 4NB	Erection of three storey extension to existing hotel (Use Class C1) to provide 39 new bedrooms (total of 84) together with the reconfiguration of the car park, associated landscaping and ancillary services, including plant equipment.	1.80	Approved	13/04/2018	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development.
MCC-APP-003	Mr Partington	115904/VO/2017	Longhurst Road, Manchester, M9 8NS	Erection of 10 two-storey residential dwellings with associated car parking, landscaping, regrading of ground levels and boundary treatments.	2.00	Approved	19/07/2017	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
MCC-APP-004	Our Lady's RC High School	134375/FO/2022	Our Lady's RC High School, Alworth Road, Manchester, M9 0RP	Erection of temporary building for a period of five years to form additional sports accommodation.	2.00	Approved	30/09/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
MCC-APP-005	Our Lady's RC High School	129587/FO/2021	Our Lady's RC High School, Alworth Road, Manchester, M9 0RP	Erection of a two-storey educational building (1,245 sqm) (Use Class F1a) to provide additional teaching space for the existing school, following removal of the temporary prefabricated classroom and associated hard and soft landscaping works.	2.00	Approved	26/05/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
Rochdale Borough Council										
RBC-APP-001	Mr Connor	22/00845/FUL	Site of Tapios, Heywood Old Road, Middleton, M24 4QG	Erection of a three-storey block comprising 10 two-bedroom apartments with associated car parking, alterations to site entrance and landscaping following demolition of existing building.	1.00	Approved	23/06/2022	Tier 1	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
RBC-APP-002	Christ's Hospital	21/01099/FUL	Unit 1 Pennines Business Park, Pilsworth Road, Heywood, OL10 2TL	Replacement of and increase in height to dock loading shelters within northern elevation of building	1.60	Approved	14/10/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
RBC-APP-003	Yeargate Limited	21/01569/FUL	Birch Business Park, Unit A, Whittle Lane, Heywood, OL10 2SX	Installation of new level access loading door and associated external works	1.60	Approved	14/01/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
RBC-APP-004	Yeargate Limited	21/01562/FUL	Birch Business Park, Unit W, Whittle Lane, Heywood OL10 2SX	Installation of two new dock levellers with ramped access and retaining walls, formation of two parking areas, with associated new access and creation of internal floor space (offices and break out area)	1.60	Approved	07/02/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
RBC-APP-005	Yeargate Limited	20/00955/FUL	Birch Business Park, Unit D, Whittle Lane, Heywood, OL10 2SX	Retrospective demolition of Unit D and erection of a B2/B8 warehouse unit with ancillary B1(a) office space at Birch Business Park including ancillary office, parking and servicing areas, associated works and infrastructure.	1.60	Approved	07/12/2020	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development.
RBC-APP-006	Mr Ullathorne	16/01455/OUT	Birch Industrial Estate, Whittle Lane, Heywood, OL10	Erection of three industrial units of B2/B8 use (with ancillary B1) including the provision of car parking and associated infrastructure including the demolition of existing commercial units.	1.60	Approved	11/10/2017	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
RBC-APP-007	WSP	20/00985/SO	Birch Industrial Estate, Whittle Lane, Heywood, OL10 2SX	Screening Opinion in respect of the demolition of existing Unit D and erection of a B2/B8 warehouse unit with ancillary B1(e) office space, including parking, servicing areas and associated works and infrastructure.	1.60	Decided - EIA Not Required	24/11/2020	Tier 2	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development.
RBC-APP-008	A Drake	21/01508/SO	Birch Industrial Estate, Whittle Lane, Heywood, OL10 2SX	Request for screening opinion in respect of the erection of a new industrial building including associated parking, landscaping and infrastructure works.	1.60	Decided - EIA Not Required	11/11/2021	Tier 2	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This applications is related to **ID RBC-APP-009 (application ref 22/01148/FUL)**.
RBC-APP-009	Yeargate Limited	22/01148/FUL	Birch Industrial Estate, Whittle Lane, Heywood, OL10 2SX	Demolition of Units B and G and erection of a warehouse unit (Class B2/B8) with ancillary office space (Class E) including parking, servicing areas, associated works and infrastructure - Resubmission of 21/01489/FUL.	1.60	Awaiting decision	24/08/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development.

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
RBC-APP-010	Elan Homes Ltd	18/01041/REM	Land east of Boothroyden Road, Middleton, Rochdale, M24 4RY	Application for approval of reserved matters (appearance, landscaping, layout and scale) pursuant to outline planning permission 18/01035/VRCON for the erection of 67 residential units with internal road configuration and associated infrastructure and ancillary facilities.	1.70	Approved	11/04/2019	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development.
RBC-APP-011	Duchy Homes Limited and the North Manchester Golf Club	21/01797/FUL	North Manchester Golf Club, Manchester Old Road, Middleton, M24 4PE	Residential development comprising 56 dwellings; erection of a replacement club house to include shop, function room and greenkeepers store; construction of bridge link from club house to golf course; relocation of the existing practice area / driving range; construction of a replacement car park; and, associated landscaping and infrastructure, following demolition of the existing clubhouse and residential dwelling.	1.80	Awaiting decision	23/12/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development.
RBC-APP-012	Mr N Smith	16/01123/FUL	North Manchester Golf Club, Manchester Old Road, Middleton, M24 4PE	Erection of 65 dwellings including the demolition of the existing buildings on site, and the erection of a replacement club house (including pro-shop and function room), erection of greenkeepers store and the relocation of the existing practice area with associated engineering, drainage and landscaping together with the construction of a replacement car park.	1.80	Refused	27/03/2019	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Application refused (to be reviewed again for potentially successful appeals).
RBC-APP-013	Heref Heywood Park Property Unit Trust (c/o Harbert Management Corporation (Europe) LLC) ('Harbert')	22/00662/FUL	Plots M400 and M5 Heywood Distribution Park, Moss Hall Road, Heywood, OL10 2TR	Engineering works including demolition of depot building (plot M5), breaking up of existing hardstanding, removal of existing services including lighting columns, ground remediation, earthworks to provide levelled site and off-site drainage.	2.00	Approved	07/10/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
RBC-APP-014	Willams Gallagher	22/00651/SO	Plot M400 Heywood Distribution Park, Pilsworth Road, Heywood, OL10 2TS	Request for EIA screening opinion in relation to the proposed erection of a Use Class B8 warehouse with ancillary officer, a Technical Service Building, a vehicle maintenance unit, parking bays, vehicle docks, refuelling facilities, staff shop and other ancillary structures.	2.00	Decided - EIA Not Required	20/07/2022	Tier 2	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
RBC-APP-015	Elan Homes Ltd.	20/00862/REM	Land East Of Boothroyden Road, Middleton, Rochdale, M24 4RY	Application for approval of reserved matters (appearance, landscaping and layout) pursuant to planning permission 19/01297/VRCON for alterations to plot 30-41.	2.00	Approved	21/01/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-010 (application ref 18/01041/REM)**.

