highways england

# Smart Motorways Programme

# Jacobs Atkins JV

# M56 Junction 6 to Junction 8

# Environmental Assessment Report

## August 2018

## Notice

This document and its contents have been prepared and are intended solely for Highways England's information and use in relation to the Smart Motorways Programme.

# Table of contents

**Figure List**

# Executive summary

## Introduction

Highways England has commissioned the Jacobs Atkins Joint Venture (JAJV) to design and assess a proposed Smart Motorway (SM) All Lane Running (ALR) scheme on the M56 between Junction 6 Manchester Airport and Junction 8 A556, referred to in this report as the 'Proposed Scheme'. The M56 is the North Cheshire Motorway connecting Cheshire, North Wales and the West Midlands (via the M6 and A556) to the Greater Manchester Conurbation. It also serves Manchester Airport at Junction 5. The M56 forms the South Pennines Strategic Route, linking North Wales, Liverpool, Greater Manchester and Leeds. The motorway serves both short commuting trips between key locations as well as long distance traffic. Significant sections of this strategic route suffer from low peak hour speeds, poor journey time reliability and high traffic flows. The Proposed Scheme will address the objectives of the Smart Motorways Programme (SMP) to relieve congestion, smooth traffic flow, improve journey times and journey time reliability, maintain safety levels for all road users, and support the economic health of the nation, whilst minimising adverse environmental effects. It will also seek to deliver environmental improvements in line with Government requirements. Highways England expects to commence construction of the Proposed Scheme by March 2019 at the latest and it is expected to be completed by April 2020, including commissioning.

The Proposed Scheme will provide a hardened central reserve with a new rigid concrete barrier (RCB) to replace the existing deformable metal vehicle restraint system (VRS). A widened RCB will be provided to the to accommodate proposed lighting columns within the central reserve where required.

The Proposed Scheme comprises the design and construction of four All Lane Running (ALR) between Junction 6 and Junction 7 in both directions, by converting the hard shoulder into a live lane. Through junction running will be provided westbound through Junction 6 by converting the hard shoulder into a running lane. and the Proposed Scheme will install 10 new gantries (7 existing gantries will be retained and upgraded). The gantries will be fitted with Advanced Motorway Indicators (AMIs), New Message Signs and/or Advanced Directional Signs (ADS), strategic signs (MS3s), Variable Messaging Signs (MS4) and emergency refuge areas (ERAs), in accordance with the standards as set out in IAN 161/15. A full description of the Proposed Scheme is provided in Section 2.

Traffic modelling has been undertaken to support the development, design, environmental assessment and business cases for the delivery of the North West schemes. Arup has used the Trans Pennine South Regional Transport Model (TPSRTM) as the basis for development of a single local traffic model to be used to assess the M62 and M56 schemes. Mott MacDonald has then utilised the Transport for Greater Manchester Model (TfGM Model) for the M60 as it is more geographically appropriate. Given the proximity of the 3 schemes (i.e. M62, M56 and M60) to each other the traffic modelling teams have worked closely to generate consistent traffic outputs which have formed the basis for cumulative environmental assessments.

This Environmental Assessment Report (EAR) presents the findings of the non-statutory environmental assessment undertaken to identify and assess potential environmental impacts that could arise from the Proposed Scheme and proposes mitigation measures to minimise these impacts in order to inform the planning, design and construction process and satisfy legal obligations.

## Air Quality

The four North West Smart Motorways Programme (SMP) Schemes (M6 J21a-26, M62 J10-12, M56 J6-8 and M60 J24-4) were all planned to be open within 18 months of each other and hence, to present a robust environmental assessment, these four schemes were initially assessed as one cumulative worst case for air quality. This initial assessment work was done by using forecast opening year traffic flows which include the cumulative worst case traffic associated with all North West SMP Schemes with a common 2020 opening year.

The findings of this initial air quality assessment work indicated that the M6 J21a-26 Scheme may be considered significant for air quality. This is because with the M6 J21a-26 Scheme included with the other three North West SMP Schemes there was predicted to be five large changes in nitrogen dioxide concentration at two locations along the M6 corridor including: two large changes at Newton-le-Willows and three large changes at Nichol Avenue, Martinscroft. The M6 J21a-26 Scheme will therefore not be progressed by Highways England until a suitable mitigation solution is identified.

In addition to developing a suitable mitigated air quality solution for the M6 J21a-26 Scheme, Highways England also requires that any mitigated solution will not change the overall acceptability of the other three North West SMP Schemes for air quality.

The remaining three North West SMP Schemes (M62 J10-12, M56 J6-8 and M60 J24-4) are being progressed by Highways England because together these schemes do not generate significant air quality effects.

The detailed air quality assessment presented for the three North West SMP Schemes considers a study area of the roads affected by the three North West SMP Schemes, and this affected road network (ARN), is illustrated in Figure 5.1. The air quality assessment presented for the three North West SMP Scheme study area utilises the traffic flows and predictions initially developed for all four North West SMP Schemes (cumulative worst case). This is because these air quality predictions are typically worst case, or very similar between the three and four scheme scenarios. Hence, where any minor differences occur, these are not significant, and a qualitative comment is provided. For example, on the M62 between J10 and 11 there is a reduction in traffic flows of only -166, and similarly -10 between J11 and 12 when comparing between scenarios.

The local air quality assessment has focused on the impacts of the air pollutant nitrogen dioxide (NO2) as the air quality criteria for this pollutant are those most likely to be exceeded in the air quality assessment study area.

Construction impacts for North West SMP Schemes were scoped out in the Scoping Report, July 2017 (Highways England – document reference MP0173) and so have not been considered in this assessment.

For the M56 geographical study area there are no designated ecological sites (which contain habitats sensitive to NOx and nitrogen deposition) within 200m of the cumulative worst case or 'M56 J6-8 Only' affected road networks.

In terms of regional emissions, there is a predicted increase in all pollutant emissions of between 0.8-1.7% in the opening year and between 1.0-1.9% in the design year. This is due to the predicted increase in vehicle kilometres travelled with the worst case cumulative scenario of 1.1% and 1.5% respectively compared to without the schemes.

Overall the Scheme is not significant for air quality and it can progress without the need for mitigation.

## Ecology and nature conservation

The assessment concludes that there are no significant effects anticipated on any statutory or non-statutory designated sites or on the favourable conservation status notable and/or legally protected species as a result of the construction and operation of the Proposed Scheme.

Construction will involve temporary loss of habitats within the soft estate, which will have temporary effects on resource availability for notable species, but this is not considered to have a significant effect on the favourable conservation status of these species. However, it will require mitigation and reinstatement.

## Landscape and cultural heritage

The motorway runs through predominantly open agricultural areas of green belt with a pattern of hedgerow field boundaries. Within the study area of 1km, there is one locally designated landscape of special value; Bollin Valley and Parklands, one Scheduled Monument; Watch Hill Motte and Bailey Castle and three Grade II Listed Buildings. Residential receptors are generally limited to scattered properties or small groups of properties adjacent to the Proposed Scheme; the largest group being properties to the edge of Warburton Green. Five public rights of way run adjacent or cross the Proposed Scheme.

The assessment concludes that in the long term following establishment of mitigation planting, there would be no permanent significant effect on landscape, visual amenity or the setting of cultural heritage assets.

During construction, potentially significant localised effects have been identified from 11 key representative viewpoints, this reduces to 7 locations at Year 1 of operation and no locations following establishment of mitigation at future Year 15. Due to the very localised and relatively temporary nature of each impact, at

each stage when the Proposed Scheme is considered as whole, it is concluded that the overall effect would not be significant.

One Heritage asset, Yew Tree House Grade II Listed Building, would experience a temporary significant adverse effect during construction only.

In addition to embedded mitigation measures achieved during the design process to reduce effects, including choice of gantry location, there would be measures to minimise disruption and visual effects for the duration of construction activities. Following construction, mitigation planting on reinstated verges would occur in locations where; visual effects require screening, and integration of the motorway into the wider landscape pattern of woodlands, trees and hedgerows would be effective.

There is the potential for a small number of visual receptors to benefit from an increase in screening from the motorway compared to their existing view and there is the potential for an increase in planting along the wider route corridor to the benefit of landscape integration and green infrastructure within the landscape through which the road passes.

Overall in the long term, the Proposed Scheme is considered to have a residual neutral effect in terms of landscape, visual amenity and the setting of cultural heritage assets.

## Noise and vibration

During the noisier phases of scheme construction, such as Emergency Refuge Area retaining walls and gantry foundations, construction noise and vibration could give rise to localised temporary (non-significant) adverse impacts at up to 7 properties. These impacts would be managed via the Outline Environmental Management Plan and the use of best practicable means to ensure that they are reduced to the lowest levels and durations possible. No significant noise or vibration effects are predicted from the construction phase.

When the Proposed Scheme is operational, in the short-term (when the scheme opens in 2021), one dwelling is predicted to experience a minor perceptible increase in noise level. Conversely, 24 dwellings are predicted to experience perceptible minor decreases in noise level. All other dwellings and other sensitive receptors are predicted to experience negligible noise impacts or no change in noise level. The decreases in noise level are due to the inclusion of a new low road noise surface on lanes 1 and 4 of the motorway as part of the Proposed Scheme. In the long-term (by 2035), all receptors are predicted to experience negligible noise impacts or no change in noise level. By the design year, 2035, there would be a decrease in the number of properties with noise levels above the significance threshold, although the changes in noise are shown not to be perceptible.

No significant noise or vibration effects are predicted and the Proposed Scheme results in an overall neutral effect during the operational phase. Additional noise mitigation is not proposed.

## Cumulative effects

The cumulative effects assessment considered two types of cumulative effects:

- Intra-project cumulative effects: Those caused only by the Proposed Scheme, and arise when an individual receptor or group of receptors would experience multiple effects as a result of the Proposed Scheme; for example, an individual property experiencing combined noise, air quality and visual amenity effects.
- Inter-project cumulative effects: Those caused by a combination of the Proposed Scheme with other relevant schemes.

Intra-project

Whilst the topic assessments have in many cases considered the same receptors, it is considered that there would be no combined effects that would be significant. During construction, it is considered that mitigation measures would be sufficient to mitigate any single effects in relation to noise, air pollution and visual amenity to such a level that no significant combined effects would arise. During operation, whilst it is acknowledged that there would be localised adverse effects on visual amenity, the fact that changes in air quality and noise would not be significant, no cumulative significant effects are expected to be a result of the Proposed Scheme.

Inter-project

The traffic model takes account of developments and road schemes in the wider region around the Proposed Scheme, including development projects at a greater distance than 1km (for example the M62 J10 to J12 SM and the M60 J24 to J4 SM) as a result of this, the air quality and noise assessments are inherently cumulative assessments.

The air quality assessment indicates that overall the effects associated with the M56 J6-8 will not be significant for air quality and no compliance risks have been identified. Therefore, no additional mitigation is required.

Other relevant projects were identified using a selection criteria methodology including scale, distance from the Proposed Scheme, development type and the degree to which they are reasonably foreseeable. A total of six developments were identified for assessment. A review was undertaken of each development by each topic but no significant cumulative effects were identified when considering source-pathway-receptor. This was due a number of reasons, including distance of these developments to the Proposed Scheme and that illustrative receptors were already assessed within the study area of the Proposed Scheme, for example within the traffic, air quality and noise modelling packages. This observation has taken account of assessment conclusions made within this report.

## Conclusion

As described above, no significant adverse environmental effects have been identified. The Proposed Scheme includes a number of design measures to avoid and reduce effects and will be delivered through an ongoing approach to environmental management that includes an Outline Environmental Management Plan.

# 1. Introduction

## 1.1. Overview of the Proposed Scheme

1.1.1 Highways England is proposing to upgrade the M56 between Junction 6 Manchester Airport and Junction 8 A556 (M56 J6-8) to a Smart Motorway. Smart Motorways use active traffic management (ATM) techniques to increase capacity by use of variable speed limits and conversion of the hard shoulder to a running lane. The Proposed Scheme will include all lane running (ALR) along this section by permanently converting the hard shoulder into a live lane. The Proposed Scheme aims to relieve congestion and smooth traffic flow; improve journey times and journey time reliability; maintain safety levels for all road users; and support the economic development of the nation.

1.1.2 The M56 is the North Cheshire Motorway connecting Cheshire, North Wales and the West Midlands (via the M6 and A556) to the Greater Manchester Conurbation.

1.1.3 The Proposed Scheme length is approximately 6.5km. Currently the network in this area is dual 3-lane (D3M) with hard shoulder, although there is an extended parallel merge / diverge arrangement for the east facing slip roads at Junction 7. Figure 1.1 provides an overview of the Proposed Scheme.

## 1.2 Purpose of the Environmental Assessment Report

1.2.1 Highways England has commissioned the Jacobs Atkins Joint Venture (JAJV) to design and assess the Proposed Scheme.

1.2.2 This Environmental Assessment Report (EAR) presents the findings of the non-statutory environmental assessment undertaken to identify and assess potential environmental impacts that could arise from the Proposed Scheme. It recommends mitigation, rectification and enhancement measures, which aim to fulfil the environmental objectives noted within both the Roads Investment Strategy (RIS) and Highways England's Licence. Where no significant effects are predicted, the conclusions of the detailed environmental assessment process, as recorded in a final EAR, are summarised in the EIA Screening (Determination), which is a separate document to this one.

1.2.3 For the purposes of this EAR, the assessment of the Proposed Scheme has been undertaken on the Design Fix 3 (DF3).

1.2.4 The design and environmental team will work closely to ensure that subsequent design change through Design Fix 4 (DF4) and beyond will not lead to a change in the significance of the effects of the Proposed Scheme, but may have an influence on the definition of measures to be reported within the Outline Environmental Management Plan (OEMP). This includes the use of change management processes via the evaluation of change register for recording and communicating design changes. Section 4.2 of this EAR provides further details of topics which have been scoped out that require consideration in the OEMP.

1.2.5 Traffic modelling has been undertaken to support the development, design, environmental assessment and business cases for the delivery of the North West schemes. Arup has used the Trans Pennine South Regional Transport Model (TPSRTM) as the basis for development of a single local traffic model to be used to assess the M62 and M56 schemes. Mott MacDonald has then utilised the Transport for Greater Manchester Model (TfGM Model) for the M60 as it is more geographically appropriate. Given the proximity of the 3 schemes (i.e. M62, M56 and M60) to each other the traffic modelling teams have worked closely to generate consistent traffic outputs which have formed the basis for cumulative environmental assessments. Further information on the traffic modelling, outcomes and on the approach to cumulative assessment is set out in Section 4 below.

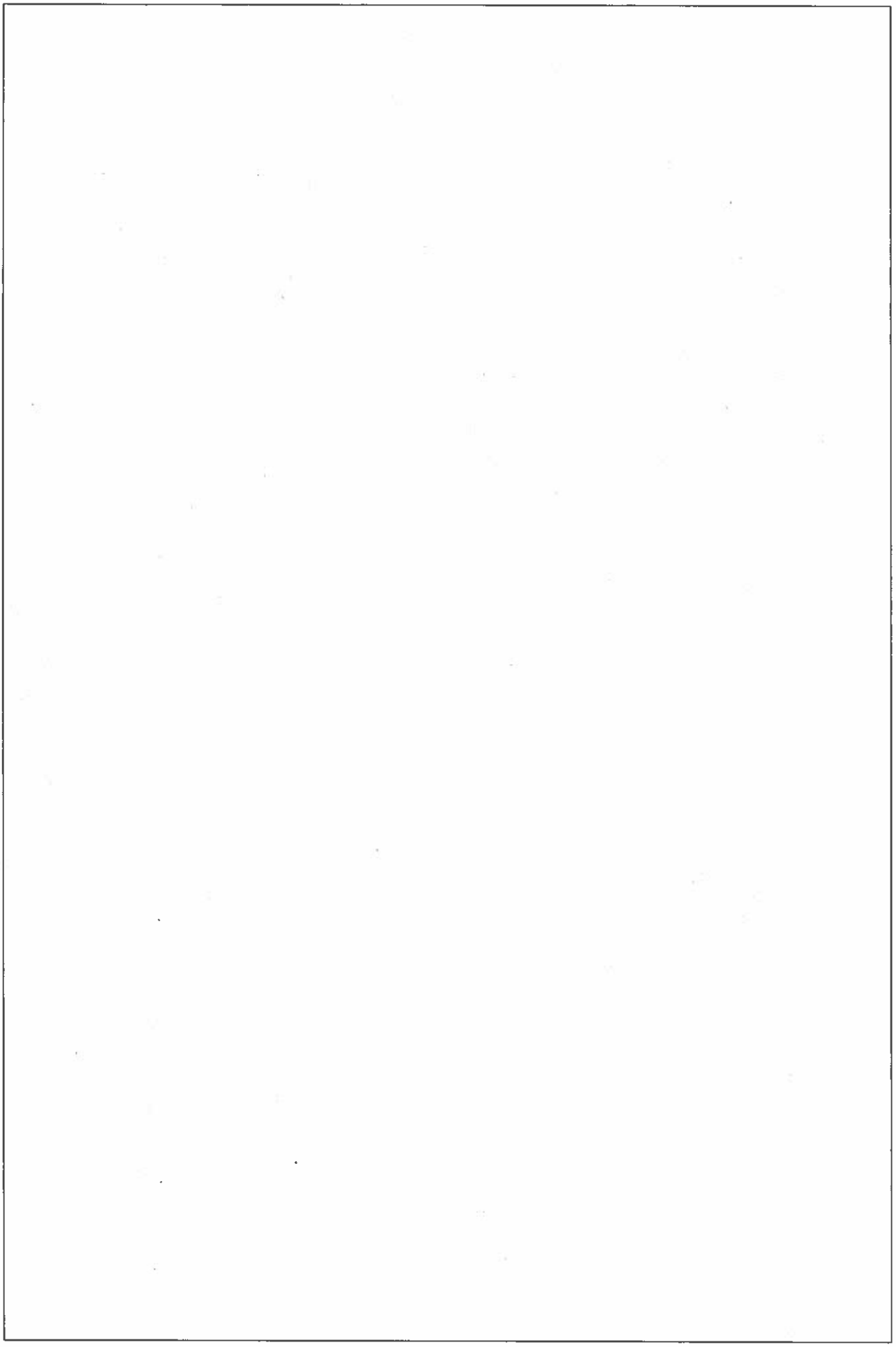
1.2.6 This EAR is supported by several other related documents produced at Project Control Framework (PCF) Stage 3, including the OEMP and Habitat Regulations Assessment, to support

Stage Gate Assessment Review 3. A discussion on the relationship between the EAR and the OEMP is provided in Section 5 of this report.

1.2.7 This EAR has been produced by qualified and competent experts, as summarised in Table 1.1.

**Table 1.1 Professional Competence**

| Name | Grade and Company | Expertise and Professional Qualification |
|---|---|---|



## 1.3 Background to the Smart Motorways Programme

1.3.1 Highways England has commenced a programme to introduce Smart Motorways to actively manage traffic, provide additional capacity and improve journey times on their motorway network. Smart Motorways are managed by regional control centres, and use CCTV, allowing Highways England traffic officers to be deployed to incidents if they occur and to help keep traffic moving.

1.3.2 Early Smart Motorways schemes used a combination of variable mandatory speed limits and extra capacity through the use of the hard shoulder as a running lane during peak traffic periods. New Smart Motorways schemes (those that started design development from 2013 onwards) will be built to the design standard set out in IAN 161/15.

1.3.3 The Proposed Scheme's objectives relate to the wider objectives of the Smart Motorways Programme and the strategic case supports achievement of the following national objectives:

- Support the Treasury's Business Plan 2011-2015 to secure an economy that is growing sustainably, is more resilient, and is more balanced between public and private sectors and between regions through developing a more effective transport network that facilitates movement of people, goods and services between places.
- The Government's priority to invest in the strategic road network to promote growth and address the congestion that affects people and businesses, and continue to improve road safety as set out in the Department for Transport Business Plan 2012-15.

- Delivering a Sustainable Transport System, implementing the recommendations of the Eddington Transport Study 2006, through enhancing national networks to tackle congestion, capacity constraints and unreliability in particular on key inter-urban corridors and international gateways.
- Support continued enhancements to the Trans European Road Network (TERN) and secure the benefits it gives in terms of maintaining international connectivity for road users.

1.3.4 The programme also supports the Strategic Outcomes of Highways England, as defined in the Delivery Plan 2015-2020, directly contributing to supporting economic growth and achieving a freer flowing network.

1.3.5 In addition, the Smart Motorways programme will support the remaining Strategic Outcomes of 'A Safe and Serviceable Network', 'Improved Environment' and an 'Accessible and Integrated Network', through a sympathetic and collaborative approach to design, working with key stakeholders. Support of all of these outcomes should, in turn, support an improvement in user satisfaction.

## 1.4 The Road Investment Strategy and Highways England Licence

1.4.1 The first 'Road investment Strategy' (RIS 1) outlines a long-term programme for England's motorways and major roads with the stable funding needed to plan ahead. The RIS 1 comprises:

- A long-term vision for England's motorways and major roads, outlining how Highways England will create smooth, smart and sustainable roads
- A multi-year investment plan that will be used to improve the network and create better roads for users; and
- High-level objectives for the first road's period 2015 to 2020.

1.4.2 In April 2015, the Highways England Operating Licence was brought into force, which sets out the Secretary of State's statutory directions and guidance to Highways England for the management of roads. The document makes clear, to both Highways England and the wider community of road users and stakeholders, what Highways England is expected to achieve and how they must behave in discharging their duties and in delivering the Government's vision and plans for the network, set out in the Road Investment Strategy (RIS).

1.4.3 The Licence in Parts 4.2g and h requires Highways England to "Minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment" and "Conform to the principles of sustainable development". The Highways England Licence and the RIS set out a series of environmental objectives to which the Proposed Scheme will seek to deliver.

1.4.4 Further distillation of the environmental policies and objectives, have been developed into Environmental Objectives included within the Smart Motorways Programme Client Environmental Scheme Requirements. The way in which the Proposed Scheme achieves these requirements have been addressed within this report and are summarised in Table 1-2 below.

**Table 1.2 Environmental Objectives**

| Objective | M56 J6 to J8 - Smart Motorway Project |
|---|---|
| **Air Quality and Carbon Emissions** | |
| To avoid an increase in emissions in $NO_2$ where they could threaten the achievement of the Air Quality Standard across the wider area likely to be affected by working with relevant authorities to secure appropriate mitigation to ensure so far as possible the standards are not breached. | In the opening year (2020 M56 DS only) there would be 9 exceedances without the Proposed Scheme and 11 exceedances with the Proposed Scheme. Changes in concentrations have been evaluated in line with IAN 174/13. Of the 138 receptors modelled, there is one receptor with a 'small increase' in annual mean $NO_2$ with the Proposed Scheme, but concentrations would be below the AQS objective. Changes in annual mean $NO_2$ concentrations at all other locations are estimated to be 'imperceptible'.<br>All changes are classed as 'not significant' for local air quality. |
| To avoid adverse effects upon SSSI due to additional nitrogen deposition. | There are no ecologically designated sites within 200m of the Affected Road Network for the 'M56 only' Do Something scenario. |
| **Noise** | |
| To achieve reductions in the number of dwellings exposed to noise levels, within Noise Important Areas or other areas experiencing elevated noise levels, using Best Available Technology in the attenuation of noise that are proportionate and reasonable. | The Department for Transport RIS 2015-2020 aspires to the target that by 2040 over 90% fewer people are impacted by noise from the strategic road network. The target for the first Road Period 2015-2020, is to mitigate at least 1,150 Noise Important Areas expecting to reduce the number of people severely affected by noise from the strategic road network by at least 250,000.<br><br>Within Noise Important Areas there is 1 property predicted to experience negligible (less than 3dB) noise increases and 9 properties predicted to experience no change or negligible noise decreases over the long term (difference between opening year Do-Minimum and Design Year Do-Something).<br><br>Overall, there is a decrease in the number of properties with noise levels over SOAEL. |
| To avoid increases in noise levels where there would be a significant impact on public amenity. | The proposal is to include new low noise road surface across lanes 1 and 4, which will have the potential to reduce noise levels by 0.5dB in the opening year when compared with the existing low noise road surface sections, and by 1.7dB when compared with existing hot rolled asphalt sections. |
| **Biodiversity** (to explore and achieve where practicable) | |
| No direct or indirect effect upon SSSI. | All proposed works are within the highways boundary. Rostherne Mere SSSI is located approximately 300m from the highways boundary. The site falls outside of the Ecological Zone of Influence (EZoI) (taken as within 200m of the footprint of the Proposed Scheme, or within the air quality affected road network, or within a river catchment for sites over 200m but hydrologically connected to the Proposed Scheme). A Habitat Regulations Assessment for this SSSI was completed as part of the Environmental Assessment, the results of which determined that there would be no likely significant adverse effects |

| Objective | M56 J6 to J8 - Smart Motorway Project |
|---|---|
| | (either alone or in-combination with other projects and plans) anticipated on Rostherne Mere SSSI during the construction and operational phase of the Proposed Scheme.<br><br>Additionally, two more SSSI's are situated within the study area; Cotterill Clough SSSI (750m from highways boundary) and Dunham Park SSSI (1.5km from highways boundary). These both fall outside the EZoI. |
| Seek to avoid loss or deterioration of irreplaceable habitats including ancient woodland and the loss of aged or veteran trees. | Any tree protection measures considered necessary would be detailed in the OEMP to prevent damage to tree roots and stems during works.<br><br>This would include buffer zones for any works immediately adjacent to ancient woodland, particularly around Hancock's Bank South which lies within 15m of the highways boundary.<br><br>No aged or veteran trees have been identified within the highways boundary. |
| Maximise opportunities to deliver beneficial biodiversity outcomes and contribute to the ecological objectives of nearby SSSI and Nature Improvement Areas. | Locations of potential enhancement opportunities both on-network and off-network have been identified, which include the potential enhancement of local wildlife sites and habitats of principal importance which fall within the study area.<br><br>Habitat reinstatement on-network would also consider the use of native trees and diverse wildflower seed mixes. |
| To establish new habitat within the soft estate that contributes towards the Client's and Biodiversity Action Plan without compromising maintenance and renewal requirements. | Planting schemes will consider the use of native trees and diverse wildflower seed mixes.<br><br>The removal and control of invasive plant species from the network would also contribute towards the plan. |
| Working towards no net loss in biodiversity | Opportunities for biodiversity enhancement have been identified both on-network and off-network. There may be opportunities to work with local wildlife and conservation groups to enhance nearby wildlife sites.<br><br>Habitats reinstated within the highways boundary would be of higher biodiversity value than existing levels, primarily through planting of native tree species and diverse wildflower seed mixes. |
| **Landscape** | |
| To deliver sustainable infrastructure that is sustainable and as aesthetically sensitive, durable, adaptable and resilient as reasonably possible. | Additional screen planting would be implemented to replace the loss of existing screening vegetation to ensure that screening value would be reinstated when mitigation planting matures. Proposed planting would be native and aim to provide improved biodiversity. Further detail on mitigation is provided in the OEMP. |

| Objective | M56 J6 to J8 - Smart Motorway Project |
|---|---|
| To ensure no adverse significant visual intrusion or significant effect upon heritage assets. | One Heritage asset, Yew Tree House Grade II Listed Building, would experience a temporary significant adverse effect during construction only. By future Year 15 the planting along the highway boundary would have matured and would largely screen gantries from within the setting of the Yew Tree House Grade II Listed Building.<br><br>There are no other significant effects on the setting of any cultural heritage assets as a result of the Proposed Scheme. |
| Take all reasonable steps to minimise any detrimental impact on amenity including the impact of light pollution. | Lighting during construction would be set within the context of existing lighting on the M56 and within housing estates. Impacts from the temporary duration of lighting during construction would occur in unlit sections of road and have been included and reported in the assessment of key representative viewpoints.<br><br>The Proposed Scheme would not change the extent of lighting along the M56 and the new technology with full cut-off LED lanterns and increased control of lighting levels would serve to lessen any existing impacts from light spill. It is considered that there would be no change from the existing situation. |
| To maintain functionality and connectivity of the green infrastructure network. Where possible, mitigate adverse impacts and where appropriate, improve the network and other areas of open space. | There is the potential for planting to replace vegetation lost and, in addition, improve the overall resource along the route to benefit landscape integration of the road, connectivity for nature, visual screening, visual amenity and driver experience.<br>There is little opportunity to improve the network due to the narrow width of the verge and lack of open space. |
| To mitigate any existing impacts. | There is the potential for a small number of visual receptors to benefit from an increase in screening from the motorway compared to their existing view and there is the potential for an increase in planting along the wider route corridor to the benefit of landscape integration and green infrastructure within the landscape through which the road passes. |
| To deliver a landscape strategy that aligns with the current environmental objectives for the scheme. | The Landscape design strategy aims to both maintain the existing Visual mitigation and Landscape Vegetation connectivity as well as improving Planting Biodiversity. |
| **Heritage** | |
| To undertake measures to avoid significant effects upon heritage assets. | One Heritage asset, Yew Tree House Grade II Listed Building, would experience a temporary significant adverse effect during construction only. By future Year 15 the planting along the highway boundary would have matured and would largely screen gantries from within the setting of the Yew Tree House Grade II Listed Building.<br><br>There are no other significant effects on the setting of any cultural heritage assets as a result of the Proposed Scheme. |

| Objective | M56 J6 to J8 - Smart Motorway Project |
|---|---|
| **Accessibility and Transport** | |
| Explore reasonable measures to enhance accessibility for pedestrians and cyclists at motorway junctions in order to reduce existing severance. | The current level of accessibility along the Proposed Scheme is considered to be adequate and will be maintained. |
| Promote equality and consider the needs of disabled people. | Designs take account of current Disability design requirements. |
| Consider other transport modes in developing the scheme. | Not considered. |
| Undertake a proportionate assessment of the impacts on other networks and take reasonable steps to mitigate such impacts. | The proposed SMP is not considered to have a negative effect on other networks and as such know further proportionate assessment has been proposed. |
| **Water Quality and Flood Risk** | |
| Rectify any existing water quality and flood risk issues to contribute towards Water Framework Directive and deliver capacity to take account of climate change. | Standard pollution prevention measures and best practice will be employed during construction; these measures are detailed in the OEMP and will be detailed in the CEMP to be prepared and implemented by the Delivery Partner. The scale of the proposed works and restriction to within the existing highway boundary result in a low likelihood of a significant effect during construction.<br><br>The Proposed Scheme is designed, and will be managed through the OEMP, to ensure water volumes or pollutants do not increase at any existing outfalls.<br><br>The Proposed Scheme will include drainage improvements, in accordance with Interim Advice Note 161/15 such that discharges will be at existing established rates (up to the 1:100 year rainfall event). |
| There is to be no increase in the volume and peak flow rates of surface water leaving the site unless specific offsite arrangements are made to the same effect. | The Proposed Scheme will include drainage improvements, in accordance with Interim Advice Note 161/15 such that discharges will be at existing established rates (up to the 1:100 year rainfall event). Hence additional drainage capacity will be provided within the piped network to account for an increase in impermeable area. |
| Avoid any detriment to water quality or flood risk. | Standard pollution prevention measures and best practice will be employed during construction; these measures are detailed in the OEMP and will be detailed in the CEMP to be prepared and implemented by the Delivery Partner. The scale of the proposed works and restriction to within the existing highway boundary result in a low likelihood of a significant effect during construction.<br><br>The Proposed Scheme is designed, and will be managed through the OEMP, to ensure water volumes or pollutants do not increase at any existing outfalls.<br><br>The Proposed Scheme will include drainage improvements, in accordance with Interim Advice Note 161/15 such that discharges will be at existing established rates (up to the 1:100 year rainfall |

| Objective | M56 J6 to J8 - Smart Motorway Project |
|---|---|
| | event). |
| Ensure/establish a state of the art pollution control system commensurate with the objectives of minimising the need for traffic management. | Standard pollution prevention measures and best practice will be employed during construction; these measures are detailed in the OEMP and will be detailed in the CEMP to be prepared and implemented by the Delivery Partner. The scale of the proposed works and restriction to within the existing highway boundary result in a low likelihood of a significant effect during construction. |
| Ensure upstream flood risk is considered through design and assessment. | Designs to take account of upstream flood risk and ensure that the Proposed Scheme has no effects on flood risk. |
| Ensure surface and groundwater constraints identified are considered through design and assessment. | Designs have considered and will continue to take account of surface and groundwater constraints identified within the AEDS. |
| **Material Resources** | |
| Maximise the quantity of locally available secondary materials to be deployed within the Proposed Scheme. | The Delivery Partner will by consider secondary material availability where possible. |
| Maximise the re-use value of surplus materials generated during construction of the Proposed Scheme. | Verges will be reinstated with original soils (which will also act to preserve the original soil profile). The reuse of crushed concrete and plainings will be considered as fill where appropriate. |
| Minimise disposal of surplus materials to waste management facilities. | Verges will be reinstated with original soils (which will also act to preserve the original soil profile). The reuse of crushed concrete and plainings will be considered as fill where appropriate. |

## 1.5 Legislative and Policy Framework

1.5.1 Highways England road projects, unless there is a requirement for a DCO determination, are subject to the Highways Act 1980. The Highways Act, as of December 2017, enacts the European Union (EU) Environmental Impact Assessment (EIA) Directive 2014/52/EU in the form of the EIA (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017.

1.5.2 The European Union (EU) Directive 2014/52/EU, requires that an EIA be undertaken by the promoters of certain types of development to identify and assess the environmental effects of certain public and private projects before development consent is given. Directive 2014/52/EU and current EIA regulations in England specify the qualification requirements and the process by which statutory EIA should be undertaken. All developments listed under Annex I of the EIA Directive must be subject to statutory EIA in every case. Developments listed under Annex II may need to be subject to statutory EIA depending on whether the Proposed Scheme qualifies as a 'relevant project' (that is if it meets certain criteria and thresholds defined in Annex II) and gives rise to significant effects. The potential to generate significant environmental effects is described within Annex III of the EIA Directive.

1.5.3 The Proposed Scheme has been classified as a relevant Annex II project (i.e. statutory EIA is not mandatory) as whilst it is not of a type listed in Annex I, the anticipated area subject to construction / reconstruction is over the trigger threshold of 1 hectare (ha). Under Highways England's procedures, Annex II relevant projects, such as the application of SM ALR on the M56 would require an appropriate level of environmental review in accordance with the regulations. The Proposed Scheme has, therefore, been subject to an environmental review and assessment in line with the Design Manual for Roads and Bridges (DMRB) Volume 11 and associated updates, Interim Advice Notes (IAN) and guidance to establish whether significant environmental effects are likely to arise during its construction and operational phases.

1.5.4 Screening procedures that accord with the requirements of the Highways (EIA) Regulations 2007 exist within Highways England to determine whether trunk road and motorway developments

require statutory EIA, leading to the preparation of an Environmental Statement. This process is known as determination, and this EAR informs this process. As the EU EIA Directive 2014/52/EU has yet to be transposed into the Highways Act 1980, and therefore the Highways (EIA) Regulations 2007, the requirements of the Infrastructure Planning (EIA) Regulations are also considered in the determination process.

1.5.5 If significant environmental effects are predicted, a statutory EIA leading to the production of an Environmental Statement will be required under the Planning Act 2008 and Infrastructure Planning (EIA) Regulations 2017, which transposed the EU EIA Directive 2014/52/EU into UK legislation in May 2017. Where no significant effects are predicted, the conclusions of the detailed environmental assessment process, as recorded in a final EAR are summarised in an EIA Screening (Determination).

1.5.6 In terms of policy context for the environmental assessment, in March 2012, the Department for Communities and Local Government (DCLG) published the National Planning Policy Framework (NPPF), which sets out the Government's economic, environmental and social planning policies. The NPPF aims to reform the planning system and is underpinned by a presumption in favour of sustainable development. There is a focus on planning for prosperity, people and places, promoting increased levels of development and supporting infrastructure, whilst also protecting and enhancing the natural and historic environment. It is designed, however, to be interpreted and implemented locally, and delegates responsibility for achieving this vision to local planning authorities.

## 1.6 Guidance followed for this report

1.6.1 The environmental assessment for the Proposed Scheme has been undertaken in accordance with:

- the DMRB Volume 11, IAN 125/15: Environmental Assessment Update;
- IAN 126/15: Environmental Assessment Screening and Determination,
- IAN 161/15: Smart Motorways;
- IAN 183/14: Environmental Management Plans; and
- MPI-57-052017: Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive).

1.6.2 The scope and content of this EAR has been informed by the M56 J6 to J8 Smart Motorway Environmental Scoping Report (hereafter referred to as the Environmental Scoping Report), and other previous and current Smart Motorways Programme EARs.

# 2. The Proposed Scheme

## 2.1 Need for the Proposed Scheme

2.1.1 The M56 is the North Cheshire Motorway connecting Cheshire, North Wales and the West Midlands (via the M6 and A556) to the Greater Manchester Conurbation. It also serves Manchester Airport at Junction 5. Significant sections of this strategic route suffer from low peak hour speeds, poor journey time reliability and high traffic flows.

2.1.2 The Proposed Scheme length is approximately 6.5km and is located within the North West Regional Control Centre area and is within Highways England Area 10, under the management of the Asset Support Contractor.

## 2.2 Description of the Proposed Scheme

2.2.1 This section provides a summary of the Proposed Scheme and is supported by the figures in Appendix A which includes DF3 drawings.

2.2.2 DF1 was completed by Jacobs and included an initial assessment of sign and signal locations designed to IAN161/13. During the DF2 mobilisation and DF2 phase, the DF1 design was reviewed and amended by JAJV to meet the new requirements of IAN161/15 and take into account infrastructure and environmental issues. This DF2 design was then firmed up within DF3 through the production of an integrated design model.

2.2.3 The Proposed Scheme will provide a hardened central reserve with a new Rigid Concrete Barrier (RCB) to replace the existing deformable metal Vehicle Restraint System (VRS). A widened RCB will be provided to the east of Sunbank Lane bridge (located between J6 and J7) to accommodate proposed lighting columns within the central reserve.

2.2.4 The Proposed Scheme will increase capacity and reduce congestion on this strategic route. The operational performance of the network was considered at DF1 and reviewed by the Project Team at DF2. Operational capacity needs for the Proposed Scheme have been based upon the traffic figures forecasting for year 2035 which was carried out by Arup in Spring 2017. The peak hour traffic flows have been considered alongside operational considerations to determine the most appropriate operational solution for each link and junction in terms of required capacity and junction layout.

## 2.3 Carriageways

2.3.1 The existing standard three lane carriageway with hard shoulder is to be upgraded to four lane ALR (with or without through junction running) between Junction 6 and Junction 8 in both directions. The four running lanes will be accommodated within the existing paved area and generally no pavement widening within the verge will be required.

2.3.2 Through Junction Running (TJR) is only proposed at Junction 6 on the westbound carriageway. TJR involves taking the four running lanes through the junction. Where a lane drop/ lane gain is to be provided, the existing three lanes and hard shoulder configuration will be retained through the junction.

2.3.3 A hard surface and an RCB will be installed for the full length of the central reserve. This will minimise the requirement for future maintenance work in the centre of the motorway, which has benefits for road worker safety.

2.3.4 On ALR sections there will be provision of a nearside hard strip of 500mm minimum width with enhanced edge drainage.

2.3.5 The carriageway within the Proposed Scheme limits will be resurfaced where necessary for construction of the Proposed Scheme and where deemed necessary as a maintenance measure

and agreed with Highways England Operations Directorate. For the purposes of a noise assessment it is assumed that the road surface would comprise of a mixture of Hot Rolled Asphalt (HRA) and Low Noise Road Surface (LNRS). The noise assessment assumes that the Proposed Scheme will incorporate a new low noise surface in the opening year to lanes 2 and 3 between J6 and J8. The junction layouts will be realigned to accommodate the fourth lane generally by re-configuration of slip road merge and diverge types.

2.3.6 Retaining walls will be installed to accommodate ERAs, Remotely Operable Temporary Traffic Management Signs (ROTTMS), communications cabinet sites and gantries as necessary.

## 2.4 Central Reserve Works

2.4.1 The Proposed Scheme provides a hardened central reserve with a new concrete barrier to replace the steel barrier for the full extent of the Proposed Scheme. This will provide for reduced maintenance and will allow the central reserve to be narrowed on ALR sections.

2.4.2 The central reserve works comprises the following components:

- Rigid Concrete Barrier (RCB) in the central reserve (approx. 6.5km) including approximately 1.3 km of wide RCB where lighting columns are proposed to be positioned in the central reserve
- Paved central reserve where RCB is introduced
- Installation of central reserve RCB over 4 no. underbridges
- Protection of central reserve piers with barriers at 1 no. overbridge
- Encapsulation of central reserve piers at up to 4 no. overbridges
- New central reserve surface water channel over significant lengths of the Proposed Scheme
- New carrier drains and attenuation as required for central reserve drainage.

## 2.5 Verge / ALR Works

2.5.1 The ALR component of the Proposed Scheme provides four permanent running lanes by converting the hard shoulder into lane one between J6 and J8 in both directions.

2.5.2 The ALR works in the verge comprise the following components:

- New carrier drains and attenuation as required for verge drainage
- Retaining walls to accommodate ERAs, communications cabinet sites, gantries etc.
- Provision of four lanes and 13.75m overall carriageway width from J6 to J7 and alterations to junction layouts to accommodate the fourth lane
- The construction of 4 no. ERAs
- Providing nearside hard strip of approximately 0.5m minimum width with enhanced edge drainage
- Reconstruction or strengthening of the hard shoulder where it becomes a running lane, and resurfacing of existing running lanes.
- The existing noise barriers will be retained. Following assessment and value for money calculations no new noise barriers are proposed for the Proposed Scheme.

2.5.3 The introduction of new signalling infrastructure will include the following:

- 10 no. new gantries (cantilevers, portal gantries, super cantilevers and super span gantries) to carry AMIs, MS4s, MS3 or Advanced Directional Signs (ADS), as shown in Table 2-1.
- 3 no. existing cantilever gantries will be retained for strategic MS3s
- 2 no. existing gantries (portal gantries and super span gantries) will be upgraded for AMIs*, , MS4s or ADS
- New longitudinal ducts between J6 and J8 and various local ducts (subject to surveys)
- Upgraded NRTS longitudinal copper and fibre cable to new copper and fibre cable from Junction 6 – 8
- Approx. 14 no. Pan Tilt Zoom zero light cameras to provide full coverage of carriageway
- Approx. 14 no. MIDAS radar units throughout the Proposed Scheme. A selected number of in-carriageway loop detectors will be retained or installed on slip roads and mid-link
- Approximately 15 no. ROTTMS installations, two sets eastbound and one set westbound. (The SMP level GD04/12 assessment will be reviewed), as shown in Table 2-4

- Installation of HADECS cameras to provide speed enforcement throughout the Proposed Scheme.

**Table 2.1 Advanced Direction Signs / Signal provision within M56 Junctions 6 to 8**

| Link | Gantry ref | Signal Type | Chainage | Distance to Datum Point | Distance to upstream signal |
|---|---|---|---|---|---|
| **Eastbound Carriageway** | | | | | |
| J7 | GB-01 | Conditioning VMS | 3603 | N/A | N/A |
| A556 | GB-01b | Link Road Gateway Gantry | 3725 | N/A | N/A |
| J7 | N/A | Entry Datum Point | 4462 | N/A | N/A |
| J7-J6 | GB-02 | Gateway Gantry | 4827 | 365 | 1224 |
| J7-J6 | GB-03 | ERA VMS | 5632 | N/A | 805 |
| J7-J6 | GB-04 | ERA VMS | 6436 | N/A | 804 |
| J7-J6 | STB-05 | Strategic MS3 | 7397 | N/A | N/A |
| J7-J6 | GB-06 | Primary DS with VMS & signals | 7577 | 1179 | 1141 |
| J7-J6 | GB-07 | Secondary DS with VMS & signals | 8230 | 526 | 653 |
| J7-J6 | STB-08 | Strategic MS3 | 8418 | N/A | N/A |
| J7-J6 | GB-09 | Final ADS | 8766 | -10 | N/A |
| J6 | N/A | Exit Datum Point | 8756 | N/A | N/A |
| J6 | GB-10 | Confirmatory DS with VMS & signals | 8960 | N/A | 730 |
| **Link** | **Gantry ref** | **Signal Type** | **Chainage** | **Distance to Datum Point** | **Distance to upstream signal** |
| **Westbound Carriageway** | | | | | |
| J6 | N/A | Exit Datum Point | 9701 | N/A | N/A |
| J6 | GA-40 | Confirmatory DS with VMS & signals | 9351 | N/A | N/A |
| J6 | | Entry Datum Point | 8870 | N/A | N/A |
| J6-J7 | GA-41 | Gateway Gantry + ERA VMS | 8525 | 345 | 826 |
| J6-J7 | GA-42 | Link VMS + Signals | 7577 | N/A | 948 |
| J6-J7 | STA-43 | Strategic MS3 | 6893 | N/A | N/A |
| J6-J7 | GA-44 | Primary DS with VMS & signals | 6436 | 1647 | 1141 |
| J6-J7 | STA-45 | Strategic MS3 | 5932 | N/A | N/A |

| Link | Gantry ref | Signal Type | Chainage | Distance to Datum Point | Distance to upstream signal |
|---|---|---|---|---|---|
| J7-J6 | GA-46 | Secondary DS with VMS & signals | 5632 | 843 | 804 |
| J7-J6 | GA-47 | Final DS with VMS & signals | 4827 | 38 | 805 |
| J7 | N/A | Exit Datum Point | 4789 | N/A | N/A |
| J6 | GA-48 | Confirmatory DS with VMS & signals | 4198 | N/A | 629 |

## 2.6 Emergency Refuge Areas

2.6.1 In the ALR sections (where the hard shoulders have been converted into a running lane), dedicated ERAs with emergency telephones will be constructed in discrete locations. ERAs, which are similar to laybys, are required to provide a safe area for vehicles to stop in an emergency without interrupting the flow of traffic. ERAs resemble a traditional layby and are 4.6m wide and extend for a length of 100m. Two ERAs will be installed on the eastbound carriageway and two on the westbound carriageway within the Proposed Scheme limits. The ERAs would be located as shown in Table 2-2. Refuge areas may be new or may be converted from an existing facility, for example a wide load bay..

**Table 2.2 Proposed ERA locations**

| ERA Ref | Start Chainage (m) | End Chainage (m) |
|---|---|---|
| **Westbound Carriageway** | | |
| **ERA-A4** | 7467 | 7367 |
| **ERA-A5** | 5810 | 5710 |
| **Eastbound Carriageway** | | |
| **ERA – B1** | 5915 | 6015 |
| **ERA – B2** | 7004 | 7104 |

2.6.2 Emergency roadside telephones (ERT) will be provided in all dedicated refuge areas. Existing ERT outside the J6-7 link will be retained aside from inter-junction between the J6 diverge and merge westbound due to through junction running at that location.

2.6.3 Recent Major Project Instruction (MPI-11-062013) requires consideration to be given to the provision of maintenance hard standings (MHS) at the upstream end of ERAs. This arrangement is referred to as a combined ERA/MHS and where reasonably practicable these features will significantly reduce the requirement for temporary traffic management (lane closures) during asset maintenance. The introduction of a combined ERA/MHS onto the M56 will be considered in DF4.

## 2.7 Signs and Gantries

2.7.1 Operation of the Smart Motorway will be controlled via LED signals, which will be mounted on overhead gantries, or pole mounted in the verge. There are three main types of LED signals, which are described below:

- AMI signals are used to display variable mandatory speed Limits (VMSL) for each lane using programmable high resolution LEDs

- MS4 signals are a type of variable message sign used to provide driver information in the form of text and pictograms
- MS3 signals are deployed in advance of strategic junctions and provide information to the travelling public in the form of text messages.

2.7.2 ADS signing are fixed retroreflective sign faces.

2.7.3 The roadside devices to be included as part of the Proposed Scheme are detailed in Table 2.3 below. Figure 2-1 illustrates typical views of MS4, MS3 ADS and AMI signage. ROTTM signs are detailed in Table 2.4.

**Table 2.3 Roadside devices**

| Roadside device | New | Existing |
|---|---|---|
| AMI (gantry mounted) | 56 | 0 |
| AMI (post mounted) | 4 | 0 |
| MS4 | 14 | 0 |
| MS3 / MS2 | 4 | 5 |
| ERT | 4 | 16 |
| HADECS enforcement cameras (ENF) (live sites) | 1 | 0 |
| HADECS enforcement cameras (ENF) (non-live sites) | 1 | 0 |
| MIDAS outstation | 21 | 24 |
| MIDAS Radar sites | 14 | 0 |
| Pan, tilt and zoom CCTV camera (PTZ) | 14 | 5 |
| ROTTM | 10 | 0 |
| Gantry mounted ADS | 8 | 4 |

**Figure 2-1 Typical views of MS4, ADS and AMI signage**

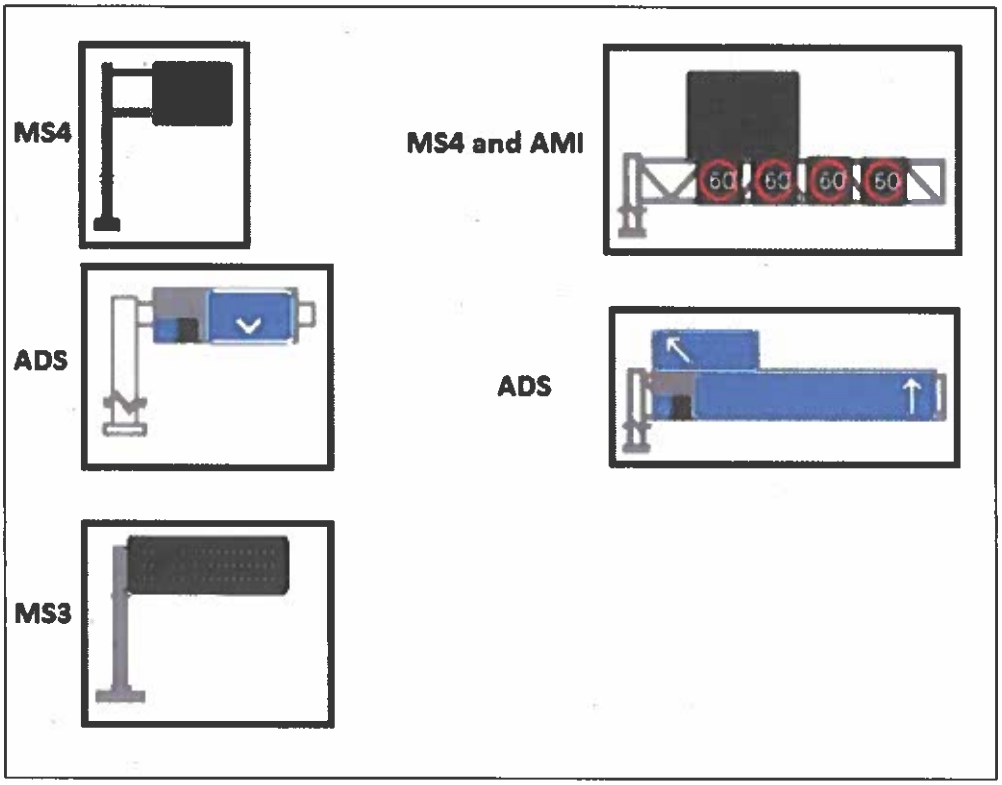



**Table 2.4 ROTTM Signs**

| ROTTM Sign Criteria Eastbound | | | |
|---|---|---|---|
| FTP Reference | FTP Datum Chainage | FTP | Actual Chainage (m) |
| FTP/EB/3 | 6886 | | 6886 |
| | | 200yds | 6703 |
| | | 400yds | 6508 |
| Eastbound | | 600yds | 6337 |
| | | 800yds | 6142 |
| | | 1 Mile | 5277 |

| ROTTM Sign Criteria Westbound | | | |
|---|---|---|---|
| FTP Reference | FTP Datum Chainage | FTP | Actual Chainage (m) |
| FTP/WB/2 | 6985 | | 6985 |
| | | 200yds | 7168 |
| | | 400yds | 7317 |
| Westbound | | 600yds | 7587 |
| | | 800yds | 7717 |
| | | 1 Mile | 8594 |
| FTP/WB/3 | 3400 | FTP | 3400 |
| | | 200yds | A-Frame |
| | | 400yds | A-Frame |

| ROTTM Sign Criteria Westbound | | | |
|---|---|---|---|
| Westbound | | 600yds | A-Frame |
| | | 800yds | A-Frame |
| | | 1 Mile | 5009 |

## 2.8 Lighting

### Existing Lighting Provision

2.8.1 The M56 mainline is lit up to the west facing J6 ½ mile ADS which is approximately 250m in advance of the end of the taper of the M56 J6 west facing slip roads.

2.8.2 The M56 mainline from the west facing J6 ½ mile ADS to J8 is currently un-lit. The M56 beyond J8 is not lit until Junction 9.

2.8.3 The full length of the M56 J6 slip roads are currently lit, whereas the M56 J7 and J8 slip roads are partially lit with lighting only on the immediate approach to / from the end of the slip roads.

### Proposed Lighting

2.8.4 The result of the TA49/07 economic assessment shows that it is not economically worthwhile to provide lighting on the M56 Junction 6 to 8 (M56 J6-8) mainline and slip roads except for the M56 Junction 7 eastbound on slip road.

2.8.5 Lighting should terminate at Junction 6 as currently, with the proposed extents of lighting across the Proposed Scheme summarised as follows.

- The full length of the M56 J6 slip roads are currently lit and will remain lit.
- The extents of lighting on the M56 mainline at J6 will remain but the extents will be reduced, the lighting will now extend through the junction and terminate approx. 156m (5 seconds driving time) from the taper of the west facing slip roads.
- The M56 mainline from J6 (from approx. 156m from end of tapers of west facing J6 slip roads) to J7 shall remain un-lit.
- The M56 J7 remains partially lit with only the roundabouts and their approaches, the mainline between J7 to J8 shall remain un-lit.

### Obtrusive light

2.8.6 As part of SMP schemes, low-carbon technologies are proposed such as the provision of LED lighting which is controlled dynamically by CMS and MoRLiCS. This will facilitate the remote control and monitoring of road lighting assets on the network, and help the Government to meet its carbon emission targets without restraining sustainable economic growth.

2.8.7 LEDs are full-cut off lanterns which do not emit any ultra violet output hence will have less impact on flora and fauna compared to the existing High Pressure Sodium (HPS) light source.

2.8.8 The CMS and MoRLiCS system controls the levels of lighting to achieve the optimum balance between road safety and the impact of road lighting on the environment by reducing light pollution.

2.8.9 The proposed lighting meets the recommendations contained in the ILP document – Bats and Lighting in the UK.

2.8.10 Other benefits of the above proposals are:

- Frequency of maintenance of the proposed LEDs is up to six years which can be programmed with the five yearly electrical testing visits hence reducing the need for costly maintenance visits and reducing the impact on the road users and network maintainers;

compared to the existing HPS lighting network which requires a 3 year maintenance frequency.

- The CMS can be used to monitor the performance of the Trunk Road lighting assets, to allow for repair and maintenance of the road lighting before failures occur, by providing early indication of the incorrect operation prior to complete failure. It will dynamically report defect information from the Trunk Road lighting assets to facilitate faster response to defects with HE's Trunk Road lighting stock.
- The CMS can be used to selectively reduce or remove the need for costly maintenance visits.

## 2.9 Works to Structures

### Overbridges

2.9.1 The works to the overbridges are outlined in Table 2-5 below.

**Table 2.5 Works to overbridges**

| Structure Name | Structure Number | Marker Post | Works to Structure |
|---|---|---|---|
| Chapel Lane | 3892 | 15.00 | Tie RCB into pier. Assessment of pier for impact loading to determine requirement for encapsulation/strengthening of central reserve pier columns. |
| Thornsgreen | 3894 | 15.70 | Tie RCB into pier. Assessment of pier for impact loading to determine requirement for encapsulation/strengthening of central reserve pier. |
| Castle Mill Lane | 3895 | 16.70 | Tie RCB into pier. Assessment of pier for impact loading to determine requirement for encapsulation/strengthening of central reserve pier columns. |
| Ashley Hall | 3898 | 17.70 | Tie RCB into pier. Assessment of pier for impact loading to determine requirement for encapsulation/strengthening of central reserve pier. |
| Ryecroft Footbridge | 3899 | 18.90 | No works proposed. |
| Bowdon View | 3901 | 19.70 | Tie RCB into pier. Assessment of pier for impact loading to determine requirement for encapsulation/strengthening of central reserve pier. |
| Yarwood Heath Lane | 3903 | 20.20 | No works proposed. |
| Chester Road Bridge | 3904 | 20.90 | No works proposed. |

### Underbridges

2.9.2 The works to the underbridges are outlined in Table 2-6 below.

**Table 2.6 Works to underbridges**

| Structure Name | Structure Number | Marker Post | Works to Structure |
|---|---|---|---|
| Hasty Lane Subway | 3890 | 13.70 | No works proposed. |
| Wilmslow Road | 3891 | 14.10 | RCB to be constructed in central reserve. Assessment required to determine arrangement of RCB over structure. |
| River Bollin | 3893 | 15.50 | RCB to be constructed in central reserve. Assessment required to determine arrangement of RCB over structure. |
| Cow Lane | 3896 | 17.10 | RCB to be constructed in central reserve. Assessment required to determine arrangement of RCB over structure. |
| Ashley Railway | 3897 | 17.40 | RCB to be constructed in central reserve. Assessment required to determine capacity of structure. |
| Birkin Culvert | 3900 | 19.30 | RCB to be constructed in central reserve. Assessment required to determine arrangement of RCB over structure. |

## 2.10 Communication Cabling and Ducting

2.10.1 Longitudinal ducting will be required to replace existing cables buried in the ground along the sections of the Proposed Scheme where the carriageway arrangement will be changed. Typically, the longitudinal ducts will only be provided in one verge about 1.5m from the edge of the existing carriageway, but other ducts will be required to connect to cabinets near the gantries and other communications equipment to the electricity interface cabinets (normally placed at various locations at the motorway boundary fence line).

## 2.11 Site Clearance

2.11.1 Where communication cabling and ducting is required, localised site clearance has been assumed from the edge of the existing hard shoulder throughout the Proposed Scheme, but this will be reduced where screening needs to be maintained.

2.11.2 Additional site clearance for working space would be required at all locations where new infrastructure is proposed, including gantries, retaining walls for gantries, and electricity cabinets. Site clearance associated with the construction of drainage features and the improvement of existing drainage is also required.

2.11.3 The assessment is based on the following clearance assumptions:

- a general 4m strip clearance from the edge of carriageway plus 4m into the verge. This will allow general highways works such as drainage and barrier to be constructed;
- clearance at infrastructure sites would be the site itself plus 20m clearance before and after the feature; and
- remaining earthworks alterations required for verge widening is calculated by taking the total site clearance minus the 4m strip and minus the total for infrastructure sites.

2.11.4 Using the above assumptions, the approximate area of clearance is 7.1ha.

# 2.12 Construction, Operation and Long Term Management

## Construction

2.12.1 It is envisaged that the works would be undertaken as a single section under traffic management, with the central reserve work being undertaken first. Some total closures will be required for the removal of existing gantries and the erection of the new superspan or cantilever gantries.

2.12.2 Overnight lane closures will be required for the removal of equipment and any sign faces on the existing gantries and their subsequent replacement later in the construction sequence. Initial estimates are for up to 100 overnight closures to be required, but during detailed design this will be optimised with the initial to significantly reduce the need. Details of lane closures and overnight closures will be confirmed during PCF Stage 5 when the contractor is appointed.

2.12.3 It is envisaged that all construction works will be undertaken within the existing highway boundary. Haul routes for materials and equipment will be routed along the existing motorway carriageways. The new gantries and ERAs will be installed from the hard shoulder. New cables will be installed within the highway verge to connect the new signage and in a few locations new cables will be installed from the verge to the fence line to connect into the electricity grid.

2.12.4 There may be a requirement for some existing environmental barriers, including existing noise barriers, to be removed temporarily during construction to allow works in the verge to be carried out safely. Should it become apparent that temporary removal of existing barrier is required during construction, the impact of this on the conclusions of the noise assessment would need to be considered. In addition, should any existing barrier be required to be temporarily removed, the construction work shall be programmed to minimise impacts arising, appropriate traffic management will be used and suitable temporary barriers will be utilised. The locations and number of existing barriers to be temporarily removed will be established during the detailed design stage. To ensure assessments are worst case noise calculations do not take into account existing noise barriers or other screening.

2.12.5 The actual construction methods and equipment, locations of compounds and access routes will be developed by the delivery partner. The key activities are expected to be:

- convert the hard shoulder into a running lane (on ALR sections)
- install traffic signs and signals, some located in the verge and others on new /existing gantries
- implement new slip road diverge / merge arrangements
- install ERAs
- change earthworks to accommodate the amended slip roads and ERAs
- resurface or strengthen the existing hard shoulder
- install a surface water channel/ linear drainage and associated drainage works
- install buried surface water attenuation systems
- install VRS in the verge to protect gantries and other apparatus
- install power supplies at the highway boundary
- Harden central reserve (where not already hardened) and install RCB in central reserve.

2.12.6 All works on site and within the construction compound will be undertaken in compliance with the Outline Environmental Management Plan (OEMP). The compound area will be confirmed during detailed design.

2.12.7 The working hours and permissible noise levels for the construction for the Proposed Scheme will be determined based on an assessment of the expected impacts of certain types of construction work and the proximity of noise sensitive areas. Works to replace signs and signals on existing gantries, to lift new gantries into place and for the resurfacing of the carriageway will require lane closures or full carriageway closures and are likely to be undertaken at night. Working hours and the associated permissible noise levels will be agreed following liaison with the Local Authority and the development of the delivery partners proposed methodology. Works are to be programmed so that the requirement for working outside of normal working hours is minimised and so noisy works are undertaken during the daytime where possible.

### Construction Traffic Management

2.12.8 It is currently anticipated that the Proposed Scheme would be constructed under a 50mph enforceable speed limit with traffic management between J6 and J8. This would need to extend beyond these junctions to allow for advanced signing and the development of traffic management tapers in advance of the works area. The existing motorway lane provision would be maintained during the daytime; reducing outside of peak periods where necessary. The actual speed limit will be reviewed and confirmed during DF4.

2.12.9 Junction and motorway closures would be required for the installation of gantries, removal of equipment and any sign faces on the existing gantries and their subsequent replacement later in the construction sequence. This would generally be for short durations, utilising night time closures. All night time closure routes would operate in accordance with BS 5228 and traffic management procedures as outlined in the OEMP. Figure 8.5 maps potential diversion routes, these are the agreed OD Area 10 tactical diversion routes, agreed with the local authority to be appropriate for emergency use. During PCF Stage 5 once the traffic management phasing is developed by the contractor these potential routes will be reviewed.

### Operational Considerations

2.12.10 ALR operates 24 hours a day with temporary traffic management introduced as appropriate for routine and emergency maintenance.

2.12.11 During periods of heavy traffic flow, VMSL would automatically be set to regulate traffic flow. It is expected that this will be a daily occurrence during the AM and PM peak periods.

2.12.12 Mandatory speed limits would also be displayed to protect localised queuing. Speed limits and lane closures can also be set manually by the regional control centre to control traffic during incidents. When none of the above conditions are present the VMSL would not be active and the national speed limit would apply.

### Environmental rectification and enhancement measures

2.12.13 For preference, and as far as is feasible, new and relocated gantries have been located to minimise potentially significant landscape and visual effects taking into account engineering and safety constraints.

2.12.14 Soft landscape earthwork solutions for retaining options have been prioritised and existing areas of hard standing used where possible.

2.12.15 In addition to landscaping elements, broad areas have been for ecological enhancement. Further information of environmental rectification and enhancement measures is provided in the individual environmental topic sections. Planned Development and Overlapping Schemes

2.12.16 Relevant planned development and other overlapping schemes are outlined in the cumulative impact assessment in Chapter 9 of this document.

## 2.13 Works area and activities

2.13.1 The Proposed Scheme covers an area of 48.4 hectares, including the slip roads and mainline M56 from Marker Post (MP) 20/1 to MP 13/0. This is non-inclusive of site compound areas.

2.13.2 All of the permanent works would lie within the existing highways boundary and hence the Proposed Scheme would fall under the General Permitted Development Order 2015 (Part 9), where Highways England would not need to obtain planning permission for any works. The Proposed Scheme will require land take for the temporary works, although most of this will be within the boundary of highways owned land with the exception of compound areas. The compound area will be confirmed at during detailed design.

## 2.14 General work methodology and sequencing

2.14.1 The Proposed Scheme is likely to involve the following general work methodology and general sequencing:

- Site mobilisation and site clearance: Establishment of temporary fencing, utility relocations and establishment of construction compound site and access and vegetation clearing and stripping, stockpiling and management of topsoil and unsuitable material.
- Main works: Establishing the ground levels and undertaking ground works including drainage systems and installing the gantries and rigid concrete barrier construction. Resurfacing of the existing surface and other pavement works.
- Landscaping and decommissioning: Vegetation planting, installation of safety barriers, fencing, pavement marking and removal of site compound and site tidy up.
- Construction of the Proposed Scheme may require temporary diversion routes for traffic. These are considered under the construction stage assessment with a focus on sensitive receptors along the diversion routes. Figure 8.5 maps diversion routes. They will also be identified in the Traffic Management Plan and Detailed Local Operating Agreement (DLOA) PCF products.

## 2.15 Drainage strategy

2.15.1 The Proposed Scheme would include installation of:

- New carrier drains and attenuation as required for verge drainage;
- New longitudinal ducts as well as various local ducts;
- At least two upgraded runoff outfalls with enhanced pollution control measures.

2.15.2 The drainage system would attenuate predicted increases in flows due to greater impermeable surface areas and climate change such that no change to the discharge parameters would arise.

2.15.3 Surface water channels, linear drainage, kerb and gully or any other edge of carriageway water collection features in the nearside verge would typically be designed to accommodate a 1 year design storm without surcharge and a 5 year storm with surcharge. Existing chambers within the hard shoulder where it is converted into a running lane would be covered over and connected to adjacent verge side chambers or replaced with larger chambers, to allow for maintenance, flow control and attenuation requirements.

2.15.4 Where drainage is required in the central reserve, all existing central reserve surface drainage would be removed and replaced with new surface water channels or, at pinch points, with longitudinal and sub-surface drains. New drainage would connect to existing cross carriageway drains.

2.15.5 The westbound carriageway between River Bollin to Castle Mill Lane is super-elevated and falling towards the central reserve. The gullies in the central reserve are frequently blocked with flooding extending into lane 3[1] require offside lane closures for removing a build-up of silt, with road workers being exposed to an increased risk while doing so. The gully grates are located close to the offside running lane which leads to an increased risk of them being damaged by vehicles. Provision of a concrete v-type channel is likely to result in a greater distance between silt traps, as the catch pits installed on a V-channel have a larger capacity than the silt trap in a gully. This would help to reduce the length of time that road workers were exposed to risk.

2.15.6 Works may be undertaken to improve one priority outfall subject to further engineering investigations to contribute to the objectives of the Water Framework Directive. A further two outfalls are classified as of Not Determined status2, of these both are on a watercourse targeted for water quality improvement or connected to SSSI would be assessed. There are no culverts for which their status is to be determined. The outfalls are identified in Table 2-7.

[1] Jacobs, 2015: Technical Note 8 – Location of Specific Maintenance Concerns, HA5446451309-JAC-GEN-MULTI-RP-TR-0007
[2] As of November 2016.

2.15.7 There are no Category A flooding hotspots associated with this Proposed Scheme. There are 57 flood events associated with this Proposed Scheme with flood severity indices ranging from <= 6 to 7-8. The flood events cross flood zone 3 at the Birkin Brook and River Bollin.

**Table 2.7: Priority Outfalls and Culvert Locations (DF1)**

| Outfall | | | Culvert | | |
|---|---|---|---|---|---|
| Reference | Location (approx.) | Priority Status | Reference | Location (approx.) | Priority Status |
| SJ7584_3879a | Birkin Brook | A (Very high) | - | - | - |
| SJ7584_3978d | Birkin Brook | Not Determined | - | - | - |
| SJ7684_9859e | Lambs Covert Brook (Birkin Brook) | Not Determined | - | - | - |

## 2.16 Proposed Scheme Delivery and Implementation

2.16.1 At the time of writing, construction of the Proposed Scheme is scheduled to commence in March 2019, and is expected to be completed by April 2020, including commissioning. The years used for assessment purposes are reported in individual topic chapters.

## 2.17 Proposed Operation and Long Term Management

2.17.1 The existing motorway maintenance regime and procedures would continue, albeit with the control of lane closures to improve the safety of Highways England operational staff.

# 3. Alternatives Considered

## 3.1 Programme Level Alternatives

3.1.1 Highways England and the Department for Transport have assessed the options for providing extra capacity on the strategic road network at programme level. This has included consideration of traditional widening options as well as options incorporating use of the hard shoulder.

3.1.2 Evaluation of the M42 Active Traffic Management (ATM) pilot demonstrated that managed motorways (Smart Motorways) are able to deliver clear benefits in terms of improved journey time reliability through reduced congestion. Managed motorways can also be delivered at a lower cost and with less environmental impact than conventional widening programmes; without detriment to road safety performance.

3.1.3 Highways England is, therefore, delivering network capacity improvements with ALR as the preferred option and is being delivered as part of the Smart Motorways Programme. The M56 J6 to J8 Smart Motorway Scheme is one of these schemes. At project level, these are being delivered as single option schemes under the Major Projects Project Control Framework (PCF), and as such, design options undergo minimal further consideration.

## 3.2 Scheme Specific Alternatives

3.2.1 As the Smart Motorways Programme schemes are single option schemes entirely within the existing Highways England road estate, there are minimal scheme-specific design alternatives available for consideration. Such alternatives relate primarily to the locations of gantries, ERA, communications equipment and noise barriers. A number of the gantry locations and other scheme elements proposed in the DF1 and DF2 have been amended as part of the DF3, these changes have been proposed for various reasons, primarily operational, safety or environmental.

# 4. Environmental Impact Assessment Methodology

## 4.1 Screening

4.1.1 Screening is an initial step in the environmental assessment process, for identifying potentially significant effects. The process for screening a project is set out in IAN125/15. Screening draws upon the current understanding of the Proposed Scheme and receiving environment, and informs a decision whether the Proposed Scheme is considered a 'Relevant' or 'EIA Development' under the EIA regulations. Screening thus determines whether an Environmental Assessment Report is required where significant effects are unlikely or whether a statutory Environmental Statement is required, where significant effects are likely. A determination of whether significant impacts are anticipated is made via the scoping process, which concluded that there are unlikely to be significant environmental effects as a result of the Proposed Scheme.

## 4.2 Scoping

4.2.1 A scoping exercise for the Proposed Scheme was undertaken by Highways England in spring 2017, following advice in DMRB Volume 11 Section 2 Part 4 and other relevant guidance.

4.2.2 The Environmental Scoping Report identified potential impacts and detailed information to be gathered to gain further certainty regarding potential environmental effects and defined the scope of any further assessment identified as required. Scoping conclusions are detailed in Table 4-1.

**Table 4.1 Scoping Conclusions**

| Topic | Scoped in/out |
|---|---|
| Air quality | Construction – scoped out<br>Operation – scoped in |
| Noise and vibration | Construction – scoped in<br>Operation – scoped in |
| Ecology and nature conservation | Construction – scoped in<br>Operation – scoped in |
| Cultural heritage | Construction – scoped out<br>Operation – scoped in |
| Landscape character | Construction – scoped out<br>Operation – scoped out |
| Visual amenity | Construction – scoped in<br>Operation – scoped in |
| Road Drainage and the Aquatic Environment | Construction – scoped out<br>Operation - scoped in |
| Geology and soils | Construction - Scoped out<br>Operation – scoped out |
| People and communities | Construction – scoped out<br>Operation - scoped out |
| Population and health | Operation – scoped in |
| Climate change | Construction – scoped out<br>Operation – scoped out |
| Major accidents and disasters | Construction – scoped out<br>Operation – scoped out |

| Topic | Scoped in/out |
|---|---|
| Demolition | Construction – scoped out<br>Operation – scoped out |
| Heat and radiation | Construction – scoped out<br>Operation – scoped out |
| Land take effects | Construction – scoped out<br>Operation – scoped out |

4.2.3 Topics scoped in above have been subject to further assessment, the result of which is described in Chapters 5 to 8 of this report.

4.2.4 For the purposes of this EAR, the assessment of the Proposed Scheme has been undertaken on the Design Fix 3 (DF3). Topics scoped out are excluded from further environmental assessment, however, mitigation is still being addressed and manged via the Outline Environmental Management Plan (OEMP). The reasoning behind the decision to scope topics out is outlined below by topic. Due to design progression since the publication of the Environmental Scoping Report there are instances where scoping decisions have been re-confirmed within the EAR and topics originally within the assessment scope have been de-scoped from the assessment; information below provides justification.

## Air Quality – Construction

4.2.5 In principle, there is the potential for effects on receptors within 200m of construction sites and haulage routes associated with the Proposed Scheme. In practice construction impacts were scoped out prior to the EAR, as any effects would be temporary, and under appropriate standard OEMP mitigation measures it is considered likely that there would be no significant effects on air quality during the construction phase. On that basis, assessment of construction was scoped out of further assessment.

4.2.6 Diversion routes for the Proposed Scheme construction are only used periodically. HA207/07 states that if construction is expected to last for more than six months in one place, then traffic management measures (diversion) and the effect of the additional construction vehicles should also be assessed as an additional scenario. SMP construction is at pace, and this is not expected to be an issue and again has been scoped out of any further assessment.

## Cultural Heritage

4.2.7 In terms of construction, the Proposed Scheme is limited to the physical extent of existing highways boundaries. This area would have been topsoil stripped during the construction phase and, as a result, any archaeological remains would have been removed or truncated. There would not be any impacts on buried archaeological remains within the existing road corridor.

4.2.8 An assessment of construction effects on cultural heritage assets was originally scoped out as construction activity would be localised and limited to the existing road corridor and no significant impact on the setting of any heritage assets was predicted as a result of the Proposed Scheme. Confirmation of this verdict is reported in Chapter 7 Landscape and Visual Effects, including the Setting of Cultural Heritage Assets, due to temporary nature of construction and that noticeable changes are not within or visible from the setting of a number of cultural heritage assets.

4.2.9 There is the potential for impacts from compounds set up on buried archaeological remains, however, mitigation through archaeological recording or use of non-invasive construction methods could reduce any potential impact.

4.2.10 An assessment of operational effect on designated cultural heritage assets is provided in Chapter 7 Landscape and Visual Effects, including the Setting of Cultural Heritage Assets.

Landscape character

4.2.11 An assessment of construction and operational effects on landscape character was originally scoped out as construction activity would be localised and the Proposed Scheme would be limited to the existing road corridor. No significant effects were predicted as a result of the Proposed Scheme as the local landscape character areas are considered to be able to accommodate change of the type proposed. However, when consulted, East Cheshire Council highlighted the local landscape area of the Bollin Valley and Parklands which they requested be included in the assessment. Taking into account new design information, confirmation of no significant effects on landscape character during construction and operation is reported in Chapter 7 Landscape and Visual Effects.

## Road Drainage and the Aquatic Environment

4.2.12 The topic of Road Drainage and the Aquatic Environment considers the implications of the proposed works upon water quality, the ecological status of local watercourses, flood risk, groundwater conditions, surface and groundwater abstractions as well as existing motorway drainage outfalls and culverts.

4.2.13 Following the publication of the Environmental Scoping Report further work on the design, construction methodologies and the OEMP has been undertaken. Following this update, the topic of Road Drainage and the Aquatic Environment has been scoped out of this Environmental Assessment Report; justification of this conclusion is provided below.

4.2.14 Standard pollution prevention measures and best practice will be employed during construction; these measures are detailed in the OEMP and will be detailed in the Construction Environmental Management Plan (CEMP) to be prepared and implemented by the Delivery Partner. The scale of the proposed works and restriction to within the existing highway boundary result in a low likelihood of a significant effect during construction and this aspect is therefore scoped out of further assessment but addressed within the OEMP.

4.2.15 The change in pollutant loading caused by the Proposed Scheme as a result of a small increase in traffic volume (less than 20%) for Proposed Scheme is assumed to be insignificant. The Proposed Scheme when comparing to the Do-Minimum and Do-Something 2035 scenarios is forecasted not to result in an increase traffic volume of 20% or more in any drainage catchment areas. Peak traffic flow increases are forecast to be 6% through junction 7 / Junction 7 to 8, 7% Junction 6 to 7 and 9% through Junction 6. These aspects are scoped out of the assessment as the effects would be localised and not significant. The OEMP addresses risk of pollutants.

4.2.16 The Proposed Scheme may necessitate temporary construction works within the floodplain of local watercourses, these will be minor as no key infrastructure is proposed within the flood zones of local water courses. As a result, there is a low likelihood of an effect on flood plain storage and therefore flood risk during construction. In the event current drainage capacity is lost it will be replaced through design. No motorway embankments will need to be built-out to within flood zones to accommodate additional infrastructure therefore flooding is scoped out of the assessment.

4.2.17 The Proposed Scheme will include drainage improvements, in accordance with Interim Advice Note 161/15 such that discharges will be at existing established rates (up to the 1:100 year rainfall event). Hence additional drainage capacity will be provided within the piped network to account for an increase in impermeable area. On this basis the potential flood risk effects are scoped out of further assessment but addressed appropriately within the OEMP.

4.2.18 The surface water abstraction located within 275m on east side of motorway and on south side of Junction 8 is closely located to the Not Determined category outfall asset reference SJ7584_3978d. The surface water abstraction is located upstream of this surface water outfall and therefore no potential effects exist, therefore abstraction issues are scoped out of the assessment.

4.2.19 Records indicate groundwater Source Protection Zones are not located within study area. Where records indicate that groundwater is located beneath the motorway then these areas would be interrogated to confirm whether they either require protection or are susceptible to groundwater

flooding. This will inform the potential for either infiltration or sealed drainage systems. The Proposed Scheme is designed, and will be managed through the OEMP, to ensure water volumes or pollutants do not increase at any existing outfalls.

4.2.20 Works, which are to be confirmed during detailed design, would be undertaken to improve one priority A outfall to contribute to the objectives of the Water Framework Directive. A further two outfalls are classified as of Not Determined status. Both are on a watercourse targeted for water quality improvement. The Proposed Scheme is designed, and will be managed through the OEMP, to ensure water volumes or pollutants do not increase at any existing outfalls. Opportunities to provide water quality betterment and enhancement through provision of managed vegetated features will be investigated at detailed design. It is anticipated that these will be located immediately downstream of outfalls when space and situation allow. Implementation of such measures will be considered alongside drainage design.

## Geology and soils

4.2.21 The topic of soils and geology considers the implications of the proposed works on materials, geology, soils and land contamination.

4.2.22 Materials would be sourced from existing quarries, batching plants or factories for which separate planning consent would be in place. The movement of materials from their origin to the Proposed Scheme would be mainly via the motorway network and the strategic road network. The volume of movements associated with the Proposed Scheme construction would be a small proportion of HGV movements on the motorway network. The aspect of materials is scoped out of the assessment as the effects would not be significant.

4.2.23 Regarding soils, geology and contamination, ground disturbance within the highway boundary will have already occurred during construction of the motorway. Furthermore, the Proposed Scheme lies within the existing highway boundary, as such, there are not expected to be any significant effects on surrounding land use, land value or soil.

4.2.24 The motorway is constructed on predominantly made ground associated with current and former road surfaces and supporting layers of imported and man-made materials. While there is potential for contaminated materials from use and maintenance of the motorway, such quantities will be small in relation to capacity of appropriate disposal sites such that no significant impact is expected. There is however the possibility that geotechnical investigations might identify substantive areas of existing contamination where measures would be required to ensure that no pathways for contamination were created. It is nevertheless unlikely that a significant impact would result given the controls available via the design and the OMEP.

4.2.25 The final location of construction site compounds is unknown at the time of writing. Should construction site compounds, or construction activities, be located outside of the highways boundary mitigation of adverse impacts of such siting should be considered through good construction practices as recorded in the OEMP.

The topic of soils and geology has been scoped out of further assessment as no significant effects upon mineral extraction, productive soils, land contamination or waste disposal are envisaged. Risks of land contamination are addressed within the OEMP.

## People and Communities

4.2.26 The Proposed Scheme does not involve any substantive change to the design of junctions and hence there would be no physical effect on the movement of non-motorised users.

4.2.27 A review of non-motorised user routes has identified whether there is an existing route through junctions, whether there is adequate illumination, visibility and safety protection. Consideration is also given to the current and attractiveness of the movement corridor by recognition of the presence of cycle routes and bus stops. In addition, awareness of development proposals provides for consideration of potential future needs. This review concluded that no movements are potentially affected by severance at the motorway junctions and hence this aspect is scoped out.

## Population and health

4.2.28 Following an assessment of air quality effects of the Proposed Scheme it has been determined that although there are three Air Quality Management Areas, and 138 human health receptors within the M56 Junction 6 to 8 (M56 J6-8) air quality study area and two adjacent Defra Noise Important Areas and several communities within the noise and vibration study area, no significant adverse air quality and noise effects are anticipated. Designs are to ensure vegetation clearance is to be mindful of the local community. For these reasons, no assessment on public health has been undertaken.

## Climate change

4.2.29 As the Proposed Scheme would be open to traffic within a 2-3 year period, the potential for existing weather conditions to materially change such that the basis of the environmental assessment becomes insecure is remote. The principal aspect for which climate change is most important is that of flood risk particularly as it affects road safety. The current 20% uplift in attenuation capacity is supported by a sensitive test providing for a 40% uplift within certain regions. Where uplift is considered necessary then the Proposed Scheme would be designed to cope with the increase in rainfall.

4.2.30 Carbon emissions associated with SMP schemes are primarily determined by the vehicles using the motorway rather than the embodied carbon associated with scheme construction and maintenance and hence embodied carbon is not reported (change in carbon emissions due to embodied carbon is not considered to be significant). The greenhouse gas contribution of the Proposed Scheme in relation to vehicles using the motorway is reported in Chapter 5: Air Quality and Appendix B: Air Quality by providing data on the change in carbon emissions.

4.2.31 Vegetation stress due to drought conditions is anticipated to be a risk to the Proposed Scheme given the reduced width of soft estate, steepened slopes and potential damage to root systems. Adding in the effect of increased wind velocities due to climate change, it is feasible that increasing loss/damage to trees could occur. Adaptive measures include the selection of drought tolerant species.

4.2.32 As the motorway soft estate is a stressful location for trees, species are selected that can withstand such conditions. As a consequence, it is considered that they are well able to accommodate climate change.

4.2.33 During construction, drought, high rainfall intensities and high winds could give rise to an increased risk of dust or water pollution. Existing construction management practices, such as avoidance of storing construction materials in floodplains and dampening of soils and stockpiles are to be recorded in the OEMP.

4.2.34 For the above reasons climate change has been scoped out of the assessment.

## Major accidents and disasters

4.2.35 In terms of both man-made and natural major accidents the incremental environmental risk is associated with the Proposed Scheme is the pollution of water quality. Enhancements are being made to Priority Outfalls where this does not involve land take such as through the upgrading of pollution protection measures. There is a low probability of a significant impact arising from a low probability major event. No further measures are proposed to deal with a major event leading to a pollution incident. Major events are therefore scoped out of the assessment.

## Demolition

4.2.36 It is not envisaged that demolition/removal operations would give rise to significant impacts that would be not controlled via the Construction Environmental Management Plan as part of the OEMP and hence demolition impacts have been scoped out of the assessment.

### Heat and radiation

4.2.37 The widening of the motorway and the introduction of signs and gantries do not involve the use of radiation. Only under controlled conditions is heat used while the road pavement is laid. Consequently, these aspects are scoped out of consideration in the assessment.

### Land take effects

4.2.38 All works are to be undertaken within the soft estate under permitted development rights. Sites outside the Highway boundary would be subject to planning consent. Consequently, land take effects are scoped out of the assessment. The location of the construction compounds and detailed treatment of verge slopes and retaining structures within the working area are not known at the time of this assessment so cannot be fully assessed at this stage.