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
RBC-APP-016	Russell Homes (UK) Ltd	22/00989/ANM	Land in the northern part of the South Heywood Masterplan Scheme, Located on land bound by Manchester Road, Hareshill Road and Pilsworth Road, West of Junction 19 of the M62 in Rochdale.	Application for non-material amendment to planning permission 16/01399/HYBR for amended wording of conditions 11 and 13 (Schedule 2) in relation to height parameters (commercial area only)	2.00	Awaiting decision	19/07/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-025 (application ref. 16/01399/HYBR)**.
RBC-APP-017	Mr Relph	22/00924/ANM	Land at South Heywood off Hareshill Road, West of Junction 19 of the M62 in Rochdale	Application for non-material amendment to planning permission 20/01524/REM for the amendment to Boundary Treatment Plan.	2.00	Awaiting decision	06/07/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-025 (application ref. 16/01399/HYBR)**.
RBC-APP-018	Russell Homes (UK) Ltd	22/00500/ANM	Land bound by Manchester Road, Hareshill Road and Pilsworth Road, West of Junction 19 of the M62 in Rochdale	Application for a non-material amendment to planning permission 16/01399/HYBR for revisions to approved parameters plan, comprising commercial buildings height and landscape buffer amendments.	2.00	Approved	10/06/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-025 (application ref. 16/01399/HYBR)**.
RBC-APP-019	Mr Lynch	22/00787/REM	Land in the northern part of the South Heywood Masterplan Scheme, Located on land bound by Manchester Road, Hareshill Road and Pilsworth Road, West of Junction 19 of the M62 in Rochdale.	Submission of reserved matters (including Appearance, Landscaping, Layout and Scale) for the construction of a distribution centre with ancillary office accommodation, gatehouse and access arrangements, car parking, HGV bays, sprinkler tanks and pump house, attenuation ponds, landscaping, spine road and other associated works, together with preparatory earthworks and landscaping on adjoining development plots pursuant to 16/01399/HYBR.	2.00	Approved	08/09/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-025 (application ref. 16/01399/HYBR)**.
RBC-APP-020	Mr Watson	22/00130/REM	Land at Manchester Road East, South Heywood, Rochdale	Reserved matters application for appearance, landscaping, layout and scale (access already approved) for 120 residential dwellings and associated works pursuant to Hybrid Permission 16/01399/HYBR.	2.00	Approved	13/09/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-025 (application ref. 16/01399/HYBR)**.
RBC-APP-021	c/o Agent	21/01811/REM	Land bound by Manchester Road, Hareshill Road and Pilsworth Road, West of Junction 19 of the M62 in Rochdale	Submission of Reserved Matters for the construction of extension to spine road, pumping station, landscaping and other associated works pursuant to 16/01399/HYBR.	2.00	Approved	25/08/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-025 (application ref. 16/01399/HYBR)**.
RBC-APP-022	Mr Penrose	21/00909/REM	Land at Manchester Road West, South Heywood, Rochdale	Reserved Matters Approval for appearance, landscaping, layout and scale (with access already approved) for 156 dwellings and associated works pursuant to Hybrid Permission 16/01399/HYBR.	2.00	Approved	27/05/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-025 (application ref. 16/01399/HYBR)**.

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
RBC-APP-023	Russell Homes UK Limited	20/01524/REM	Land in the northern part of the South Heywood Masterplan Scheme, Located on land bound by Manchester Road, Hareshill Road and Pilsworth Road, West of Junction 19 of the M62 in Rochdale.	Reserved Matters Approval for appearance, landscaping, layout and scale (with access already approved) for 61 dwellings and associated works pursuant to Hybrid Permission 16/01399/HYBR.	2.00	Approved	27/05/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-025 (application ref. 16/01399/HYBR)**.
RBC-APP-024	Mr Gary Lynch	20/01480/REM	Land in the northern part of the South Heywood Masterplan Scheme, Located on land bound by Manchester Road, Hareshill Road and Pilsworth Road, West of Junction 19 of the M62 in Rochdale.	Submission of reserved matters (including Appearance, Landscaping, Layout and Scale) for the construction of a distribution centre with ancillary office accommodation, gatehouse and access arrangements, car parking, HGV bays, sprinkler tanks and pump house, attenuation ponds, landscaping, spine road and other associated works, together with preparatory earthworks and landscaping on adjoining development plots pursuant to 16/01399/HYBR.	2.00	Approved	17/06/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-025 (application ref. 16/01399/HYBR)**.
RBC-APP-025	Russell Homes (UK) Ltd	16/01399/HYBR	Land bound by Manchester Road, Hareshill Road and Pilsworth Road, West of Junction 19 of the M62 in Rochdale	Part full/part outline planning application for the development of land at South Heywood, including the demolition of a number of existing on-site buildings and structures. Full consent sought for the construction of a new link road between Junction 19 of the M62 and Pilsworth Road and the widening of part of Pilsworth Road, together with associated works. Outline consent (all matters reserved for except access) for a major mixed-use development comprising up to 1000 dwellings; employment uses (Classes B2/B8); a new primary school; employment land; associated landscaping, open space and sports pitches, drainage, ecological enhancements, cycleway and footpath linkages, infrastructure and other ancillary works.	2.00	Approved	31/03/2020	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development.
RBC-APP-026	Yeargate Limited	16/01455/OUT	Birch Industrial Estate, Whittle Lane, Heywood, OL10 2SX	Outline planning permission by means of layout and scale for the erection of three industrial units of B2/B8 use (with ancillary B1) including the provision of car parking and associated infrastructure including the demolition of existing commercial units.	2.00	Approved	11/10/2017	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.