### Topics assessed within this EAR

4.2.39 Topics which have been assessed within this Environmental Assessment Report are noted in Table 4.2.

**Table 4.2. Topics assessed within this Environmental Assessment Report.**

| Topic | Assessment |
|---|---|
| Air quality | Operation covered in Chapter 5; Air Quality |
| Noise and vibration | Construction and Operation covered in in Chapter 8; Noise and Vibration |
| Ecology and nature conservation | Construction and Operation covered in Chapter 6; Biodiversity |
| Cultural heritage | Construction and Operation covered in Chapter 7; Landscape and Visual Effects including the setting of cultural heritage assets |
| Landscape character | Construction and Operation covered in Chapter 7; Landscape and Visual Effects including the setting of cultural heritage assets |
| Visual amenity | Construction and Operation covered in Chapter 7; Landscape and Visual Effects including the setting of cultural heritage assets |

## 4.3 Stakeholder Engagement

4.3.1 At this stage, stakeholder engagement has comprised:

- Contacting landowners to seek permission to access their land for non-intrusive site visits, such as GCN surveys; and
- Contacting local authorities in respect to the landscape and visual assessment.

4.3.2 Chapter 6, Biodiversity and Chapter 7, Landscape and Visual report the outcomes of this consultation.

4.3.3 Going forward, engagement with Highways England operational teams and key stakeholder organisations, such as Local Authorities and Police Authorities, would be undertaken if there is a specific discipline need to obtain their input to a design matter or a need to seek agreement on the mitigation of a potentially significant effect.

4.3.4 This EAR will be made available to the statutory environmental organisations (Local Authorities, Natural England, Historic England and Environment Agency). Highways England will also host public information events later in the Proposed Scheme to allow interested organisations and members of the general public to learn more about and comment on the proposals.

## 4.4 Methodology

4.4.1 Assessment methods follow DMRB Volume 11 and other relevant best practice guidance. Specific methodologies for each topic are defined in each topic section (chapters 5 to 9).

4.4.2 The structure of each specialist topic section broadly follows the structure for non-statutory environmental impact assessment in DMRB Volume 11, Section 2, Part 6 (HD 48/08), as follows:

- introduction
- study area
- methodology
- baseline conditions
- sensitivity of resource
- assumptions and limitations
- design and mitigation measures
- potential construction effects
- potential operational effects
- further mitigation and enhancement, where relevant
- residual effects
- summary.

4.4.3 Impacts may be adverse/negative or beneficial/positive, direct, indirect, secondary or cumulative, temporary or permanent, short, medium or long term.

4.4.4 The baseline and modelled/ predicted future scenario years vary between topics depending on methodology, these are set out in each topic section as relevant.

4.4.5 Impacts are defined as a physical or measurable change to the environment that is attributable to the Proposed Scheme. Effects are defined as the result of an impact on a particular receptor or resource. For the purposes of this report, both terms are used in an interchangeable way, with the key focus on significance.

### Study Area

4.4.6 Each environmental topic has set a study area for the assessment of the potential impacts of the Proposed Scheme according to the requirements of the applied methodology. The study area for each topic assessment is defined and described in the relevant topic section.

### Baseline Conditions

4.4.7 Potential significant environmental impacts are described in relation to the extent of changes to the existing baseline environment. The baseline comprises the environmental characteristics and conditions of the area likely to be affected that are present at the time of assessment, or which are predicted to be the case at certain times during a scheme's development. Baseline information obtained in order to inform the environmental assessment, as well as topic-specific receptors, is identified within each technical topic section.

### Significance Criteria

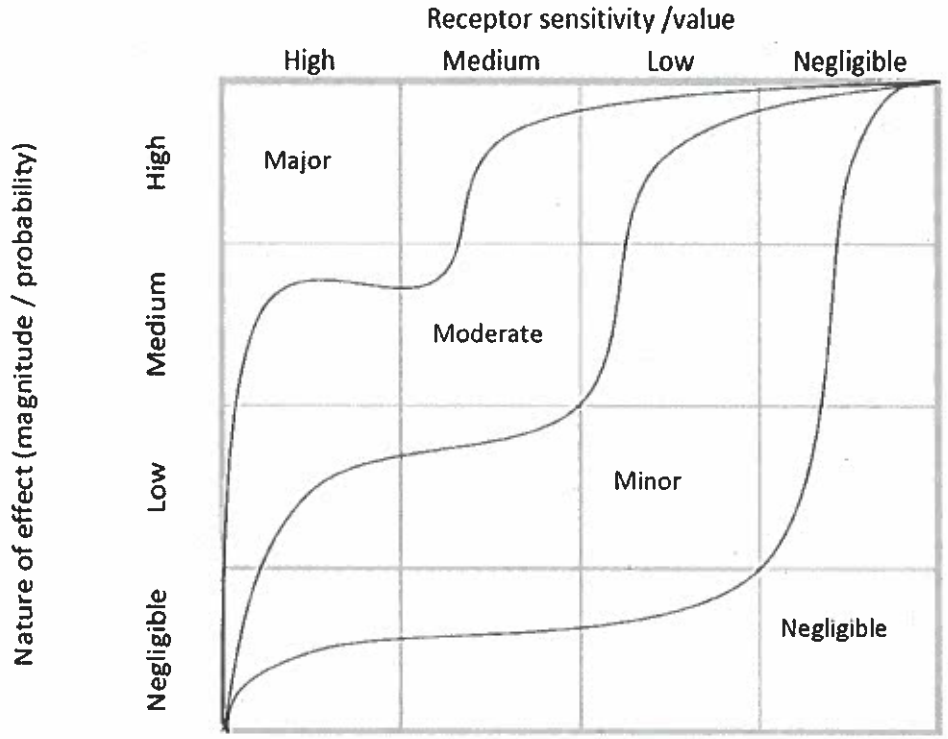
4.4.8 Effects, whether beneficial or adverse, would be expressed in terms of their significance. Significance is derived through consideration of the sensitivity of a receptor (sometimes referred to as its value or importance) and the magnitude of the effect, as defined by the amount of change from the baseline. Therefore, the significance of an effect is influenced by both of these variables.

4.4.9 Certain disciplines use a matrix approach to assess the significance of any particular effect, with the sensitivity of the receptor on one axis and the magnitude of effect on the other. Matrices for individual topics may be slightly different, and may appear in the individual topic guidance in DMRB Volume 11, Section 3. Moderate and major effects are considered 'significant' for the purposes of the EIA regulations. In all cases, the topic-specific guidance would be referenced and followed if there is any discrepancy.

4.4.10 Some disciplines would not use a matrix-based approach, because they use calculations to assess effects in numerical terms; for example, noise and air quality.

4.4.11 In all cases, professional judgement will be applied to the assessment to underpin the outcomes identified through the matrix or calculation assessments, as indicated by the wavy lines on Figure 4-1. In each case, the summary will conclude whether the effects are assessed as either significant or insignificant.

**Figure 4-1 Assessment matrix**




4.4.12 Significance of effect for each potential impact has been assigned following consideration of the effectiveness of the design and committed mitigation measures, in accordance with Highway England requirements. As far as practicable, mitigation has been incorporated into (and assessed as part of) the Proposed Scheme design.

## Design, Mitigation and Enhancement Measures

4.4.13 The general approach to mitigation and enhancement used in this report is as follows.

4.4.14 Embedded mitigation is that which is built into the Proposed Scheme designs from the outset and has resulted in a lower environmental impact as a result. This would include where the gantries and ERAs have been moved to avoid sensitive features, as outlined in Chapter 2.

4.4.15 Secondary mitigation represents actions that will require further activity in order to achieve the anticipated outcome, e.g. replacement planting where possible to ensure that screening value would be reinstated when mitigation planting matures. Secondary mitigation is documented in the OEMP, where relevant.

4.4.16 Tertiary mitigation represents standard good practice measures, for example, considerate contractors' practices that manage activities which have potential nuisance effects. Tertiary mitigation is identified within the individual topic sections. Tertiary mitigation is documented in the OEMP, where relevant.

4.4.17 Topic assessments have assumed that embedded, secondary and tertiary measures will be included as part of the Proposed Scheme, in order to avoid and reduce significant adverse effects.

4.4.18 The residual effects assessment considers all of these mitigation measures and provides a conclusion on likely significant effects. The assessment takes into account potential risks associated with change in effectiveness over time, such as growth of planting, the establishment of new habitats or the change in noise generated from older road surfaces

4.4.19 In addition to the mitigation measures above which focus on avoiding or reducing significant effects, topic assessments have also identified environmental enhancements where possible and where these are within the highways estate. Such enhancements are described in the potential effects sections of the relevant topic chapters.

4.4.20 Any variation to the general above approach is identified within the topic assessments.

## Traffic Modelling

4.4.21 The M62 J10-12, M56 J6-8 and M60 J24-4 are all heavily trafficked sections of the Strategic Road Network (SRN). Collectively they provide key strategic linkages for both long distance and significant local intra urban traffic demands. There is also a significant key commuter corridor for the interconnected multiple urban communities between Liverpool and Greater Manchester. The proposed scale of development within the local and regional area, linked to existing bottlenecks will generate increased congestion if not addressed, hence the need for these schemes.

4.4.22 The implementation of ALR on these networks will help address the challenges of congestions and increased demand through the creation of an additional 33% capacity by the utilisation of the hard shoulder as a running lane. Furthermore, this increased capacity and throughput generates savings in time which also supports increased demand. The Addendum to this EAR, Addendum to Environmental Assessment Report (Supplementary explanation regarding combined traffic impacts of M62 J10-12; M56 J6-8 and M60 J24-4 SMP Scheme) (Document Reference HE549341-ACM-GEN-M62-SW-ZZ-ZZ-RP-Z-0002), sets out in greater detail the effects of the cumulative implementation of the schemes on flows along the M62 and M56 specifically and on the wider key linkages between the Manchester area and the wider SRN.

## Assumptions and Limitations

4.4.23 This EAR is based on assumed construction and design information, which is subject to change and development. More detailed design information and construction methods will be developed as the Proposed Scheme progresses forwards.

4.4.24 The traffic models have been built on the best available data (including a rich mobile phone data set used in the development of the TPSRTM), tailored to the specific requirements of the traffic networks and supported by additional data collection, such as new traffic surveys and targeted detailed investigations of key areas, including scheme links, junctions and locations associated with significant congestion.

4.4.25 Information presented within the EAR, is based on readily available online databases and mapping data. Site surveys have been undertaken in a targeted way, which was considered to be proportionate to the Proposed Scheme. For health and safety reasons, access to the verge was restricted to areas behind permanent barriers and avoiding access from the live carriageway. Other areas were not accessible due to existing site constraints.

4.4.26 Topic specific assumptions and limitations are identified in their respective sections.

# 5. Air Quality

**Key features for this topic:**

The four North West SMP Schemes (M6 J21a-26, M62 J10-12, M56 J6-8 and M60 J24-4) were all planned to be open within 18 months of each other and hence, to present a robust environmental assessment, these four schemes were initially assessed as one cumulative worst case for air quality. This initial assessment work was done by using forecast opening year traffic flows which include the cumulative worst case traffic associated with all four North West SMP Schemes with a common 2020 opening year.

The findings of this initial air quality assessment work indicated that the M6 J21a-26 Scheme may be considered significant for air quality. This is because with the M6 J21a-26 Scheme included with the other three North West SMP Schemes there was predicted to be five large changes in nitrogen dioxide concentration at two locations including: two large changes at Newton-le-Willows and three large changes at Nichol Avenue, Martinscroft. The M6 J21a-26 Scheme will therefore not be progressed by Highways England until a suitable mitigation solution is identified.

In addition to developing a suitable mitigated air quality solution for the M6 J21a-26 Scheme, Highways England also requires that any mitigated solution will not change the overall acceptability of the other three North West SMP Schemes for air quality.

The remaining three North West SMP Schemes (M62 J10-12, M56 J6-8 and M60 J24-4) are being progressed by Highways England because together these schemes do not generate significant air quality effects.

The air quality assessment presented for the three North West SMP Schemes considers a study area of the roads affected by the three North West SMP Schemes, and this affected road network (ARN), is illustrated in Figure 5.1.

The air quality assessment presented for the three North-West SMP Scheme study area utilises the traffic flows and predictions initially developed for all four North West SMP Schemes (known as the 'Cumulative Worst Case' scenario). This is because these air quality predictions are typically worst case, or very similar between the three and four scheme scenarios. Hence, where any minor differences occur, these are not significant, and a qualitative comment is provided.

There are two locations, however, comprising 3 properties to the east of the M6 at Martinscroft and 2 properties to the east of the M6 at Newton-le-Willows, where the four Scheme traffic data would result in unrealistic large predicted changes in air quality and hence an incorrect evaluation of the significance of air quality effects. In these areas, air quality modelling using specific three North West SMP scheme scenario traffic data has been used. A summary of the key features of the air quality study are provided below.

There are five Air Quality Management Areas (AQMAs) within the air quality study area that have been declared for exceedances of the annual mean NO2 UK Air Quality Strategy objective: all of these are adjacent to the Proposed Schemes.

Four designated ecological sites are located within the air quality study area – Hollinwood Branch Canal SSSI, Holcroft Moss SSSI/Manchester Mosses SAC, Rixton Clay Pits SSSI and Woolston Eyes SSSI.

In order to assist the reader, the overall study area for the three North West SMP Schemes has been divided up into three geographical study areas around each of the individual schemes and adjoining affected routes (i.e. M62 geographical study area, M56 J6-8 geographical study area and M60 J4-4 geographical study area):

In the M62 geographical study area there are two medium increases and six small increases in annual mean $NO_2$ concentrations, along with five small decreases, at receptors predicted to be above the objective. The two medium increases are predicted at Nichol Avenue at Martinscroft Moss within 10m of the existing highway boundary of the M6.

In the M56 J6-8 geographical study area there are two small increases in annual mean $NO_2$ concentrations at a receptor to the north-east of the M6 between Junction 19 and 20 and at a receptor to the north-west of the M6 to the south of junction 20.

In the M60 J24-4 geographical study area all changes in annual mean $NO_2$ concentrations at receptors where exceedances of the UK Air Quality Strategy (AQS) objective were modelled to occur in the opening year (2020) are predicted to be 'imperceptible'.

The M56 J6-8 is overall not significant for air quality and no compliance risks have been identified.

**M56 J6-8 Only Case**

- No significant adverse effect on local air quality is anticipated following the 'M56 only' DS scenario air quality assessment.
- There are three Air Quality Management Areas within the M56 J6-8 geographical study area declared for exceedances of the annual mean $NO_2$ UK AQS objective: two of these are adjacent to the M56 J6-8 Proposed Scheme.
- There are no ecologically designated sites within 200m of the Affected Road Network for the 'M56 only' DS scenario.
- 37 exceedances of the annual mean $NO_2$ UK AQS objective were calculated in the base year (2015), mostly in the section of M56 that extends from Junction 6 to Junction 3A. Eleven exceedances were calculated in the opening year (2020) without the M56 J6-8 Proposed Scheme and thirteen with the M56 J6-8 Proposed Scheme.
- One receptor is modelled to experience a 'small increase' in annual mean $NO_2$ concentrations with the 'M56 only' Do Something scheme, but concentrations would be below the Air Quality Strategy objective. This is the largest change in annual mean $NO_2$, 0.6 $\mu g/m^3$, which is modelled to occur at receptor R50, an isolated residential property on Hasty Lane approximately 60m east of the M56 between Junction 5 and Junction 6.
- Changes in annual mean $NO_2$ concentrations at all other receptors are modelled to be 'imperceptible' in the assessment based on traffic changes as a result of the M56 Proposed Scheme.
- There are not expected to be any DEFRA PCM links that exceed the annual mean $NO_2$ EU limit value in 2020 and changes in concentrations as a result of the M56 J6-8 Proposed Scheme would not result in exceedances. There is therefore not expected to be a compliance risk due to the M56 J6-8 Proposed Scheme.

## 5.1 Introduction

5.1.1 Air quality is a consideration for any scheme proposal involving material changes in the nature and location of emissions to air. Any changes to traffic volumes, speed and composition associated with the M56 J6-8 Proposed Scheme and the cumulative case of traffic from all four Tranche 4 North West SMP Schemes (M62 J10 to J12, M6 J21A to J26, M56 J6 to J8 and M60 J24 to J4) have potential subsequent impacts on emissions to air and thus ambient air quality at nearby receptors. All four North West SMP schemes are forecast to attract more traffic, and change traffic flows on roads in the surrounding area.

5.1.2 The four North West SMP Schemes (M6 J21a-26, M62 J10-12, M56 J6-8 and M60 J24-4) were all planned to be open within 18 months of each other and hence, to present a robust environmental assessment, these four schemes were initially assessed as one cumulative worst case for air quality. This initial assessment work was done by using forecast opening year traffic flows which include the cumulative worst case traffic associated with all four North-West SMP Schemes with a common 2020 opening year. The four North-West SMP Schemes are also referred to hereinafter as the 4 North West SMP scheme scenario or cumulative worst case.

5.1.3 The findings of this initial air quality assessment work indicated that the M6 J21a-26 Scheme may be considered significant for air quality. This is because with the M6 J21a-26 Scheme included with the other three North West SMP Schemes there was predicted to be five large changes in nitrogen dioxide concentration at two locations including: two large changes at Newton-le-Willows and three large changes at Nichol Avenue, Martinscroft. The M6 J21a-26 Scheme will therefore not be progressed by Highways England until a suitable mitigation solution is identified.

5.1.4 In addition to developing a suitable mitigated air quality solution for the M6 J21a-26 Scheme, Highways England also requires that any mitigated solution will not change the overall acceptability of the other three North West SMP Schemes for air quality.

5.1.5 The remaining three North-West SMP Schemes (M62 J10-12, M56 J6-8 and M60 J24-4) are being progressed by Highways England because together these schemes do not generate significant air quality effects.

5.1.6 The air quality assessment presented for the three North West SMP Schemes considers a study area of the roads affected by the three North West SMP Schemes, and this affected road network (ARN), is illustrated in Figure 5.1.

5.1.7 The air quality assessment presented for the three North West SMP Scheme study area utilises the traffic flows and predictions initially developed for all four North West SMP Schemes. This is because these air quality predictions are typically worst case, or very similar between the 3 and 4 scheme scenarios. For example, on the M62 between J10 and 11 there is a reduction in traffic flows of only -166, and similarly -10 between J11 and 12 when comparing between scenarios.

5.1.8 There are two locations, however, comprising 3 properties to the east of the M6 at Martinscroft and 2 properties to the east of the M6 at Newton-le-Willows, where the four Scheme traffic data would result in unrealistic large predicted changes in air quality and hence an incorrect evaluation of the significance of air quality effects. In these areas, air quality modelling using specific three North West SMP scheme scenario traffic data has been used, also referred to hereinafter as the 3 North West SMP scheme scenario.

5.1.9 A detailed assessment has been undertaken to establish the potential effects on four North West SMP Schemes on local and regional air quality. This chapter describes the assessment and the operational effects arising from the Proposed Schemes. Construction impacts for the M56 J6-8 Proposed Scheme were scoped out in the M56 J6-8 Environmental Scoping Report (as with all other SMP schemes) and so are not considered further in this assessment.

5.1.10 The assessment includes:

- the determination of the air quality assessment study area (i.e. ARN);
- the determination of existing baseline conditions and constraints; and
- the estimation and consideration of effects on local air quality (human and ecological receptors) and regional emissions during the operational phase of the North West SMP Schemes.

5.1.11 The local air quality assessment has focused on the impacts of the air pollutant nitrogen dioxide ($NO_2$) as the air quality criteria for this pollutant are those most likely to be exceeded in the air quality assessment study area. The regional assessment of emissions considers oxides of nitrogen (NOx), carbon dioxide ($CO_2$) and particulate matter. The scope of the assessment is in line with that set out in the M56 J6-8 Environmental Scoping Report[3], whilst reflecting the need to directly model the cumulative impact of the traffic from all four proposed North West schemes (including coordination of approach across the delivery teams).

## 5.2 Assessment Approach

5.2.1 The air quality assessment presented for the 3 North West SMP Schemes considers a study area of the roads affected by the 3 North West SMP Schemes, the Affected Road Network (ARN), and this is illustrated on Figure 5.1. This is the maximum potential study area for any of the individual schemes and so considers all the areas which could be affected by all 3 North West SMP Schemes.

5.2.2 The air quality assessment and predictions made using the traffic flows utilised initially for all 4 North West SMP Schemes (cumulative worst case) are still presented for the 3 North West SMP Scheme study area. This is because these air quality predictions are typically worst case, as more traffic is, in general, predicted from the four Schemes compared to the 3 Schemes scenario.

5.2.3 There are two locations, however, comprising 3 properties to the east of the M6 at Martinscroft and 2 properties to the east of the M6 at Newton-le-Willows, where the four Scheme traffic data would result in unrealistic large predicted changes in air quality and hence an incorrect evaluation of the significance of air quality effects. In these areas, air quality modelling using specific 3 scheme scenario traffic data has been used.

[3] Highways England, Smart Motorways Programme M56 Junction 6 to 8 Environmental Scoping Report, July 2017.

## 5.3 Study Area

5.3.1 The air quality assessment presented for the three NW SMP Schemes considers a study area of the roads affected by the three North West SMP, Schemes, the ARN, and this is illustrated on Figure 5.1. This is the maximum potential study area for any of the individual schemes and so considers all the areas which could be affected by all three North West SMP Schemes.

5.3.2 The air quality assessment and predictions made using the traffic flows utilised initially for all four North West SMP Schemes (cumulative worst case scenario) are still presented for the three North West SMP Scheme study area. This is because these air quality predictions are typically worst case, as more traffic is, in general, predicted from the 4 Schemes compared to the 3 Schemes scenario.

5.3.3 There are two locations, however, comprising three properties to the east of the M6 at Martinscroft and 2 properties to the east of the M6 at Newton-le-Willows, where the 'cumulative worst case' four North West SMP Schemes traffic data would result in unrealistic large predicted changes in air quality and hence an incorrect evaluation of the significance of air quality effects. In these two locations, air quality modelling using specific three North West SMP schemes scenario traffic data has been used.

5.3.4 The air quality study area has been determined in accordance with traffic change criteria set out in the DMRB Volume 11, Section 3, Part 1 (HA207/07)4 which defines affected road networks (ARN) for local (paragraph 3.12) air quality assessments. The 3 Schemes scenario ARN is the cumulative scenario, with an additional ARN determined for the M56 Scheme in isolation.

5.3.5 The ARN for the purposes of a local air quality assessment is defined as those roads within a defined 'traffic reliability area' (i.e. the area of the traffic model considered to provide reliable estimates of traffic when the base traffic model is compared to observed traffic) that meet any of the traffic change criteria (based on the two-way flow on all roads), whereby:

- Road alignment will change by 5 metres (m) or more, or
- Daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more, or
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more, or
- Daily average speed will change by 10 kilometres per hour (km/hr) or more, or
- Peak hour speed will change by 20 km/hr or more.

5.3.6 The air quality study area has been defined, based on the ARN, for those links which have relevant receptors within 200m of either side of road carriageways. This distance of 200m from roads is industry best practice guidance specified in DMRB HA207/07, which has been derived from calculations using atmospheric dispersion modelling of dispersion profiles that have been reviewed in a series of field measurements[5]. In practice, any air quality assessment is undertaken by identifying where there are relevant receptors adjacent to the ARN and including all road sources within 200m of that receptor, whether in the ARN or not.

5.3.7 For the purposes of the regional air quality assessment the study area has been defined as all road links within the 'traffic reliability area'.

### Geographical Study Area

5.3.8 Due to the overall size of the ARN for the study area (three North West SMP Schemes) the study area was divided into geographical areas centred around the schemes: M56, M60 and M62 geographical study areas. These are shown simplistically in Diagram 5.1, and in more detail overlaid on the ARN in Figure 5.1.

[4] http://www.standardsforhighways.co.uk/ha/standards/dmrb/index.htm
[5] HA207/07 DMRB Volume 11 Section 3 Part 1, May 2007 Paragraph C3.1 http://www.standardsforhighways.co.uk/dmrb/

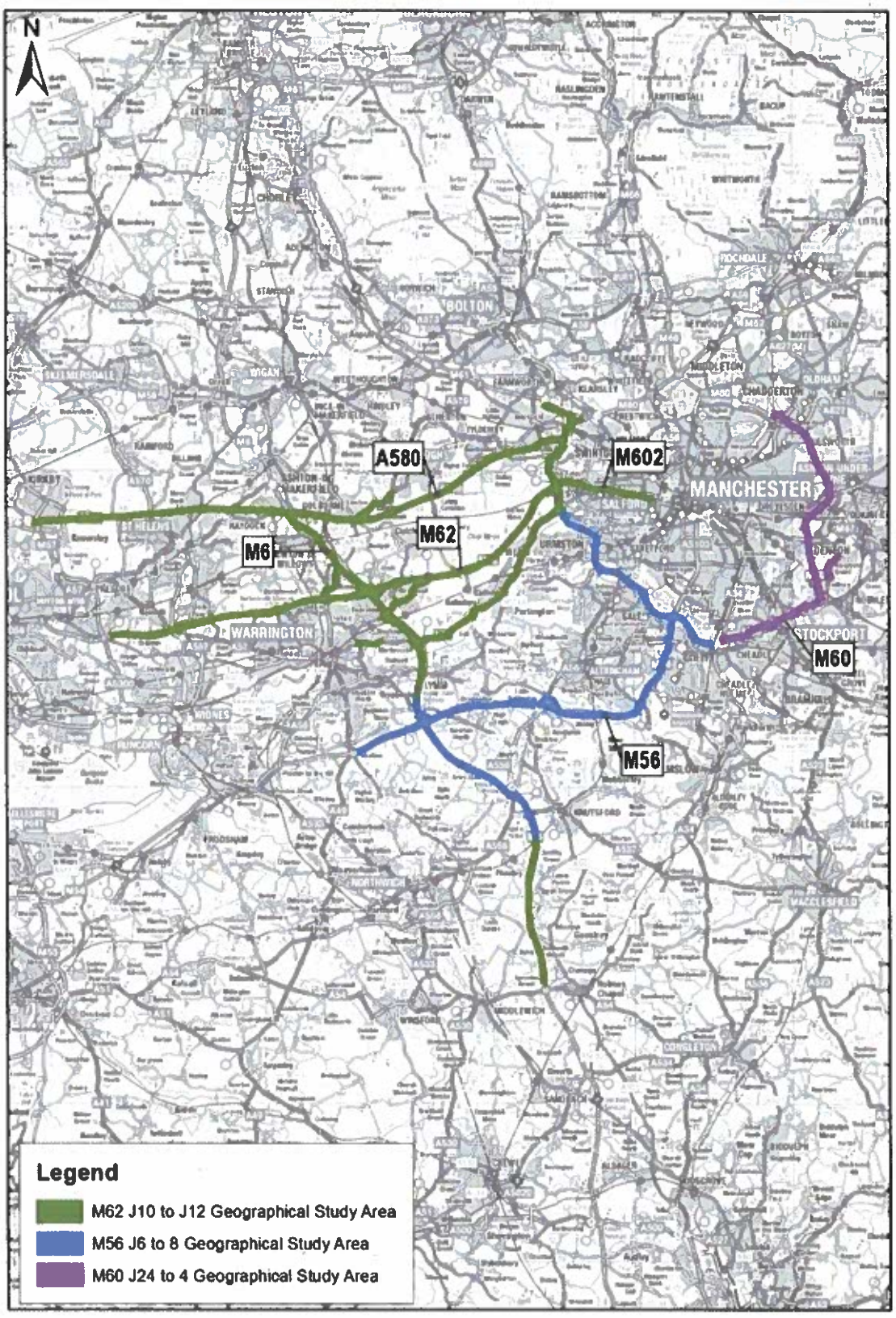



**Diagram 5.1: Simplistic illustration of Geographical Study Area for Air Quality**

5.3.9 Each North West SMP Scheme EAR reports the results for all three geographical study areas in turn, to then consider the assessment of significance across the air quality study area as a whole. Where relevant, the 'scheme only' scenario (M56 scheme only in this EAR) is then based on the single geographical study area relevant to that North West SMP Scheme.

5.3.10 For ease of modelling and comparison, impacts were predicted at all receptors within this area for both scenarios, despite the fact that in some instances the receptors considered within a particular scenario were not adjacent to ARN links and therefore unlikely to be affected (for example the A556 is only really in the ARN for the 'M56 scheme only', not for the cumulative worst case).

**M56 J6-8 Geographical Study Area**

5.3.11 The M56 J6-J8 geographical study area was defined with reference to the three North West Scheme ARN and those routes affected around the M56 Scheme. The M56 J6-J8 geographical study area and ARN are illustrated in Figure 5.2a for the cumulative worst case and in Figure 5.2b for the 'M56 J6-8 only' scenario, and are discussed in the following sub-sections.

*Cumulative Worst Case ARN - M56 J6-8 Geographical Study Area*

5.3.12 The ARN within the M56 J6-8 geographical study area extends within the areas administered by Warrington Borough Council (WBC), Cheshire East Council (CEC), Trafford Council (TC), Manchester City Council (MCC) and Stockport Metropolitan Borough Council (SMBC). The ARN includes the following key roads, with the cumulative worst case flows shown below:

- M60 between Junction 3 and Junction 5 (AADT change between +1,359 and +1,711;
- M60 between Junction 5 and Junction 10 (change in annual average HDV between +267 and +331);
- A5103 Princess Parkway (AADT change between -1,253 and -1,570 and change in annual average HDV between -258 and +21);
- M56 between Junction 5 and Junction 3A (AADT change between –1,570 and – 1,022 and change in annual average HDV between -309 and -116);
- M56 between Junction 5 and Junction 9 (AADT change between +1,545 and +3,633 and change in annual average HDV between -307 and -149);
- M56 between Junction 9 and Junction 10 (AADT change of +1,792);
- M6 between Junction 18 and Junction 20 (AADT change between +2,336 and +2,990); and
- M6 between Junction 20 and Junction 21 (AADT change between +5,503 and +6,383 and change in annual average HDV between -325 and -335).

*'M56 J6-8 only' Scenario ARN*

5.3.13 The 'M56 J6-8 Only' ARN is located within the boundaries of Manchester City Council, Trafford City Council and Cheshire East Council. The ARN includes the following key roads:

- A5103 Princess Parkway (AADT change between +1,177 and +1,504);
- M56 between Junction 5 and Junction 3A (AADT change between +2,274 and +3,635);
- M56 between Junction 5 and Junction 8 (AADT change between +5,419 and +6,219 and relevant change in annual average HDV between +142 and +271);
- M56 between Junction 8 and Junction 10 (AADT change between +2,567 and +1,033); and
- A556 between M56 Junction 8 and M6 Junction 19 (AADT change between +1,591 and +1,287).

**M60 J24-4 Geographical Study Area**

5.3.14 The M60 J24-4 geographical study area and ARN is illustrated in Figure 5.2 – M60 J24-4 and discussed below, with the cumulative worst case flows shown below.

5.3.15 The ARN within the M60 J24-4 geographical study area is located within the boundaries of Stockport Metropolitan Borough Council (SMBC), Tameside Metropolitan Borough Council (TMBC) and Oldham Council (OC). The ARN includes the following key roads:

- M60 between Junction 3 and Junction 1 (AADT change between +1,104 and +1,863);
- M60 between Junction 1 and Junction 27 (AADT change between +2,426 and +2,488);
- M60 between Junction 27 and Junction 25 (AADT change between +3,723 and +6,696);
- M60 between Junction 25 and Junction 24 (AADT change between +11,172 and +12,591);
- M60 between Junction 24 and Junction 21 (AADT change between +1,187 and +5,877).

**M62 J10-12 Geographical Study Area**

5.3.16 The ARN within the M62 J10-12 geographical study area is located within the boundaries of Salford City Council (SCC), Trafford Council (TC) and Wigan Council (WC), which form part of the Greater Manchester Combined Authority; Knowsley Metropolitan Borogh Council (KMBC), St Helens Metropolitan District Council (SHMDC), Halton Borough Council (HBC), and Warrington Borough Council (WBC), Liverpool Combined Authority; and Cheshire East Council (CEC) and Cheshire West and Chester Council (CWaCC).

5.3.17 The ARN includes the following key roads in the M62 J10-12 geographical study area for the cumulative worst case traffic flow changes:

- M62 J10-11 (AADT Change +22,082)
- M62 J11-11a (AADT Change +18,973)
- A580 west of M6 J23 (AADT Change +372, with +212 HDVs)
- M6 J21-J21A (AADT Change +18,159)
- M6 J21A-J22 (AADT Change +21,862)
- M6 J22-J23 (AADT Change +23,710)

5.3.18 As described above with the M6 J21a-26 Scheme included with the other three North West SMP Schemes there was predicted to be five large changes in nitrogen dioxide concentration at two locations including: two large changes at Newton-le-Willows and three large changes at Nichol Avenue, Martinscroft. This is not representative of the three North West SMP Schemes that are being assessed and so in these two locations specific three North West SMP traffic flows have been used with the below flow changes:

- M6 J21-J21A (AADT Change +5,962 AADT change); and
- M6 J22-J23 (+1,094 AADT change).

## 5.4 Methodology

5.4.1 Relevant air quality legislation, policy and guidance, including relevant Air Quality Strategy (AQS) objectives, are provided in Table B1 in Appendix B.1.

5.4.2 Potential effects on air quality have been assessed following principles in relevant guidance outlined in DMRB HA207/07, associated Interim Advice Notes (IANs) and the Department for the Environment, Food and Rural Affairs' (Defra) Local Air Quality Management Technical Guidance (LAQM.TG(16)). Relevant guidance documents used for the air quality assessment are listed below:

- HA207/07 Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1, May 2007[6];
- IAN 170/12 v3 Updated air quality advice on the assessment of future NOx and $NO_2$ projections for users for the DMRB Volume 11, Section 3, Part 1 Air Quality, November 2013[7];
- IAN 174/13 Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 Air Quality (HA207/07), June 2013[8];
- IAN 175/13 Updated advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for users of DMRB Volume 11, Section 3, Part 1 Air Quality (HA207/07), June 2013[9];
- IAN 185/15 Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' for users of DMRB Volume 11, Section 3, Part 1 'Air Quality and Volume 11, January 2015[10];
- Note on HA's Interim Alternative Long Term Annual Projection Factors (LTTE6) for Annual Mean $NO_2$ and NOx Concentrations between 2008 and 2030, draft, October 2013[11];
- MPI-28-082014: Highways England Major Projects' Instructions – Determining the correct base year traffic model to support air quality assessments (August 2014);
- MPI-29-082014: Highways England Major Projects' Instructions – 'One-Team' delivery approach for Traffic and Environmental Teams (August 2014); and
- DEFRA's Local Air Quality Management Technical Guidance (LAQM.TG(16))[12], where appropriate.

### Operational Air Quality Assessment

5.4.3 A detailed assessment has been carried out for local air quality, which takes into account diurnal changes in traffic flows using the dispersion modelling software (ADMS-Roads v4) to determine potential impacts on $NO_2$ concentrations at human health receptors, and NOx concentrations at designated ecological sites in the expected opening year. A simple level of assessment has been undertaken for regional emissions of NOx, $PM_{10}$ and $CO_2$ for the opening and design years.

5.4.4 All three North West SMP schemes that are still being progressed by Highways England (M62 J10-12, M56 J6-8 and M60 J24-4) have an assumed first full year open to traffic of 2020 in the traffic and economics assessments, and thus this assessment is based on an opening year of 2020. There is expected to be a negligible change in traffic flow between the 18month difference in opening years between the component schemes. Defra background concentrations and vehicle emission factors both allow for improvements in future years, therefore the modelled opening year of 2020 represents a conservative assessment compared to some expected opening years (for example, the M56 has an actual expected opening year of 2021).

[6] http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/ha20707.pdf
[7] http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian170v3.pdf
[8] http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian174.pdf
[9] http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian175.pdf
[10] http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian185.pdf
[11] 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. Department for Transport.
[12] http://laqm.defra.gov.uk/documents/LAQM-TG16-April-16-v1.pdf

5.4.5 The following scenarios have been considered within the local air quality assessment:

- Base year (2015);
- Projected base year (2020);
- Opening year Do-Minimum (DM) (2020);
- Opening year 'Cumulative Worst Case" Do Something (DS) (2020); and
- Opening year 'M56 J6-8 scheme Only' DS (2020);

5.4.6 As discussed previously, predictions in the majority of the air quality study area have used the traffic flow increases associated with the four NW SMP Schemes, known as the cumulative worst case scenario. The three North West SMP Schemes Scenario traffic flows have been utilised for two locations (three properties to the east of the M6 at Nichol Avenue in Martinscroft and two properties to the east of the M6 at Newton-le-Willows) where the four North West SMP traffic data (i.e. cumulative worst case scenario) would result in unrealistic large predicted changes in air quality and significant air quality effects that would not be representative of the three North West SMP Schemes.

5.4.7 The following scenarios have been considered within the regional air quality assessment:

- Base year (2015);
- Opening year Do-Minimum (DM) (2020);
- Opening year 'Cumulative Worst Case' (2020);
- Opening year 'M56 J6-8 scheme Only' DS (2020);
- Design year DM (2035); and
- Design year 'Cumulative Worst Case' (2020);
- Design year 'M56 J6-8 scheme Only' DS (2035);

5.4.8 The TAG assessment will be reported alongside the EAR.

## Baseline Information and Data Sources

5.4.9 Information on existing baseline air quality conditions within the North West study area was obtained from the following sources:

- The Greater Manchester Combined Authority (GMCA), Cheshire East Council (CEC), , Knowsley Metropolitan District Council (KMBC), St. Helens Metropolitan District Council (SHMDC), Warrington Borough Council (WBC), Salford City Council (SCC), Trafford Council (TC), Wigan Council (WC), Bolton District Council (BDC), Chorley District Council (CDC), Preston District Council (PDC), Salford City Council (SCC), Sefton District Council (SDC), South Ribble District Council (SRDC) and West Lancashire Borough Council's (WLBC) Local Air Quality Management (LAQM) review and assessment reports (additional detail is provided in Appendix B3);
- Diffusion tube surveys and continuous air quality monitoring stations (CMS) operated by relevant local authorities, in addition to diffusion tube surveys managed by or for Highways England;
- Air pollutant background concentrations, monitoring data, emissions data and Pollution Climate Mapping (PCM) modelling data acquired from DEFRA's UK Air Quality Information Resource (UK-AIR) (http://uk-air.defra.gov.uk); and
- Designated ecological site information from the Multi-Agency Geographic Information for the Countryside (MAGIC) website (www.magic.gov.uk) and Natural England and critical load data for identified designated ecological habitats and background nitrogen deposition rates from the UK Air Pollution Information System (APIS) (www.apis.ac.uk).

5.4.10 A summary of existing air quality conditions within each geographical study area has been based on information collected as part of the SMP Advanced Environmental Desk Studies (AEDS) process, supplemented with more recent air quality monitoring data where available, and data from the wider study area from the ARN. Baseline air quality is discussed further in Section 5.5

and in Appendix B.2.

5.4.11 Analysis of measured trends in annual mean $NO_2$ has been undertaken using the Finnish Meteorological Institute MAKESENS (v1) spreadsheet using the annual mean time series data for relevant CMS. The analysis identifies if and where there are statistically significant trends in measured annual mean $NO_2$, informing the selection of suitable long term trend factors. Further details are presented in Appendix B.2.

## Constraints Mapping

5.4.12 A constraints map for the M56 J6-8 geographical study area is shown in Figure 5.3 – M56 J6-8. The figure shows sensitive receptors within the study area; boundaries of Air Quality Management Areas (AQMAs); measured annual mean $NO_2$ concentrations for comparison to the AQS objective; exceedances of the annual mean $NO_2$ EU limit value in 2015 and 2020 respectively from Defra's PCM model; and the locations of designated sites containing features sensitive to nitrogen air pollution.

5.4.13 A constraints map for the M62 J10 to 12 and M60 J24 to J4 geographical air quality study areas are shown in the Appendix.

## Traffic Data

5.4.14 The cumulative worst case traffic impacts for the four North West SMP Schemes uses traffic data from two different traffic models, due to the extent of the study area and the coverage of available traffic models.

5.4.15 For the geographical study areas M56 and M62, the traffic data used were derived from the Trans Pennine South Local Model (TPSLTM), provided by Arup. For the M60 geographical study area, traffic data were derived from the Greater Manchester Local Traffic Model (GMLTM) provided by Mott McDonald.

5.4.16 Extensive engagement has been undertaken between the air quality and traffic modelling teams. This has included inclusion of the air quality team in traffic model calibration/validation meetings and inclusion of traffic representatives in air quality meetings, including joint presentations to Highways England, and participation of the traffic team in the Air Quality Peer2Peer meetings. Close collaboration has also been undertaken to iteratively agree speed banding approaches, and to jointly undertake further detailed investigation of initial results to aid understanding and, where necessary, develop traffic data enhancements.

5.4.17 Specific collaboration has also been required between the two traffic teams to develop a traffic dataset leveraging both traffic models for the M602 corridor which was outside of the modelled area for both traffic models.

5.4.18 Further details on traffic data are provided in Appendix B.6.

## Local Air Quality Assessment

5.4.19 A summary of the inputs required for dispersion modelling is provided below, with further details presented in Appendix B.3.

5.4.20 A local air quality assessment for relevant illustrative sensitive receptors was undertaken using Cambridge Environmental Research Consultant's ADMS-Roads (version 4) dispersion modelling software to determine the operational effects of the North West SMP Scheme(s) on human health receptors and sensitive ecological receptors (where relevant). The model used information on road link emission rates, road alignment and width, and local meteorological data (using Manchester Airport 2015 data) to estimate local air pollutant concentrations.

5.4.21 The dispersion model was set up based on the following key inputs and assumptions:

- Road sources were modelled using the ADMS Road source representation tool;
- Ordnance Survey Master Map topography base mapping was used to define the road geometry;

- A single centreline was entered in the model for modelled roads, with the exception of motorway links which have a centreline included for each carriageway directions; and
- Road widths have been manually measured through the measurement tool in Google Earth.

5.4.22 Traffic conditions vary throughout the course of a day, hence 24-hour emission profiles have been applied to each road link in the model to represent the corresponding variation in road traffic emissions for the M56 J6-8 geographical area and also the M60 J24-4 geographical area. The ADMS Roads model was setup with a unit emission rate entered into the model for each road link (rather than the emission for an average hour) and a 'fac' file (which represents the diurnal emissions profile) created containing the estimated emissions for each hour for the M56 J6-8 geographical area and also the M60 J24-4 geographical area.

5.4.23 In the M62 J10-12 geographical area four specific time periods were modelled to capture diurnal effects. This included a morning peak period (AM) (7am to 10am), an inter peak period (IP) (10 am to 4pm), an evening peak period (PM) (4pm to 7pm) and an off-peak period (OP) (7pm to 7am). The emissions from these periods were included in ADMS-Roads and a 'fac' file was used to switch these periods on and off as required. The traffic data provided and modelling approaches used follow MPI 29-082014 in its approach. Further details of the emission rate estimation approach are shown in Appendix B.3.

5.4.24 Estimates of the contribution from road traffic emissions to annual mean concentrations of NOx were provided by the model at discrete receptors, which were combined with estimates of background concentrations, to derive total annual mean $NO_2$ concentrations.

5.4.25 The modelled road NOx and background $NO_2$, based on DEFRA background maps with a 2013 base year, were converted to total annual mean $NO_2$ for comparison with the UK AQS objective using the DEFRA NOx to $NO_2$ tool, version 5.1, June 2016.

5.4.26 In order to avoid double counting the contribution from modelled emission sources, the in-square contributions within DEFRA background maps from motorways, primary A roads and trunk roads were removed from the total background $NO_2$ concentration, using the $NO_2$ Adjustment for NOx Sector Removal Tool v5.1, June 2016.

5.4.27 The potential for exceedances of the 1 hour $NO_2$ UK AQS objective to occur was assessed based on whether annual mean $NO_2$ concentrations were greater than 60 $\mu g/m^3$, in accordance with DEFRA LAQM.TG(16).

5.4.28 Base year (2015) modelled annual mean $NO_2$ concentrations were verified separately for each geographical study area, by comparison against available ratified monitoring data in the each geographical study area, with reference to DEFRA's Technical Guidance LAQM.TG(16). The M62 J10-12 geographical study area was verified using data collected within the M62 geographical study area and a wider area covered by the same traffic model. Where systematic bias, in either direction, was clearly evident in the base year, adjustment was applied to bring modelled concentrations more into line with measured concentrations. Further details on verification are given in the section below and in Appendix B.3.

5.4.29 The consequence of the conclusions of DEFRA's advice on long term $NO_2$ trends is that there is a gap between projected vehicle emission reductions and the estimated annual rate of improvement in annual mean $NO_2$ within DEFRA's previously published technical guidance, and observed trends. Air quality assessments following DEFRA LAQM.TG(16) guidance are therefore considered likely to be overly optimistic in some cases. IAN 170/12v3 therefore requires that steps are taken to adjust the estimated total $NO_2$ concentrations from modelling, termed "gap analysis", in order to better reflect future trends. The assessment uses the Highways England LTTE6 projection factors based on analysis of monitoring data trend analysis as presented in Appendix B.3.

5.4.30 An additional scenario (projected base year) is required to enable the gap analysis to be completed. The projected base year scenario is modelled using the base year traffic data with the opening year vehicle emission factors and opening year background concentrations. Total $NO_2$ concentrations for the projected base year are calculated as described above. The results for the opening year are then adjusted using gap analysis to represent the observed long term trend profile.

5.4.31 Modelled annual mean $NO_2$ concentrations and impacts have been evaluated with regard to compliance with the EU Directive on ambient air quality in accordance with IAN 175/13.

## Receptors

5.4.32 Receptors that are potentially sensitive to changes in NOx and $NO_2$ concentrations are defined in DMRB HA207/07 as representative sensitive human health receptors and designated ecological sites (containing habitats sensitive to NOx) located within 200m of the ARN. The assessment considers impacts at residential properties, schools and hospitals, and ecological receptors including the following types of designated sites: Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar sites. Receptors assessed are those located within 200m of the ARN (not all receptors within 200m were modelled, as parts of the scheme geographical study areas are densely populated urban areas).

5.4.33 The receptors selected included those located closest to the ARN, together with those within 200m of the ARNs which were considered likely to experience the highest ambient $NO_2$ concentrations. In addition, relevant monitoring locations have been included in the air quality model for use in air quality model verification.

### M56 J6-8 Geographical Study Area

5.4.34 A total of 138 discrete illustrative human health receptors and 64 monitoring locations were included in the air quality model.

5.4.35 There are no designated ecological sites identified within 200m of the M56 J6-8 geographical study area ARN with the potential to be affected by traffic flow changes in the core cumulative worst case scenario, therefore no assessment of the effect of this scenario on ecological sites has been undertaken.

5.4.36 The assessed human health receptors are listed in Table B.45 in Appendix B.5 shown on Figure 5.4 – M56 J6-8.

### M60 J24-4 Geographical Study Area

5.4.37 A total of 54 discrete illustrative human health receptors and 29 monitoring locations were included in the air quality model.

5.4.38 A single designated ecological site was identified within the study area, which contain features potentially sensitive to airborne nitrogen, the Hollinwood Branch Canal SSSI. The Hollinwood Branch Canal SSSI is located west of the M60 between Junction 23 and Junction 22. A receptor was positioned at the closest sensitive point within this designated site to the M60. Further details of the designated ecological sites assessed, including habitat types and applicable critical loads, are provided in the Appendix B.2.

5.4.39 The assessed human health receptors are listed in Table B.46 in Appendix B.5 and the ecological site receptors listed in Table B.46 in Appendix B.5. Both human health and ecological modelled receptors are shown on Figure 5.4 – M60 J24-4.

### M62 J10-12 Geographical Study Area

5.4.40 A total of 1,383 discrete illustrative human health receptors and 151 monitoring locations were included in the air quality model.

5.4.41 There are three designated ecological sites identified within the M62 J10-12 geographical study area, Holcroft Moss SSSI/Manchester Mosses SAC, Rixton Clay Pits SSSI, and Woolston Eyes SSSI which have the potential to be affected by traffic flow changes in the cumulative worst case scenario. Transects of receptor points from the closest point within the designated site to the ARN up to 200m were included in the air quality assessment. Further details of the designated ecological sites, including habitat types and applicable critical loads are provided in the Appendix B.2.

5.4.42 The assessed human health receptors are listed in Table B.47 in Appendix B.5 and the

designated ecological site transects are listed in Table B.51 in Appendix B.5. Both modelled human health and ecological receptors are shown on Figure 5.3 – M62-J10-12.

## Verification

5.4.43 Model verification is the process by which uncertainties in the modelling are investigated and, wherever possible, minimised. The verification step involves comparison of model estimated pollutant concentrations with monitored values that are representative of the base year model (which for this assessment is 2015). Verification was undertaken in accordance with DEFRA's Technical Guidance LAQM.TG(16). Details of the verification process are provided in Appendix B.4. The key findings of the verification process for each corridor are summarised below.

**M56 J6-8 Geographical Study Area**

5.4.44 The location of monitoring sites used for model verification and the model domain boundaries defined are shown in Figure 5.4 – M56-J6-8. In summary:

- 64 monitoring sites were used to compare modelled results with measured 2015 annual mean $NO_2$ concentrations;
- Unadjusted modelled $NO_2$ concentrations were compared with measured concentrations;
- The air quality model was found to both underestimate and overestimate compared with monitoring data and adjustment by domain was required to account for localised conditions that could not be represented in the air quality model;
- 11 model domains were defined within the M56 J6-8 geographical study area, with separate model adjustment factors derived for eight of these domains;
- The adjusted total $NO_2$ concentrations were considered to have acceptable model performance in accordance with DEFRA LAQM.TG(16), with all of the verification sites modelled being within 25% of measured values and 80% within 10% of measured values. The model performance statistics are presented in Appendix B.4, and post-adjustment are all acceptable; and
- The model results for human health and ecological receptors in each model domain were adjusted where necessary using the model adjustment factors derived for the base year scenario and also in the opening year with and without the 'cumulative worst case' and 'M56 J6-8 Only' scenarios.

**M60 J24-4 Geographical Study Area**

5.4.45 The location of monitoring sites used for model verification and the model domain boundaries defined are shown in Figure 5.4– M60-J24-4. In summary:

- 29 monitoring sites were used to compare the modelled results with 2015 annual mean $NO_2$ concentrations;
- Unadjusted modelled $NO_2$ concentrations were compared with the monitoring data;
- The air quality model was found to compare well with monitoring data at the majority of locations, with no evidence of systematic bias;
- A separate adjustment factor was however derived for a small domain, where the model significantly overpredicted annual mean $NO_2$ concentrations due to the M60 being in cutting at this location;
- The adjusted (where necessary) total $NO_2$ concentrations were considered to have acceptable model performance in accordance with DEFRA LAQM.TG(16), with all of the verification sites modelled, except one (an overprediction), being within 25% of measured values, and 69% being within 10% of measured values. The model performance statistics are presented in Appendix B.4 and post-adjustment are all acceptable; and
- The model results for human health and designated ecological receptors in each model domain were adjusted (where necessary) using the model adjustment factors derived for the base year scenario and also in the opening year with and without the Scheme.

**M62 J10-12 Geographical Study Area**

5.4.46 The location of monitoring sites used for model verification and the model domain boundaries defined are shown in Figure 5.3 – M62 J10-12. In summary:

- 126 monitoring sites were used to compare modelled results with measured 2015 annual mean $NO_2$ concentrations from within the M62 geographical study area;
- Unadjusted modelled $NO_2$ concentrations were compared with measured concentrations;
- The air quality model was found to both underestimate and overestimate compared with monitoring data and adjustment by domain was required to account for localised conditions that could not be represented in the air quality model;
- Seven model domains were defined within the M62 J10-12 geographical study area, with separate model adjustment factors derived for all of these domains;
- For the seven domains, the adjusted total $NO_2$ concentrations were considered to have acceptable model performance in accordance with DEFRA LAQM.TG(16), with the adjusted $NO_2$ concentrations modelled at the 126 monitoring sites within +/- 25% of monitored concentrations at 123 out of 126 sites following model adjustment, and the majority (75 of 126 sites, or 60%) are within 10% of monitored concentrations. This suggests that the model, following adjustment, performs well at most locations in accordance with DEFRA Technical Guidance LAQM.TG(16). The model performance statistics are presented in Appendix B.4, and
- The model results for human health and ecological receptors in each model domain were adjusted where necessary using the model adjustment factors derived for the base year scenario and also in the opening year with and without the cumulative worst case.
- Additional data utilised in the model verification from wider area is presented in Appendix B.4.

## Regional Air Quality Assessment

5.4.47 A regional air quality assessment was undertaken in accordance with DMRB HA 207/07 to determine the change in pollutant emissions as a result of the 'M56 J6-8 Only' scenario for the entirety of the Traffic Reliability Area (TRA). Emission calculations were undertaken using emission rates derived from IAN 185/15 on speed banding. The pollutants included in this assessment were NOx, $PM_{10}$ and $CO_2$.

5.4.48 The scenario modelled was: the existing base year of 2015; the opening year (2020) without (DM) and with (DS) the cumulative worst case; and the design year (2035) without and with the cumulative worst case. In addition, for completeness, the 'M56 J6-8 Only' scenario was also modelled (opening year and design year).

## Assumptions and Limitations

5.4.49 Any air quality model has inherent areas of uncertainty, including:

- The traffic data used in the air quality model;
- The appropriateness of vehicle emissions data;
- Simplifications in model algorithms and empirical relationships that are used to simulate complex physical and chemical processes in the atmosphere;
- The appropriateness of background concentrations; and
- The appropriateness of meteorological data.

5.4.50 Uncertainty associated with traffic data has been minimised by using validated traffic models (as discussed in Appendix B.6), with active engagement between traffic and air quality teams so that uncertainty was discussed and controlled by agreement, not just in straight traffic model output but in post-processed traffic data (as used in air quality assessments). The overall air quality assessment made use of two traffic models, balancing the wider coverage and lower network density of TPSLTM with the smaller geographic coverage but greater network density of the GMLTM.

5.4.51 Uncertainty associated with traffic data has also been minimised by recognising areas required for air quality modelling which the traffic modelling did not cover (such as the M602 corridor), and from the close working between the traffic and air quality teams, a jointly agreed approach was developed, tested together and rolled out with the agreement of Transport Planning Group (TPG) consistent with Major Project Instructions (MPI-29-082014)..

5.4.52 The Croft Interchange (M62 J10) metering pilot scheme has not been included in either the transport modelling or the air quality modelling. The pilot study does not include additional capacity along the scheme route and so notable changes in traffic volumes would not be expected. Therefore, significant differences in predicted air quality would not be expected if this pilot scheme had been included.

5.4.53 Uncertainties associated with vehicle emissions data have been minimised by using the speed-band emission factors described within DMRB IAN 185/15 (but based on version 7.0 of DEFRA's Emission Factors Toolkit).

5.4.54 Uncertainties associated with model algorithms and empirical relationships have been minimised by using algorithms and relationships that have been independently validated and judged as fit for purpose.

5.4.55 Another uncertainty is with using historical meteorological data to estimate future concentrations. The key limiting assumption is that conditions in the future will be the same as in the past; however, in reality no two years are the same. In line with best practice, the base year meteorology (as used in the model verification and adjustment process) has been used in future year modelling to allow any adjustments to be applied in future cases.

5.4.56 Overall, the assessment has demonstrated that post adjustment, the model verification showed good agreement between modelled and monitored results, which leads to confidence in the results.

## Magnitude of Impact Classification

5.4.57 Descriptors for magnitude of change (impact) and consequent significance of effect due to changes in ambient concentrations of $NO_2$ are provided in Highways England's IAN 174/13. These criteria have been used in the assessment of annual mean concentrations of $NO_2$.

5.4.58 The changes in magnitude, which are based on an assumed measure of uncertainty (MoU) of 10%, may be described as small, medium, large or imperceptible, depending on the change in concentration relative to the air quality criterion as follows:

- A change in concentration less than or equal to 1% of the relevant air quality criterion is considered to be 'imperceptible';
- A change in concentration greater than 1% and less than 5% of the relevant air quality criterion is considered to be 'small';
- A change in concentration greater than 5% and less than 10% of the relevant air quality criterion is considered to be 'medium'; and
- A change in concentration greater than 10% of the relevant air quality criterion is considered to be 'large'.

5.4.59 Table 5.1 presents magnitude of change criteria for annual mean $NO_2$ concentrations. According to IAN 174/13, only those receptors that are predicted to exceed relevant air quality thresholds need to be considered when determining significance.

5.4.60 In line with guidance within IAN174/13 where a change in annual mean concentrations of NOx for the assessment of designated ecological sites is less than 0.4 $\mu g/m^3$ this has been identified as imperceptible. Where a change is greater than 0.4 $\mu g/m^3$ advice has been sought from the Ecology team.

5.4.61 There is no guidance on classification of magnitude of impact or significance of effect for the regional air quality assessment.

**Table 5.1 Magnitude of Change Criteria for Local Air Quality**

| Magnitude of change in concentration | Value of change in annual mean $NO_2$ |
|---|---|
| Large (>4 µg/m$^3$) | Greater than full measure of uncertainty (MoU) value of 10% of the air quality objective (4 µg/m$^3$) |
| Medium (>2 to 4 µg/m$^3$) | Greater than half of the MoU (2 µg/m$^3$), but less than the full MoU (4 µg/m$^3$) of 10% of the air quality objective. |
| Small (>0.4 to 2 µg/m$^3$) | More than 1% of the objective (0.4 µg/m$^3$) and less than half of the MoU i.e. 5% (2 µg/m$^3$). The full MoU is 10% of the air quality objective (4 µg/m$^3$). |
| Imperceptible (≤0.4 µg/m$^3$) | Less than or equal to 1% of objective (0.4 µg/m$^3$). |

## Significance of Effect Classification

5.4.62 In order to assess the significance of effects for annual mean $NO_2$, the number of receptors that fall within the 'small', 'medium', and large magnitude of change categories is calculated and compared to the guidelines presented in Table 5.2 (an imperceptible magnitude of change need not be considered further with regards to significance of effects).

5.4.63 As outlined in Table 5.2 (from IAN 174/13), significant air quality effects are only identified for receptors where air quality thresholds are exceeded in either the without Scheme and/or with Scheme scenarios.

5.4.64 Where the difference in concentrations are less than 1% of the AQS Objectives (e.g. less than 0.4 µg/m$^3$ for annual mean $NO_2$) then the change at these receptors is considered to be 'imperceptible' and can be scoped out of the judgement on significance.

5.4.65 As outlined in IAN 174/13, for the determination of significance for NOx effects on designated ecological sites, where the difference in concentration is less than 0.4 µg/m$^3$ for annual average NOx, then the change at these receptors is considered to be 'imperceptible' and can be scoped out of the judgement on significance.

5.4.66 A selection of illustrative discrete receptors have been included at worst placed locations adjacent to the ARN. Where potential exceedances of the annual mean $NO_2$ AQS objective were modelled to occur, additional receptors have been included in the surrounding area to identify the total number of receptors affected.

5.4.67 Commentary on compliance with the EU Air Quality Directive in accordance with IAN 175/13, has been provided where DEFRA PCM model links coincide with ARN links to aid the assessment of significance of effect.

5.4.68 Highways England has developed a framework, as set out in IAN 174/13, to provide guidance on the number of receptors for each of the magnitude of change categories that might result in a significant effect. These are guideline values to be used to inform professional judgement on significant effects if the Scheme shows exceedances. The guideline bands are intended to help provide consistency across all Highways England schemes. The significance categories and guideline property numbers are summarised in Table 5.2.

**Table 5.2 Guideline to Number of Receptors Constituting a Significant Effect for Air Quality**

| Magnitude of change in concentration | Number of receptors with: | |
|---|---|---|
| | Worsening of air quality objective already above objective or creation of a new exceedance | Improvement of an air quality objective already above objective or the removal of an existing exceedance |
| Large (>4µg/m$^3$) | 1 to 10 | 1 to 10 |
| Medium (>2 to 4µg/m$^3$) | 10 to 30 | 10 to 30 |
| Small (>0.4 to 2µg/m$^3$) | 30 to 60 | 30 to 60 |

## 5.5 Baseline conditions

5.5.1 The sources of baseline conditions are outlined in paragraph 5.4.9 and summarised below.

### Local Air Quality Management

#### M56 J6-8 Geographical Study Area

5.5.2 The M56 J6-8 geographical study area falls within the boundaries of Manchester City Council (MCC), Stockport Metropolitan Borough Council (SMBC), Trafford City Council (TCC), Cheshire East Council (CEC), and Warrington Borough Council (WBC). These local authorities have carried out regular reviews and assessments of local air quality. In common with many other authorities across the UK, the councils have shown that the UK AQS objective (as set out in Table B-1 in Appendix B1) most likely to be exceeded is for annual mean $NO_2$, due to road traffic emissions.

5.5.3 There are three AQMAs within the M56 J6-8 geographical study area, which are designated due to exceedances of the annual mean $NO_2$ UK AQS objective. The three AQMAs are: the Greater Manchester AQMA (which includes areas within five of the ten local authorities which form part of the Greater Manchester Combined Authority, namely Manchester City Council (MCC), Stockport Metropolitan Borough Council (SMBC), Trafford City Council (TCC), and Salford City Council (SCC); WBC's Warrington AQMA No1 and CEC's A556 Chester Road AQMA. Details of these AQMAs are given in Appendix B.2, the locations of which are shown in Figure 5.3 – M56 J6-8.

#### M60 J24-4 Geographical Study Area

5.5.4 The M60 J24-4 geographical study area is located within the boundaries of Oldham Council (OC), Tameside Metropolitan Borough Council (TMBC) and Stockport Metropolitan Borough Council (SMBC). These local authorities have carried out regular reviews and assessments of local air quality. In common with many other authorities across the UK, these councils have shown that the UK AQS objective most likely to be exceeded is for annual average $NO_2$ due to road traffic emissions.

5.5.5 Parts of the Greater Manchester AQMA (which includes areas within OC, TMBC and SMBC) are located within the M60 J24-4 geographical study area. This AQMA was designated due to exceedances of the annual mean $NO_2$ UK AQS objective. Details of this AQMA are given in Appendix B.2, the location of which is shown in Figure 5.3 – M60-J24-4.

#### M62 J10-12 Geographical Study Area

5.5.6 The M62 J10-J12 geographical study area includes SCC, TC and WC, which form part of the GMCA; KMBC, SHMDC, HBC, and WBC, which form part of LCA; and CEC and CWaCC. These local authorities have carried out regular reviews and assessments of local air quality. In common with many other authorities across the UK, the councils have shown that the UK AQS objective most likely to be exceeded is for annual mean $NO_2$, due to road traffic emissions.

5.5.7 The local authorities in the M62 J10-12 geographical study area have designated a number of AQMAs, four of which are within 200m of the ARN, and therefore could potentially be affected. The eastern most extent of the Scheme, from the Salford City Council boundary to Junction 12, is located within the Greater Manchester AQMA. Within SHMBC the extent of the M6, from the

boundary with Wigan to the boundary with Warrington, is located within the M6 AQMA. Within Warrington Borough Council the extent of the M62, from the boundary with Salford City Council to the Boundary with St. Helens Metropolitan Borough Council between Junctions 7 and 8, is located within Warrington AQMA No. 1. Additionally the ARN approaches Warrington AQMA No. 4 at a closest distance of 110 m at the junction between the A49 and the M62. Details of these AQMAs are given in Appendix B.2, the locations of which are shown in Figure 5.2 – M62 J10-12.

## DEFRA Mapping

### Pollution Climate Mapping (PCM)

5.5.8 Further information on locations where the annual mean $NO_2$ EU limit value is exceeded is available from DEFRA's Pollution Climate Mapping (PCM) model. This model provides projected roadside concentrations of pollutants, including annual mean $NO_2$ and NOx in the years 2017-2030 inclusive, based on a 2015 base year.

5.5.9 Where roads are not included in the PCM model no assessment of compliance risk can be undertaken. This is in accordance with IAN 175/13, which states that *"where the two road networks intersect, only this subset of the road network should be used to inform the compliance risk"*.

#### M56 J6-8 Geographical Study Area

5.5.10 The locations of DEFRA PCM model links within the M56 J6-8 geographical study area and those PCM model links which are projected to exceed the annual mean $NO_2$ EU limit value in the modelled base year (2015) and opening year (2020), are shown in Figure 5.3– M56 J6-8.

5.5.11 It should be noted that of those road links included in the M56 J6-8 geographical study area, only those on the M56 between Junction 5 and Junction 1, the A5103 between the M56 and M60, and the M60 between Junction 8 and 10 are included in the DEFRA PCM model. Whilst the annual mean $NO_2$ EU limit value is modelled to be exceeded on the southern section of the A5103 between the M56 and M60 and along the M60 between Junction 8 and 10 in 2015, compliance with the EU limit value is modelled to be achieved on these links by 2020.

#### M60 J24-4 Geographical Study Area

5.5.12 The locations of DEFRA PCM model links within the M60 J24-4 geographical study area and those PCM model links which are projected to exceed the annual mean $NO_2$ EU limit value in the modelled base year (2015) and opening year (2020), are shown in Figure 5.3 – M60 J24-4.

5.5.13 DEFRA PCM mapping indicates that there were roadside exceedances of the annual mean $NO_2$ EU limit value within the M60 24-4 geographical study area in the base year (2015), including along the M60 between Junction 1 and Junction 26, at Junction 23 and between Junction 22 and Junction 21. In the scheme opening year (2020), exceedances of the EU limit value are modelled to remain on the M60 at Junction 23, Junction 22 and Junction 21.

5.5.14 As the annual mean $NO_2$ EU limit value is projected to be exceeded in the scheme opening year (2020) along a number of links which are coincident with the ARN for the Scheme, the potential risk of affecting compliance with the EU Air Quality Directive has been considered using the principles in IAN 175/13.

#### M62 J10-12 Geographical Study Area

5.5.15 The locations of Defra PCM model links within the M62 J10-12 geographical study area and those PCM model links which are projected to exceed the annual mean $NO_2$ EU limit value in the opening year (2020), are shown in Figure 5.2.

5.5.16 Defra PCM modelling indicates that there are two affected links (the A57 and the M61) within the study area, that are reported by Defra as non-compliant in 2020. The A57 is in the Greater Manchester Urban Area and the M61 bridges the Greater Manchester and Northwest and Merseyside Urban Areas Urban Area.

## Background Mapping

5.5.17 As discussed above, estimates of current and future year background pollutant concentrations in the UK are available on the DEFRA UK-Air website. These background estimates, which are based on a combination of measured and modelled data, are available for each one kilometre grid square throughout the UK for a base year of 2013, which is the basis for the future estimates up to 2030. These background estimates include contributions from all source sectors, e.g. road transport, industry, and domestic and commercial heating systems.

### M56 J6-8 Geographical Study Area

5.5.18 The 2015 background $NO_2$ concentrations for the 46 grid squares within the M56 J6-8 geographical study area show that background $NO_2$ concentrations are all below the relevant UK AQS objective.

5.5.19 Where mapped and monitoring values are not within 30% of each other, it may be necessary to adjust the mapped background values. For the M56 J6-8 geographical study area, the difference between mapped DEFRA background $NO_2$ concentrations for 2015 and those measured at four local background CMS sites was between -11% and +8.7%, with measured $NO_2$ concentrations at all of these sites being within 30% of mapped DEFRA background concentrations. On this basis, the DEFRA background maps were used unadjusted.

### M60 J24-4 Geographical Study Area

5.5.20 The 2015 background $NO_2$ concentrations for the 27 grid squares within the M60 J24-4 geographical study area indicate that concentrations are all below the relevant UK AQS objective.

5.5.21 Where mapped and monitoring values are not within 30% of each other, it may be necessary to adjust the mapped background values. For the M60 J24-4 geographical study area, the difference between mapped DEFRA background $NO_2$ concentrations for 2015 and those measured at six local background CMS sites was between -11% and +8.7%, with measured $NO_2$ concentrations at all of these sites being within 30% of mapped DEFRA background concentrations. On this basis, the DEFRA background maps were used unadjusted.

### M62 J10-12 Geographical Study Area

5.5.22 The 2015 background $NO_2$ concentrations for the grid squares within the M62 J10-12 geographical study area show that background $NO_2$ concentrations are all below the relevant UK AQS objective.

5.5.23 Where mapped and monitoring values are not within 30% of each other, it may be necessary to adjust the mapped background values. For the M62 J10-12 geographical study area, the difference between mapped DEFRA background $NO_2$ concentrations for 2015 and those measured at local background CMS site was between -12 and 12 %, so the measured $NO_2$ concentration is within 30% of mapped DEFRA background concentrations. There was generally good agreement between measured and mapped background data therefore, with the DEFRA background maps tending to slightly overestimate in some locations and slightly under-estimate in others. On this basis, the DEFRA background maps were used unadjusted.

# 5.6 Air Quality Monitoring

## Local Authority Monitoring

5.6.1 Air quality monitoring data from passive diffusion tubes operated by the relevant local authorities (see paragraph 5.4.9) have been used in the assessment, including in the characterisation of baseline conditions and, where relevant, in model verification.

**M56 J6-8 Geographical Study Area**

5.6.2 Air quality monitoring data in the M56 J6-8 geographical study area are presented in Appendix B.2, shown on Figure 5.3 – M56 J6-8, colour coded by the 2015 annual mean $NO_2$ concentration, and summarised below. There are no CMS within 200m of the ARN in the study area.

5.6.3 In 2015 (the modelled base year), two of the local authority diffusion tube measurements (sites CE55 and MAN13) within the M56 J6-8 geographical study area measured exceedances of the annual mean $NO_2$ UK AQS objective. These diffusion tubes are located within the A556 Chester Road and Greater Manchester AQMAs respectively. CE55 is roadside diffusion tube located adjacent to the A556, at a distance of 4.9m from the kerb. The $NO_2$ annual mean concentration measured in 2015 at this location was 50.8 µg/m$^3$. MAN13 is a roadside monitoring site located approximately 2m from the M56 between Junction 4 and Junction 5. The $NO_2$ annual mean concentration measured in 2015 at this location was 48.9 µg/m3.

5.6.4 Trend analysis of data from continuous monitoring sites was undertaken to determine the most suitable future year projections to use in the local air quality assessment. Trend analysis indicated that there is a statistically significant downward trend in annual mean $NO_2$ concentrations adjacent to the M60. Comparison of various future year projection methods with annual mean $NO_2$ concentrations interpolated from monitored trends at roadside CMS sites indicates that the Highways England IAN 170/12v3 LTTE6 future year projections are likely to be the most appropriate for the assessment of the cumulative worst case and 'M56 J6-8 Only' scenarios. Further details on trend analysis are provided in Appendix B.2

**M60 J24-4 Geographical Study Area**

5.6.5 Air quality monitoring data from passive diffusion tubes in the M60 J24-4 geographical study area are presented in Appendix B.2, shown on Figure 5.3 – M60 J24-4, colour coded by the 2015 annual mean $NO_2$ concentration, and summarised below. There are no CMS within 200m of the ARN in the study area.

5.6.6 In 2015, two of the local authority diffusion tube sites (SK20 and T13) within the M60 J24-4 geographical study area measured concentrations above the annual mean $NO_2$ UK AQS objective. These diffusion tube sites are located with the greater Manchester AQMA. Site SK20 is an urban background monitor operated by SMBC, which is located approximately 35m north of the M60, east of Junction 2. Site T13 is a roadside site, operated by TMBC, which is located 2m north of the A635, and approximately 180m east of the M60 at Junction 23. The 2015 $NO_2$ annual mean concentration measured by these monitors was 44.0 µg/m$^3$ and 42.5 µg/m$^3$ respectively. The locations of the local authority monitoring sites which measured exceedances of the annual mean $NO_2$ AQS objective are shown in the constraints map in Figure 5.3 – M60.

5.6.7 Trend analysis of data from continuous monitoring sites was undertaken to determine the most suitable future year projections to use in the local air quality assessment. Trend analysis indicated that there is a statistically significant downward trend in annual mean $NO_2$ concentrations adjacent to the M60. Comparison of various future year projection methods with annual mean $NO_2$ concentrations interpolated from monitored trends at roadside CMS sites indicates that the Highways England IAN 170/12v3 LTTE6 future year projections are likely to be the most appropriate for the assessment of the 'M60 J24-4' scenario. Further details on trend analysis are provided in Appendix B.2.

### M62 J10-12 Geographical Study Area

5.6.8 The locations of air quality monitoring data collection in 2015 (the modelled base year) in the M62 J10-12 geographical study area are presented in Appendix B.2 and shown Figure 5.3.

5.6.9 In 2015, 11 of the 37 local authority diffusion tube measurements, and 2 of the 3 CMS measurements within the M62 J10-12 geographical study area measured exceedances of the annual mean NO2 UK AQS objective. These include Salford sites SA34 and M60, Wigan site 52, St Helens site AN2 and Warrington site DT6 which were used within the model verification. Salford site SA34 is a roadside diffusion tube site, just off Rooke Street immediately east of J11 of the M60, approximately 8m back from the junction. Salford M60 is a roadside continuous monitoring site, located approximately 18m west of the M60, approximately 300m north of M60 J13. Wigan site 52 is a roadside diffusion tube site located approximately 3m back from the B5207 and 30m from the A580 between Lowton Heath and Lane Head. St Helens site AN2 is a roadside continuous monitoring site located approximately 3m from Southworth Road and 10m from the M6. Warrington site DT6 is a roadside diffusion tube site located approximately 8m from the M6 at J21, Martinscroft. The remaining 8 sites which exceeded the AQS objective but are not used in the verification include Salford SA 20, SA 21 and SA 22, which are diffusion tube sites co-located with the M60 CMS site, St Helens T10 and St Helens T7, both co-located with site AN2 on Southworth Road.and Warrington DT 44, 45 and 46 which are located on Winwick Road (DT44 and DT45) and Long Lane (DT46), which are further than 200m from the ARN and so not within the study area for the assessment. The locations of the local authorities monitoring sites which measured exceedances of the annual mean NO2 AQS objective are shown in the constraints map in Figure 5.3.

5.6.10 Trend analysis of data from continuous monitoring sites was undertaken to determine the most suitable future year projections to use in the local air quality assessment. Trend analysis indicated that there is a statistically significant downward trend in annual mean $NO_2$ concentrations adjacent to the M62. Comparison of various future year projection methods with annual mean $NO_2$ concentrations interpolated from monitored trends at roadside CMS site indicates that the Highways England IAN 170/12v3 LTTE6 future year projections are likely to be the most appropriate for the assessment of the cumulative worst case. Further details on trend analysis are provided in Appendix B.2.

## Highways England Monitoring

### M56 J6-8 Geographical Study Area

5.6.11 Highways England have undertaken a series of $NO_2$ diffusion tube surveys in the M56 J6-8 geographical study area between 2013 and 2016 to inform the assessment of Highways England schemes, including:

- M56 Junction 6 to Junction 8;
- M6 Junction 19 Improvement;
- Manchester Managed Motorway;
- A556; and
- M60 Junction 24 to Junction 27.

5.6.12 The measured period means for each of these surveys have been calculated and then annualised in accordance with the methodology within LAQM.TG(16) to provide 2015 annual means for use in verification.

5.6.13 The annualised and bias adjusted $NO_2$ concentrations for 2015 are provided in Appendix B.3. The results indicate that, at the 87 Highways England diffusion tube sites with data within the M56 J6-8 geographical study area, there were 25 exceedances of the annual mean AQS objective in 2015. The majority of these exceedances are located at roadside locations adjacent to the M56 between Junction 6 and Junction 3, and along the A5103 between the M56 and M60. Additional isolated exceedances were measured at roadside locations: east of the M60 just south of Junction 9; adjacent to the A538 near M56 Junction 6; and adjacent to the now bypassed A556 (near to where it meets the M6). The locations of the Highways England survey diffusion tubes which measured exceedances of the $NO_2$ AQS objective in 2015 are shown in the constraints map in

Figure 5.3 – M56 J6-8.

**M60 J24-4 Geographical Study Area**

5.6.14 Highways England carried out an $NO_2$ diffusion tube survey in the M60 J24-4 geographical study area between 2013 and 2015 in support of the M60 Junction 24 to Junction 27 scheme.

5.6.15 The measured period means for the most recent 12 months of data obtained during this survey have been calculated and then annualised in accordance with the methodology within LAQM.TG(16) to provide 2015 annual means for use in verification.

5.6.16 The annualised and bias adjusted $NO_2$ concentrations for 2015 are provided in Appendix B.3. The results indicate that of the 23 highways England diffusion tubes within the M60 J24-4 geographical study area, only a single exceedance of the annual mean AQS objective was recorded at the monitoring site M60J24J27_029_0813. This site was located 5m from the A5145 Didsbury Road, approximately 120m north of the M60 at Junction 1. The 2015 annual mean $NO_2$ concentration for this site was calculated to be 40.4 $\mu g/m^3$.

**M62 J10-12 Geographical Study Area**

5.6.17 Highways England have undertaken a series of $NO_2$ diffusion tube surveys in the M62 J10-12 geographical study area between 2013 and 2016 to inform the assessment of Highways England schemes, including:

- M62 Junction 10 to Junction 12;
- M6 Junction 21A to Junction 26;
- M6 Junction 19 Improvement;
- Manchester Managed Motorway;

5.6.18 The measured period means for each of these surveys have been calculated and then annualised in accordance with the methodology within LAQM.TG(16) to provide 2015 annual means for use in verification.

5.6.19 The annualised and bias adjusted $NO_2$ concentrations for 2015 are provided in Appendix B.3. The results indicate that, at the 107 HE diffusion tube sites with data within the M62 J10-12 geographical study area, there were 34 exceedances of the annual mean AQS objective in 2015. The majority of these exceedances are located at roadside locations adjacent to the M62 between Junction 9 and Junction 12, the M60 between Junction 11 and Junction 14 and along the A575 through Worsley between the A572 and A580, and the M6 between J21a and J23 alongside Newton-le-Willows, and between J18 and J19. There are also some isolated exceedances; one adjacent to the M602 between Junction 1 and Junction 2, one adjacent to the A572 just west of Junction 13 of the M60 and one on Penny Lane where it crossed the A580. The locations of the Highways England survey diffusion tubes which measured exceedances of the $NO_2$ AQS objective in 2015 are shown in the constraints map in Figure 5.3-M62 J10-12.

## Ecological Designations

**M56 J6-8 Geographical Study Area**

5.6.20 There are no designated ecological sites are located within 200m of the cumulative worst case or 'M56 J6-8 Only' ARNs, which contain habitats sensitive to NOx and nitrogen deposition.

**M60 J24-4 Geographical Study Area**

5.6.21 There is a single designated site of national importance, Hollinwood Branch Canal (SSSI), within 200m of the Scheme ARN, containing habitats sensitive to airborne NOx and nitrogen deposition. Critical loads for nitrogen deposition are available from the APIS website. The recommended UNECE critical loads for the main habitat type have been selected (where available) and these are set out in Table B16 in Appendix B.2.

5.6.22 Baseline annual average NOx concentrations at this site, the Hollinwood Branch Canal SSSI,

exceed the vegetation objective of 30 µg/m$^3$.

**M62 J10-12 Geographical Study Area**

5.6.23 There are three designated ecological sites within the M62 J10-12 geographical study area which contains habitats sensitive to NOx and nitrogen deposition, the Holcroft Moss SSSI/Manchester Mosses SAC, the Rixton Clay Pits SSSI, and the Woolston Eyes SSSI.

5.6.24 The critical loads for nitrogen deposition along with background nitrogen deposition and NOx at the designated ecological site are shown in Table B-17 in Appendix B.2. These show that the average background deposition already exceeds the lower band of the critical load at all five sites. The upper band is exceeded at all sites except for Woolston Eyes SSSI. The annual average NOx concentration is below the vegetation objective of 30 µg/m$^3$ at all three sites.

## 5.7 Sensitivity of resource

5.7.1 Receptors that are potentially sensitive to changes in annual mean air pollutant concentrations are defined in DMRB HA207/07 as residential properties, schools, hospitals and designated species or habitats within a designated ecological site located within 200mof a Scheme ARN or construction sites. The assessment considers the impacts of the cumulative worst case and 'scheme' scenarios at such defined receptors. These locations can all be considered to be of potentially high sensitivity.

## 5.8 Assumptions and limitations

5.8.1 A discussion of the limitations of the dispersion modelling is provided above in Section 4.3. Model verification has been carried out to minimise, where possible, uncertainties in the modelling and adjustment of the model output has been undertaken to account for local factors unable to be represented in the modelling. It was demonstrated that post adjustment the modelled and monitored results at verification locations showed good agreement.

5.8.2 Assumptions regarding the traffic data have been set out in the "Traffic Data" section in Section 5.6 with addition details provided in Appendix B.6.

## 5.9 Design and mitigation measures

### Construction

5.9.1 This EAR is supported by an Outline Environmental Management Plan (OEMP), that details secondary and tertiary mitigation measures that will be implemented during the construction phase to reduce potential air quality impacts associated with construction activities. The OEMP will be developed further going forwards and will form the basis for the Delivery Partner's Construction Environmental Management Plan (CEMP).

## 5.10 Potential operational effects

### Local Air Quality Assessment

5.10.1 The estimated concentrations from explicitly modelled road sources at receptors have been combined with background concentrations and compared with relevant air quality thresholds to determine whether there are likely to be any exceedances of the annual mean $NO_2$ AQS objective.

**M56 J6-8 Geographical Study Area**

5.10.2 Results within the M56 J6-8 geographical study area are presented in detail for the 'cumulative worst case' and 'M56 J6-8 Only' scenarios assessed in table B45 and B48 in Appendix B.5 and Figure 5.5 – M56 J6-8 and 5.6 M56 J6-8, respectively. The results tables in the appendices indicate which figure each modelled receptor can be found.

*'Cumulative worst case*

5.10.3 The modelling results show that estimated concentrations exceed the $NO_2$ annual mean AQS objective of 40 µg/m$^3$ at 37 modelled receptors in the base year (2015) and 12 receptors in the opening year (2020), either with or without the 'cumulative worst case'.

5.10.4 The maximum concentration in the opening year was estimated to be 47.8 µg/m$^3$ in the Do-Minimum and 48.4 µg/m$^3$ in the 'core' scenario at receptor M56 - R137, equating to a change of 0.6 µg/m$^3$, which is a 'small increase' according to the criteria in Table 5.1. Receptor M56 - R137 is located approximately 30m north-east of the M6, between Junction 19 and 20. Additionally receptor M56-R147 (located north west of the M6 south of Junction 20) is predicted to experience an increase of 0.5 µg/m$^3$ on a Do-Minimum concentration of 42.4 µg/m$^3$, which is a small increase. These two locations are the only small increases at locations which already exceed in the M56 geographical study area. These changes are as a result of increased traffic flows on the M6 of approximately 3000 AADT in the cumulative worst case. This change in concentration is likely to be conservative as along the M6 corridor the three North West SMP Scheme scenario results in lower increases in traffic (1300 AADT less) and so the change is likely to be lower than that predicted in the cumulative worst case.

5.10.5 On the M56 itself the maximum concentration in the opening year was estimated to be 41.7 µg/m$^3$ at receptor M56-R68 in both the Do-Minimum and 'cumulative worst case'. Receptor M56-R68 is located on Greenwood Road, approximately 60m east of the M56 between Junction 4 and Junction 3A. Receptor M56 – R68 is expected to experience an increase in annual mean NO2 concentrations of 0.1 µg/m$^3$, which can be described as 'imperceptible' according to the criteria in Table 5.1. Under the three North West SMP Scheme scenario actual traffic changes would be slightly higher on this section, with an additional increase in traffic between Junction 3 and 5 of around 550 AADT – however, as the cumulative worst case increased traffic by over 3000 AADT and the change in concentration was imperceptible, then this additional increase would still not result in anything other than an imperceptible change.

5.10.6 All other receptors where an exceedance of the annual mean AQS objective is modelled to occur in the opening year (2020), have modelled changes in annual mean $NO_2$ concentrations between -0.1 and 0.0 µg/m$^3$ and can be described as 'imperceptible' according to the criteria in Table 5.1.

5.10.7 At the remaining 127 modelled receptors, where concentrations are estimated to be below the $NO_2$ annual mean AQS objective, changes in concentrations are also estimated to be 'imperceptible' (i.e. less than or equal to 0.4µg/m$^3$). The largest changes in annual mean $NO_2$, 0.4 µg/m$^3$, are modelled to occur at two locations: at receptor M56-R20, which represents an isolated residential property approximately 100m northeast of the southbound off-slip from the M6 to the M56; and at receptor M56-R39, which represents an isolated residential property on Hasty Lane approximately 60m east of the M56 between Junction 5 and Junction 6.