Development description								Cumulative Effects Assessment Stage 1		
ID	**Applicant or proponent**	**Application reference**	**Location**	**Description**	**Distance from project (km)**	**Application status**	**Submission / Decision date**	**Tier**	**Within ZOI?**	**Progress to Stage 2?**
RBC-APP-027	Yeargate Limited	19/00144/VRCON	Birch Industrial Estate, Whittle Lane, Heywood, OL10 2SX	Application to vary condition 5 (development to be carried out in accordance with submitted Ground Investigation Report) and condition 16 (to refer to updated energy statement submitted) of planning permission 18/01048/VRCON.	2.00	Approved	23/04/2019	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-026 (application ref 16/01455/OUT**).
RBC-APP-028	Yeargate Limited	19/00092/REM	Birch Industrial Estate, Whittle Lane, Heywood, OL10 2SX	Submission of reserved matters pursuant to outline planning permission 18/01048/VRCON relating to the means of access, appearance and landscaping in relation to phase 1 of the development.	2.00	Approved	22/05/2019	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-026 (application ref 16/01455/OUT**).
RBC-APP-029	Rochdale Borough Council	20/00912/OUT	Land to the east of Heywood Old Road, Middleton, OL10 2QL	Outline planning application for new secondary school development and associated parking, sports provision and landscaping (with details of access provided, and all other matters reserved)	2.00	Approved	16/10/2020	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
RBC-APP-030	Rochdale Borough Council	20/01560/REM	Land to the east of Heywood Old Road, Middleton, OL10 2QL	Application for approval of reserved matters (including Appearance, Landscaping, Layout and Scale) for a new secondary school development with associated parking, sports provision and landscaping pursuant to outline planning permission 20/00912/OUT	2.00	Approved	23/03/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-029 (application ref. 20/00912/OUT)**.
RBC-APP-031	Lovell Partnership Ltd	14/00547/FUL	Land off Latrigg Crescent (Langley Site F), Middleton, Manchester	Residential development - 202 dwellings including associated infrastructure	2.00	Approved	02/04/2015	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development.
RBC-APP-032	Lovell Partnership Ltd	15/00794/VRCON	Land off Latrigg Crescent (Langley Site F), Middleton, Manchester	Variation of condition no 2 to amend siting of plot nos. 140 - 145 of planning permission 14/00547/FUL.	2.00	Approved	08/04/2016	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID RBC-APP-031 (application ref. 14/00547/FUL)**.
RBC-APP-033	Riverside	19/01487/FUL	Land between Threlkeld Road and Gatesgarth Road, Middleton	Construction of 41 dwellings with associated highways, landscaping and retained/enhanced public open space.	2.00	Approved	10/07/2020	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
Salford City Council										
SCC-APP-001	Roydon Group PLC	21/78502/FUL	Units 1 to 3 Junction Business Park, Rake Lane, Clifton, Swinton, M27 8LU	Erection of an access and gatehouse building and associated works	1.50	Approved	14/07/2022	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.

Development description								Cumulative Effects Assessment Stage 1		
ID	**Applicant or proponent**	**Application reference**	**Location**	**Description**	**Distance from project (km)**	**Application status**	**Submission / Decision date**	**Tier**	**Within ZOI?**	**Progress to Stage 2?**
SCC-APP-002	Mateo N/A	21/78501/FUL	Units 1 to 3 Junction Business Park, Rake Lane, Clifton, Swinton, M27 8LU	Variation and removal of conditions attached to planning permission ref. 20/76423/FUL, as follows: (a) Condition 2 (Approved Plans) relating to amendments to the scheme for the retention and refurbishment of the existing Unit 2 wash plant, inclusion of additional plant and machinery (substation, compressor, chillers and condensers), installation of external storage silos and fire suppression sprinkler tanks, amendments to the external loading bay and pedestrian door arrangements and reduction in the size of the office floorspace (b) Condition 20 removal of restriction on outdoor storage, and (c) Submission of detail relating to Conditions 3 (CMP), 4 (Phase 2 SI), 5 (Tree Protection Measures), 6 (Levels), 7 (Invasive Plant Species), 8 (Borehole Decommissioning), 9 (Drainage), 10 (Landscaping), 13 (Boundary Treatments), 14 (EV Charging), 15 (Shower and Changing Facilities), 16 (Cycle and Motorcycle Parking) and 19 (External Lighting).	1.50	Awaiting decision	22/09/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	This application is related to **ID SCC-APP-001 (application ref. 21/78501/FUL)**.
SCC-APP-003	Roydon Group PLC	20/76423/FUL	Units 1 to 3 Junction Business Park, Rake Lane, Clifton, Swinton, M27 8LU	Erection of building for B2 Use (general industrial) to form extension to existing recycling facility, along with ancillary office space, parking and associated works.	1.50	Approved	04/03/2021	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Yes, due to the nature/scale of development.
SCC-APP-004	Mr Seth	20/76264/FUL	Clifton Industrial Estate, Rake Lane, Clifton, M27 8LP	Erection of holding warehouses to weather protect separated materials waiting onward transfer to other suitable treatment facilities.	1.50	Approved	28/10/2020	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
SCC-APP-005	Mr Seth	19/72952/FUL	Clifton Materials Recycling Facility, Former Pilkington Tiles, Rake Lane, Salford, Clifton, M27 8LP	Change of use to a waste transfer station including physical treatment of inert and non-hazardous waste.	1.50	Approved	14/06/2019	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.
SCC-APP-006	Mr Woolhouse	20/75418/FUL	Clifton Green, The Green, Clifton, M27 8RH	Erection of four three-storey houses and two three-storey apartment blocks comprising of 47 apartments.	2.00	Approved	30/10/2020	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Due to the nature and scale of development and distance from the project it is considered unlikely that there would be significant cumulative effects.