*'M56 J6-8 Only' Scenario*

5.10.8 The modelling results show that estimated concentrations exceed the $NO_2$ annual mean AQS objective of 40 µg/m$^3$ at 37 receptors in the base year (2015), at 11 receptors in the opening year (2020) without the 'M56 J6-8 Only' scenario and 13 receptors in the opening year (2020) with the 'M56 J6-8 Only' scenario.

5.10.9 The maximum concentration in the opening year was estimated to be 47.8 µg/m$^3$ in the Do-Minimum and 47.6 µg/m$^3$ at receptor M56 – R137. Receptor M56 – R137 is located approximately 30m north-east of the M6, between Junction 19 and 20. On the M56 itself, the maximum concentrations in the opening year (2020) were estimated to be 41.7 µg/m$^3$ at receptor M56-R68 without the 'M56 J6-8 Only' scenario and 42.1 µg/m$^3$ with the 'M56 J6-8 Only' scenario. Receptor M56-R68 is located on Greenwood Road, approximately 60m east of the M56 between Junction 4 and Junction 3A.

5.10.10 The modelled changes in annual mean $NO_2$ concentrations at those receptors where an exceedance of the annual mean AQS objective is modelled to occur in the opening year (2020), range between -0.2 and +0.4 µg/m$^3$ and can therefore be described as 'imperceptible' according to the criteria in Table 5.1.

5.10.11 At the remaining 125 modelled receptors, where concentrations are estimated to be below the

$NO_2$ annual mean AQS objective in the opening year (2020), changes in concentrations are also estimated to be 'imperceptible' (i.e. less than or equal to 0.4µg/m$^3$), at all but one receptor. The largest change in annual mean $NO_2$, 0.6 µg/m$^3$, is modelled to occur at receptor M56-R39, which represents an isolated residential property on Hasty Lane approximately 60m east of the M56 between Junction 5 and Junction 6. A change of this magnitude can be described as 'small' according to the criteria in Table 5.1, while the total concentration is below the objective.

**M60 J24-4 Geographical Study Area**

5.10.12 Results within the M60 J24-4 geographical study area are presented in detail in Table B46 in Appendix B.5 and shown on Figure 5.5 – M60 J24-4. The results tables in the appendices indicate which figure each modelled receptor can be found.

5.10.13 The modelling results show that estimated concentrations exceed the annual mean $NO_2$ AQS objective of 40µg/m$^3$ at three modelled receptors in the base year (2015), but that no exceedances of the annual mean $NO_2$ AQS objective are modelled to occur in the opening year (2020), either with or without the Scheme. The maximum concentrations in the opening year (2020) were estimated to be 35.6 µg/m$^3$ (without the Scheme) and 35.7 µg/m$^3$ (with the Scheme) at receptor M60-R33, which is located approximately 80m east of the M60 at Junction 23, 40m east of the southbound M60 off-slip and 40m north of the A653.

5.10.14 In line with IAN 174/13, significant air quality effects need only be identified for receptors where air quality thresholds are exceeded in either the do-minimum or do-something scenarios. As such, all changes in $NO_2$ annual mean concentrations at human health receptors are considered not to be significant.

5.10.15 Although there are no exceedances of the annual mean $NO_2$ AQS objective, changes in concentrations have been evaluated in line with IAN 174/13. Of the 54 human health receptors modelled within the M60 J24-4 geographical study area, five receptors (M60-R11, R17, R22, R25 and R50) were estimated to experience a 'small increase' in annual mean $NO_2$ concentration according to the criteria in Table 5.1 (of between 0.5 and 0.7 µg/m$^3$ respectively). One receptor, M60-R5, was estimated to experience a "small decrease" in annual mean $NO_2$ concentrations (-0.5 µg/m$^3$). The remaining 48 receptors were modelled to experience an 'imperceptible' change in annual mean $NO_2$ concentration (i.e. a change less than or equal to 0.4µg/m$^3$).

**M62 J10-12 Geographical Study Area**

5.10.16 Results within the M62 J10-12 geographical study area are presented and described in detail in Appendix B.5, Table B-47 and shown on Figure 5.3. The results tables in the appendices indicate which figure each modelled receptor can be found. Where an annual mean concentration is above 40 µg/m$^3$ and there is a greater than imperceptible change in pollutant concentrations the predicted cumulative worst case scenario concentration is shown after the receptor name along with colour coding indicating the scale of change (i.e. small, medium or large). Otherwise, where locations are just colour coded, with no numerical value after the name, annual mean concentrations are below 40 µg/m$^3$. This section describes the general pattern of changes within this geographical study area. This section also describes only those locations with a qualifying change in $NO_2$ concentration (i.e. small, medium or large change) in air quality at a location predicted to be above the $NO_2$ annual average air quality objective.

5.10.17 The modelling results show that estimated concentrations exceed the $NO_2$ annual mean AQS objective of 40 µg/m$^3$ at 163 modelled receptors in the base year (2015), 46 receptors in the opening year (2020) without the scheme and 47 receptors in the opening year with the 'core' scenario. The maximum concentration in the opening year was estimated to be 68.4 µg/m$^3$ at receptor M6 – ER3 in the Do-Minimum scenario and 71.1 µg/m$^3$ in the 'cumulative worst case'. Receptor M6 – ER3 is located at Martinscroft, approximately 7m east of the M6 between J21 and J21A. The modelled changes in annual mean $NO_2$ concentrations at those receptors where an exceedance of the annual mean AQS objective is modelled to occur in the opening year (2020), are up to 0.3 µg/m$^3$ at 35 out of the 47 receptors and can therefore be described as 'imperceptible' according to the criteria in Table 5.2.

5.10.18 Two medium increases and one small increase in annual mean $NO_2$ concentrations are predicted at Martinscroft under the three scheme scenario at concentrations predicted to be above the air quality objective for annual average $NO_2$ concentrations. These receptors (M6 – ER1 (small

increase), M6 – ER2 (medium increase) and M6 – ER3 (medium increase)) are located at Martinscroft between J21 and 21A on the M6.

5.10.19 Five small increases in annual mean concentrations of $NO_2$ at receptors above the objective value are predicted. These are at receptors located at Sandsfields Cottages at M6 J21a (M62 – R69) ), at M6 J22 (M6-R98), and on Kenyons Lane North at Haydock, next to the A580, west of the M6 (M62 – R2455, M62 – ER4 and M62 – ER5).

5.10.20 Five small decreases in annual mean concentrations of $NO_2$ at receptors above the objective value are predicted, with reductions between 0.8 and 1.5 $\mu g/m^3$ predicted at these receptors. These receptors are M62 - R1998 (located on Summercroft Close, Goldborne, next to the A580 east of the M6), M62 – R2058 (located on A574, next to the junction with the A580 east of the M6) and M62 R2324-2326 (located along Liverpool Road, the A57 at Peel Green, east of the M60 J11).

5.10.21 The following sections discuss the main areas of exceedance with worsening from the scheme effects.

*A57 Manchester Road East of J21 and West of M60*

5.10.22 A total of 47 receptors were considered alongside the A57 Manchester Road, east of J21 to the M60. Annual mean concentrations of $NO_2$ are predicted to be above the 40 $\mu g/m^3$ annual $NO_2$ objective at 3 of these receptors without the scheme in place. These three receptors are located just off the A57 immediately west of Junction 11 with the M60, and are within 10m of the existing highway boundary (M62 - R2324, M62 - R2325 and M62 - R2326, refer to Figure 5.3 - M62 J10-12, Map 9).

5.10.23 With the cumulative worst case in place, small decreases in pollutant concentrations are predicted at these three receptors (-0.9 to -1.5 $\mu g/m^3$), resulting in concentrations with the scheme in place below the annual $NO_2$ objective at M62 - R2324 (38.9 $\mu g/m^3$), but still above the objective at M62 - R2325 and M62 - R2326 (42.9 and 40.8 $\mu g/m^3$ respectively). The predicted improvements here are due to a decrease in AADT flow of approximately 2,600 vehicles along the A57.

5.10.24 As the annual mean concentrations remain below 60 $\mu g/m^3$ with and without the cumulative worst casein 2020, it is predicted that the hourly mean $NO_2$ objective (200 $\mu g/m^3$) is unlikely to be exceeded at these three receptors, with and without the scenario in operation.

5.10.25 Concentrations at the other 44 receptors in this area are predicted to remain below an annual average $NO_2$ concentration of 40 $\mu g/m^3$.

5.10.26 As concentrations are predicted to be below 60 $\mu g/m^3$ with and without the cumulative worst case in 2020, it is predicted that the hourly mean $NO_2$ objective (200 $\mu g/m^3$) is unlikely to be exceeded at these receptors, with and without the scenario in operation.

*A580 between the Junction with the A573 and the Junction with the A572 at Golborne*

5.10.27 A total of 19 receptors were considered alongside the A580 between junction 23 of the M6 and the junction with the A572. Annual mean concentrations of $NO_2$ are predicted to be above the 40 $\mu g/m^3$ annual $NO_2$ objective at 1 of these receptors (M62 - R1998, refer to Figure 5.3- M62 J10-12, Map 20) with the cumulative worst casein operation, located on Summercroft Close in Golborne.

5.10.28 With the cumulative worst casein place, a small decrease in pollutant concentrations (-0.8 $\mu g/m^3$) is predicted at this receptor, due to a decrease in AADT flow of approximately 2,100 vehicles along the A580, resulting in a concentration with the scheme in place of 40.5 $\mu g/m^3$.

5.10.29 Concentrations at the other 18 receptors in this area are predicted to remain below an annual average $NO_2$ concentration of 40 $\mu g/m^3$. As concentrations are predicted to be below 60 $\mu g/m^3$ with and without the cumulative worst casein 2020, it is predicted that the hourly mean $NO_2$ objective (200 $\mu g/m^3$) is unlikely to be exceeded at these receptors, with and without the cumulative worst case in operation.

5.10.30 As concentrations are predicted to be below 60 $\mu g/m^3$ with and without the cumulative worst case

in 2020 PCM exceeded, with and without the cumulative worst case in operation.

*A580 between the Junction with the A574 and the Junction with the A572 at Boothstown*

5.10.31 A total of 20 receptors were considered alongside the A580 between the junction with the A574 to the junction with the A572. Annual mean concentrations of $NO_2$ are predicted to be above the 40 $\mu g/m^3$ annual $NO_2$ objective at one of these receptors (M62 - R2058, refer to Figure 5.3 – M62 J10-12, Map 22) with the cumulative worst case in operation, located at the junction with the A574.

5.10.32 With the cumulative worst case in place, a small decrease in pollutant concentrations (-1.2 $\mu g/m^3$) is predicted at this receptor, due to a decrease in AADT flow of approximately 2,450 vehicles along the A580, resulting in a concentration with the scheme in place of 40.2 $\mu g/m^3$.

5.10.33 Concentrations at the other 19 receptors in this area are predicted to remain below an annual average $NO_2$ concentration of 40 $\mu g/m^3$. As concentrations are predicted to be below 60 $\mu g/m^3$ with and without the cumulative worst case in 2020 at all 19 receptors, it is predicted that the hourly mean $NO_2$ objective (200 $\mu g/m^3$) is unlikely to be exceeded, with and without the cumulative worst case in operation.

A580 between the Junction with the A58 to M6 J23

5.10.34 A total of 73 receptors were considered alongside the A580 between the junction with the A58 and M6 J23. Annual mean concentrations of $NO_2$ are predicted to be above the 40 $\mu g/m^3$ annual $NO_2$ objective at 3 of these receptors (M62 - R2455, M62 - ER4, and M62 - ER5, refer to Figure 5.3 M62 Map 20A) with the cumulative worst case scenario in operation, located on the A580 at Haydock.

5.10.35 With the cumulative worst case in place, small increases in pollutant concentrations (+0.5–0.6 $\mu g/m^3$) are predicted at these receptors. The effect of this is to create one new exceedance of the annual $NO_2$ objective. These changes are due to an increase in AADT flow of approximately 350 vehicles along the A580, and an increase in HDV AADT flow of approximately 200 vehicles, resulting in concentrations with the scheme in place ranging from 40.2 – 42.4 $\mu g/m^3$.

5.10.36 Concentrations at the other 70 receptors in this area are predicted to remain below an annual average $NO_2$ concentration of 40 $\mu g/m^3$. As concentrations are predicted to be below 60 $\mu g/m^3$ with and without the cumulative worst case scenario in 2020 at all 11 receptors, it is predicted that the hourly mean $NO_2$ objective (200 $\mu g/m^3$) is unlikely to be exceeded, with and without the scenario in operation.

M6 J22 to J23

5.10.37 A total of 31 receptors were considered alongside the M6 between J22 and J23. Annual mean concentrations of $NO_2$ are predicted to be above the 40 $\mu g/m^3$ annual $NO_2$ objective at 3 of these receptors, located on Southworth Road (M6 - R61, M6 - R112), and Winwick Lane (M6 - R98) with the cumulative worst case scenario in operation, refer to Figure 5.3 M62 Maps 60 and 60A.

5.10.38 Small increases in pollutant concentrations are predicted at the remaining receptor on Winwick Lane (+1.2 $\mu g/m^3$). These changes are due to an increase in AADT flow of approximately 23,700 vehicles along the M6, and result in concentrations that range from 42.4 to 50.0 $\mu g/m^3$.

5.10.39 With the three scheme scenario in place, imperceptible increases in pollutant concentrations are predicted at the 2 receptors on Southworth Road.

5.10.40 Concentrations at the other 28 receptors in this area are predicted to remain below an annual average $NO_2$ concentration of 40 $\mu g/m^3$. As concentrations are predicted to be below 60 $\mu g/m^3$, it is anticipated that the hourly mean $NO_2$ objective (200 $\mu g/m^3$) is unlikely to be exceeded at these receptors.

M6 J21A to J22

5.10.41 A total of four receptors were considered alongside the M6 between J21A and J22. Annual mean concentrations of $NO_2$ are predicted to be above the 40 µg/m$^3$ annual $NO_2$ objective at 1 of these receptors, located at Sandsfields Cottage (M6 - R69, refer to Figure 5.3 M62 Map 5) with the cumulative worst case scenario in operation.

5.10.42 With the cumulative worst case scenario in place, a small increase in pollutant concentrations are predicted at this receptor (+1.9 µg/m$^3$), due to an increase in AADT flow of approximately 23,050 vehicles along the M6, resulting in a concentration of 42.0 µg/m$^3$.

5.10.43 Concentrations at the other receptor in this area are predicted to remain below an annual average $NO_2$ concentration of 40 µg/m$^3$. As concentrations are predicted to be below 60 µg/m$^3$ with and without the cumulative worst case scenario in 2020, it is anticipated that the hourly mean $NO_2$ objective (200 µg/m$^3$) is unlikely to be exceeded at these receptors, with and without the cumulative worst case scenario in operation.

M6 J21 to J21A

5.10.44 A total of 19 receptors were considered alongside the M6 between J21 and 21A. Annual mean concentrations of $NO_2$ are predicted to be above the 40 µg/m$^3$ annual $NO_2$ objective at 3 of these receptors. These three receptors are located just off Nichol Avenue at Martinscroft Moss, and are within 10m of the existing highway boundary (M6 - ER1, M6 - ER2 and M6 - ER3, refer to Figure 5.3 M62 Maps 14 and 15).

5.10.45 With the three scheme scenario in place, small to medium increases in pollutant concentrations are predicted at these three receptors (+1.8 to +2.7 µg/m$^3$), resulting in concentrations with the scheme in place that range from 63.4 to 71.1 µg/m$^3$, due to an increase in AADT flow of approximately 6,000 vehicles along the M6.

5.10.46 As the annual mean concentrations remain above 60 µg/m$^3$ in 2020, it is anticipated that the hourly mean $NO_2$ objective (200 µg/m$^3$) may be exceeded at these three receptors.

5.10.47 Concentrations at the other 16 receptors in this area are predicted to remain below an annual average $NO_2$ concentration of 40 µg/m$^3$. As concentrations are predicted to be below 60 µg/m$^3$ with and without the cumulative worst case scenario in 2020, it is anticipated that the hourly mean $NO_2$ objective (200 µg/m$^3$) is unlikely to be exceeded at these receptors, with and without the cumulative worst case scenario in operation.

## Designated Ecological Sites

### M56 J6-8 Geographical Study Area

5.10.48 No designated ecological sites were identified within 200m of the 'cumulative worst case' or 'M56 J6-8 Only' ARNs, therefore, no assessment of the effect of these scenarios on ecological sites has been undertaken within the M56 J6-8 Geographical Study Area.

### M60 J24-4 Geographical Study Area

5.10.49 The assessment has shown that there are exceedances of the annual mean NOx UK AQS objective of 30 µg/m$^3$ for the protection of vegetation in the base year (2015) and opening year 2020, either with or without the Schemes, at the closest locations to the M60 within the Hollinwood Branch Canal SSSI.

5.10.50 The maximum change in annual mean NOx concentrations within the Hollinwood Branch SSSI (E1) is 0.8 µg/m$^3$. In accordance with IAN 174/13, as this change is greater than 0.4 µg/m$^3$, the effect on nutrient nitrogen deposition at this location has been estimated. The change in nitrogen deposition at the closest point in the Hollinwood Branch SSSI to the M60 as a result of the Scheme is estimated to be less than 1% of the most relevant critical load, and is therefore considered unlikely to be significant.

5.10.51 The annual mean NOx and nitrogen deposition results for all modelled ecological receptors are presented in detail in Table B49 and B50 in Appendix B.5.

**M62 J10-12 Geographical Study Area**

5.10.52 The assessment has shown that the annual mean NOx UK AQS objective of 30µg/m$^3$ for the protection of vegetation is achieved in the base year (2015) at locations further than 149m back from the 'cumulative worst case' ARN within the Holcroft Moss SSSI/Manchester Mosses SAC; at locations further than 10m back from the ARN within the Rixton Clay Pits SSSI/SAC; at locations further than 170m back from the ARN within Woolston Eyes 1; and at no locations within 200m of the ARN within Woolston Eyes 2.

5.10.53 The annual mean NOx UK AQS objective of 30 µg/m$^3$ for the protection of vegetation is achieved in the opening year (2020) at locations further than 69m back from the ARN without the scheme in place, and in the opening year with the scheme in place at locations further than 79m back from the ARN. The maximum change in annual mean NOx concentrations at this designated ecological site, within 200m of the ARN, is 3.7 µg/m$^3$, at the transect location closest to the road centreline (Holcroft_Moss_SSSI_Manchester_Mosses_SAC_19m) in the 'cumulative worst case'.

5.10.54 The annual mean NOx UK AQS objective of 30µg/m$^3$ for the protection of vegetation is achieved in the opening year (2020) with or without the 'cumulative worst case', at locations closest to the 'core' scenario ARN within the Rixton Clay Pits SSSI/SAC site. The maximum change in annual mean NOx concentrations at this designated ecological site, within 200 metres of the ARN, is -1.3µg/m$^3$, at the transect location closest to the road centreline (Rixton_Clay_Pits_SSSI_SAC_0m) in the 'cumulative worst case'.

5.10.55 The annual mean NOx UK AQS objective of 30µg/m$^3$ for the protection of vegetation is achieved in the opening year (2020) at locations further than 80 m back from the ARN with or without the 'cumulative worst case', within the Woolston Eyes 1 site. The maximum change in annual mean NOx concentrations at this designated ecological site, within 200 metres of the ARN, is +1.2 µg/m$^3$, at the transect location closest to the road centreline (Woolston_Eyes_1_0m) in the 'cumulative worst case'.

5.10.56 The annual mean NOx UK AQS objective of 30µg/m$^3$ for the protection of vegetation is achieved in the opening year (2020) at locations further than 155 m back from the ARN without the 'cumulative worst case', and 160 m back from the ARN with the 'cumulative worst case' within the Woolston Eyes 1 site. The maximum change in annual mean NOx concentrations at this designated ecological site, within 200 metres of the ARN, is +3.6µg/m$^3$, at the transect location closest to the road centreline (Woolston_Eyes_2_0m) in the 'cumulative worst case'.

5.10.57 In line with IAN 174/13, where changes are greater than 0.4 µg/m$^3$, then effects are considered to be perceptible and as such nitrogen deposition has been calculated. This is the case at all sites considered,

5.10.58 The maximum change in annual nitrogen deposition at Holcroft Moss SSSI/Manchester Mosses SAC, within 200m of the ARN, is 0.19 kg N ha-1 yr-1, at the transect location closest to the road centreline (Holcroft_Moss_SSSI_Manchester_ Mosses_SAC_19m) in the 'cumulative worst case'.

5.10.59 The maximum change in annual nitrogen deposition at the Rixton Clay Pits SSSI/SAC, within 200 metres of the ARN, is -0.08 kg N ha-1 yr-1, at the transect location closest to the road centreline (Rixton_Clay_Pits_SSSI_SAC_0m) in the 'cumulative worst case'.

5.10.60 The maximum change in annual nitrogen deposition at Woolston Eyes 1, within 200m of the ARN, is +0.05 kg N ha-1 yr-1, at the transect location closest to the road centreline (Woolston_Eyes_1_0m) in the 'cumulative worst case'.

5.10.61 The maximum change in annual nitrogen deposition at Woolston Eyes 2, within 200m of the ARN, is +0.13 kg N ha-1 yr-1, at the transect location closest to the road centreline (Woolston_Eyes_2_0m) in the 'cumulative worst case'.

5.10.62 The annual mean NOx concentrations and Nitrogen Deposition results for all modelled ecological receptors are presented in detail in Table B51 in Appendix B.5 for the 'cumulative worst case' scenario.

5.10.63 Additional discussion of the air quality predictions for these designated ecosystem sites is presented in the Chapter 6 - Ecology. Overall no significant effects are identified.

## Compliance Risk Assessment

M56 J6-8 Geographical Study Area

5.10.64 Within the M56 J6-8 geographical study area, there are not expected to be any Defra PCM model links that exceed the annual mean $NO_2$ EU limit value in the opening year (2020) which coincide with the air quality study area. It is therefore concluded that there is no risk of the core cumulative worst case scenario affecting compliance with the EU Directive on ambient air quality within the M56 J6-8 geographical study area.

**M60 J24-4 Geographical Study Area**

5.10.65 According to the Defra PCM model, exceedances of the annual mean $NO_2$ EU limit value are projected to occur in the modelled opening year (2020) adjacent to a small number of road links within the M60 J4-4 geographical study area, which are coincident with the ARN for the Proposed Scheme.

5.10.66 In accordance with IAN 175/13, the potential risk of the Proposed Scheme affecting compliance with EU limit values has been assessed by considering the changes in annual mean $NO_2$ concentration at the closest modelled receptors to those links where the EU limit value is projected to be exceeded within the M60 J24-4 geographical study area (M60-R18, R29, R33 and R52). In accordance with IAN 175/13, as the change in annual mean $NO_2$ concentration at these receptors is less than 1% of the annual mean $NO_2$ EU limit value, the overall risk rating associated with the Proposed Scheme is concluded to be "Neutral".

M62 J10-12 Geographical Study Area

5.10.67 Within the M62 J10-12 geographical study area, there is one affected link (the A57) with the Defra PCM model links that exceeds the annual mean $NO_2$ EU limit value in the opening year (2020) which coincides with the ARN.

5.10.68 In accordance with IAN 175/13, the potential risk of the Proposed Scheme affecting compliance with EU limit values has been assessed by considering the changes in annual mean $NO_2$ concentration at the closest modelled receptors to those links where the EU limit value is projected to be exceeded within the M62 J10-12 geographical study area (M62 - R2366). In accordance with IAN 175/13, as the change in annual mean $NO_2$ concentration at these receptors is less than 1% of the annual mean $NO_2$ EU limit value, the overall risk rating associated with the Proposed Scheme is concluded to be "Neutral".

## Regional Air Quality Assessment

5.10.69 Total emissions from roads within the TRA have been estimated for NOx, $PM_{10}$ and $CO_2$ in 2015 (the base year), and with and without the four North West SMP Schemes and 'scheme only' scenarios in 2020 (the opening year) and 2035 (the design year). In addition, the number of vehicle kilometres travelled is given for each scenario.

5.10.70 *'Cumulative worst case'* The results are presented in Table B52 in Appendix B.5. Emissions are shown for the base year 2015 and the without and with the 'cumulative worst case'in 2020 and 2035.

5.10.71 In the opening year (2020) there is a predicted increase in all pollutant emissions of between 0.8-1.7%. This is due to the predicted increase in vehicle kilometres travelled with the 'cumulative worst case'of 1.1% compared to without the schemes.

5.10.72 In the design year (2035) there is a predicted increase in all pollutant emissions of between 1.0-1.9%. This is due to the predicted increase in vehicle kilometres travelled with the 'cumulative worst case'of 1.5% compared to without the schemes.

**'M56 J6-8 Only' Scenario**

5.10.73 The results are presented in Table B53 in Appendix B.5. Emissions are shown for the base year 2015 and the without and with 'M56 J6-8 Only' scenarios in 2020 and 2035.

5.10.74 In 2020, emissions of NOx, $PM_{10}$ and $CO_2$ are all expected to decrease by 0.1%. In 2035, emissions of $CO_2$ and NOx are expected to increase by 0.1% whilst emissions of $PM_{10}$ are expected to rise by <0.1%.

5.10.75 Overall, reductions in emissions of NOx (-63.8%) and $PM_{10}$ (-6.1%) are estimated by 2035 when compared with 2015 emissions. This is in line with the expected reduction in vehicle emissions over time, together with reduced congestion and increased free flow conditions in the 'M56 J6-8 Only' scenario.

5.10.76 There is however expected to be a 7.8% increase in $CO_2$ emissions by 2035 when compared with 2015 emissions. This is in line with the large overall increase in vehicle kilometres travelled of 24.6%.

## 5.11 Further mitigation and enhancement measures

5.11.1 The four North West SMP Schemes (M6 J21a-26, M62 J10-12, M56 J6-8 and M60 J24-4) were all planned to be open within 18 months of each other and hence, to present a robust environmental assessment, these four schemes were initially assessed as one cumulative case for air quality. This was done by using forecast opening year traffic flows which include the cumulative traffic associated with all four North West SMP Schemes with a common 2020 opening year. This traffic dataset is known as the 'cumulative worst case'.

5.11.2 This initial air quality assessment work indicates that the M6 J21a-26 Scheme may be considered significant for air quality. This is because with the M6 J21a-26 Scheme included with the other three North West SMP Schemes there was predicted to be five large changes in nitrogen dioxide concentration at two locations including: two large changes at Newton-le-Willows and three large changes at Nichol Avenue, Martinscroft. The M6 J21a-26 Scheme will therefore not be progressed by Highways England until a suitable mitigation solution is identified.

5.11.3 In addition to developing a suitable mitigated air quality solution for the M6 J21a-26 Scheme, Highways England also requires that any mitigated solution will not change the overall acceptability of the other three North West SMP Schemes for air quality.

5.11.4 This air quality assessment identifies that the remaining three North West SMP Schemes (M62 J10-12, M56 J6-8 and M60 J24-4) can be progressed by Highways England because together these three Schemes do not cumulatively generate significant air quality effects

## 5.12 Residual effects

### Construction impacts

5.12.1 No significant residual effects are expected to occur as a consequence of the M56 J6-8 Scheme construction assuming that appropriate mitigation measures to prevent and control dust emissions are maintained by the Delivery Partner.

### Operational impacts

5.12.2 This air quality assessment identifies that the remaining three North West SMP Schemes (M62 J10-12, M56 J6-8 and M60 J24-4) can be progressed by Highways England because together these three Schemes do not generate significant air quality effects.

5.12.3 For the M56 J6-8 geographical study area, no significant adverse residual effects are expected to occur as a consequence of the Scheme after opening, either under the cumulative worst case or the 'M56 J6-8 only' scenario.

## 5.13 Summary

5.13.1 This section presents the overall significance of effects tables for the three North West SMP Schemes (M62 J10 to 12, M56 J6 to 8 and M60 J24 to 4 Scheme) and should the M56 J6-8 Scheme be progressed in isolation.

**Table 5.3 Number of Receptors With Perceptible Changes in Air Quality above the Objective Value (M56-M60-M62-M6)**

| Magnitude of change in concentration | Number of receptors with: | |
|---|---|---|
| | Worsening of air quality objective already above objective or creation of a new exceedance | Improvement of an air quality objective already above objective or the removal of an existing exceedance |
| Large (>4µg/m$^3$) | 0 | 0 |
| Medium (>2 to 4µg/m$^3$) | 2 | 0 |
| Small (>0.4 to 2µg/m$^3$) | 8 | 5 |

**Table 5.4 Overall Evaluation of Local Air Quality Significance - Cumulative worst case Scenario (M56-M60-M62)**

| Key Criteria Questions | Yes/No |
|---|---|
| Is there a risk that environmental standards will be breached? | Yes<br>It has been estimated that there will be exceedances of the annual mean $NO_2$ UK AQS objective in the base year (2015). In the opening year (2020) without the SMP North West Schemes there would be exceedances, and additional exceedances with the proposed 'cumulative worst case'.<br><br>There are two DEFRA PCM links that exceed in 2020 on the A57 and M61, however predicted changes in concentrations at receptors along these links are imperceptible. There is therefore not expected to be a compliance risk due to the SMP North West Schemes. |
| Will there be a large change in environmental conditions? | No.<br>There are no predicted large changes in the estimated annual mean $NO_2$. |
| Will the effect continue for a long time? | No.<br>There are no predicted large changes in the estimated annual mean $NO_2$. |
| Will many people be affected? | No, there are no large increases, two medium increases and eight small increases, along with five small improvements. All medium and small changes are located in the M62 J10-12 geographical study area, with the exception of two of the small deteriorations which are in the M56 J6-J8 geographical study area (on the M6). |
| Is there a risk that designated sites, areas, or features will be affected? | Yes, this is discussed in the Ecology and Nature Conservation chapter (Chapter 6). No significant effects identified. |
| Will it be difficult to avoid or reduce or repair or compensate for the effect? | No, there are no overall significant air quality effects. |
| On balance is the overall effect significant? | The overall conclusion regarding the effect of the 'cumulative worst case' of the three North West SMP NW Schemes on local air quality is that there would be **no significant adverse effect** on local air quality. The three NW SMP Schemes (M62 J10 to J12, M56 J6 to J8 and M60 J24 to J4 Scheme) are not significant as the majority of questions have been answered with a no and as no compliance risk has been identified. |

5.13.2 The findings of the air quality assessment indicate that the three North West SMP Schemes (M62 J10 to J12, M56 J6 to J8 and M60 J24 to J4 Schemes) are not significant for air quality and these schemes can be progressed, without any additional mitigation.

**Table 5.5 Overall Evaluation of Local Air Quality Significance - 'M56 J6-8 Only' Scenario**

| Key Criteria Questions | Yes/No |
|---|---|
| Is there a risk that environmental standards will be breached? | No.<br>It has been estimated that there will be 37 exceedances of the annual mean $NO_2$ UK AQS objective in the base year (2015). In the opening year (2020) without the M56 J6-8 Scheme there would be 11 exceedances and 13 with the M56 J6-8 Scheme. The maximum concentration with the scheme is 47.6 µg/m$^3$ at M56-R137 (located approximately 30m north-east of the M6, between Junction 19 and 20). However, the change at all locations exceeding the annual mean AQS objective in the opening year is imperceptible.<br><br>There are not expected to be any DEFRA PCM links that exceed the annual mean $NO_2$ EU limit value in 2020 and changes in concentrations as a result of the M56 J6-8 Scheme would not result in exceedances in these years. There is not expected to be a compliance risk due to the M56 J6-8 Scheme. |
| Will there be a large change in environmental conditions? | No.<br>There are no large changes in the estimated annual mean $NO_2$ concentrations with the M56 J6-8 Scheme.<br><br>There is one receptor (out of 137) modelled to experience a small increase in annual mean $NO_2$ with the M56 J6-8 scheme, but concentrations would be below the AQS objective. This is the largest change in annual mean $NO_2$, 0.6 µg/m$^3$, which is modelled to occur at receptor R39, an isolated residential property on Hasty Lane approximately 60m east of the M56 between Junction 5 and Junction 6.<br><br>Changes in annual mean $NO_2$ concentrations at the majority of receptor locations are estimated to be 'imperceptible'. |
| Will the effect continue for a long time? | No.<br>No significant changes to in annual mean $NO_2$ concentrations are modelled to occur. |
| Will many people be affected? | No.<br>No significant changes in annual mean $NO_2$ concentrations are modelled to occur. |
| Is there a risk that designated sites, areas, or features will be affected? | No.<br>There are no designated sites within the M56 J6-8 geographical study area. |
| Will it be difficult to avoid or reduce or repair or compensate for the effect? | No.<br>Since all estimated changes are considered to be insignificant there will be no need to avoid, reduce, repair or compensate residents. |
| On balance is the overall effect significant? | The overall conclusion regarding the effect of the M56 J6-8 Scheme on local air quality is that there **would be no significant adverse effect** on local air quality. |

# 6. Biodiversity

Key features for this topic:

- No significant effects are anticipated on any statutory or non-statutory designated sites as a result of the construction and operation of the Proposed Scheme.
- No significant effects on the favourable conservation status notable and/or legally protected species are anticipated as a result of the construction and operation of the Proposed Scheme.
- Construction will involve temporary loss of habitats within the soft estate, which will have temporary effects on resource availability for notable species, but this is not considered to have a significant effect on the favourable conservation status of these species. However, it will require mitigation and reinstatement.

## 6.1 Introduction

6.1.1 This section summarises the findings of an ecological impact assessment undertaken for the Proposed Scheme. It considers the potential impacts to relevant ecological features identified from desk study and field surveys, the effects of those impacts on important features, outlines recommended mitigation measures and concludes by identifying any potential significant residual effects during construction and/or operation. The important ecological features comprise designated sites for nature conservation (statutory and non-statutory), notable habitats, and notable and/or legally protected species recorded within or near to the proposed works.

6.1.2 The information gathered as part of this ecological impact assessment has been used to inform the Outline Environmental Management Plan (OEMP). The OEMP will be used as a baseline to inform the Construction Environmental Management Plan (CEM which will include details for protected species licences which will be required as part of the Proposed Scheme development.

6.1.3 Highways England is committed to achieving biodiversity gains, as set out in their Biodiversity Plan, which may be achieved through careful consideration of impacts and opportunities during the environmental assessment process for schemes of this type.

6.1.4 This section is supported by:

- Appendix C.1 – M56 Junction 6 to 8: Notable and/or Legally Protected Species Report
- Appendix C.2 – M56 Junction 6 to 8: Smart Motorway Habitat Regulations Assessment
- M56 Junction 6 to 8: Figure 6.1 – Figure 6.4

## 6.2 Study Area

6.2.1 The Environmental Scoping Report details the initial Study Area. This is the spatial extent over which it is considered that significant effects could result from the Proposed Scheme. As the Proposed Scheme has progressed this extent has been refined taking into account the presence and location of ecological features and their potential Ecological Zone of Influence (EZoI) in relation to the Proposed Scheme. This is the area used in the assessment in which ecological features may be subject to impacts from the Proposed Scheme. The potential EZoI of each important feature differs according to the attributes of that feature. These are outlined in Table 6-1.

**Table 6.1 Study Area and EZoI for each ecological feature**

| Ecological Feature | Study Area (from Proposed Scheme) | Zone of Influence (from Proposed Scheme) |
|---|---|---|
| European and internationally designated sites for nature conservation | • Within 2 km<br>• Within 30 km for sites designated for bats | • Within 200 m of the footprint of Proposed Scheme and of air quality affected road network[13], or,<br>• Within river catchment for sites over 200 m but hydrologically connected to the Proposed Scheme, or<br>• Within 30 km for sites for which bats are a qualifying feature |
| Other Statutory designated sites for nature conservation | • Within 2 km | • Within 200 m of the footprint of Proposed Scheme and of air quality affected road network[2], or,<br>• Within river catchment for sites over 200 m but hydrologically connected to the Proposed Scheme |
| Non-statutory designated sites for nature conservation and notable habitats | • Within 1 km<br>• Ancient Woodlands within 200 m | • Within 200 m of the footprint of Proposed Scheme and of air quality affected road network[2],<br>• Within river catchment for sites over 200 m but hydrologically connected to the Proposed Scheme, or,<br>• Ancient Woodland within 15m[14] |
| Notable and /or legally protected species | • Within 500 m | • Great crested newt up to 500m.<br>• Bats up to 50m.<br>• Badger up to 50m<br>• Otter up to 50m<br>• Water vole up to 50m<br>• White clawed crayfish up to 50m |

6.2.2 The Proposed Scheme footprint for this assessment has been taken as the M56 highways boundary between Junction 6 to Junction 8, as this is the full extent of works (including habitat clearance) required for the Proposed Scheme (at the current Design Fix 3).

6.2.3 All proposed works will be within the highways boundary; however, a site compound is likely to be constructed outside of this area. No information relating to the site compound is currently available and therefore any impacts relating to this will be reported separately. The construction of the site compound is to be subject to their own assessment of implications on European protected species. Consideration will be given to the baseline ecological data when determining the site compound location which would minimise the impacts to ecological features.

## 6.3 Methodology

6.3.1 The scope of this assessment is in accordance with the Environmental Scoping Report and the Highways England Interim Advice Note (IAN)[15]. The Environmental Scoping Report was made available by Highways England to JAJV in July 2017 following completion of the ecological surveys. The following deviations from the recommendations in the Environmental Scoping Report are noted below:

- Habitats – the Environmental Scoping Report states an extended phase 1 habitat survey would be completed. Instead, broad habitat mapping was completed for habitats in the soft estate as this was considered a suitable level of detail to inform the detail design of the Proposed Scheme.

[13] Refer to Air Quality Section 5 for methodology and description of affected road network

[14] Natural England and the Forestry Commission's standing advice for planning authorities is that a minimum buffer of 15 metres should be maintained between ancient woodland and development https://www.gov.uk/guidance/ancient-woodland-and-veteran-trees-protection-surveys-licences

[15] Highways England. (2015). DMRB Interim Advice Note 125/15: Environmental Assessment Update, UK.

- Great crested newt –the Environmental Scoping Report recommended that where no data is available following assessment, to complete works under a precautionary method of working. The current programme allows surveys to be staged over 2 survey seasons (2017 / 2018), with sufficient data collected to inform licencing prior to construction.
- Badger – the Environmental Scoping Report recommends targeted surveys to be completed in November/December 2017. These surveys have been brought forward and were completed through September/October 2017 to determine the occupation of 'potential setts' and to aid the assessment of badger risk to the construction programme.
- Otter surveys - the Environmental Scoping Report states that surveys of water course should cover 200m up and down stream of the Proposed Scheme. This has been reduced to 50m for habitat suitability assessment surveys as this is assessed as the likely zone of influence for these features.
- Water vole surveys - the Environmental Scoping Report states that surveys of water course should cover 200m up and down stream of the Proposed Scheme. This has been reduced to 50m for habitat suitability assessment surveys as this is assessed as the likely zone of influence for these features.
- White Clawed Crayfish surveys – the Environmental Scoping Report states that surveys of water course should cover 200m up and down stream of the Proposed Scheme. This has been reduced to 50m for habitat suitability assessment surveys as this is assessed as the likely zone of influence for these features.
- Invertebrate surveys – Invertebrate surveys were scoped out of further assessment due to the anticipated improvements in water quality at priority outfalls.

## Desk Study

6.3.2 A desk study was undertaken in March 2017 (in addition to the desk based Environmental Scoping Report supplied by Highways England) to obtain ecological information about statutory and non-statutory designated sites for nature conservation, notable habitats and notable and/or legally protected species present within the Study Area. Data was obtained from the following sources:

- Greater Manchester Ecology Unit (GMEU)
- RECORD Local Record Centre for Cheshire
- Highways England Environmental Information System (EnvIS) database (accessed August 2016)
- Multi-Agency Geographic Information for the Countryside (MAGIC) website www.magic.defra.gov.uk
- M56 Environmental Scoping Report – includes access to Ordnance Survey mapping (scales 1:50,000 and 1:25,000), aerial photography and Maintenance Service Providers.

## Field Survey

6.3.3 The general approach to detailed survey work for habitats and notable and/or legally protected species has been proportional and appropriate to the risk of significant effects and of legal offences in relation to these features.

6.3.4 Due to the localised nature of the Proposed Scheme i.e. construction footprint will be minor (within 10m of existing motorway), detailed surveys have been scoped in only where it is deemed necessary to fully assess the impacts of the Proposed Scheme (such as temporary habitat losses) or to identify specific mitigation requirements, as defined in Section 6.7.

6.3.5 Where safe access allowed (or where areas could be viewed with permission from third party land owners), broad habitat mapping was undertaken within the soft estate only between 4th April 2017 and 12th June 2017 broadly following Phase 1 habitat survey methodology as set out in Joint Nature Conservation Committee (JNCC) guidance[16]. The survey recorded information on the habitats and was extended to include a search for evidence of confirmed presence and an assessment of the potential of each habitat to support notable and/or legally protected species as

[16] JNCC (2010) Handbook for Phase 1 Habitat Survey – A technique for environmental audit. ISBN 0 86139 636 7

recommended by the Chartered Institute of Ecology and Environmental Management (CIEEM)[17]. The survey extents for each species are defined in Table 6-1 above.

6.3.6 The main habitats within the Proposed Scheme boundary were mapped and are shown in Figure 6.4 - Ecology Survey Results. Where safe access was not possible, habitats have been mapped using aerial and Google Street View imagery. These areas are shown on Figure 6.3. Where access was possible, or where habitats could be viewed from adjacent third party land, the preliminary investigations undertaken in respect of notable habitats and notable and/or legally protected species were as follows:

- Assessment of notable habitats, including those listed on Section 41 of the NERC Act (2006) (Habitats and Species of Principal Importance)
- Assessment of suitable habitats for nesting birds and reptiles
- Search for signs of badger (*Meles meles*) activity including setts, tracks, foraging holes and latrines
- Assessment of habitat potential for amphibians, in particular great crested newts (*Triturus cristatus*)
- Assessing the suitability of watercourses which pass beneath or adjacent (within 50m) to the Proposed Scheme for water vole (*Arvicola amphibius*), otter (*Lutra lutra*) and white-clawed crayfish (*Austropotamobius pallipes*)
- A ground level external inspection of structures and trees along the route of the Proposed Scheme to assess their suitability for roosting bats following current good practice guidance[18];

6.3.7 The broad habitat mapping also involved a search for non-native invasive plant species included on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

6.3.8 As a result of the findings and recommendations of the notable habitats and/or legally protected species surveys, more detailed surveys are scheduled to be undertaken in 2017 and 2018 for Great Crested Newt (GCN), bat, badger, otter and water vole to further inform the design. The detailed survey methods for these species, together with any specific limitations to the methodology, are provided in the Notable & Protected Species Report, Appendix C.1.

## Assessment Methodology

6.3.9 The ecological assessment was undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) [19]; IAN 130/10[20]; and the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines[21].

6.3.10 This section describes the method of ecological assessment to determine residual effects on ecological feature and whether an effect will be significant. The method of assessment comprises the following key stages:

- Establishing the baseline conditions through desk study and field survey data.
- Assessment of nature conservation value of each ecological feature.
- Description of embedded and general mitigation measures.
- Identification and characterisation of potential impacts on the favourable conservation status and/or conservation objectives of ecological feature during construction and operational phases. This takes into account factors such as likelihood, reversibility, duration, timing and frequency.

[17] CIEEM (2016) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal* (2nd edn.). Chartered Institute of Ecology and Environmental Management, Winchester.
[18] Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London. ISBN 13 978 1 872745 96 1.
[19] Highways England. (1993) Design Manual for Roads and Bridges (DMRB) *Ecology & Nature Conservation* Vol. 11, Section 3, Part 4, UK.
[20] Highways England (2010) DMRB Interim Advice Note (IAN) 130/10 *Ecology and Nature Conservation: Criteria for Impact Assessment*
[21] CIEEM (2016) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal* (2nd edn.).

- Identification of mitigation measures to avoid and reduce potentially significant impacts on the favourable conservation status and/or integrity of ecological feature.
- Determination of any significant residual effects after mitigation is taken into account during construction and operation.
- Identification of potential enhancement measures including creation of higher quality habitat and creation of habitats to support notable and/or legally protected species.

## Nature Conservation Valuation

6.3.11 To determine importance, ecological features have been valued based on the following framework provided in IAN 130/10 (see Table 6-2). Valuing ecological features requires professional judgment and information available on the distribution and status of the features. For the purpose of this assessment, the value of each ecological feature has been based on available information from the results of the desk and field surveys. No stakeholder engagement has been undertaken for this assessment to date as the Proposed Scheme is unlikely to lead to significant effects. However, future consultation with stakeholders is likely where protected species licence applications are required.

**Table 6.2 Resource Valuation, adapted from IAN 130/10**

| Examples of resource valuation based on geographical context |
|---|
| **International or European Value** |
| • International or European designated sites[22], or sites that meet the published selection criteria for International or European designated sites but are not themselves designated as such<br>• Resident or regularly occurring populations of species which may be considered at an at International or European level where loss of the population would adversely affect the conservation status or distribution at this geographic scale; where the population forms a critical part of a wider population at this scale; or where the species is at a critical phase of its life-cycle at this scale. |
| **National (UK/ England)** |
| • Nationally designated sites including Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR) and sites that meet published criteria for nationally designated sites but are not themselves designated as such<br>• Notable habitats (including ancient woodland), where considered to be of national importance (and not already designated)<br>• Resident or regularly occurring populations of species which may be considered at International, European or National level where loss would adversely affect the conservation status or distribution at National level; where the population forms a critical part of a wider population at this scale, or where the species is at a critical phase of its life-cycle at this scale. |
| **Regional (North West England)** |
| • Notable habitats that exceed the county-level designations but fall short of SSSI selection criteria<br>• Resident or regularly occurring populations of species which may be considered at International, European or National level where loss of these species would adversely affect the conservation status or distribution at Regional level; where the population forms a critical part of a wider population at this scale; or where the species is at a critical phase of its life-cycle at this scale. |
| **County (Greater Manchester)** |
| • Local Wildlife Sites (LWS); and Local Nature Reserves (LNRs) designated in the county context; or sites that meet the published selection criteria for these designated sites but are not themselves designated as such<br>• Notable habitats and habitats where considered to be of county importance (and not already designated)<br>• Resident or regularly occurring populations of species which may be considered at International, European or National level where loss would adversely affect the conservation status or distribution at county level; where the population forms a critical part of a wider population at this scale; or where the species is at a critical phase of its life cycle at this scale. |
| **Local (Immediate local area)** |
| • Designated sites including LNRs designated in the local context<br>• Areas of habitat; or populations/ communities of species considered to appreciably enrich the |

[22] This includes: Sites of Community Importance, Special Protection Areas, potential Special Protection Areas, Special Areas of Conservation, candidate Special Areas of Conservation, Wetlands of International Importance (Ramsar sites), Biogenetic Reserves, World Heritage Sites (designated for their nature conservation value) and Biosphere Reserves.

| Examples of resource valuation based on geographical context | |
|---|---|
| | habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange. |
| **Scheme (land within the Proposed Scheme extent which falls within the Highway England boundary)** | |
| • | Notable habitats or species considered of value within the context of the Proposed Scheme only, such as small ponds, scrub or populations of notable species widespread in the local area. |

6.3.12 Important ecological features carried through to assessment are those considered to be of local value and above. Ecological features valued below this (i.e. within the Proposed Scheme boundary only), which are considered sufficiently widespread, unthreatened or resilient to impacts from the Proposed Scheme such as toad and hedgehog, may still be subject to legal protection. As such they may still require mitigation or compensation measures as outlined in Section 6.7.

## Characterisation of Impacts

6.3.13 This assessment takes into account both on-site impacts and those that may occur to adjacent and more distant ecological features. Impacts may be adverse or beneficial to the feature, permanent or temporary, and can occur through several mechanisms, including:

- Direct loss of habitats (including temporary loss of wildlife habitats during construction or small-scale permanent loss of habitats within the soft estate to accommodate Emergency Refuge Areas (ERAs), gantries, signs and other equipment).
- Fragmentation or isolation (dividing habitats or wildlife corridors within the soft estate).
- Changes to the local hydrology, water quality and/or air quality (pollution during construction and operation affecting the water environment and adjacent habitats).
- Direct mortality or injury to wildlife through construction activities and traffic accidents.
- Disturbance to species from noise, light or other visual stimuli.

6.3.14 In order to characterise potential impacts on the important ecological feature, the following parameters have been used:

- Extent – the area over which an impact occurs (e.g. size of habitat or territory lost).
- Duration – the time for which an impact is expected to last (e.g. is the impact permanent or temporary, or occur over the life-cycle of feature).
- Reversibility – whether an impact can be reversed, whether this is planned or not.
- Timing and frequency – whether impacts occur during critical life stages or seasons.

## Categorising the Significance of Effects

6.3.15 The determination of the significance of effects takes into account any mitigation provided as identified in section 6.7.

6.3.16 The effect on an individual ecological feature is categorised as 'significant' or 'not significant' at the level at which the feature is valued. A significant effect would constitute impacts on the structure and functions of designated sites, notable habitats, or ecosystems; or the conservation status of habitats and species at an appropriate geographic scale. Therefore, an effect can be significant at local, county, regional, national or international levels dependant on its value. Overall residual effects for each ecological feature are categorised on a five-point scale in line with IAN 130/10 (see Table 6-3). For the purposes of this impact assessment an effect is considered to be significant if it falls into the moderate category or above.

**Table 6.3 Significance of effects (IAN 130/10)**

| Significance Category | Typical Descriptors of Effect (Nature Conservation) |
|---|---|
| Very large | An impact on one or more feature(s) of international, European, UK or National Value. NOTE: only adverse effects are normally assigned this level of significance. They should be considered to represent key factors in the decision-making process. |
| Large | An impact on one or more feature(s) of regional Value. NOTE: these effects are considered to be very important considerations and are likely to be material in the decision-making process.) |
| Moderate | An impact on one or more feature(s) of county or Unitary Authority Area Value. NOTE: these effects may be important, but are not likely to be key decision-making factors |
| Slight | An impact on one or more feature(s) of local Value. NOTE: these effects are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the Proposed Scheme. |
| Neutral | No significant impacts on key nature conservation feature. NOTE: absence of effects, or those that are beneath levels of perception. |

## Assumptions and Limitations

6.3.17 The following assumptions and limitations are taken into account during this assessment:

- The habitat survey was carried out as a combination of views from accessible third party land, views from footpaths and online aerial and Street View imagery. Taking into account the age of the habitats present and the details of the Proposed Scheme, this does not provide a significant limitation to the assessment, as rare or uncommon habitats are not expected to be present.

- Due to the restrictions on access to third party land in 2017, it was not possible to carry out GCN eDNA surveys at 37 waterbodies within the Study Area. For the purposes of this assessment, it is assumed that GCN are present in all waterbodies that were inaccessible for eDNA survey and this does not pose a constraint to the assessment within this Environmental Assessment Report.

- Some areas of the soft estate are isolated by the live carriageway. These areas are accessible only through the use of appropriate traffic management. However, given these areas are limited to small sections of the overall Study Area and are isolated from the wider landscape, it is considered highly unlikely these access constraints would affect the overall assessment for each species provided within this Environmental Assessment Report. Access to these areas will be completed under appropriate traffic management in 2017 and 2018 to inform the Construction Environmental Management Plan (CEMP).

- Ecological surveys are limited by factors which affect the presence of plants and animals such as the time of year and animal behaviours. The ecological survey has not therefore produced a complete list of plants and animals, and the absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it would not be present in the future. The current baseline information available for protected species associated with the Scheme is not sufficient to inform European Protected Species Licence (EPSL) applications. Further surveys will be undertaken for GCN, bats, otter, water vole and badgers in 2017 / 2018 to help inform mitigation and licensing required as part of the CEMP.

- The data that has been gathered and understanding of the local ecology and distribution of the species considered as part of this assessment, is considered sufficient to make an informed judgement as to the potential impacts and significance of effects.

- The results of the survey work to date have allowed an evaluation of ecological features within the EZoI to be made, together with an assessment of the significance of any impacts of the proposed development and the requirements for mitigation measures.

6.3.18 Where access issues cannot be resolved, evidence to satisfy Natural England that all access options for safe access has been explored would be required.

## 6.4 Baseline Conditions

### Context

6.4.1 This section of the M56 carriageway lies within a largely semi-rural landscape setting. The area becomes more urbanised around Junction 6 with Manchester Airport situated approximately 250m to the east of the junction. Surrounding landscape habitats include woodland (ancient, semi-natural and plantation), arable and pastoral farmland with hedgerows and waterbodies including flowing and standing water. Of particular note is Rostherne Mere Ramsar and Site of Special Scientific Interest (SSSI), a large, deep mere situated approximately 300m south of Junction 8.

6.4.2 The description of baseline conditions in this section should be read in conjunction with the assessment assumptions and limitations, set out in Section 6.4

### Designated Sites

6.4.3 One internationally designated site for nature conservation, Rostherne Mere lies within the Study Area but outside the EZoI for the Proposed Scheme. Rostherne Mere Ramsar lies approximately 300m to the south of the footprint of the Proposed Scheme. This Ramsar is primarily designated for its wintering wildfowl populations. Rostherne Mere is also designated as a SSSI and forms part of a series of open water and peatland habitats across the region which collectively is referred to as the North West Midlands Meres & Mosses. The SSSI covers a larger area than the Ramsar site and lies approximately 250 m to the south of the M56 at its closest point which is within the Study Area but outside the EZoI.

6.4.4 Rostherne Mere Ramsar has also been assessed separately as part of the Habitat Regulations Assessment report for the Proposed Scheme, the details of which have been summarised within this report.

6.4.5 Two further statutory designated sites for nature conservation, Cotterill Clough SSSI (situated approximately 750m south of junction 6) and Dunham Park SSSI (situated approximately 1.5km NW of junction 7). Both sites lie within the Study Area but outside the EZoI for the Proposed Scheme with no ecological pathways between the sites and the Proposed Scheme. These statutory designated sites are not considered further within this report.

6.4.6 Thirteen non-statutory designated sites for nature conservation are situated within the Study Area. Seven of these lie within 200m of the Proposed Scheme or are hydrologically linked to the Proposed Scheme and therefore fall within the EZoI, these are:

- Sunbank Wood and Ponds Site of Biological Interest (SBI) - 20m south of.Proposed Scheme
- Jackson's Bank East Local Wildlife Site (LWS) – adjacent to Proposed Scheme
- Rossmill (SBI) – adjacent to Proposed Scheme
- Hancock's Bank North (LWS) – adjacent to Proposed Scheme
- Hancock's Banks South (LWS) – adjacent to Proposed Scheme
- Ryecroft Covert (LWS) – adjacent to Proposed Scheme
- Yarwood Heath Covert (LWS) – 45m north of Proposed Scheme

6.4.7 All designated sites within the Study Area are shown on the Figure 6.1.

## Notable Habitats

6.4.8 Three areas of ancient woodland are present within 200m of the Proposed Scheme and located within the EZoI; Warburton Wood, Hancock's Bank North and Hancock's Bank South. Hancock's Bank North and South are located adjacent to the Proposed Scheme. These areas of woodland are shown on Figure 6.2. A number of these woodlands are also designated as Local Wildlife Sites (LWS) in Cheshire or SBIs in Greater Manchester.

6.4.9 The following Habitats of Principal Importance[23] have been identified adjacent to the Proposed Scheme:

- Deciduous Woodland
- Hedgerows
- Ponds
- Rivers

6.4.10 No Habitats of Principal Importance have been identified within the footprint of the Proposed Scheme.

## Other Habitats

6.4.11 The broad habitat mapping survey identified the following habitats within the Proposed Scheme:

- Semi-natural broadleaved woodland
- Broadleaved plantation
- Broadleaved scattered trees
- Dense continuous and scattered scrub
- Tall ruderal vegetation
- (Poor) semi-improved grassland.

## Notable and/or Legally Protected Species

6.4.12 The following notable species[24] were recorded (from desk study or field survey) or are potentially present due to the suitability of the habitats, frequency of distribution of the species within the county and/or presence of local records. Figure 6.2 illustrates the locations of these records:

- Great crested newt – Conservation of Habitats and Species Regs, WCA Sch.5, EPS, NERC S41, LBAP;
- Bats, including Daubenton's bat (*Myotis daubentonii*), Noctule (*Nyctalus noctule*), common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), Nathusius's pipistrelle (*Pipistrellus nathusii*), brown long eared bat (*Plecotus auritus*), natterer's bat (*Myotis nattereri*), and whiskered / brandt's bat (*Myotis mystacinus / brandtii*) – Conservation of Habitats and Species Regulations, WCA Sch.5, EPS, NERC S41, LBAP;
- Otter – Conservation of Habitats and Species Reg. 43, WCA Sch.5, EPS, NERC S41;
- Water vole - WCA Sch.5, NERC S41, LBAP;
- Breeding and foraging bird species notable for their conservation concern status including a range of water fowl, raptors and farmland birds; records include hobby (*Falco subbuteo*) - WCA Sch.1; IUCN Red Data Book; BCC;

[23] Habitat of Principal Importance for the Conservation of Biological Diversity in England notified under Section 41 of the NERC Act 2006 and as listed in the England Biodiversity List.

[24] Principal species for the conservation of biodiversity listed under Section 41 of the Natural Environment and Rural Communities Act 2006; species included in local biodiversity action plans, species considered notable for their conservation concern (for example, IUCN Red Data Books, bird species are taken as those listed on Schedule 1 of the *Wildlife and Countryside Act 1981* (as amended); any bird species listed as Red, Amber of Green status in the Birds of Conservation Concern 3 (RSPB, 2009); and species considered rare in the UK or in local counties.

- Reptiles including slow worm (*Anguis fragilis*) - WCA Sch.5, NERC S41, LBAP;
- Hedgehog (*Erinaceus europaeus*) - NERC S41; and
- Common toad (*Bufo bufo*) - NERC S41

6.4.13 The species listed above are legally protected under Section 41 of the NERC Act[25]. Other species that are legally protected but not covered under Section 41 that are known or highly likely to be present within the Proposed Scheme or in habitats adjacent to the Proposed Scheme include badger. Specific mitigation has been provided in the OEMP for the Proposed Scheme where ecological risks have been identified.

6.4.14 Legally protected species such as natterjack toad (*Epidalea calamita*) and sand lizard (*Lacerta agilis*), where their known geographical territory extents are positioned outside of the Proposed Scheme Study Area, have not been included within this assessment.

6.4.15 Surveys undertaken to date in respect of GCN, bats, otter, water vole, white-clawed crayfish and badger are summarised below. Full details of these surveys are provided in Appendix C.1. These surveys are continuing through 2017 and 2018 to inform the CEMP and for species licencing requirements, as necessary.

6.4.16 The sections of watercourse scoped in for assessment which pass under the Proposed Scheme (River Bollin, River Bollin Drain, Lambs Covert Brook and Birkin Brook) were not considered suitable for white-clawed crayfish during scoping surveys. No specific surveys will be required.

6.4.17 There are no desk study records of reptiles within the Study Area. Due to the lack of connective habitat between the wider landscape and the Proposed Scheme, and only small areas of suitable habitats available for reptiles on site, this species is not considered further within this assessment. No specific surveys will be required for reptile; however incidental records of reptile species would be recorded and any general working practices/mitigation that are required will need to be outlined by the Ecological Clerk of Works (ECoW).

6.4.18 The habitats within the Proposed Scheme are highly likely to support a low density of common breeding bird species noted as Species of Principal Importance and covered under Local BAP. No specific surveys will be required, although incidental field sightings of breeding birds will be recorded. General mitigation and precautionary working measures have been included in the OEMP as necessary.

6.4.19 The structure and nature of the habitats within the Proposed Scheme do not provide the diversity required to promote an invertebrate community of special interest. Therefore, no specific surveys will be required. Invertebrates are not considered further within this assessment.

6.4.20 There is potential for hedgehog and common toad to be present within and adjacent to the Proposed Scheme. These notable species will be safeguarded through embedded and additional mitigation. No specific surveys will be required, although incidental field signs of any activity should be recorded as part of other surveys.

6.4.21 A summary of the baseline information for each notable and/or legally protected species recorded within the Study Area has been provided below. The conservation valuation of each species has also been provided and is based upon the current baseline information.

### Great Crested Newts

6.4.22 The terrestrial habitats within the Proposed Scheme are suitable for foraging, sheltering, hibernating and dispersing GCN where these habitats lie near to waterbodies used by this species to breed.

[25] Principal species for the conservation of biodiversity listed under Section 41 of the Natural Environment and Rural Communities Act 2006; species included in local biodiversity action plans, species considered notable for their conservation concern (for example, IUCN Red Data Books, bird species are taken as those listed on Schedule 1 of the *Wildlife and Countryside Act 1981* (as amended); any bird species listed as Red, Amber of Green status in the Birds of Conservation Concern 3 (RSPB, 2009); and species considered rare in the UK or in local counties.

6.4.23 The survey methodology outlined in the M56 Environmental Scoping Report has been amended and GCN surveys are being completed over a two season span. Full details of the amended GCN survey methodology and results are provided in Appendix C.1 with a summary of survey methodology and results to date outlined below.

6.4.24 A total of 95 waterbodies shown on OS maps were scoped in for GCN surveys. Of these a total of 92 were visited in spring 2017 and a Habitat Suitability Index (HSI) Survey was completed (the remaining were not surveyed due to land access restrictions). Forty-three ponds were scoped out for further survey during HSI surveys as they were deemed unsuitable breeding habitat for GCN. Habitat Suitability Assessments were conducted on 49 ponds. Of these 49, 42 were scoped out or not surveyed due to desiccation, new access limitations or surveys being carried out by other consultancies connected to other ongoing Schemes. eDNA assessments were completed at seven waterbodies. Great crested newts were detected in two of the seven ponds surveyed by eDNA. Ponds not surveyed in 2017 will be surveyed in 2018. The results of GCN surveys are shown on Figure 6.4.

6.4.25 Additional survey work is required in 2018 to inform the CEMP for the Proposed Scheme and any licensing requirements. Ponds returning a positive eDNA result during 2017 surveys will be subject to population assessment surveys through the 2018 survey season where access permits. Ponds not subject to eDNA surveys during the 2017 survey window due to access issues will be surveyed in 2018, if the conditions for breeding GCN are suitable and where access permits. Full details of ponds requiring additional survey work can be found in Appendix C.1.

6.4.26 For the purpose of this report, where it was not possible to access land to carry out surveys, it has been assumed GCN are present based on the known widespread distribution of the species across the region[26]. Great crested newts have been assessed as being of local nature conservation value/biodiversity importance.

**Bats**

6.4.27 Habitats within and in the wider landscape surrounding the Proposed Scheme are likely to provide foraging and commuting opportunities for bats.

6.4.28 Under bridges, over bridges and culverts may be affected due to works directly above/below them. As such fifteen structures including seven under bridges, seven over bridges and one culvert, were assessed to determine potential for their use by bats as roost sites. Two of the fifteen structures (River Bollin tributary culvert and Ashley Hall road) could not be surveyed due to access limitations. Full details of the survey methodology and results are provided in Appendix C.1 with a summary of the results outlined below. These surveys were completed in accordance with the methodology outlined in the M56 J6-J8 Environmental Scoping Report - HE549345-JAJV-EGN-SG_MULTI-RP-LE-0006.

6.4.29 Eleven bridges were considered to have suitable bat roosting potential including, Wilmslow Road, Chapel Lane, River Bollin, Thornsgreen, Castle Mill Lane, Cow Lane, Ashley Railway, Ryecroft Footbridge, Bowdon View, Yarwood Heath Lane and Chester Road Bridge. These bridges will be subject to dusk emergence / dawn re-entry surveys in 2018. Two structures were considered to have negligible potential for roosting bats – Hasty Lane Subway and Birkin Brook Culvert.

6.4.30 Trees along the M56 verge and within 50m of the Proposed Scheme footprint that were likely to be affected by the Proposed Scheme were also assessed for roost potential. Sixty-three trees with roosting potential have been recorded within 50m of the Proposed Scheme. Trees with bat suitability were located outside of the highways boundary. The majority of trees within the footprint of the Proposed Scheme are relatively even aged with limited features suitable for roosting bats.

6.4.31 There were a number of areas where access was restricted. Where safe access can be obtained to the remainder of soft estate prior to construction, surveys of trees will be undertaken to assess bat roosting potential to inform the CEMP and any licensing requirements.

6.4.32 No emergence / re-entry surveys have been carried out on any of the structures and therefore the final roost status of the structures is unknown. Currently the structures have been assessed as

[26] WILKINSON, J.W., WRIGHT, D., ARNELL, A. & DRIVER, B. 2011. Assessing population status of the great crested newt in Great Britain. Natural England Commissioned Reports, Number 080

containing features that could support roosting bat species; therefore, they are of at least local conservation value/biodiversity importance on the basis that maternity roosts of less common bat species are highly likely to be absent (due to the identified features being of limited suitability for maternity roosts).

### Otter

6.4.33 Six watercourses crossed by the Proposed Scheme were scoped in for initial assessment. Of the watercourses, one watercourse (Sutts Hollow Brook) had access limitations inhibiting any assessment. The remaining five watercourses were assessed during 2017 to determine the potential for otter to utilise the watercourses.

6.4.34 Three watercourses that flow under the Proposed Scheme footprint were considered to have potential to support otter; River Bollin, River Bollin Drain (7-GCN-22) and Birkin Brook. They are likely to provide suitable resting, foraging and commuting habitat for otter. These habitats may also provide suitable breeding habitat. Full details of the survey methodology and results are provided in Appendix C.1 with a summary of the results outlined below.

6.4.35 An additional survey in September/October 2017 was completed across all watercourses identified with otter potential due to the potential risks resorting from the works. Suitability remained consistent with that observed during the initial habitat suitability survey.

6.4.36 Otter presence was confirmed on one watercourse (River Bollin) through identification of field signs including spraints, footprints and feeding remains. No resting or breeding evidence (lay-ups/holts) was identified within 50m of the Proposed Scheme footprint.

6.4.37 Otter have been recorded along most watercourses across both Manchester and Cheshire with numbers steadily improving across the region[27]. Otters are considered to be utilising the watercourses that cross the Proposed Scheme for foraging and commuting purposes only. Therefore, otters are considered to be of local conservation value/biodiversity importance.

### Water Vole

6.4.38 The riparian habitats that flow under the Proposed Scheme footprint are likely to provide suitable resting, foraging and commuting habitat for water vole. These habitats may also provide suitable breeding habitat. Full details of the survey methodology and results are provided in Appendix C.1 with a summary of the results outlined below.

6.4.39 Six watercourses crossed by the Proposed Scheme were scoped in for initial habitat suitability assessment. Of the six watercourses, one watercourse (Sutts Hollow Brook) had access limitations inhibiting any assessment. The remaining five were assessed during 2017 to determine the potential for water vole to utilise the watercourses.

6.4.40 Two watercourses were considered to have potential to support water vole; River Bollin and Birkin Brook. However, no evidence of water vole was identified along any of the watercourses during surveys in April / May 2017.

6.4.41 The two watercourses with suitable water vole habitat were revisited in September/October 2017. Suitability remained consistent with that observed during the initial habitat suitability survey. No water vole evidence was recorded.

6.4.42 Water vole are considered likely to be present within the Study Area, however, suitable habitat is limited to two watercourses across the Proposed Scheme. Water vole populations are sparsely spread through the region with large tracts where water vole appear absent[28]. Water vole are considered to be of county conservation value/biodiversity importance.

[27] Environment Agency (2010) *Fifth otter survey of England 2009-2010 Technical Report*. Environment Agency, Bristol

[28] Powell, A. Milburn, K. (2011) Northwest Lowlands Water Vole Project, June 2011. The Wildlife Trust.

### White-Clawed Crayfish

6.4.43 The riverine habitats that flow under the Proposed Scheme footprint were considered likely to provide suitable habitat to support white-clawed crayfish during the desk study assessment. Full details of the survey methodology and results are provided in Appendix C.1 with a summary of the results outlined below.

6.4.44 Six watercourses crossed by the Proposed Scheme were scoped in for initial assessment. Of the six watercourses, one watercourse (Sutts Hollow Brook) had access limitations inhibiting any assessment (see Figure 6.3), whilst the remaining five were assessed during 2017 to determine the potential for white-clawed crayfish to utilise the watercourses.

6.4.45 None of the watercourses scoped in for initial assessment offered any potential for white-clawed crayfish with most of the watercourses providing little or no refuge for the species.

6.4.46 No additional surveys are required for the white-clawed crayfish due to the limited availability of suitable habitat.

6.4.47 Due to the lack of records in the wider area and limited habitat available, it is unlikely that white-clawed crayfish are present within the Study Area. White-clawed crayfish have been assessed as being of county nature conservation value/biodiversity importance.

### Breeding Birds

6.4.48 Habitats within the highways boundary were assessed for their suitability to support nesting birds, although no specific bird surveys (breeding or wintering surveys) have been undertaken nor deemed necessary.

6.4.49 Other habitats on site, such as woodland and scrub, are suitable for a range of breeding bird species. Bird species present on site are assessed as being of at least local conservation value/biodiversity importance.

### Badger

6.4.50 The terrestrial habitats within the Proposed Scheme and the adjacent land provide optimal foraging and commuting opportunities for badger. Optimal sett construction opportunities were present along the soft estate embankments within the footprint of the Proposed Scheme and along hedgerows and woodland in adjacent land. Full details of the survey methodology and results are provided in Appendix C.1 with a summary of the survey methodology and results to date outlined below.

6.4.51 Where access was possible, a visual inspection of the entire soft estate and the adjacent land (up to 50m from the highways boundary) was completed to identify and locate any badger setts. Additional field records were also recorded and included latrines, guard hairs, footprints and mammal paths.

6.4.52 Twenty-eight individual badger setts were identified along the soft estate and within 50m of the highways boundary (the Study Area). Of these, 13 were identified within the soft estate. The setts within the soft estate ranged in size from single hole outlier setts to multiple hole setts with the largest sett comprising seven holes. Several inactive and disused setts were also identified as well as numerous other field signs including latrines, mammal paths and guard hairs.

6.4.53 Additional monitoring surveys will be completed at a number of setts identified within the highway boundary to determine badger occupancy and the level of badger activity at each sett. The information will be used to inform the CEMP and any licensing requirements.

6.4.54 Based on the locations of the setts and associated annexe setts, it is highly likely that several badger groups are using the Study Area and the wider landscape beyond. Taking this into account, the badger populations within the soft estate are assessed as being of local nature conservation value/biodiversity importance.

### Invasive Plant Species

6.4.55 Invasive plant species occur within the highways boundary.

6.4.56 As part of the broad habitat mapping surveys, invasive plant species were recorded through the use of target notes. Himalayan Balsam, *Impatiens glandulifera)*, Japanese knotweed *(Fallopia japonica)*, rhododendron *(Rhododendron ponticum)* and giant hogweed *(Heracleum mantegazzianum)* have all been identified within the footprint of the Proposed Scheme. The locations of identified invasive species can be found on Figure 6.4

6.4.57 Incidental records of invasive plant species should be recorded throughout the life-cycle of the Proposed Scheme. The information will be used to inform the CEMP.

## 6.5 Sensitivity of Resource

6.5.1 The nature conservation value of the ecological features is described in Table 6-4. Features of importance in the context of the Proposed Scheme only i.e. of least ecological value, have been scoped out for further assessment. Any mitigation required has been included in the OEMP, as described in Section 6.7.

**Table 6.4 Rationale and Valuation of Ecological Features within the EZoI**

| Features | Valuation | Rationale |
|---|---|---|
| Rostherne Mere Ramsar | International | Site covered by an international designation. |
| SSSIs within 2km of the Proposed Scheme | National | Site covered by a national designation |
| SBIs and LWS adjacent to the Proposed Scheme | County | Local Wildlife Sites are designated by the Local Planning Authority as examples of important habitats within the county. |
| Ancient woodland (ancient semi-natural and ancient replanted) | National (but may range in value depending on location, connectivity, history, condition and quality) | Ancient woodland is woodland that has existed since 1600 AD, and is irreplaceable.<br><br>Semi-natural woodland is woodland may have existed since woodland first colonised the British Isles after the last glaciation, but in many cases they have grown up on land that was previously cleared, but many hundreds of years ago.<br><br>Ancient replanted woodland has been felled and planted with non-native trees, often conifers. |
| Notable habitats within and adjacent to the Proposed Scheme | National | The following habitats situated adjacent to the Proposed Scheme are considered notable as they are Habitats of Principal Importance:<br>• Rivers<br>• Ponds<br><br>The habitats are also a resource for notable and/or legally protected species including GCN otter and water vole. |
| Other habitats | Local | Habitats within the Proposed Scheme include broadleaved semi-natural and plantation woodland; scattered trees, scrub (dense continuous and scattered); tall ruderal, and (poor) semi-improved grassland. The habitats are a resource for notable and/or legally protected species including GCN. |

| Features | Valuation | Rationale |
|---|---|---|
| Great crested newts | Local (further assessment to inform this) | Great crested newt is a Species of Principal Importance. However, this species is widespread throughout Cheshire and Greater Manchester and therefore in the context of the Proposed Scheme it has local value. |
| Bats | Local (further assessment to inform this) | There is limited potential for roosting bats within the Proposed Scheme. In addition, desk study records and habitat suitability surveys indicate that any bat species that may be present are likely to be common and less sensitive species. Therefore, in the context of the Proposed Scheme any populations of bat species present will have local value. |
| Otter | Local | Otters are a Species of Principal Importance. They are re-colonising Greater Manchester and Cheshire. |
| Water vole | County | Water vole are a Species of Principal Importance due to dramatically declining populations. |
| Notable breeding birds | Local | There are habitats within and adjacent to the Proposed Scheme that are suitable for breeding bird species, including species notable for their conservation concern, although traffic noise may deter most bird species from nesting close to the carriageway. |
| Badger | Local | Badgers are widespread in Greater Manchester and Cheshire. There are habitats within and adjacent to the Proposed Scheme suitable for badger. |
| Other notable species | Scheme | Other notable animals such as hedgehog and common toad may utilise habitats within or immediately adjacent to the Proposed Scheme. |

## 6.6 Design, Mitigation and Enhancement

6.6.1 Throughout the ongoing design process, consideration has been given to avoiding impacts on important ecological features, such as notable habitats or species. This has included minimising vegetation clearance requirements and taking into account the findings of the ecological study in the design process.

6.6.2 Standard good practices, such as the CIRIA Environmental Good Practice on Site Guidelines[29], would be implemented during the construction phase to minimise harm to ecological features and avoid impacts on the favourable conservation status of species and habitats. These measures have been detailed in the OEMP, which has been produced to provide guidance to the Principal Contractor in preparing their environmental management processes. Further detail can be found in the OEMP but such measures include:

- The OEMP includes standard measures to prevent potential pollution risks (water, dust, noise).
- Silt barriers would be used for works adjacent to statutory and non-statutory designated sites for nature conservation value and ancient woodland present adjacent to the Proposed Scheme, to prevent soil run off and pollution of these habitats.
- The series of Pollution Prevention Guidelines (PPGs) produced by the Environment Agency would be used as "good practice" guidance for works adjacent to sensitive habitats, in particular waterbodies and courses. It should be noted that these documents have been withdrawn (17th December 2015), but although the Environment Agency no longer provide

[29] Charles, P, Edwards, P (eds). 2015. CIRIA *Environmental Good Practice on Site Guidelines*

"good practice" guidance, the contents of the PPGs are still relevant to industry good practices. The PPGs are still available for reference purposes on the National Archives website[30].

- Vegetation clearance would be minimised to be of the least extent possible to facilitate construction, provide adequate and safe movement of people and equipment during works and provide adequate lines of site for new and updated signage. Where vegetation clearance is required, connective canopy / scrub habitat would need to be retained where possible.
- Protection of notable and/or legally protected species (during site clearance) - all site clearance would be carried out at appropriate times of the year to minimise risks to notable and/or legally protected species (bats, breeding and notable birds, GCN, common reptiles, common toad, hedgehog, and badger) by avoiding the most sensitive times of year (such as breeding and hibernation). Site clearance would also be completed outside of breeding bird season where possible, with additional control measures implemented as and when required. This clearance would be carried out under a written method statement such as a Precautionary Method of Working (PMW) or protected species licence method statement (as required). Detailed measures for each species would be included in the CEMP and supporting method statements.
- Protection of notable and/or legally protected species (habitat availability) – where necessary, retained habitats outside of the construction footprint would be protected and provisions of compensation habitat within the soft estate supplied prior to construction to ensure that this habitat can support the notable species displaced by construction (such as log piles for sheltering and hibernating newts).
- Protection of foraging animals (lighting) –night time working (taken as 30 minutes prior to sunset to 30 minutes after sunrise) during construction should be avoided where possible, particularly through the season when bats are active (April to September). If night time work is required, any site illumination would be fully directional to minimise light-spill into adjacent habitat and impacts to disturbance of foraging bats or other animals such as GCN, areas near to watercourses (potential presence of otter) and badgers.
- Fox and rabbit - to prevent unnecessary suffering, such as crushing and suffocation during site clearance, humane methods would be employed where it is necessary to remove fox earths and rabbit burrows from within the working area if these are found to be present.
- All excavations left open overnight would include measures to prevent mammals becoming trapped (ramped sides or wooden planks). All excavations would be checked for animals the prior to infilling.
- Update species survey – a programme of monitoring surveys for badgers, bats, otter, water vole and GCN would be included to ensure that, should the construction programme change, these species would continue to be taken into account throughout the works. Where necessary, this would involve advance clearance of vegetation.
- Appropriate storage of materials, equipment and machinery ensuring vehicles are kept off retained habitats in the soft estate.
- Any tree protection measures considered necessary (according to British Standard BS 587:2012 *Trees in relation to design, demolition and construction*) have been detailed in the OEMP to prevent damage to tree roots and stems during works. This would include buffer zones for any works immediately adjacent to ancient woodland which is typically considered to be at least 15m[31].
- Any non-native invasive plant species would be subject to controlled avoidance under a written method statement.

## Protected Species Implications

[30] http://webarchive.nationalarchives.gov.uk/20140328090931/http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx

[31] https://www.gov.uk/guidance/ancient-woodland-and-veteran-trees-protection-surveys-licences#avoid-impacts-reduce-impacts-and-compensate-as-a-last-resort

6.6.3 The OEMP includes specific measures to be carried out to ensure that works do not result in an offence with regard to legally protected species. As described above, all habitat clearance would be carried out under a clear method statement, such as a PMW or under a scheme-wide licence for GCN. This would include Tool Box Talks for site contractors, ecological watching briefs where required and hand searches for species by an ecologist prior to clearance. As described above, the OEMP includes appropriate timing of habitat clearance to avoid the most sensitive times of year for protected species.

6.6.4 In addition to the measures described under the OEMP above, in habitats suitable for GCN, mitigation measures would be implemented. At present, the mitigation required is unknown but may include habitat manipulation by phased habitat clearance, followed by destructive searches. In areas where GCN are highly likely to be present in the working area, exclusion fencing and capture by pitfall trapping may be required.

6.6.5 Update survey work for bats being carried out as part of the OEMP would include assessment of structures being affected by the construction works. Should roosting bats be recorded, appropriate measures would be taken to ensure that no disturbance to bats takes place (for example, use of acoustic barriers can provide additional screening to roosts particularly at locations with noise level increases during construction works). If impacts cannot be avoided, works would take place under an EPSL.

6.6.6 There may be a requirement for temporary and permanent exclusion of badger setts during the construction period; this is to avoid the risk of killing, injuring or disturbing any badgers that may be using setts in or adjacent to the Proposed Scheme footprint during the construction phase. The mitigation approach would be subject to agreement with Natural England as part of the licence application, developed as part of the detailed design of the Proposed Scheme and final construction programme. This would ensure there is no detriment to the conservation status of local badger populations.

6.6.7 In riparian habitats confirmed to support otter and/or water vole, there may be a requirement for PMW including Tool Box Talks for site contractors. This would include information on pollution prevention taken from PPGs as well as environmental good practice on site guidance. There may also be a requirement for watching briefs depending on the scope of works.

6.6.8 No specific measures have been identified for white-clawed crayfish and reptiles as these species have been scoped out for further assessment. However, should any evidence of these protected species be identified during the life-cycle of the Proposed Scheme, a suitably qualified ecologist would be informed who would advise on the appropriate action to take and implement any mitigation measures which may be required.

## No Net Loss Commitment

6.6.9 The Road Investment Strategy (RIS) for the 2015/16 to 2019/20 Road Period includes an objective to halt 'net loss' of biodiversity across the RIS Schemes. It also includes a note that 'in the long term, the Company (Highways England) should deliver a net gain across its broader range of works'. The Proposed Scheme includes mitigation measures to ensure that Highways England are working towards no net loss of biodiversity. Compensation measures are required as part of the scheme-wide licence for GCN. This would involve appropriate re-planting of temporarily cleared habitats where necessary, or measures to promote natural recolonisation. In addition to this, where minor permanent loss is required (beneath footprint of new infrastructure), retained habitats would be enhanced to increase their carrying capacity for GCN. This would include the creation of log/debris piles to provide sheltering, hibernating and foraging opportunities for the species. These measures would benefit other notable species which may be present such as common reptiles and toads. By carrying out this work, greater floristic and structural diversity in the soft estate habitats is anticipated.

6.6.10 Throughout detailed design opportunities for enhancement would be implemented which are likely to work towards a No Net Loss in biodiversity for the Proposed Scheme. This could include enhancing breeding bird and bat opportunities with bird and bat boxes. The HE approved method to identify this is in the process of being developed and therefore it is not possible to comment on No Net Loss or Net Gains for the Proposed Scheme.

## 6.7 Potential Construction Effects

6.7.1 It is understood that the construction period is anticipated to start in 2019 and be complete in 2020. An outline construction methodology is described in Section 2 of this EAR.

6.7.2 The potential impacts on important ecological features are characterised here with the mitigation described in Section 6.7 above.

6.7.3 Diversion routes for the Proposed Scheme construction are still to be confirmed, but the nature of SMP construction is that these would only be used periodically. Night time carriageway closures will be utilised where possible. When diversion routes are used they are likely to increase disturbance from noise and lights along the diversion route itself due to increase volume of traffic. Diversion routes would occur largely within urban areas including Hale, Altrincham and areas in close proximity to Manchester airport. Additional surveys would be required to determine the potential ecological impacts of the diversion routes, however, the diversions are not likely to impact upon habitats with potential to support notable and/or legally protected species. The frequency of use of diversion routes is likely to be low, and significant impacts are not anticipated. Therefore, diversion routes are not considered further in this assessment.

### Designated Sites

6.7.4 With respect to European designated sites and Ramsar sites, a Habitat Regulations Assessment screening report has been completed for the Proposed Scheme and concludes that there are no likely significant adverse effects (either alone or in-combination with other projects and plans) anticipated on the integrity and/or the favourable conservation status of Rostherne Mere Ramsar and SSSI during construction. This has been subject to consultation with Natural England and the outcome has been agreed. The report assessed the potential impacts upon Rostherne Mere during the construction and operational phases of the Proposed Scheme including; habitat/species direct loss or damage, habitat/species severance, change in edaphic conditions, change in air emissions, change in surface water run-off and changes in general disturbance levels. Further detail associated with this assessment can be found in Appendix C2.

6.7.5 Construction of the Proposed Scheme would not have any significant effect on the structure and function of SBIs and LWSs which lie adjacent to the Proposed Scheme including Jackson's Bank East, Rossmill, Hancock's Bank North and South, and Ryecroft Covert. There would be no loss of habitat within the SBIs or LWSs as all the works would be restricted to within the highways boundary of the soft estate. Major earthworks adjacent to these designated sites would be avoided where possible. Any potential temporary construction effects on statutory or non-statutory sites would be mitigated through best practice construction methods specified in the OEMP.

### Notable Habitats

6.7.6 It is considered that the construction of the Proposed Scheme would have no significant effect on the structure and function of ancient woodland which lies adjacent to the Proposed Scheme. There would be no loss of habitat within these areas of ancient woodland. Currently there is one gantry (GA48) situated within 15m of Hancock's Bank South. Major earthworks adjacent to ancient woodland would be avoided where possible and best practice construction methods implemented.