Development description								Cumulative Effects Assessment Stage 1		
ID	**Applicant or proponent**	**Application reference**	**Location**	**Description**	**Distance from project (km)**	**Application status**	**Submission / Decision date**	**Tier**	**Within ZOI?**	**Progress to Stage 2?**
Planning applications within 0.4km of the Affected Road Network										
Bury Metropolitan Borough Council										
BMBC-APP-027	Prestwich Heys F.C	59412	Prestwich Heys F.C., Sandgate Road, Whitefield, Manchester, M45 6WG	Covered stand of 50 no. seats for spectators	0.05km from ARN	Approved	04/01/2016	Tier 1	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.
BMBC-APP-028	Prestwich Heys F.C	67687	Prestwich Heys F.C., Sandgate Road, Whitefield, M45 6NT	Erection of 100 seater football stand following removal of existing stand.	0.05km from ARN	Approved	07/01/2022	Tier 1	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.
BMBC-APP-029	Mrs S S Armstrong	67859	Unsworth Academy, Parr Lane, Bury, BL9 8LP	Siting of a 6 no. classroom modular building with associated landscape works including relocated car parking, playground and athletics facility	0.10km from ARN	Approved	16/03/2022	Tier 1	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.
BMBC-APP-030	Bowmer and Kirkland	68079	Former Castlebrook High School, Parr Lane, Bury, BL9 8LP	Erection of Two storey special education needs and disabilty school (SEND) including hard and soft landscaping, multi use games area (MUGA), creation of on-site car parking and creation of new vehicular access on Parr Lane with a pick up and drop off area	0.15km from ARN	Approved	15/06/2022	Tier 1	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.
BMBC-APP-031	Chris Hamlett	66804	Unsworth South Social Club, Derwent Avenue, Whitefield, Manchester, M45 8HU	Demolition of existing building and erection of 10 residential dwellings with associated access, car parking and landscaping	0.20km from ARN	Approved	18/11/2021	Tier 1	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.
Rochdale Borough Council										
RBC-APP-034	Moto Hospitality Ltd	17/01269/FUL	Esso Petroleum Station, Whittle Lane, Heywood, OL10 2RB	Installation of 16 no. electric vehicle charging parking spaces on perimeter of existing car parking area	0.00km from ARN	Approved	18/12/2017	Tier 1	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.
RBC-APP-035	Paul Comer	20/00683/FUL	M62 Birch Services (Westbound), Whittle Lane Heywood, OL10 2RB	Variation of conditions 3 & 5 on planning permission 55197 to allow the retention of changing rooms, store, toilets, floodlights and clubhouse until 31st December 2018	0.05km from ARN	Approved	02/09/2020	Tier 1	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.

Development description								Cumulative Effects Assessment Stage 1		
ID	**Applicant or proponent**	**Application reference**	**Location**	**Description**	**Distance from project (km)**	**Application status**	**Submission / Decision date**	**Tier**	**Within ZOI?**	**Progress to Stage 2?**
RBC-APP-036	Sarah Allen	20/01314/SO	Castleton WwTW, Hopwood Cottage, Rochdale Road, Middleton, M24 6QP	Request for Screening Opinion in relation to the proposed installation of wastewater equipment necessary to deliver the Environment Agency Water Industry National Environmental Programme and to meet phosphorus, ammonia and Biological Oxygen Demand final effluent consent standards to achieve Water Framework Directive good status for the River Irk (for 4.4km reach: Source to upstream of the confluence of the Wince Brook)	0.05km from ARN	Decided - EIA Not Required	11/12/2020	Tier 3	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.
RBC-APP-037	GLP Ltd And Barratt Homes	19/00006/SO	Land Off Cowm Top Lane, Rochdale	Request for screening opinion in respect of proposed residential development (up to 600 dwellings).	0.05km from ARN	Decided - EIA Not Required	05/02/2019	Tier 3	Air quality (construction traffic)	Yes, due to the nature/scale of development.
RBC-APP-038	Gleeson Homes	20/00423/AM	Hilltop Park, Hilltop School, Rochdale, OL11 2XD	Section 73 application to vary condition 2 of planning permission 15/00826/FUL for substitution of house type on plots 32 and 33 from one pair of semi-detached dwellings to one detached dwelling	0.05km from ARN	Approved	25/09/2020	Tier 1	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.
RBC-APP-039	Taylor Wimpey	17/00968/FUL	Land At Dean Farm, Badger Lane, Rochdale, OL16 4RQ	Erection of 58 residential dwellings including access, landscaping and associated works	0.05km from ARN	Approved	21/12/2017	Tier 1	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.
RBC-APP-040	St Cuthberts Rc Business And Enterprise College	16/01490/FUL	St Cuthberts Rc Business And Enterprise College, Shaw Road, Rochdale, OL16 4RX	Surfacing of sports activity area and formation of new vehicular access including the erection of 2m high perimeter security fencing and gates	0.05km from ARN	Approved	10/03/2017	Tier 1	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.
RBC-APP-041	Asda	20/01286/FUL	Asda Distribution Centre, Dig Gate Lane, Rochdale, OL16 4NR	Installation of storage tanks and associated equipment to facilitate storage of liquefied natural gas and liquefied nitrogen	0.05km from ARN	Approved	14/07/2021	Tier 1	Air quality (construction traffic)	No. Nature and scale of development considered unlikely to generate significant cumulative effects on air quality.
Development allocations within 2km of the Proposed Scheme **Note: Allocations in general have been scoped out of the shortlist because, as Tier 3 developments, the amount of information available and the resulting certainty around the assessment of cumulative effects is limited. It is expected that future developers bringing forward projects in line with the allocations would carry out their own assessments of cumulative effects.*										
Bury Metropolitan Borough Council										
BMBC-ALL-001	Bury Metropolitan Borough Council	N/A	Whitefield	Emerging Greater Manchester Spatial Framework (2019 Consultation Draft) GMA1.3 600 homes 64.56ha	0	N/A	N/A	Tier 3	All topics	No. Allocations have been scoped out*.