6.7.7 No rivers or ponds would be modified during the works with pollution prevention measures implemented.

6.7.8 Vegetation clearance will be, at maximum, 7ha and would include mixed deciduous woodland. Totals of vegetation clearance are, however, subject to revision at PCF 4. While some areas of poor quality lowland mixed deciduous woodland ((young to semi-mature saplings with dominant species comprising ash (*Fraxinus excelsior*), hawthorn (*Crataegus monogyna*) silver birch (*Betula pendula*) and Scots pine (*Pinus sylvestris*)) would be lost during the proposed works, these areas are not representative of the habitat quality that is generally associated with habitats of Principal Importance – Lowland Mixed Deciduous Woodland.

6.7.9 No impacts to Habitats of Principal Importance identified adjacent to the Proposed Scheme are anticipated. Therefore, it is considered that there would be no likely significant effects on the conservation status of identified Habitats of Principal Importance.

## Other Habitats

6.7.10 The Proposed Scheme would not have any significant effect on the structure and function of habitats in the long term.

6.7.11 There would be temporary clearance of habitats within the soft estate to facilitate construction (primarily hidden drainage channels and cabling excavations) of the Proposed Scheme. This loss of habitat is temporary and reversible. Habitat would be re-planted or left to recolonise naturally. This would be determined by protected species requirements (including EPSL requirements), in particular GCN.

6.7.12 There would be small scale permanent loss of habitats beneath the footprint of the new infrastructure (primarily ERAs, gantries, gantry access routes and camera installations) which cannot be compensated for within the boundary of the Proposed Scheme. However, planting plans in areas where temporary clearance is required will be designed to enhance the floristic and structural diversity of the habitats lost during construction, which on maturity will provide a greater area of valuable habitat than that lost. The habitat structure and design has recognised the absence of future maintenance of the soft estate.

6.7.13 Habitat clearance would create temporary gaps in the continuity of habitats within the boundary of the Highways England land along the soft estate and would include the clearance required for footway access to gantries and other structures. However, habitat connectivity is retained through habitats adjacent to the Proposed Scheme and in the wider landscape.

6.7.14 Standard pollution prevention measures would be put in place to protect retained habitats such as trees and semi-improved neutral grassland during construction.

6.7.15 Taking into account the largely temporary nature of the habitat loss, it is considered that there are no likely significant effects on the conservation status of habitats within the soft estate in the long term.

## Notable and/or Legally Protected Species

### Great Crested Newts

6.7.16 Construction of the Proposed Scheme is unlikely to have any significant effect on the favourable conservation status of the local populations of GCN.

6.7.17 Great crested newts are confirmed to be present in two ponds within 250m of the Proposed Scheme. Great crested newts are assumed to be present in 33 waterbodies where eDNA surveys were not undertaken because of access restrictions. Due to the proximity of these waterbodies to the Proposed Scheme, being known or assumed to be used by GCN for breeding, it is considered highly likely that GCN from populations within the wider landscape would use the habitats within the construction area for foraging, sheltering, hibernating and dispersal. This assumption is based on a precautionary approach, in the absence of evidence, and once further surveys have been completed this data will be used to provide information for any potential mitigation required.

6.7.18 There would be temporary loss of available terrestrial habitat for great created newts within the construction area of the Proposed Scheme, but taking into account the location of the construction works and extensive habitat available to this species in the wider landscape, this temporary loss is considered unlikely to have any significant impact on any of the populations of GCN.

6.7.19 There would likely be small scale permanent loss of available terrestrial habitat for GCN beneath the footprint of the new infrastructure. The scale of permanent habitat loss would be very minor and is considered unlikely to have any significant impact on local populations of GCN.

6.7.20 To minimise the risk of killing and injury to individual GCN and to remove any significant impacts on the populations of GCN, habitat clearance, as proposed within the OEMP, would be carried out

under a written scheme-wide licence. Where necessary (due to proximity of breeding waterbody and size of population), a capture and temporary exclusion programme may be implemented to move individual GCN from the construction footprint.

6.7.21 The majority of habitat loss would be temporary and reversible. Habitats would be replanted or left to naturally recolonise/regenerate. The exact mitigation measures are currently unknown and will be determined following further surveys. At present the detailed mitigation design information is not known, however, during construction, retained habitats would be enhanced with log/brash piles to provide additional shelter for GCN displaced by the construction works. Where drainage updates are required near to waterbodies with GCN, appropriate design and consideration would be implemented to ensure that drainage features do not trap individual newts (for example, filter drains).

### Bats

6.7.22 Construction of the Proposed Scheme is unlikely to have any significant effect on the favourable conservation status of the local and county population of bats.

6.7.23 The potential for roosting bats is currently not known, however if bat roosts are present this will have a larger impact and require suitable mitigation measures. General highways upgrades including parapet replacements, vehicle restrain system upgrades and slot drain have the potential to cause disturbance above baseline levels. For the purpose of this assessment, presence of bat roost(s) within all structures with bat roost potential has been assumed until further detailed surveys can confirm presence / absence or roost status of the structures.

6.7.24 Vegetation clearance and temporary lighting from construction works may reduce the overall availability of suitable foraging and commuting habitat for bats. However, habitat temporarily lost during construction is unlikely to form a large proportion of the foraging habitat of bats within the local area.

6.7.25 Updated survey work will be carried out to inform the CEMP, which will include surveys of fifteen bridges that will be affected by construction activities and trees which would be removed during construction to ensure appropriate measures are taken if any roosting bats are found. This may include construction works being completed under a PMW or protected species licence method statement. Alternative roosting provisions for bats would be installed where the direct loss of a roost is likely.

6.7.26 Appropriate, directed lighting used during any night time construction works would minimise light spill into surrounding habitats, including under bridges that are found to be used by commuting bats. This would also reduce any temporary impacts on bat foraging/commuting routes within land adjacent to the Proposed Scheme. Where possible, a buffer strip of vegetation would be retained at the highways boundary fence to prevent light spill and minimise potential short-term / temporary interruption of bat foraging/commuting routes within land adjacent to the Proposed Scheme due to temporary night-time construction lighting. In addition to this, there is a large amount of suitable alternative foraging habitat (hedgerows, woodlands, fields and waterbodies) available in the wider landscape surrounding the Proposed Scheme for bats to utilise.

### Otter

6.7.27 Construction of the Proposed Scheme is unlikely to have any significant effect on the favourable conservation status of the local population of otters.

6.7.28 Otter are confirmed to be commuting along one watercourse associated with the Proposed Scheme. However, no holts or other resting sites have been identified within the Study Area.

6.7.29 The construction of the Proposed Scheme could cause temporary disturbance to otter if undertaken at night through both noise and light disturbance. This may discourage otters from foraging and commuting within this section of the watercourses causing temporary fragmentation of otter habitats along watercourses. However, this would only be a small section of available foraging habitat, as many of the river corridors extend way beyond the extent of the highways boundary and there is sufficient riparian habitat in the wider landscape for otters to use for foraging. Where possible, appropriate directed lighting would be used to minimise light spill into

the surrounding river corridors. This would be critical for works associated with the River Bollin overbridge, River Bollin Drain (7-GCN-22) overbridge and Birkin Brook overbridge.

6.7.30 Otters are inquisitive animals and may be attracted onto work sites during the construction phase to investigate new machinery or spoil heaps. There is a risk of otters becoming trapped in any pits and piping, chemical containers or wire mesh. However, this would be controlled with construction standard good practices which would be outlined within a PMW (if required).

6.7.31 A pollution incident or run-off from the construction activities may affect the availability of prey in the short-term. Good site management practices and standard pollution prevention measures would be implemented to avoid pollution incidents from occurring. Site compounds and storage areas would be sited away from watercourses and waterbodies (at least 8m) as specified in the OEMP.

### Water Vole

6.7.32 Construction of the Proposed Scheme is unlikely to have any significant effect on the favourable conservation status of the county population of water vole.

6.7.33 There are two watercourses that cross the carriageway (River Bollin and Birkin Brook) with potential to support water vole; however, no evidence was found during surveys in 2017.There are some drainage ditches present on site, although these were dry and considered sub-optimal to support water vole. The ditches within the highways boundary are linked to a larger ditch network in the wider area where more suitable habitat for water vole to utilise is present.

6.7.34 Drainage design for the Proposed Scheme could include re-profiling and culverting to facilitate attenuation during periods of high rainfall. This would minimise the potential for direct mortality of water vole in the future and reduce the impact on the county water vole population.

6.7.35 Water pollution from construction activities is likely to affect watercourses potentially used by water vole. A pollution incident or run-off from the construction activities may affect the water quality in the ditches and impact breeding success or cause direct mortality of water vole. This can cause local extinction, particularly in areas that support low water vole populations. Good site standard practices along with pollution prevention guidelines would be implemented as part of the CEMP to avoid pollution incidents occurring. No pollution effects are anticipated beyond 50m (the Study Area) of the Proposed Scheme.

### Breeding Birds

6.7.36 Construction of the Proposed Scheme is unlikely to have any significant effect on the favourable conservation status of the local population of nesting birds including species notable for their conservation concern.

6.7.37 Suitable timing of vegetation clearance is recommended in the OEMP and would avoid damage and destruction of nests in current use. Clearance of suitable nesting habitat during breeding bird season should be completed under a watching brief. Vegetation. clearance associated with construction of the Proposed Scheme would result in temporary negative impacts to nesting birds through loss of nesting and foraging habitat; and construction would result in disturbance (noise and night time lighting) of retained and adjacent foraging and nesting habitat and may displace birds from the immediate area. However, the impact is considered to be low as the habitats within the soft estate are already perceptible to high levels of light and noise disturbance. Furthermore, optimal breeding habitat is abundant throughout the adjacent land and the displacement of low numbers of breeding birds from the immediate area is unlikely to impact on the breeding success of bird species

6.7.38 Disturbance of nesting habitat would be a temporary negative impact, over two breeding seasons. Vegetation. temporarily lost to facilitate construction would be replanted or left to naturally recolonise and there would be no long-term effect in relation to habitat loss.

6.7.39 These temporary effects are not considered to be significant in terms of the favourable conservation status of the local population of nesting birds.

6.7.40 There would be only very small scale permanent loss of habitat beneath the footprint of the new infrastructure. However, this small scale loss is largely adjacent to the carriageway where it is less likely that birds would currently nest due to disturbance from traffic.

**Badger**

6.7.41 Construction of the Proposed Scheme is unlikely to have any significant effect on the favourable conservation status of the local population of badgers.

6.7.42 The construction works within the soft estate would require ground works from the hard shoulder rib line to an anticipated minimum distance of 4m; and in some locations the ground works would extend up to the highways boundary. Excavation depths would vary along the soft estate, from shallow excavations required for ducting to more significant excavations required for the gantry foundations.

6.7.43 Thirteen badger setts were recorded within the Proposed Scheme footprint with an additional 15 active setts located within 50m of the highways boundary. The construction works outlined above have the potential to damage or destroy active badger setts through direct loss of the sett or loss of habitat close to the sett. There would be a requirement for temporary and permanent exclusion of badger setts during the construction period; this is to avoid the risk of killing, injuring or disturbing any badgers that may be using setts in the hard shoulder during the construction phase. The mitigation approach would be subject to agreement with Natural England as part of the licence application, developed as part of the detailed design of the Proposed Scheme and final construction programme. This would ensure there is no detriment to the conservation status of local badger populations

6.7.44 The vegetation clearance and construction works would lead to temporary and permanent loss of foraging habitats within the soft estate. The majority of construction works would be close to the hard shoulder, which is generally of low quality and degraded, and therefore, of poor suitability for foraging badgers There is also sufficient suitable habitat in the wider landscape for badgers to use for foraging. No significant negative effects are anticipated on badger movement or interruption of commuting activities across the construction period.

6.7.45 Badgers are likely to move across the soft estate to forage and disperse between setts during the construction period. Therefore, there is a risk of badgers becoming trapped in any pits, piping, chemical containers or wire mesh. As badgers are largely nocturnal, any night works may also lead to badgers being run-over by works vehicles. Good site management practices, such as correct storage of materials and equipment and ensuring that badger cannot get trapped in excavations would avoid direct mortality of badgers during the construction of the Proposed Scheme. These have been outlined within the OEMP.

## 6.8 Potential Operational Effects

### Designated Sites

6.8.1 With respect to European designated sites and Ramsar sites, a Habitat Regulations Assessment screening report has been completed for the Proposed Scheme and concludes that there are no likely significant adverse effects (either alone or in-combination with other projects and plans) anticipated on the integrity and/or the favourable conservation status of Rostherne Mere Ramsar and SSSI as a result of the operation of the Proposed Scheme. (This has been subject to consultation with Natural England and the outcome has been agreed.

6.8.2 No significant effects on the structure and function of statutory and non-statutory designated sites for nature conservation are anticipated as a result of operation of the Proposed Scheme.

6.8.3 Wildlife within statutory and non-statutory sites adjacent to the Proposed Scheme are highly likely to be habituated to live traffic currently present on the carriageway. Whist traffic would be marginally closer to the boundary of these sites, this is unlikely to have any additional effect above that which already exists.

## Notable Habitats

6.8.4 No significant effects on notable habitat adjacent to the Proposed Scheme are anticipated as a result of the operation of the Proposed Scheme.

6.8.5 Potential pollution risks are managed through the existing and new drainage network. Whist traffic is expected to increase; the air quality assessment concludes there would be no significant effect on local air quality as a result of the Proposed Scheme.

## Other Habitats

6.8.6 Spray from road vehicles, road gritting and accidental pollution events, such as road traffic accidents, during the operation of the Proposed Scheme, could negatively affect terrestrial habitat adjacent to the hard shoulder when in use as a running lane. However, this would mainly affect habitats in the immediate vicinity of the hard shoulder that would have been landscaped as part of the Proposed Scheme design; as such, no significant effect on any habitat of local or greater value is anticipated.

## Notable and/or Legally Protected Species

### Great Crested Newts

6.8.7 No significant effects on the conservation status of GCN is anticipated as a result of the operation of the Proposed Scheme.

6.8.8 The Proposed Scheme would be undertaken on an existing major road which likely already acts as a significant barrier to dispersal, and GCN are unlikely to attempt to cross the carriageway to move between ponds. The risk of GCN fatalities is unlikely to change during the operation of the Proposed Scheme compared to existing numbers. Additionally, the Proposed Scheme when operational would not create any new barriers to dispersal for any existing populations of GCN within or outside of the Study Area.

6.8.9 In-organic and organic diffuse run-off from the Proposed Scheme (e.g. salts, fuel spills) could pollute waterbodies in adjacent land, adversely affecting GCN populations. There is also the potential for sediment from run-off to block rain-seepage lines and alter the depth and size of ponds, adversely affecting resident GCN populations. Approximately 17 ponds could be impacted by blocked seepage lines. This is a worst case scenario and is based on the direct connectivity of these ponds to the motorway drainage system and topography of the land. However, there will be no change to existing run-off levels of both organic and in-organic materials and appropriate protective measures would be included into the design of the Proposed Scheme to ensure levels remain constant.

### Bats

6.8.10 No significant effect on the conservation status of bats is anticipated as a result of the operation of the Proposed Scheme.

6.8.11 Lighting would not be extended beyond the current situation, although existing lighting in the central reserve and verges would be replaced.

6.8.12 The lighting columns and LED bulbs would be selected and designed to minimise light spill beyond the highways boundary. This could include the use of lighting hoods and remote controlled dimming technology.

6.8.13 Where there is likely to be a direct loss of known bat roosts then a licence from Natural England would be required. Mitigation measures would be confirmed once survey data is available but are likely to include providing alternative roosting opportunities such as bat boxes.

### Otter

6.8.14 No significant effect on the conservation status of otter is anticipated as a result of the operation of the Proposed Scheme.

6.8.15 Operation of the Proposed Scheme would not result in any additional barrier to the dispersal of otters through the local landscape or any additional disturbance to watercourses.

6.8.16 A pollution incident or run-off from the motorway may affect the availability of prey in the short-term. A particularly severe pollution incident (such as large scale fuel/chemical spillages) could lead to bio-accumulation of toxic contaminants in the prey species eaten by otters. This may increase mortality, decrease breeding success or result in abandonment of the site. However, the likelihood of a pollution event occurring would not increase during the operational phase of the Proposed Scheme compared to existing, and as such, no significant effects are anticipated. Appropriate protective measures would be included into the design of the Proposed Scheme to minimise the effects of a pollution event affecting otter habitat.

### Water Vole

6.8.17 No significant effect on the conservation status of water vole is anticipated as a result of the operation of the Proposed Scheme.

6.8.18 Operation of the Proposed Scheme would not result in any additional barrier to the dispersal of water vole through the local landscape or any additional disturbance to watercourses.

6.8.19 Inorganic diffuse run-off from the Proposed Scheme could pollute watercourses, adversely affecting water vole populations. If salt used to de-ice roads in winter were to enter watercourses used by water vole, this could have adverse effects on water vole in areas close to the road resulting in a significant negative effect at site level. This may be worse than the existing situation due to increase in hardstanding area, and thus increase in run-off. However, appropriate protective measures would be included into the drainage design of the Proposed Scheme to minimise the effects of a pollution event affecting water vole habitat.

### Breeding Birds

6.8.20 No significant effect on the conservation status of nesting birds is anticipated as a result of the operation of the Proposed Scheme.

6.8.21 Localised removal of screening vegetation will mean birds are more likely to fly lower during taking off and landing potentially putting them at a higher risk of vehicle strike. It is possible that there would be minor loss of nesting habitat for passerine birds immediately adjacent to the carriageway as live traffic would be closer to nesting habitat during operation of the Proposed Scheme. However, these impacts are not considered to be significant to the favourable conservation status of the bird community in the local context.

### Badger

6.8.22 No significant effect on the conservation status of badger is anticipated as a result of the operation of the Proposed Scheme.

6.8.23 Under bridges and over bridges with existing commuting routes used by badgers would be retained and would allow continued badger movement between both sides of the motorway. Therefore, no fragmentation or severance effects are anticipated during the operation of the Proposed Scheme.

6.8.24 There remains a risk that badger could attempt to cross the road in other locations when commuting across terrestrial land. No increase to the risk of badger fatalities is anticipated during the operation of the Proposed Scheme.

## 6.9 Enhancement Measures

### Habitats

6.9.1 To aid natural colonisation and ensure higher quality habitat is achieved, areas not permanently used as hard standing should be re-planted with appropriate habitats to provide greater structural diversity and more foraging opportunities for species such as GCN, badger and birds. This secondary mitigation will be outlined in the OEMP. Scalloped edging would encourage greater insolation and the development of a more floristically diverse herbaceous layer providing habitat for pollinating insects contributing to the National Pollinator Strategy[32].

6.9.2 Habitat enhancement measures would be met through the landscape and ecology detailed design. Where possible, further measures to help meet these objectives would be integrated into the landscape design proposals including retention of existing habitats where the habitat is considered to provide value to the local ecology (i.e. Optimal terrestrial habitat in close proximity to GCN ponds) and retention of habitat corridors (tree lines and hedgerows) for species including GCN, bats and badgers.

### Notable and/or Legally Protected Species

6.9.3 As part of the mitigation and compensation measures (secondary mitigation) proposed for notable and/or legally protected species such as GCN and reptiles, increased sheltering, hibernating and breeding opportunities would be created in retained habitats throughout the Proposed Scheme, such as log / brash piles, and nesting/roosting boxes.

## 6.10 Residual effects

6.10.1 No residual effects are anticipated as a result of the Proposed Scheme. No significant effects on designated sites, notable habitats (trees and hedgerows) or notable and/or legally protected species are anticipated as a result of the Proposed Scheme and when considered in conjunction with other proposals.

6.10.2 Chapter 9 provides an assessment of the intra-project and inter-project cumulative effects, covering the topic of biodiversity.

## 6.11 Summary

6.11.1 Table 6-5 provides a summary of the impacts and residual effects anticipated from the Proposed Scheme.

[32] Defra (2014) The National Pollinator Strategy: for bees and other pollinators in England. Available from: www.gov.uk/government/publications.

**Table 6-5 Summary of impacts and residual effects**

| Baseline | | | Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|
| **Important Ecological Feature** | **Value** | **Location** | **Effect during construction** | **Effect during operation** | **Mitigation** | **Significance of residual effect** | **Significance category** |
| Rostherne Mere Ramsar | International | South of M56 Junction 8 (see figure 6.2) | No impacts identified. | No impacts identified.<br><br>NOx level change considered imperceptible. | None required. | No effect | Neutral |
| Rostherne Mere SSSI | National | South of M56 Junction 8 (see figure 6.2) | No impacts identified. | No impacts identified.<br><br>NOx level change considered imperceptible. | None required. | No effect | Neutral |
| SBI's and LWS adjacent to the Proposed Scheme | County | Multiple locations adjacent to the Scheme (see figure 6.2) | No impacts identified. | No impacts identified.<br><br>NOx level change considered imperceptible. | None required. | No effect | Neutral |
| Ancient woodland | National | Multiple locations adjacent to the Scheme (see figure 6.2) | No impacts identified | No impacts identified.<br><br>NOx level change considered imperceptible. | None required. | No effect | Neutral |
| Notable habitats within and adjacent to the Proposed Scheme | Local | Multiple locations adjacent to the Scheme (see figure 6.4) | No impacts identified | No impacts identified.<br><br>NOx level change considered imperceptible. | None required. | No effect | Neutral |
| Other habitats | Local | Within soft-estate along the Scheme extent | No impacts identified | No impacts identified.<br><br>NOx level change considered imperceptible. | None required. | No effect | Neutral |

| Baseline | | | Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|
| **Important Ecological Feature** | **Value** | **Location** | **Effect during construction** | **Effect during operation** | **Mitigation** | **Significance of residual effect** | **Significance category** |
| Great crested newts | Local | Multiple pond locations within adjacent land (see Figure 6.4) | Temporary loss and damage of terrestrial habitat reducing available habitat resource.<br><br>Small scale permanent loss of terrestrial habitat with new structures including gantries, drainage/electrical chambers and emergency refuge areas.<br><br>Killing, injuring or disturbance of individuals during works. | Direct mortality, pollution | Pre-construction monitoring surveys for this species where necessary;<br><br>Standard measures in OEMP to include:<br>- enhancement of retained habitats to accommodate individuals displaced by construction;<br>- implementation of pollution control measures;<br>- habitat reinstatement and enhancement works.<br>- prevention of injury and mortality of individuals during construction controlled through implementation of PMW and appropriately timed construction phases.<br>- Construction to take place under a scheme-wide EPSL which may include GCN exclusion / trapping programme in high risk areas.<br><br>Appropriate drainage design to protect the welfare of the species. | No effect | Neutral |

| Baseline | | | Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|
| **Important Ecological Feature** | **Value** | **Location** | **Effect during construction** | **Effect during operation** | **Mitigation** | **Significance of residual effect** | **Significance category** |
| Bats | Local | Multiple trees/structures within Scheme footprint and adjacent land (see Figure 6.4) | Vegetation clearance resulting in temporary minor loss of resources, such as potential roost sites, commuting and foraging habitats.<br><br>Disturbance to roosts (if present) and foraging/commuting habitat due to noise, vibrations and night-time lighting during construction and due to presence of personnel. Construction activities which have potential to cause disturbance include RCB installation, deck proofing and wing wall and parapet replacements. | Additional light pollution from changes in lighting design. | Upgrade of lighting infrastructure to minimise impacts to bats.<br><br>Pre-construction update surveys for this species where necessary.<br><br>Standard measures in OEMP to include:<br>- appropriate, directed lighting during night time construction works<br>- sensitive construction lighting in accordance with the OEMP.<br>- retention of strip of vegetation along highways boundary fence line where possible to prevent light spill onto surrounding land and retain continuity of potential commuting/foraging habitat.<br>- bat EPSL and roost replacement/precautionary working methods in structures with confirmed bat roosts. | No effect | Neutral |

| Baseline | | | Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|
| **Important Ecological Feature** | **Value** | **Location** | **Effect during construction** | **Effect during operation** | **Mitigation** | **Significance of residual effect** | **Significance category** |
| Otter | Local | River Bollin, River Bollin Drain and Birkin Brook | Potential temporary loss and damage of terrestrial habitat resulting in loss of resource availability.<br><br>Destruction, damage or disturbance of a resting place within terrestrial habitat.<br><br>Pollution into watercourses caused by spills or wash off from disturbed soil due to construction activities. | Pollution incidents including inorganic diffuse run-off. | Pre-construction surveys for this species where deemed necessary.<br><br>Standard measures in OEMP to include:<br>- prevention of mortality of individuals during construction;<br>- implementation of pollution control measures.<br><br>Appropriate drainage design to minimise changes to the local hydrology. | No effect | Neutral |
| Water vole | County | River Bollin and Birkin Brook | Potential temporary loss and damage of terrestrial habitat resulting in loss of resource availability.<br><br>Destruction, damage or disturbance of a resting place within terrestrial habitat.<br><br>Pollution into watercourses caused by spills or wash off from disturbed soil due to construction activities. | Pollution incidents including inorganic diffuse run-off. | Pre-construction surveys for this species where deemed necessary<br><br>Standard measures in OEMP to include:<br>- implementation of pollution control measures.<br><br>Appropriate drainage design to minimise changes to the local hydrology | No effect | Neutral |
| White-clawed crayfish | County | N/A | Scoped out of Impact Assessment during initial walkover surveys due to unsuitable habitat. | | | | N/A |

| Baseline | | | Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|
| **Important Ecological Feature** | **Value** | **Location** | **Effect during construction** | **Effect during operation** | **Mitigation** | **Significance of residual effect** | **Significance category** |
| Notable breeding birds | Local | Multiple locations within the Scheme footprint and immediate adjacent land | Temporary loss of foraging and nesting habitat.<br>Small scale permanent loss of foraging and nesting habitat. | Slight increase in bird strike due to proximity of live traffic to habitat.<br>Minor loss of nesting habitat due to displacement from habitat close to live traffic. | Standard measures detailed in OEMP to prevent damage and disturbance of nesting birds.<br>Habitat re-planted or left to naturally recolonise. | No effect | Neutral |
| Badger | Local | Multiple sett locations within Scheme footprint and adjacent land (see Figure 6.4) | Temporary habitat loss and fragmentation. | Badger | Local | Multiple sett locations within Scheme footprint and adjacent land (see Figure 6.4) | Temporary habitat loss and fragmentation. |

# 7. Landscape and Visual Effects and Setting of Cultural Heritage Assets

Key features for this topic:

- The landscape and visual assessment set out in this chapter has been based on a Simple Assessment as described in Interim Advice Note (IAN) 135/10. The choice of a simple assessment was made because the potential landscape or visual effects were not considered to be significant.
- There are no nationally designated landscapes within the study area and one local landscape Designation within Cheshire East, the Bollin Valley and Parklands. This area crosses, and lies adjacent to the Proposed Scheme north of the M56 motorway. Construction effects on the Bollin Valley and Parklands designation are considered to be **slight adverse**, reducing to **neutral** during operation Year 1 and future Year 15.
- There would be no permanent significant residual landscape and visual effects, or significant residual effects on the setting of cultural heritage assets during operation.
- During construction, potentially significant localised effects have been identified for 11 key visual locations, this reduces to 7 locations at Year 1 of operation and no locations following establishment of mitigation at future Year 15. At each stage, when the Proposed Scheme is considered as whole, it is concluded that the overall effect would not be significant.
- The setting to one Heritage asset, Yew Tree House Grade II Listed Building, would experience a temporary significant adverse effect during construction only.
- In addition to embedded mitigation measures achieved during the design process to reduce effects, including choice of gantry location, there would be measures to minimise disruption and visual effects for the duration of construction activities. Following construction, mitigation planting on reinstated verges would occur in locations where; visual effects require screening, and integration of the motorway into the wider landscape pattern of woodlands, trees and hedgerows would be effective.
- There is the potential for a small number of visual receptors to benefit from an increase in screening from the motorway compared to their existing view and there is the potential for an increase in planting along the wider route corridor to the benefit of landscape integration and green infrastructure within the landscape through which the road passes.
- Overall in the long term, the Proposed Scheme is considered to have a residual **neutral** effect in terms of landscape, visual amenity and the setting of cultural heritage assets.

## 7.1 Introduction

7.1.1 This section considers effects on landscape, visual amenity and the setting of cultural heritage assets that would result from the construction and operation of the Proposed Scheme, including vegetation clearance, and the introduction of new highways infrastructure. The findings are set out in this chapter with further information provided on Figure 7.1 and in the Landscape, Visual and Cultural Heritage Effects Schedule found in Appendix D.1.

7.1.2 The section of M56 under consideration in this report passes through green belt rural locations west of Manchester Airport and to the south of urban areas such as Hale Barns, Hale and Bowdon on the outer suburbs of Manchester. The land use is predominantly agricultural with urban edge uses and some significant large scale developments around Manchester Airport.

7.1.3 Existing vegetation cover has been described in terms of adequacy of its integration and screening functions along this section of motorway and the potential to improve these functions through proposed planting and with regard to the Highways England Licence and Route Investment Strategy (RIS) environmental objectives for the Proposed Scheme.

**Changes to assessment scope**

7.1.4 The Environmental Scoping Report found that the Proposed Scheme would not have significant effects on designated landscape receptors or landscape character and, following review of the proposals at DF2 to confirm this assessment, they have largely been excluded from this assessment. However, when consulted, East Cheshire Council highlighted the local landscape area of the Bollin Valley and Parklands which they requested be included in the assessment. This area has therefore been considered.

7.1.5 The Environmental Scoping Report concluded that that the Proposed Scheme would have the potential to cause significant effects on visual receptors and the setting of cultural heritage assets. Highly sensitive receptors may have views of parts of the Proposed Scheme because of the loss of existing mature vegetation during construction and the new highway infrastructure including new and upgraded gantries, new running lanes, remotely operated temporary traffic management sign (ROTTMS) and emergency refuge areas (ERA).

7.1.6 This chapter therefore provides an assessment to address the visual and cultural heritage receptors that were scoped in for further assessment in the Environmental Scoping Report, together with the landscape area noted above and new receptors identified during this assessment, new receptors are noted in section 7.4. The aspects assessed include:

- Existing vegetation.
- Local Landscape Area.
- Visual receptors (largely residential) with views towards the carriageway and new highway infrastructure.
- Views experienced by people on National Trails and public rights of ways (PRoWs) that run in close proximity to the Proposed Scheme.
- The landscape setting of designated cultural heritage assets.

7.1.7 As the areas which would be affected by the works are intermittent and focused around individual structures, a Zone of Theoretical Visibility (ZTV), which identifies the extent of land from which the proposals would be visible in a hypothetical 'bare earth' environment, has not been produced.

7.1.8 Viewpoints for visual receptors were refined on site to account for accessibility and to provide a representative range of views based on professional judgement applied in the field. The location of these key representative viewpoints are mapped in Figure 7.1 and described in Appendix D.1.

## 7.2 Study Area

7.2.1 The study area for the landscape and visual assessment is broadly based on a 1km offset from the Proposed Scheme highway boundary identified within the Environmental Scoping Report, within which locations where changes as a result of construction or operation may be experienced have been identified. As visual effects would be generated within the existing highway boundary and would largely be experienced by receptors located within 300m of the motorway, visual effects beyond this, up to and more than 1km distance, are considered negligible.

7.2.2 The study area for cultural heritage assets is based on a 1km offset of the Proposed Scheme although a buffer of 300m has been imposed for primary consideration of their setting, only assets with exceptional sensitivity are considered up to 1km.

7.2.3 The following Local Authorities have been consulted in regard to areas where views or visual amenity is considered important; Cheshire East Council, Trafford Council and Manchester City Council. Cheshire East Council responded on 7 August 2017 noting that two areas of the Bollin Valley and Parklands Area of Special County Value (ASCV) should be considered along with footpaths/ bridleways in close proximity to the motorways and residential dwellings, including Listed Buildings, located to the north and south of this route. These have all been included within this assessment.

7.2.4 Natural England has published the Manchester Conurbation, Mersey Valley, and Shropshire, Cheshire and Staffordshire Plain NCA profiles (NCA 55[33], NCA 60[34], and NCA 61[35] respectively). As well as describing the distinctive characteristics of each area, these profiles identify opportunities for positive environmental change through Statements of Environmental Opportunity (SEO). Of the three NCA's, NCA 55, and NCA 61 are considered, whereas NCA 60 which is remote from the Proposed Scheme and therefore not considered. Of the SEOs in the considered NCA's, those of relevance to the Proposed Scheme are presented in Table 7-1.

[33] http://publications.naturalengland.org.uk/publication/5989113924681728?category=587130
[34] http://publications.naturalengland.org.uk/publication/6387892108656640?category=587130
[35] http://publications.naturalengland.org.uk/publication/6076647514046464

**Table 7.1: Summary of National Character Area Statements of Environmental Opportunity**

| |
|---|
| **NCA 55: Manchester Conurbation** |
| • **SEO 1**: Provide and maintain green infrastructure, including multi-functional green spaces and trees, improving links between habitats as well as creating a high-quality urban environment – to aid adaptation to climate change, to provide opportunities for recreation, and to enable people to enjoy the benefits that access to nature brings.<br>• **SEO 2**: Conserve and enhance the cultural heritage and character of the Manchester Conurbation, recognising the industrial and textile history of the area, and providing opportunities for access and interpretation of the urban environment for people to understand and enjoy.<br>• **SEO 4**: Conserve and enhance the river valleys and canals, as corridors through the urban areas, for the multiple benefits that the natural environment provides, to improve the landscape, and to make green spaces available for the benefit of both wildlife and people. |
| **NCA 61: Shropshire, Cheshire and Staffordshire Plain** |
| • **SEO 2**: Protect the landscape of the plain, recognising its importance to food production and incorporating well-maintained hedgerows, ponds and lowland grassland margins within agricultural systems, to secure resource protection and maintain productivity, while reducing fragmentation of semi-natural habitats to benefit a wide range of services, such as landscape character, sense of place, water quality and biodiversity.<br>• **SEO 3**: Manage and restore lowland heathland and ancient and plantation woodland, support partnerships to plan appropriately scaled new woodland cover, particularly where this will link and extend existing woodlands, restore and reinstate traditional orchards and increase biomass provision to mitigate the impact of climate change, where this will benefit biodiversity, landscape character and enhance the experiential qualities of the area.<br>• **SEO 4**: Protect and manage the nationally important geological sites and heritage features demonstrating how the interaction of natural and historical factors influenced the distinctive character of its landscape and settlement patterns, and help to promote greater understanding of the link between wildlife, heritage and geodiversity, particularly the importance of former extraction sites for both geodiversity and biodiversity. |

## 7.3 Methodology

7.3.1 The Proposed Scheme was reviewed against the criteria for the type of assessment required in Interim Advice Note (IAN) 135/10 Landscape and Visual Effects Assessment (Highways England, November 2010). This guidance confirmed the use of the Simple Assessment format and this assessment has been carried out broadly in accordance with a Simple Assessment, as set out within IAN 135/10. The assessment also takes account of Guidelines for Landscape and Visual Impact Assessment (GLVIA) 3rd Edition (Landscape Institute and Institute of Environmental Management and Assessment 2013).

7.3.2 Data sources used in this assessment include:

- Ordnance Survey – 1:50,000 and 1:25,000 scale maps.
- Google Earth and Street View to check as appropriate.
- M56 J6 to J8 Environmental Scoping Report, July 2017.
- Aerial photography to determine the likely structure and integrity of existing vegetation within and outside the boundaries of the road corridor.

- Landscape designations, including Local Landscape Designations (formerly Areas of Special County Value (ASCV))[36].
- National Heritage List for heritage designations, including World Heritage Sites, Listed Buildings, Scheduled Monuments and Conservation Areas, Registered Battlefields and Registered Parks and Gardens[37].
- The Setting of Heritage Assets, Historic Environment Good Practice Advice in Planning38.

7.3.3 Site visits were made in March and May 2017 to carry out the landscape, visual amenity and heritage setting assessment from publicly accessible areas during winter and summer months.

7.3.4 In accordance with a Simple Assessment, and to make the assessment proportionate to the Proposed Scheme, visual effects have been considered in broad terms. Key representative viewpoints have been assessed to illustrate the visual effects from a range of visual receptors surrounding the Proposed Scheme. These encompass, and occasionally expand upon, the receptors identified within the Environmental Scoping Report.

7.3.5 Visual amenity and heritage setting effects have been assessed from publicly accessible vantage points at key representative viewpoints. Where access to the viewpoint was not possible, i.e. residential properties, the existing view and likely visual effects were determined by using professional judgement and comparison to views from nearby accessible locations, together with the use of aerial photography. All site assessment work has been undertaken at ground level and on foot and any descriptions of views from first floor windows have been assumed using professional judgement.

7.3.6 The locations of the landscape areas, key representative viewpoints and cultural heritage assets are indicated on Figure 7.1. All Highly Sensitive Receptors identified in the Environmental Scoping Report are also indicated for reference.

7.3.7 Detailed assessment schedules in Appendix D.1 record and describe each assessed landscape area, key viewpoints and the setting of cultural heritage assets in terms of sensitivity and the predicted impact and effect of the Proposed Scheme at construction, operation Year 1 and future Year 15.

**Landscape and Visual Assessment Criteria**

7.3.8 The criteria which determines the sensitivity of identified landscape and visual receptors are set out in Table 7-2.

**Table 7.2 Landscape and Visual Receptor Sensitivity Criteria[39]**

| Sensitivity | Landscape - typical criteria descriptors | Visual – typical criteria descriptors |
|---|---|---|
| High | Landscapes which by nature of their character would be unable to accommodate change of the type proposed. Typically, these would be:<br>• Of high quality with distinctive elements and features making a positive contribution to character and sense of place.<br>• Likely to be designated, but the aspects which | Residential properties.<br><br>Users of Public Rights of Way or other recreational trails (e.g. National Trails, footpaths, bridleways etc.).<br>Users of recreational facilities where the purpose of that recreation is enjoyment of the countryside (e.g. Country Parks, National Trust or other access land etc.) |

[36] www.cheshireeast.gov.uk/PDF/En-LDF-Landscape%20Study.pdf
[37] https://www.historicengland.org.uk/listing/the-list/data-downloads
[38] https://historicengland.org.uk/images-books/publications/gpa3-setting-of-heritage-assets/
[39] Landscape and Visual Sensitivity Criteria derived from Guidelines for Landscape and Visual Impact Assessment Third edition (GLVIA3 April 2013).

| Sensitivity | Landscape - typical criteria descriptors | Visual – typical criteria descriptors |
|---|---|---|
| | underpin such value may also be present outside designated areas, especially at the local scale.<br>• Areas of special recognised value through use, perception or historic and cultural associations.<br>• Likely to contain features and elements that are rare and could not be replaced. | |
| Moderate | Landscapes which by nature of their character would be able to partly accommodate change of the type proposed. Typically, these would be:<br>• Comprised of commonplace elements and features creating generally unremarkable character but with some sense of place.<br>• Locally designated, or their value may be expressed through non-statutory local publications.<br>• Containing some features of value through use, perception or historic and cultural associations.<br>• Likely to contain some features and elements that could not be replaced. | Outdoor workers.<br>Users of scenic roads, railways or waterways or users of designated tourist routes.<br>Schools and other institutional buildings, and their outdoor areas. |
| Low | Landscapes which by nature of their character would be able to accommodate change of the type proposed. Typically, these would be:<br>• Comprised of some features and elements that are discordant, derelict or in decline, resulting in indistinct character with little or no sense of place.<br>• Not designated.<br>• Containing few, if any, features of value through use, perception or historic and cultural associations.<br>• Likely to contain few, if any, features and elements that could not | Indoor workers.<br>Users of main roads (e.g. trunk roads) or passengers in public transport on main arterial routes.<br>Users of recreational facilities where the purpose of that recreation is not related to the view (e.g. sports facilities). |

| Sensitivity | Landscape - typical criteria descriptors | Visual – typical criteria descriptors |
|---|---|---|
| | be replaced. | |

7.3.9 The magnitude of impact experienced by landscape receptors relates to the degree of change that would be caused by the Proposed Scheme. Factors taken into consideration include the scale, duration and nature of potential changes present at each assessment point and the effectiveness of mitigation measures. Definitions relating to the magnitude of landscape impact are defined in Table 7-3 and IAN 135/10.

**Table 7.3 Magnitude of Impact Criteria[40] for Landscape Receptors**

| Magnitude | Typical Criteria Descriptors |
|---|---|
| Major | Adverse - Total loss or large scale damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic conspicuous features and elements.<br>Beneficial - Large scale improvement of character by the restoration of features and elements, and/or the removal of uncharacteristic and conspicuous features and elements, or by the addition of new distinctive features. |
| Moderate | Adverse - Partial loss or noticeable damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic noticeable features and elements.<br>Beneficial - Partial or noticeable improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic and noticeable features and elements, or by the addition of new characteristic features. |
| Minor | Adverse - Slight loss or damage to existing character or features and elements, and/or the addition of new but uncharacteristic features and elements.<br>Beneficial - Slight improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements. |
| Negligible | Adverse - Barely noticeable loss or damage to existing character or features and elements, and/or the addition of new but uncharacteristic features and elements.<br>Beneficial - Barely noticeable improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements. |
| No change | No noticeable loss, damage or alteration to character or features or elements. |

7.3.10 The magnitude of impact, scale, type and duration of change, experienced by visual receptors as a result of the Proposed Scheme has been determined using the criteria in Table 7-4 and IAN135/10.

[40] Magnitude of Impact Landscape Criteria derived from Guidelines for Landscape and Visual Impact Assessment Third edition (GLVIA3 April 2013).

**Table 7.4 Magnitude of Impact Criteria[41] for Visual Receptors**

| Magnitude of Impact | Typical Criteria descriptors |
|---|---|
| Major | The Proposed Scheme, or a part of it, would become the dominant feature or focal point of the view. |
| Moderate | The Proposed Scheme, or a part of it, would form a noticeable feature or element of the view which is readily apparent to the receptor. |
| Minor | The Proposed Scheme, 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 Proposed Scheme would be discernible, or it is at such a distance that it would form a barely noticeable feature or element of the view. |
| No change | No part of the Proposed Scheme, or work or activity associated with it, is discernible. |

7.3.11 The significance of landscape and visual effects is a function of sensitivity and magnitude of impact and has been determined as set out in Table 7-5.

7.3.12 Moderate, large or very large significance of effect values are considered to be significant and are arrived at using the Table 7-5 below as a guide and balanced using professional judgement.