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
BMBC-ALL-002	Bury Metropolitan Borough Council	N/A	Hodder Way	Adopted Bury Unitary Development Plan (1997) H1.1.42 14 homes 13.92ha	0	N/A	N/A	Tier 3	All topics	No. Allocations have been scoped out*.
BMBC-ALL-003	Bury Metropolitan Borough Council	N/A	Cedar Avenue	Adopted Bury Unitary Development Plan (1997) H1.1.43 20 homes 113.36ha	0.05	N/A	N/A	Tier 3	All topics	No. Allocations have been scoped out*.
BMBC-ALL-004	Bury Metropolitan Borough Council	N/A	Bury New Road	Adopted Bury Unitary Development Plan (1997) S4.2.2 66.48ha	0.2	N/A	N/A	Tier 3	All topics	No. Allocations have been scoped out*.
BMBC-ALL-005	Bury Metropolitan Borough Council	N/A	Prestwich Hospital	Adopted Bury Unitary Development Plan (1997) H1.1.45 120 homes 15.53ha	0.25	N/A	N/A	Tier 3	Air quality (construction dust); Geology and soils; Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
BMBC-ALL-006	Bury Metropolitan Borough Council	N/A	Albert Road and Hazel Road	Adopted Bury Unitary Development Plan (1997) H1.1.40 55 homes 106.71ha	0.3	N/A	N/A	Tier 3	Air quality (construction dust); Geology and soils; Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
BMBC-ALL-007	Bury Metropolitan Borough Council	N/A	Land South of Albert Road	Adopted Bury Unitary Development Plan (1997) H1.1.41 129 homes 16.84ha	0.4	N/A	N/A	Tier 3	Air quality (construction dust); Geology and soils; Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
BMBC-ALL-008	Bury Metropolitan Borough Council	N/A	Albert Road	Adopted Bury Unitary Development Plan (1997) H1.1.39 24 homes 11.5ha	0.5	N/A	N/A	Tier 3	Geology and soils; Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
BMBC-ALL-009	Bury Metropolitan Borough Council	N/A	St. Margaret's Road	Adopted Bury Unitary Development Plan (1997) H1.1.44 27 homes 14.16ha	0.6	N/A	N/A	Tier 3	Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.

Development description								Cumulative Effects Assessment Stage 1		
ID	Applicant or proponent	Application reference	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
BMBC-ALL-010	Bury Metropolitan Borough Council	N/A	Pilsworth Industrial Estate	Adopted Bury Unitary Development Plan (1997) EC2.1.2	0.6	N/A	N/A	Tier 3	Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
BMBC-ALL-011	Bury Metropolitan Borough Council	N/A	Ribble Drive	Adopted Bury Unitary Development Plan (1997) H.1.1.38 10 homes	0.6	N/A	N/A	Tier 3	Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
BMBC-ALL-012	Bury Metropolitan Borough Council	N/A	Howard Hill and Hollins Lane	Adopted Bury Unitary Development Plan (1997) H1.1.25 15 homes 21.4ha	0.7	N/A	N/A	Tier 3	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
BMBC-ALL-013	Bury Metropolitan Borough Council	N/A	Victoria Mill	Adopted Bury Unitary Development Plan (1997) H1.1.27 40 homes 360.7ha	0.7	N/A	N/A	Tier 3	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.

Development description								Cumulative Effects Assessment Stage 1		
ID	**Applicant or proponent**	**Application reference**	**Location**	**Description**	**Distance from project (km)**	**Application status**	**Submission / Decision date**	**Tier**	**Within ZOI?**	**Progress to Stage 2?**
BMBC-ALL-014	Bury Metropolitan Borough Council	N/A	Land off Heys Road	Adopted Bury Unitary Development Plan (1997) H1.1.46 18 homes 28.35ha	0.7	N/A	N/A	Tier 3	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
BMBC-ALL-015	Bury Metropolitan Borough Council	N/A	Manchester Road, Bury	Adopted Bury Unitary Development Plan (1997) H1.1.26 26 homes 0.97ha	1.3	N/A	N/A	Tier 3	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
BMBC-ALL-016	Bury Metropolitan Borough Council	N/A	Lily Hill Street	Adopted Bury Unitary Development Plan (1997) H1.1.37 26 homes 279.19ha	1.8	N/A	N/A	Tier 3	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
BMBC-ALL-017	Bury Metropolitan Borough Council	N/A	Johnson Street	Adopted Bury Unitary Development Plan (1997) H1.1.36 75 homes 93.45ha	2	N/A	N/A	Tier 3	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
Bury Metropolitan Borough Council / Rochdale Borough Council										
BMBC-ALL-018	Bury Metropolitan Borough Council / Rochdale Borough Council	N/A	Heywood and Pilsworth	Emerging Greater Manchester Spatial Framework (2019 Consultation Draft) GMA1.1 1,200,000 sqm employment, 1,200 homes 650.03ha	0	N/A	N/A	Tier 3	All topics	No. Allocations have been scoped out*.
BMBC-ALL-019	Bury Metropolitan Borough Council / Rochdale Borough Council	N/A	Simister	Emerging Greater Manchester Spatial Framework (2019 Consultation Draft) GMA1.2 2,700 homes in total 210.3ha	0	N/A	N/A	Tier 3	All topics	No. Allocations have been scoped out*.
BMBC-ALL-020	Bury Metropolitan Borough Council / Rochdale Borough Council	N/A	Heywood and Pilsworth	Places for Everyone (2021) JPA1.1 1,200,000 sqm employment, 1,200 homes 650.03ha	0	N/A	N/A	Tier 3	All topics	No. Allocations have been scoped out*.

Development description								Cumulative Effects Assessment Stage 1		
ID	**Applicant or proponent**	**Application reference**	**Location**	**Description**	**Distance from project (km)**	**Application status**	**Submission / Decision date**	**Tier**	**Within ZOI?**	**Progress to Stage 2?**
BMBC-ALL-021	Bury Metropolitan Borough Council / Rochdale Borough Council	N/A	Simister and Bowlee	Places for Everyone (2021) JPA1.2 1,550 homes in total 97ha	0	N/A	N/A	Tier 3	All topics	No. Allocations have been scoped out*.
BMBC-ALL-022	Bury Metropolitan Borough Council / Rochdale Borough Council	N/A	Bowlee	Emerging Greater Manchester Spatial Framework (2019 Consultation Draft) GMA1.2 2,700 homes in total 24.08ha	1.1	N/A	N/A	Tier 3	Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
Rochdale Borough Council										
RBC-ALL-001	Rochdale Borough Council	N/A	Clifton Industrial Estate	Adopted Salford City Council UDP (2006) SL2 Area Allocation for Waste Management Development 46.37ha	1.3	N/A	N/A	Tier 3	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
RBC-ALL-002	Rochdale Borough Council	N/A	Birch Industrial Estate	Adopted Rochdale Borough Council Unitary Development Plan (2006) D/5(ii) Infilling at Major Existing Developed site in the Green Belt 14.2ha	1.5	N/A	N/A	Tier 3	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
RBC-ALL-003	Rochdale Borough Council	N/A	Birch Motorway Service Area	Adopted Rochdale Borough Council Unitary Development Plan (2006) D/5(vii) Infilling at Major Existing Developed site in the Green Belt 12.03ha	1.85	N/A	N/A	Tier 3	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
RBC-ALL-004	Rochdale Borough Council	N/A	Land at Manchester Road, Hareshill Road and Pilsworth Road	Emerging Rochdale Draft Allocations Plan (2018) AL.EMP.33	2	N/A	N/A	Tier 3	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. Allocations have been scoped out*.
Other major planned highway authority schemes										
NH-PHS-001	National Highways	N/A	M60, Junctions 8 to 18	Manchester North West Quadrant scheme. Improvements on the North West quadrant of the M60 between junctions 8 and 18.	0	N/A. Future Planned Highway Authority Scheme	N/A	Tier 3	All topics	Yes.

Appendix 16.2. Shortlist of other developments

Development details (carried through from Appendix 16.1)						Cumulative Effects Assessment – Stage 2			
ID	Application reference	Description	Distance from project (km)	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
NSIPs within 2km of the Proposed Scheme									
No NSIPs were progressed to Stage 2 (see Appendix 16.1).									
Major developments within 2km of the Proposed Scheme									
Bury Metropolitan Borough Council									
BMBC-APP-001	58918	Erection of 33 apartments with associated parking and a detached dwellinghouse.	0.00	Tier 1	All topics	No. The proposed development has been constructed and is now operational.	As the proposed development has been constructed and is now operational, it has been considered as part of the baseline.	N/A	No.
BMBC-APP-002	63003	Erection of new four storey office building (Class B1) and new four storey building comprising of 11 residential apartments (Class C3) together with dedicated parking.	0.05	Tier 1	All topics	The proposed development does not appear to have been constructed. Planning permission for the proposed development expired in June 2022, therefore the developer would be required to submit a new planning application before the proposed development could be constructed. If the developer submits a new planning application it will be considered in the cumulative effects assessment.	No. The development is approximately 0.14 hectares in size, below the 1 hectare (ha) threshold in EIA Regulations 2017, Schedule 2 for urban development projects. The proposed development has similar character and land use to the surrounding industrial urban area. Due to the small scale of development and unlikely temporal overlap it is not considered likely that there would be any significant cumulative effects with the Proposed Scheme.	N/A	No.
BMBC-APP-003	63378	Variation of condition of planning permission 61515 for erection of new main school building: Revised site layout plan to show amendments to the habitat zone and parking layout. Ref 61515: Demolition of existing main school building and erection of new (relocated replacement) main school building, relocated hard surface games areas, car parking and landscaping and new substation.	0.05	Tier 1	All topics	No. The proposed development has been constructed and is now operational.	As the proposed development has been constructed and is now operational, it has been considered as part of the baseline.	N/A	No.

Development details (carried through from Appendix 16.1)						Cumulative Effects Assessment – Stage 2			
ID	Application reference	Description	Distance from project (km)	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
BMBC-APP-004	65379	Demolition of existing building and construction of a three-storey block of apartments consisting of 27 units.	0.40	Tier 1	Air quality (construction dust); Geology and soils; Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	A temporal overlap is considered unlikely. Construction of the proposed development is currently underway at time of writing and is therefore likely to have been completed prior to construction of the Proposed Scheme.	As the proposed development is likely to have been completed before construction of the Proposed Scheme, it has been considered as part of the baseline.	N/A	No.
BMBC-APP-004	65379	Demolition of existing building and construction of a three-storey block of apartments consisting of 27 units.	0.40	Tier 1	Air quality (construction dust); Geology and soils; Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	A temporal overlap is considered unlikely. Construction of the proposed development is currently underway at time of writing and is therefore likely to have been completed prior to construction of the Proposed Scheme.	As the proposed development is likely to have been completed before construction of the Proposed Scheme, it has been considered as part of the baseline.	N/A	No.
BMBC-APP-006	68691	Redevelopment and change of use of the site to provide 30 new residential dwellings along with associated works including landscaping and provision of access from Victoria Avenue, including highway works to Victoria Avenue.	0.50	Tier 1	Geology and soils; Cultural heritage (non-designated assets and their settings); Noise and vibration (construction noise); Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual;	There is potential for a temporal overlap with the Proposed Scheme if planning permission is granted.	No. The proposed development comprises 30 dwellings, below the 150 dwellings threshold in EIA Regulations 2017, Schedule 2. It is considered unlikely that there would be significant cumulative effects with the Proposed Scheme.	N/A	No.

Development details (carried through from Appendix 16.1)						Cumulative Effects Assessment – Stage 2			
ID	**Application reference**	**Description**	**Distance from project (km)**	**Tier**	**Within ZOI?**	**Overlap in temporal scope?**	**Scale and nature of development likely to have a significant effect?**	**Other factors**	**Progress to Stage 3?**
					Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater				
BMBC-APP-010	68530	Hybrid application - Full application: Zone 1 development of Commercial building No1 (Creche, Use Class E), car parking and internal site roads, a new site access junction to Pilsworth Road, highway improvements to Hollins Brook Way and Pilsworth Road, and continued use of an existing car park exit to Aviation Road. Outline application: Zone 2 development of Commercial building No.2 (Hub building, Use Class E) car parking and internal site roads and a multi-purpose all-weather sports pitch (Including reserved matters of means of access, layout and scale included for determination).	0.80	Tier 1	Cultural heritage (setting of designated heritage assets); Hydromorphology; Population and human health (land use and community health); Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	There is potential for a temporal overlap with the Proposed Scheme if planning permission is granted.	The core development area of the proposed development is approximately 1.7ha, above the threshold of 1.0ha for urban development which is not dwellinghouse development in EIA Regulations 2017, Schedule 2. There is potential for significant cumulative effects arising from the physical scale of developments and potential increase in traffic, emissions and noise.	N/A	Yes.
Manchester City Council									
MCC-APP-002	118800/FO/2018	Erection of three storey extension to existing hotel (Use Class C1) to provide 39 new bedrooms (total of 84) together with the reconfiguration of the car park, associated landscaping and ancillary services, including plant equipment.	1.80	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. The proposed development has been constructed and is now operational.	As the proposed development has been constructed and is now operational, it has been considered as part of the baseline.	N/A	No.

Development details (carried through from Appendix 16.1)						Cumulative Effects Assessment – Stage 2			
ID	**Application reference**	**Description**	**Distance from project (km)**	**Tier**	**Within ZOI?**	**Overlap in temporal scope?**	**Scale and nature of development likely to have a significant effect?**	**Other factors**	**Progress to Stage 3?**
Rochdale Borough Council									
RBC-APP-005	20/00955/FUL	Retrospective demolition of Unit D and erection of a B2/B8 warehouse unit with ancillary B1(a) office space at Birch Business Park including ancillary office, parking and servicing areas, associated works and infrastructure.	1.60	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	There is potential for a temporal overlap with the Proposed Scheme.	The area of the proposed development is approximately 0.68ha, above the threshold of 0.5ha for industrial estate development projects. However, it is considered unlikely that there would be significant cumulative effects due to the scale and nature of development and distance from the project. The proposed development is located on an industrial estate and the development would not change the land use, therefore it is considered unlikely that there would be a significant impact on landscape character or views. To secure planning permission it is expected that the developer would be required to implement construction best practice and mitigation measures which would minimise impacts to the water environment and biodiversity.	N/A	No.
RBC-APP-007	20/00985/SO	Screening Opinion in respect of the demolition of existing Unit D and erection of a B2/B8 warehouse unit with ancillary B1(e) office space, including parking, servicing areas and associated works and infrastructure	1.60	Tier 2	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	The proposed development does not appear to have been constructed. Therefore, there is a potential overlap with the Proposed Scheme.	The applicant submitted a screening request to Rochdale Borough Council. The Screening Opinion issued in November 2020 confirmed that the proposed development is not an EIA development. Due to the small scale of development and distance from the Proposed Scheme it is considered unlikely that there would be any significant cumulative effects with the Proposed Scheme.	N/A	No.
RBC-APP-009	22/01148/FUL	Demolition of Units B and G and erection of a warehouse unit (Class B2/B8) with ancillary office space (Class E) including parking, servicing areas, associated works and infrastructure - Resubmission of 21/01489/FUL.	1.60	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	There is potential for a temporal overlap with the Proposed Scheme if planning permission is granted.	The area of the proposed development is approximately 0.8ha, above the threshold of 0.5ha for industrial estate development projects. However, it is considered unlikely that there would be significant cumulative effects due to the scale and nature of development and distance from the project. The proposed development is located on an industrial estate and the development would not change the land use, therefore it is considered unlikely that there would be a significant impact on landscape character or views. To secure planning permission it is expected that the developer would be required to implement construction best practice and mitigation measures which would minimise impacts to the water environment and biodiversity.	N/A	No.

Development details (carried through from Appendix 16.1)						Cumulative Effects Assessment – Stage 2			
ID	**Application reference**	**Description**	**Distance from project (km)**	**Tier**	**Within ZOI?**	**Overlap in temporal scope?**	**Scale and nature of development likely to have a significant effect?**	**Other factors**	**Progress to Stage 3?**
RBC-APP-010	18/01041/REM	Application for approval of reserved matters (appearance, landscaping, layout and scale) pursuant to outline planning permission 18/01035/VRCON for the erection of 67 residential units with internal road configuration and associated infrastructure and ancillary facilities.	1.70	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Unlikely. Construction is currently underway and is therefore likely to be have been completed prior to construction of the Proposed Scheme.	No. The proposed development comprises 67 dwellings, below the 150 dwellings threshold in EIA Regulations 2017, Schedule 2. There may be a temporal overlap in construction, however given the distance from the Proposed Scheme and the small scale of remaining development under construction it is considered unlikely that there would be significant cumulative effects with the Proposed Scheme.	N/A	No.
RBC-APP-011	21/01797/FUL	Residential development comprising 56 dwellings; erection of a replacement club house to include shop, function room and greenkeepers store; construction of bridge link from club house to golf course; relocation of the existing practice area / driving range; construction of a replacement car park; and, associated landscaping and infrastructure, following demolition of the existing clubhouse and residential dwelling.	1.80	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	There is potential for a temporal overlap with the Proposed Scheme if planning permission is granted.	The development includes more than 1ha of urban development which is not dwellinghouse development in EIA Regulations, Schedule 2. The development is located at an existing golf course and adjacent to existing residential development, therefore it would not significant change the land use or character of the area. Given the relatively small scale of residential development and nature of the other proposals, it is considered unlikely that there would be significant cumulative effects.	N/A	No.
RBC-APP-025	16/01399/HYBR	Part full/part outline planning application for the development of land at South Heywood, including the demolition of a number of existing on-site buildings and structures. Full consent sought for the construction of a new link road between Junction 19 of the M62 and Pilsworth Road and the widening of part of Pilsworth Road, together with associated works. Outline consent (all matters reserved for except access) for a major mixed-use development comprising up to 1000 dwellings; employment uses (Classes B2/B8); a new primary school; employment land; associated landscaping, open space and sports pitches, drainage, ecological enhancements, cycleway and footpath linkages, infrastructure and other ancillary works.	2.00	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	Possible. The proposed development is likely to be constructed in phases, with a potential temporal overlap in construction with the Proposed Scheme.	The proposed development is an EIA development. The part/full planning application was accompanied by an Environmental Statement. Due to the nature and scale of the development and potential temporal overlap with the Proposed Scheme, there may be significant cumulative effects on landscape and visual, biodiversity, population and human health (physical activity opportunities), flood risk, water quality and groundwater.	N/A	Yes.
RBC-APP-031	14/00547/FUL	Residential development - 202 dwellings including associated infrastructure	2.00	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	No. The proposed development appears to have been constructed and is now operational.	As the proposed development has been constructed and is now operational, it has been considered as part of the baseline.	N/A	No.

Development details (carried through from Appendix 16.1)						Cumulative Effects Assessment – Stage 2			
ID	**Application reference**	**Description**	**Distance from project (km)**	**Tier**	**Within ZOI?**	**Overlap in temporal scope?**	**Scale and nature of development likely to have a significant effect?**	**Other factors**	**Progress to Stage 3?**
Salford City Council									
SCC-APP-003	20/76423/FUL	Erection of building for B2 Use (general industrial) to form extension to existing recycling facility, along with ancillary office space, parking and associated works.	1.50	Tier 1	Landscape and visual; Biodiversity; Population and human health (physical activity opportunities); Flood risk; Water quality; Groundwater	The planning permission for the proposed development expires in March 2024, three years following approval. Therefore, there may be a potential temporal overlap with the Proposed Scheme if construction starts by this date.	The proposed development would cover an area of approximately 0.9ha, which is greater than the threshold of 0.5ha in EIA Regulations 2017, Schedule 2 for industrial estate development projects. However, the proposed development is located on an existing industrial estate, and the proposals comprise an extension to an existing recycling facility and associated works and would therefore not be expected to change the land use or character of the area. It is expected that the developer would adopt best practice construction measures and comply with legislation and guidance to minimise impacts. Therefore, it is considered unlikely that there would be significant cumulative effects.	N/A	No.
Planning applications within 0.4km of the Affected Road Network									
Rochdale Borough Council									
RBC-APP-037	19/00006/SO	Request for screening opinion in respect of proposed residential development (up to 600 dwellings).	0.05km from ARN	Tier 3	Air quality (construction traffic)	A planning application has not been submitted yet. Assuming the developer submits a full planning application and planning permission is subsequently granted, there is potential for a temporal overlap with the Proposed Scheme.	The construction traffic screening assessment (discussed in Chapter 6: Air Quality) confirmed that all affected roads are associated with reductions in traffic flows (which are likely to have a positive effect), and it is considered unlikely that a significant increase in air pollutant concentrations would occur at any modelled receptor locations. It is therefore considered unlikely that there would be significant cumulative effects on air quality from construction traffic emissions.	N/A	No.
Other major planned highway authority schemes									
NH-PHS-001	N/A	Manchester North West Quadrant. Improvements on the North West quadrant of the M60 between junctions 8 and 18.	0	Tier 3	All topics	Temporal overlap unknown. PCF Stage 1 (Option Identification) has been completed, however the status of the project is uncertain.	Yes. Due to the scale of development and proximity to the Proposed Scheme, if construction works overlap it is likely that there could be significant effects.	N/A	Yes.

If you need help accessing this or any other National Highways information, please call **0300 123 5000** and we will help you.

This document is also available on our website at **www.nationalhighways.co.uk**

For an accessible version of this publication please call **0300 123 5000** and we will help you.

If you have any enquiries about this publication email **info@nationalhighways.co.uk**
or call **0300 123 5000***. Please quote the National Highways publications code **PR247/22**.

National Highways creative job number CRE22_0236

*Calls to 03 numbers cost no more than a national rate call to an 01 or 02 number and must count towards any inclusive minutes in the same way as 01 and 02 calls.

These rules apply to calls from any type of line including mobile, BT, other fixed line or payphone. Calls may be recorded or monitored.

Printed on paper from well-managed forests and other controlled sources when issued directly by National Highways.

Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ

National Highways Limited registered in England and Wales number 09346363