**Table 7.5 Significance of Effect Values[42] for Landscape and Visual Receptors**

| Landscape/Visual Sensitivity | Magnitude of Impact | | | | |
|---|---|---|---|---|---|
| | No change | Negligible | Minor | Moderate | Major |
| High | Neutral | Slight | Moderate | Large | Very Large |
| Moderate | Neutral | Neutral or Slight | Slight | Moderate | Large |
| Low | Neutral | Neutral or Slight | Neutral | Slight | Moderate |

**Heritage Asset Setting Assessment Criteria**

7.3.13 Assessment of significance of effects on heritage assets follows a similar matrix-based approach to reach a value for significance of effect as shown in Table 7-5 above. It has been undertaken with reference to the guidance provided in DMRB Volume II section 3 Part 2 (HA208/07), The Setting of Heritage Assets[43] and professional judgement. Detailed description of the historic asset setting and impacts on it are found in the Visual Effects Schedule in Appendix D.1.

7.3.14 Heritage assets have been taken forward to assessment if they fall within the 300m buffer of the Proposed Scheme or are assets which lie between 300m and 1km, and are of high sensitivity where historic views are important.

7.3.15 Up to date Conservation Area designations have been reviewed. Due to the amendment of the South Hale Conservation area there are now no Conservation Areas in the study area of the Proposed Scheme.

7.3.16 It should be noted that although there may be localised significant effects, when the impact of the whole Proposed Scheme is considered, the overall effect of the Proposed Scheme on the

[41] Magnitude of Impact Visual Criteria derived from Guidelines for Landscape and Visual Impact Assessment Third edition (GLVIA3 April 2013).
[42] Significance of Landscape and Visual Effect Categories derived from Guidelines for Landscape and Visual Impact Assessment Third edition (GLVIA3 April 2013).
[43] The Setting of Heritage Assets, Historic Environment Good Practice Advice in Planning 3, Historic England

landscape, visual amenity or cultural heritage assets, may be judged to be not significant due to consideration of the full range of effects from the complete scheme. This is a matter of professional judgement and reasoning.

## 7.4 Baseline Conditions

### Existing Vegetation

7.4.1 The motorway runs through predominantly open agricultural areas of green belt with a pattern of hedgerow field boundaries. Larger fields to the west of the Proposed Scheme give way to small irregular fields south and north of the motorway between junction 6 and 8 and they are typically bounded by hedgerows with trees. Small blocks of woodland are a feature in the landscape and several abut the edge of the motorway. The Proposed Scheme crosses or passes close to two notable areas of woodland; the heavily wooded River Bollin Valley and Sunbank Wood near the airport. Tree cover within the wider landscape includes woodland to the south in Tatton Park and Rostherne Mere National Nature reserve.

7.4.2 The existing motorway is in low cutting for a large portion of the Proposed Scheme extending onto embankment where it crosses over local routes and slip road rise on embankments at junctions. Trees and shrubs are intermittent on cutting slopes which are predominantly grass while overbridge embankments are wooded as are areas enclosed by and adjacent to slip roads rising at junctions. There are some hedgerows along the highway boundaries adjacent to fields.

7.4.3 As a result of the maturity and extent of vegetation along the motorway, views towards traffic and infrastructure along it are frequently screened from adjacent visual receptors and in these location vegetation is meeting the current environmental objectives. There are exceptions, where these objectives are not being met. Firstly, where gantries have been installed and replacement screen planting has not been undertaken the gantries remain a visual impact to individual receptors and within the wider landscape character. Secondly, where earlier planting has not established fully, such as hedgerows in the vicinity of Ashley Road overbridge which has resulted in a less coherent landscape within the wider field pattern and within the road corridor. Other areas include patches of clearance at new slip road junctions. Mitigation and enhancement proposals, taking into consideration of Highways England Licence and RIS environmental objectives, are documented in section 7.7 and the Outline Environmental Management Plan (OEMP).

7.4.4 Areas of ancient woodland have been identified on Figure 7.1. There are no Tree Preservation Order Trees within the immediate vicinity of the Proposed Scheme. Three areas of ancient woodland exist within 300m of the Proposed Scheme; north of the motorway along the River Bollin, south of the motorway and Yew Tree Farm and north and south of the motorway at junction 7 where the woodland abuts the highway boundary.

### Landscape Character

7.4.5 No nationally designated landscapes fall within the study area, however, following consultation with Cheshire East Council, the Bollin Valley and Parklands local landscape designation (previously Area of Special Countryside Value) has been included in the assessment.

7.4.6 The special qualities of this designation include: 'The valley landscape of the River Bollin, including its distinct pastoral and parkland character and small, intimate scale enclosed by steep topography of the valley.'[44] The parkland character is evident along the M56 where it runs east along the southern edge of this designation between junction 8 and Ashley Road overbridge and includes Tatton Farm. The smaller scale steep sided wooded topography is present where the motorway passes through the designation further east, crossing the River Bollin, between Castle Mill Lane and Sunbank Lane. The sensitivity of the area is considered to be Moderate due to the local designation.

[44] Cheshire East: Local Landscape Designations, Draft Report prepared by LUC, May 2013

## Visual Amenity - Key Representative Viewpoints

7.4.7 Key representative viewpoints have been selected to identify visual effects on the Highly Sensitive visual receptors identified within the Environmental Scoping Report. These receptors were reviewed and refined on site to account for accessibility and others added to ensure that a representative range of visual effects was included in the assessment.

7.4.8 Following assessment on site the following receptors have been added to those identified within in Table 7-3 of the Environmental Scoping Report:

- Receptor 10 - residential properties at end of Rivershill Gardens and Haselmere Avenue.
- Receptor 6 - residential properties to west of Ashley.
- Receptor 4 - at Dairy House Farm, Ashley Road.

7.4.9 As well as the above additions, the following receptors listed in the Environmental Scoping Report have been omitted following assessment on site:

- PRoW along River Bollin was observed to be set within wooded river valley and would be screened by landform and existing woodland both along the river and along the M56.
- PRoW Castle Mill Lane, Ashley is screened by existing hedgerow up to Castle Mill Road from where no new gantries would be visible as a result of the Proposed Scheme.
- Yarwood Heath Farm and PRoW, and Cherry Tree Farm would have no change in views as a consequence of either clearance or operation of the Proposed Scheme.

7.4.10 As the areas which would be affected by the works are intermittent and focused around individual structures a ZTV has not been produced.

7.4.11 Key representative viewpoints are shown on Figure 7.1 and are listed in Table 7-6 below. Detailed descriptions of the viewpoints are set out in Appendix D.1.

7.4.12 All of the key representative viewpoints are highly sensitive.

**Table 7.6 Key Representative Viewpoint**

| Key Representative Viewpoint No. | Key Representative Viewpoint |
|---|---|
| 1 | View from local PRoW overbridge on Yarwood Heath Lane |
| 2 | View from Bowdon View Farm, Tom Lane |
| 3 | View from local PRoW overbridge south of Ryecroft Farm |
| 4 | View from Dairy House Farm and Ashley Hall on Ashley Road |
| 5 | View from local PRoW overbridge south of Ashley Hall |
| 6 | View from residential properties on Ashley Road, west of the village |
| 7 | View from residential properties on the northern edge of Ashley |
| 8 | View from residential properties on Castle Mill Lane at Thorns Green |
| 9 | View from Hale Bank Farm and residential properties on Sunbank Lane |
| 10 | View from residential properties on Rivershill Gardens and Haslemere Avenue |
| 11 | View from local PRoW between Sunbank Lane overbridge and Keepers Cottage |
| 12 | View from Keepers Cottage |
| 13 | View from local PRoW south of housing in Warburton Green |
| 14 | View from residential properties on Bankside, Warburton Drive and Close, Marlfield Road and Burnside |

### Designated Cultural Heritage Assets

7.4.13 The following designated cultural heritage assets and their landscape setting, shown on Figure 7.1, were identified within the Environmental Scoping Report as having the potential to have their setting affected by the Proposed Scheme. The Environmental Scoping Report primarily considered 300m as the distance within which the setting was likely to be impacted, this was extended to 1km for cultural heritage assets with exceptional sensitivity. The following cultural heritage assets are described in detail within Appendix D.1 of this EAR:

- Watch Hill Motte and Bailey Castle Scheduled Monument.
- Yew Tree House Grade II Listed Building.
- Church of St Elizabeth Grade II Listed Building.
- Sycamore Cottage Grade II Listed Building.

## 7.5 Sensitivity of Resource

7.5.1 The sensitivity of the identified landscape, visual receptors and heritage assets has been assessed in accordance with Table 7-7.

**Table 7.7 Assessed sensitivity of key landscape, visual receptors and heritage assets**

| Landscape/Visual Resource | Sensitivity | Justification |
|---|---|---|
| Existing mature vegetation within highway boundary | Moderate | Existing vegetation is considered to be of moderate sensitivity. Whilst it comprises undesignated and standard highway vegetation, it forms an integral part of the wider pattern of vegetation, and because it plays an important role in screening and filtering views of the M56 from surrounding visual receptors. |
| Local Designated Landscape - Bollin Valley and Parklands | Moderate | The sensitivity of this landscape is considered to be moderate taking into account it a local designation and is set within a wider landscape where development, including new highways, are ongoing. There are existing detracting features, including the M56 present. |
| Key representative viewpoints | High | Key representative viewpoints are from residential properties, PRoWs and Country Parks and Nature Reserves. |
| **Heritage Assets** | **Sensitivity** | **Justification** |
| Setting of Cultural Heritage Assets (Scheduled Monuments) | High | The landscape setting of Scheduled Monuments is considered to be of High sensitivity, due to the national designation. |
| Setting of Cultural Heritage Assets (Grade II Listed Buildings) | Moderate | The landscape setting of Grade II Listed Buildings is considered to be of moderate sensitivity. Whilst this is a national designation, the landscape setting of Grade II Listed Buildings is not generally considered to be as highly sensitive as the landscape setting of Grade II* or Grade I Listed Buildings. |

## 7.6 Assumptions and Limitations

7.6.1 This assessment assumes that all environmental barriers shown to be retained in the design would be removed and replaced in situ, which represents the worst case scenario. This is because the need to remove and replace barriers is reliant on design confirmation, which was not available at the time of assessment. Temporary visual intrusion during construction and the extent of existing vegetation loss would theoretically result in a reduced impact if the barriers are not replaced.

7.6.2 It has been assumed that general construction activity within the highway boundary would include the presence of construction machinery, vegetation removal (as illustrated at DF3) and installation/removal and replacement of screen fences/environmental barriers, gantries and associated features. It has been assumed that environmental barriers would be removed and replaced in a progressive operation and within a short timeframe. Where properties are within 100m. Reference should be made to Chapter 8 Noise and Vibration. The location of the construction compounds, detailed treatment of verge slopes and retaining structures within the working area are not known at the time of this assessment so cannot be fully assessed at this stage.

7.6.3 This assessment assumes that replacement native tree and shrub planting would be implemented in areas cleared for construction access and where sufficient space remains post construction taking regard of sight lines and as safety requirements allow. A conservative approach to mitigation planting has been applied for the purposes of this assessment to account for sight lines. Detailed landscape design will take full account of sight lines. If during detail design sufficient space is not available, such as at gantry locations on embankments, or where there are existing narrow verges, alternative screening such as a visual screen may be proposed should there be a risk of a significant effect being triggered.

7.6.4 The site survey work was undertaken at a time when deciduous vegetation was both in and without leaf coverage.

7.6.5 A tree survey has not been undertaken, therefore, the locations of trees that could potentially be saved on the edge of vegetation clearance areas would be more accurately identified once the works areas are marked out or through site consultation with an engineer to physically show the line of the works extents. This way an arboriculturist, or other appropriately qualified professional, can determine whether trees outside of the works footprint can be retained or require felling due to the threat of wind throw or because of tree root severance.

## 7.7 Design, Mitigation and Enhancement

7.7.1 This section describes the series of mitigation measure and enhancement opportunities to be undertaken during the life of the Proposed Scheme. The first area of mitigation described are those features that are embedded into the design. The second set of mitigation proposals are those that are possible to reduce effects during construction and are embedded into the OEMP. The third area of mitigation described is the proposed landscape planting undertaken after construction has been completed. At the end of this section enhancement measure are described.

7.7.2 The following relevant measures are embedded into the DF3 design:

- For preference, and as far as is feasible, new and relocated gantries have been located to minimise potentially significant landscape and visual effects taking into account engineering and safety constraints. An AEDS review was carried out in February 2016 to assess the potential visual impact of gantry locations which informed the final locations.
- Soft landscape earthwork solutions for retaining options have been prioritised and existing areas of hard standing used where possible.
- Relevant construction activity measures are embedded into the OEMP, such as the undertaking of preconstruction vegetation surveys and the production of detailed plans of vegetation to be retained. The delivery partner shall monitor and maintain all newly planted vegetation to ensure their establishment for a 2-year period from the date of completion. Any planting defects during this period shall be rectified.

7.7.3 Where existing noise barriers or screen fences are to be removed and replaced they shall be replaced within a short timeframe to reduce any visual (and noise) impact, and affected residents informed appropriately. The visual assessment would be updated following confirmation of noise barrier proposals at the next stage.

7.7.4 At outline (DF4) and detail design (DF5) landscape plans would be produced showing proposed areas of replacement planting. Landscape mitigation principles have been assumed for the assessment. They would be integrated into the design at DF4 and detail design at DF5 and included in the OEMP for those stages. The principles are noted below and are expanded upon within the assessment tables in Appendix D.1.

- Where vegetation is required to be removed for installation and construction of the Proposed Scheme features, sight lines and safety requirements, replacement planting shall be provided wherever possible. A conservative approach to mitigation planting has been applied for the purposes of this assessment to account for sight lines.
- Replacement planting shall provide a similar or improved habitat type to that removed. Species shall be native and/or non-invasive and of a similar or improved species mix to that removed or representative of the wider area.
- Where during further design it is considered that sufficient replacement planting is not possible, due to engineering or space constraints, and where this may then result in a significant visual or landscape impact, alternative solutions to the design or the installation of a visual screen shall be explored to prevent a significant effect.
- Onsite areas suitable for enhancement would be identified and proposals established as part of further design stages. Areas with the potential for onsite enhancement noted at this stage include:
  - Route wide infill where thin and plant up gaps in existing hedgerow boundaries to reinforce wider field pattern and habitat connectivity.
  - Tree planting on northern verge from junction at Rycroft farm to Ashley Road overbridge to connect existing woodland areas.
  - Increase woodland planting on approaches to junction 6 from the west.

## Enhancement

7.7.5 Areas of on-site enhancement (rather than mitigation) to meet the Highways England Licence and RIS environmental objectives, shall also be proposed to promote green infrastructure, integrate the Proposed Scheme into the wider landscape, and enhance the local character and driver experience. Such measures would work towards a no net biodiversity loss. It should be noted that any potential future enhancement measures are not included within this assessment.

7.7.6 The RIS objectives of relevance to the topics of landscape, visual amenity and cultural heritage assets are as follows:

- RIS 1: Improving green infrastructure – by increasing tree cover within the corridor as appropriate.
- RIS 2: Improving local landscape management – through reinforcing the landscape pattern and existing features.
- RIS 4: Improving the Strategic Road Network experience – by planting sensitively to allow views out where conditions are suitable and enclosing views to reflect adjacent vegetation cover.

7.7.7 The following principles shall be considered at further design stages. It should be noted that these measures have not been included in the assessment, however, where they may have additional mitigation benefits this has been noted in the assessment tables in Appendix D.1. Additional mitigation resulting from the implementation of these principles, would be experienced during the Operational stage.

- Infill gaps and/or improve, existing planting to screen visual receptors and aid integration of the motorway into the local landscape through new planting within the highway estate; close to Warburton Green, Ashley, the interface with the Bollin Valley and Parkland designation,

along footpaths close to and running parallel to the motorway and the western end of junction 7.

- Enhance/improve the existing species mix/habitat typology in otherwise poor quality areas to improve biodiversity and connectivity along the route taking the opportunity to tie into the local landscape through which the road passes, particularly adjacent woodlands, scrub, field boundary hedgerows and flight lines.
- Improve driver experience through planting to enhance the local character in opened out, restricted and filtered views of the landscape through which they are passing.
- Solid barrier fencing or earth mounding may be considered at further design stages to improve or constrain existing views away from the motorway.

7.7.8 In addition, later design work may consider areas of off-site enhancement to meet the Highways England licence and RIS environmental objectives; to further promote green infrastructure, integrate the Proposed Scheme as a whole into the wider landscape, and enhance the local character. It should be noted that any off-site measures have not been included in the assessment as such areas shall be considered at later stage, however, some potential measures have been noted briefly below and in more detail at specific locations within the assessment tables in Appendix D.1:

- Infill gaps to planting to close off views beyond the highway boundary particularly at locations where gantries are on embankment or in close proximity to visual receptors.
- Provide improved off site planting to local nature reserves and/or park areas to enhance local biodiversity and further limit the impact of the existing and proposed motorway, in particular within the Bollin Valley and Parkland Landscape north of Ashley and around junction 7.
- Additional individual tree planting to key off site areas to break up existing views towards the motorway and integrate the motorway into the landscape around Warburton Green and along the edge of Ashley.

## 7.8 Potential Construction Effects

7.8.1 This section considers construction effects on the landscape, visual amenity and cultural heritage assets. The impacts are generally of short term duration, except for tree removal, where the impact would be medium to long term.

### Landscape Effects

#### Existing Vegetation

7.8.2 This assessment is based on the Vegetation Site Clearance plans provided at DF3 (HE549345-JAJV-HSC-SG_MULTI-DR-CH-1000 - 1006). These plans which include additional areas of vegetation clearance required for structures, including noise barriers and general bank regrading covering a maximum of 7ha, this is to be revised at PCF4. It should be noted that these plans may not account for all clearance required for the Proposed Scheme, however, where possible potential clearance areas have been considered for the assessment.

7.8.3 Vegetation loss would be restricted to what is essential for the implementation of the Proposed Scheme and is generally around 4m from the existing verge edge. As the majority of vegetation is set back from the verge edge, loss within the 4m would be limited. However, where gantries and Emergency Refuge Areas are proposed and for sight line and bank regrading purposes, greater clearance would be required. Loss of existing vegetation within the highway boundary would cause a minor adverse magnitude of impact and a **slight adverse** significance of effect within the study area during construction because it contributes towards the surrounding landscape pattern, provides amenity value and performs an important visual screening function. This would be subject to further assessment if the Proposed Scheme changes materially.

#### Local Designated Landscape – Bollin Valley and Parklands

7.8.4 Construction would be contained within the highway boundary limiting the impact within the wider designated area. Vegetation loss and construction vehicles and activities would be visible although limited as the Proposed Scheme is in cutting for most of the section between junction 8 and Ashley Road overbridge. The Proposed Scheme continues east in cutting/false cutting between Castle Mill Lane and Sunbank Lane but there is a short section at grade with open views north across fields to woodland along the River Bollin valley where construction activities, including upgrading a gantry, would result in an adverse impact on the setting of and visual amenity within the designated landscape.

7.8.5 Only a small portion, of the designated Valley and Parklands area, around the Bollin River in the northern section, would experience an impact due to the Proposed Scheme. The remaining larger sections beyond the Bollin River and to the south would not be affected because the cutting slopes limit inter-visibility. For this reason, the magnitude of impact would be minor adverse to reflect the small proportion of the overall designated area affected by construction activities and the fact that the Proposed Scheme would be contained within the existing highway boundary and largely screened in cutting. The significance of effect would be **slight adverse**.

## Visual Effects

7.8.6 Appendix D.1 provides a detailed schedule of visual effects from key representative viewpoints (shown on Figure 7.1) at different timescales including during construction. This is summarised below.

7.8.7 From three of the fourteen key representative viewpoints assessed, No. 1 PRoW overbridge, Yarnwood Health Lane, No.2 Bowden View Farm, Tom Lane, and No.6 Properties along Ashley Road to west of the Village, the significance of visual effect during construction would be **slight adverse**. This is either because of:

- the distant nature of the view.
- only glimpsed views of construction activity would be available due to intervening screening elements or partially hidden in cutting.
- existing views of the M56 and other detracting visual features are open and construction activity would be viewed in this context.

7.8.8 There would be visual effects of moderate adverse significance during construction from six key representative viewpoints No.4 Dairy House Farm & Ashley Hall, Ashley Road, No. 5 PRoW on overbridge south of Ashley Hall, No.7 Properties on northern edge of Ashley, No.10 Properties on Rivershill Gardens and Haslemere Avenue, No. 12 Keepers Cottage, Sunbank Lane and No.13 PRoW south of housing at Warburton Green with receptors that are in close proximity to the Proposed Scheme, where construction activity would be:

- partially screened by intervening vegetation.
- where only some elements of construction would be visible, such as installation of environmental barriers where they are not currently located or construction partially concealed in cutting.
- Where construction is seen within the context of the existing motorway.

7.8.9 Five key representative viewpoints No.3 PRoW on overbridge south of Rycroft Farm, No.8 Residential properties on Castle Mill Lane, Thorns Green, No.9 Hale Bank Farm and properties on Sunbank Lane, No.11 PRoW between Sunbank Lane overbridge and Keepers Cottage and No. 14 Properties on Bankside, Warburton Drive, Warburton Close, Marlfield Road and Burnside would experience a large adverse significance of effect during construction where the receptors have:

- close full views of construction activity over a distance, such as along a footpath.
- have views of more than one element under construction.
- construction is on embankment.
- little screening or open views to construction activity.

### Lighting Effects

7.8.10 Lighting during construction would be set within the context of existing lighting on the M56 and within housing estates. Impacts from the temporary duration of lighting during construction would occur in unlit sections of road and have been included and reported in the assessment of key representative viewpoints.

### Designated Cultural Heritage Effects

7.8.11 Appendix D.1 details the effects on cultural heritage assets. This is summarised below.

7.8.12 The Proposed Scheme has the potential to cause a **moderate adverse** effect on the setting of one Grade II Listed Building, Yew Tree Farmhouse, during construction. This is because the landscape setting of the property extends across the farmland between it and the motorway and would be affected by loss of screen vegetation, close views of motorway gantry structures out of keeping with, and detracting from, the immediate rural farmland setting of the Grade II Listed Building.

7.8.13 Although this rating may be considered significant, given the temporary nature of construction, the effect it is judged to not be significant.

7.8.14 The remaining cultural heritage assets within the study area are not expected to be impacted by the Proposed Scheme as noticeable changes are not within or visible from the setting of these features:

- Church of Elizabeth Grade II Listed Building is well screened around its curtilage and would not have views to construction or gantries on the Proposed Scheme and the setting would not be impacted.
- Sycamore Cottage Grade II Listed Building's setting is within the garden on the northern side of the house and is screened by hedgerow along Ashley Road. There would not be views of the Proposed Scheme from the garden.
- Watch Hill Mott and Bailey Castle Scheduled Monument is located to the north of the northern end of the Proposed Scheme. It is screened by existing woodland along the intervening roads and would not have views to construction or gantries and its setting would not be affected.

7.8.15 No further assessment has therefore been undertaken on these.

## 7.9 Potential Operational Effects

### Year 1

7.9.1 This section considers operational landscape and visual amenity effects in winter Year 1 following Proposed Scheme completion, when vegetation would not be in leaf and when secondary mitigation planting would be immature and ineffective in contributing to the landscape fabric and as visual screening. This provides an assessment of the 'reasonable worst case' scenario.

### Landscape Effects

#### Existing Vegetation

7.9.2 Areas of removed vegetation would be replaced with secondary mitigation planting where feasible, although full replacement would not be possible due to sight line and safety requirements, a conservative approach to mitigation planting has been applied for the purposes of this assessment. Detailed landscape design will take full account of sight lines. In addition, new planting would be proposed where it could achieve landscape and connectivity objectives within the wider landscape and road corridor. In the short term, when mitigation planting would be immature, the magnitude of impact on vegetation would remain as for construction; minor adverse magnitude of impact and the significance of effect would be **slight adverse**.

#### Local Designated Landscape – Bollin Valley and Parklands

7.9.3 With construction activities ceasing and ground reinstated there would remain a slight loss of vegetation along the edge of the Bollin Valley and Parklands designation as the new mitigation planting would not yet contribute to views within and around this landscape and upgraded gantries would remain visible. Overall however, the magnitude of impact would reduce to negligible adverse and the significance of effect would be **neutral**.

## Visual Effects

7.9.4 Appendix D.1 provides a schedule of visual effects from key representative viewpoints (illustrated on Figure 7.1) at different timescales including during operation in winter Year 1. At this time construction activities, would have ceased and working areas and verges reinstated. There would remain increased visibility as a result of loss of vegetation along the road corridor and potentially an increase in traffic visible at closer proximity and increased width due to all lane running. Where views are of the whole road, rather than elements visible above the cutting slope, a new solid central reservation would be a feature as would structural elements associated with gantries located in the verge.

7.9.5 Seven of the fourteen key representative viewpoints assessed No.1 PRoW overbridge, Yarnwood Health Lane, No.2 Bowden View Farm, Tom Lane, No.4 Dairy House Farm & Ashley Hall, Ashley Road, No. 5 PRoW on overbridge south of Ashley Hall, No.6 Properties along Ashley Road to west of the Village, No.7 Properties on northern edge of Ashley and No. 12 Keepers Cottage, Sunbank Lane, would have a significance of visual effect during operation of **neutral** or **slight adverse** at Year 1 because:

- construction activities would have ceased and verges reinstated.
- the limited nature of the view towards new motorway features.
- the Proposed Scheme would be viewed in the context of existing views of the M56 and other detracting visual features.

7.9.6 **Moderate adverse** significant visual effects would remain for seven key representative viewpoints, No.3 PRoW on overbridge south of Rycroft Farm, No.8 Residential properties on Castle Mill Lane, Thorns Green, No.9 Hale Bank Farm and properties on Sunbank Lane, No.10 Properties on Rivershill Gardens and Haslemere Avenue, No.11 PRoW between Sunbank Lane overbridge and Keepers Cottage, No.13 PRoW south of housing at Warburton Green and No. 14 Properties on Bankside, Warburton Drive, Warburton Close, Marlfield Road and Burnside during operation in winter Year 1 reasons for this include:

- Open or extended views towards new Smart Motorway infrastructure and traffic
- Mitigation planting would not be effective at Year 1.

### Lighting Effects

7.9.7 The Proposed Scheme would not change the extent of lighting along the M56 and the new technology with full cut-off LED lanterns and increased control of lighting levels would serve to lessen any existing impacts from light spill. It is considered that there would be no change from the existing situation. For this reason, lighting during operation is not considered further.

## Designated Cultural Heritage Asset Effects

7.9.8 With construction activities completed, the verges reinstated and gantries in place the impact on the setting of Yew Tree House Grade II Listed Building would reduce. However, the planting at Year 1 would not yet be effective in limiting the influence of the gantries as detractors to the setting of the Grade II Listed Building and the magnitude of impact would be minor adverse and the significance of effect **slight adverse**.

## Year 15

7.9.9 This section describes the residual effects 15 years after scheme opening in summer, once mitigation planting is mature.

### Landscape Effects

7.9.10 By summer, Year 15 (15 years following implementation of mitigation planting), the planting would be mature and effective in contributing to the fabric of the wider landscape, integrating with adjacent features and provide visual screening along the Proposed Scheme.

#### Existing Vegetation

7.9.11 In the longer term, mitigation planting would mature and, the design functions allotted within the highway corridor would be restored. Opportunities would also have been taken to address, through planting, the environmental objectives of the Proposed Scheme as set out in section 7.7 relating to landscape.

7.9.12 Mitigation planting would be mature and, where enhancement measures have been implemented, the increase in overall trees and shrubs would benefit green infrastructure along the route corridor as well as screen views and help to integrate the motorway into the landscape and townscape. As a consequence, the residual magnitude of impact would lie between no change to negligible beneficial and the significance of effect **neutral to slight beneficial**.

#### Local Designated Landscape – Bollin Valley and Parklands

7.9.13 The mitigation planting would have established and integrated the road into the local landscape reducing the magnitude of impact to no change and the significance of effect would remain **neutral.**

### Visual Effects

7.9.14 Appendix D.1 provides a detailed schedule of visual effects from key representative viewpoints (illustrated on Figure 7.1) at different timescales including during operation in summer Year 15 and is summarised here.

7.9.15 Of the fourteen key representative viewpoints assessed, twelve, No.1 PRoW overbridge, Yarnwood Health Lane, No.3 PRoW on overbridge south of Rycroft Farm, No.4 Dairy House Farm & Ashley Hall, Ashley Road, No. 5 PRoW on overbridge south of Ashley Hall, No.7 Properties on northern edge of Ashley, No.8 Residential properties on Castle Mill Lane, Thorns Green, No.9 Hale Bank Farm and properties on Sunbank Lane, No.10 Properties on Rivershill Gardens and Haslemere Avenue, No.11 PRoW between Sunbank Lane overbridge and Keepers Cottage, No. 12 Keepers Cottage, Sunbank Lane, No.13 PRoW south of housing at Warburton Green and No. 14 Properties on Bankside, Warburton Drive, Warburton Close, Marlfield Road and Burnside , would have **slight adverse or neutral** significance of effect. The reduction in impacts from Year 1 are the result of mitigation planting having grown to its design size and resulting ability to screen elements of the Proposed Scheme from receptors.

7.9.16 Two of the fourteen key representative viewpoints No.2 Bowden View Farm, Tom Lane and No.6 Properties along Ashley Road to west of the Village, would have a **slight beneficial** significance of effect as a result of the improved screening from the introduction of new hedgerows and trees along the highway boundary.

### Designated Cultural Heritage Asset Effects

7.9.17 At Year 15 the planting along the highway boundary would have matured and would largely screen gantries from within the setting of the Yew Tree House Grade II Listed Building. The predicted residual magnitude of impact would be negligible adverse and the significance of effect **neutral** in Year 15.

## 7.10 Residual Effects

### Landscape

7.10.1 As noted above, residual effects are considered in the summer 15 years after the opening of the Proposed Scheme and considers all proposed mitigation and enhancement measures.

7.10.2 The Proposed Scheme has the potential to improve the condition of existing woodland and trees both within the highway corridor and to aid connectivity and reinforcement of the adjacent landscape pattern. The landscape design would be developed at a future stage to meet the Highways England licence and RIS environmental objectives, which are set out in paragraph 7.7.6. This would be achieved by measures such as reinstating poorly established boundary hedgerows and proposing woodland in locations where it would work with existing woodland in adjacent areas to increase the extent of cover and improve the structure and diversity of species as appropriate for the area.

7.10.3 There is the potential for planting to replace vegetation lost and, in addition, improve the overall resource along the route to benefit landscape integration of the road, connectivity for nature, visual screening, visual amenity and driver experience. Residual effects on vegetation would be insignificant or (subject to detail design) **slightly beneficial.**

### Visual Amenity

7.10.4 Views towards the Proposed Scheme would be restricted by intervening vegetation, natural landform, new environmental barriers and because it is hidden from view in cutting for much of the Proposed Scheme. For most visual receptors, visual effects would be limited because the Proposed Scheme would be set within the context of the existing highway infrastructure and associated traffic. Whilst there would be some residual visual effects of **slight adverse** significance from housing and PRoWs immediately adjacent to the Proposed Scheme corridor, these effects are very much localised.

### Designated Cultural Heritage Assets

7.10.5 The Proposed Scheme would not have any significant adverse effects on the setting of the surrounding cultural heritage assets assessed once mitigation planting along the Proposed Scheme boundary to screen new gantries has established.

7.10.6 Chapter 9 provides an assessment of the intra-project and inter-project cumulative effects, covering the topics of landscape, visual amenity and the setting of cultural heritage assets.

## 7.11 Summary

7.11.1 There would be no permanent significant residual landscape and visual amenity effects, or significant residual effects on the setting of heritage assets.

7.11.2 During construction, potentially significant localised effects have been identified for 11 key visual locations, this reduces to 7 locations at Year 1 of operation and no locations following establishment of mitigation at Year 15. At each stage, when the Proposed Scheme is considered as whole, it is concluded that the overall effect would not be significant.

7.11.3 There are a small number of visual receptors that would benefit from an increase in screening from the motorway compared to their existing view and there is the potential for an increase in planting along the route corridor which would benefit landscape integration and reinforce the landscape pattern of the landscape through which the road passes.

7.11.4 Overall in the long term, the Proposed Scheme is considered to have a residual **neutral** effect in terms of landscape and visual amenity.

# 8. Noise and Vibration

Key features for this topic:

- Overall, the operational noise impacts are considered to be neutral and not significant.
- Once operational, twenty four sensitive receptors are predicted to experience minor noise decreases in the opening year.
- One sensitive receptor is predicted to experience a minor increase in noise in the opening year.
- In the long term, all sensitive receptors are predicted to experience negligible changes in noise or no changes in noise, with both the daytime and night time assessments.
- One receptor within NIA 7221 would experience a short-term minor daytime adverse effect.
- The Proposed Scheme would reduce the number of people exposed to noise levels in excess of the Significant Observed Adverse Effect Levels. There would be two fewer in the daytime and 64 fewer during the night-time.
- No dwellings are expected to qualify for noise insulation under the requirements of the Noise Insulation Regulations.
- Construction noise from piling activities for retaining wall structures at Emergency Refuge Areas could give rise to temporary (non-significant) adverse impacts at up to six sensitive receptors between 100m and 200m if it occurred at night.
- Construction vibration from piling activities could give rise to temporary (non-significant) adverse impacts at up to one sensitive receptor between 50 and 100m of percussive piling locations.

## 8.1 Introduction

8.1.1 This section sets out the findings of the noise and vibration assessment for both the construction and operation of the Proposed Scheme. It builds on the findings and recommendations of the July 2017 Scoping Report, and incorporates any new information that has become available since the Scoping Report was produced.

8.1.2 The Proposed Scheme has the potential to change road traffic noise by altering the traffic flows, composition, speeds and/ or proximity of traffic to nearby sensitive receptors. Changes of 1dB $L_{A10,18h}$ or more may be significant under certain conditions, such as when the noise level is already above a guideline value, for day and/or night-time period. Noise and vibration during construction may also cause adverse impacts at the closest receptors depending upon its level and duration.

8.1.3 The assessed scheme includes mitigation and enhancement measures necessary to deliver the Route Investment Strategy (RIS) and Highways England Licence objectives.

8.1.4 Current noise policy in England is based on the Noise Policy Statement for England (NPSE), which through the effective management and control of environmental noise within the context of Government policy on sustainable development, aims to:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise other adverse impacts on health and quality of life; and
- contribute to improvements to health and quality of life, where possible.

8.1.5 The Explanatory Note to the NPSE assists in the definition of significant adverse and adverse with the following concepts:

- NOEL – no observed effect level. Below this level, there is no detectable effect on health and quality of life due to the noise.
- LOAEL – lowest observed adverse effect level. This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL – significant observed adverse effect level. This is the level above which significant adverse effects on health and quality of life occur.

8.1.6 The Government policy and guidance do not state values for the NOEL, LOAEL and SOAEL, rather, it considers that they can be different for different noise sources, for different receptors and at different times, and should be defined on a strategic or project basis taking into account the specific features of that area, source or project. The derived values for the effect levels that shall be adopted for the assessment of the Proposed Scheme are set out in the methodology text in Section 5.3.

8.1.7 Further detail of regulatory and policy framework can be found in Appendix E.1.

8.1.8 A list of all figures associated with the noise and vibration section can be found in Appendix E.2.

8.1.9 This section details the potential noise and vibration effects of the Proposed Scheme, in terms of:

- noise effects during construction;
- vibration effects during construction;
- noise effects during operation; and
- airborne vibration effects during operation.

8.1.10 Several construction activities are proposed as part of the Proposed Scheme, which may affect noise sensitive receptors. The main activities include the construction of the Rigid Concrete Barrier (RCB) in the central reserve, installation of new gantries, signs and ERAs, as well as resurfacing of the existing hard shoulder and existing lane 3 pavement. These activities have the potential to generate adverse noise and vibration impacts, whilst some of the activities include the potential for piling which may be undertaken at night.

8.1.11 The Proposed Scheme will convert parts of the hard shoulder between M56 Junctions 6 and 8 to a permanent running lane. The permanent use of the hard shoulder as a running lane moves part of the source of road traffic noise approximately 3.6m closer to receptors adjacent to the motorway.

8.1.12 During construction, the import and export of all materials and waste will be via the motorway rather than separate haul routes. The number of extra vehicles associated with construction works would likely be small in comparison with the current volumes of traffic on the motorway network. As such no noise or vibration impacts are anticipated because of this activity.

8.1.13 It is likely that full or partial motorway closures will be required during the construction phase, although they will likely be restricted to night-time hours. Closures are likely to be required for activities such as superspan gantry removal, gantry installation (including superspan and cantilever). A high-level appraisal of the potential for local disturbance arising from the use of diversion routes at night has been provided in Section 8.8.

8.1.14 Ground-borne vibration effects during the operation of Proposed Scheme are scoped out as these effects are not anticipated to be significant, particularly due to the beneficial effects associated with the resurfaced carriageway.

## 8.2 Study area

8.2.1 The study areas for different assessments are presented below.

### Construction noise

8.2.2 DMRB HD213/11 states that "the area in which construction is considered to be a nuisance is generally more localised than where the impacts of the road project are likely to be a cause of concern once it has opened to traffic. The impact of construction nuisance in one form or another diminishes rapidly with distance".

8.2.3 The study area for construction noise covers the area within a 300m buffer of proposed construction activities and potential site compound locations. Significant adverse impacts would not be expected beyond this distance based on prior experience and expert judgement.

### Construction vibration

8.2.4 Vibration usually affects a smaller area than noise. The study area for construction vibration covers the area within 100m from potential piling works, which would give rise to the highest levels of vibration as part of the construction. This is based on the worst case predicted vibration levels from percussive piling. There are not expected to be any other significant sources of construction vibration associated with the construction of the Proposed Scheme.

8.2.5 Figure 8-1 shows the extent of the study area for construction noise and vibration.

### Operational noise

8.2.6 In accordance with DMRB HD213/11, the noise assessment has considered the area where there could be changes in noise levels in magnitude of at least 1dB $L_{A10,18h}$ in the short-term or 3dB $L_{A10,18h}$ in the long-term due to the Proposed Scheme (see Appendix E.3 for further details).

8.2.7 DMRB HD 213/11 provides details to determine the Study Area and Calculation Area. The study area generally extends 1km from the Proposed Scheme extents and any roads being bypassed or improved. The calculation area generally extends 600m from the scheme extents and any roads being bypassed or improved. Affected routes beyond the study area are also considered, with a study area extending 50m from these roads.

8.2.8 The Calculation Area for the Proposed Scheme generally covers an area 600m from the M56 main carriageway and junctions between Junction 6 and 8.

8.2.9 Figures 8.2 to 8.4 show the extent of the study area for operational noise and the Calculation Area for operational noise modelling.

### Operational road traffic airborne vibration

8.2.10 The study area for airborne vibration is limited to 40m from all carriageways within the noise study area as the DMRB HD213/11 methodology for assessing airborne vibration nuisance has not been validated for greater distances.

# 8.3 Methodology

## General

8.3.1 Each topic within the scope of this section has its own methodology as shown in Table 8-1.

**Table 8-1 Assessment methodology for each noise and vibration topic**

| Topic | Methodology |
|---|---|
| Construction noise from the site of the Proposed Scheme. | BS 5228-1 |
| Construction vibration from the site of the Proposed Scheme. | BS 5228-2 (partially sourced from BS 7385-2) |
| Operational road traffic noise. | DMRB HD 213/11 |
| Operational airborne vibration. | DMRB HD 213/11 |

Sources: 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.
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.
DMRB Volume 11 Section 3 Part 7 HD 213/11 Rev. 1 Noise and Vibration, Highways Agency et al., 2011.

## Baseline

8.3.2 The following data sources have been examined to determine the baseline environment:

- The location of Defra Noise Important Areas (NIA) taken from the EnvIS database;
- Locations of any existing noise barriers within the motorway boundary using the EnvIS, SMIS databases and imagery from Google Earth (2016/2017 images);
- The Environmental Scoping prepared by Highways England for the Proposed Scheme;
- An understanding of the existing highway pavement regime from data recorded in Highways England pavement database (HAPMS);
- Receptor locations and associated sensitivities from OS AddressBase Premium associated with the OS MasterMap database;
- An understanding of potentially disruptive construction activities; and
- A high-level assessment of the potential for adverse impacts to be associated with the diversion of motorway traffic during construction.

8.3.3 Baseline noise monitoring has not been undertaken as part of this assessment. This is because the DMRB HD 213/11 assessment methodology considers the predicted changes in noise levels as a result of the Proposed Scheme using forecast traffic information for a number of scenarios in future assessment years (opening year and 15 years after opening).

8.3.4 In addition, noise from road traffic has already been strategically mapped for most of the study area by Defra, as part of the England Noise Mapping exercise undertaken in 2012 to meet the requirements of the Environmental Noise Directive (Directive 2002/49/EC) and the Environmental Noise (England) Regulations 2006 (as amended).

## Construction noise

8.3.5 At the time of writing, no Delivery Partner has been appointed for the Proposed Scheme, therefore a risk based approach has been adopted based on typical road construction activities and noise levels reported in BS 5228-1 Annexes C and D. These risks will be taken into account in the development of the construction methodology and programme for the Proposed Scheme.

8.3.6 The effects of construction noise are temporary and defined by the intrusion that construction noise causes in the existing noise environment (or soundscape) of the area. Table 8-2 (adapted from Table E.1 in BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1 Noise', Annex E) shows the noise level thresholds for LOAEL (Category B) and SOAEL (Category C) for construction noise adopted for Smart Motorways Programme (SMP) projects as set out in "Smart Motorways Programme - EnvTN11 Construction noise and vibration assessment". The thresholds only indicate where there could be a potential significant effect as a result of the level of noise; however, the duration of the impact, character of the area, numbers of receptors affected and the existing acoustic climate also need to be taken into account in determining significance. It is also noted that where the existing ambient noise level is already above Category C noise levels, threshold levels may be permitted to be higher.

**Table 8-2 Threshold of potential significant adverse and adverse effects at dwellings in dB $L_{Aeq,T}$**

| Period | Category A | Category B (LOAEL) | Category C (SOAEL) |
|---|---|---|---|
| Daytime weekday (07:00-19:00) and Saturdays (07:00-13:00) | 65 | 70 | 75 |
| Evenings weekday (19:00-23:00), Saturdays (13:00-23:00) and Sundays (07:00-23:00) | 55 | 60 | 65 |
| Night-time (23:00-07:00) | 45 | 50 | 55 |
| Note: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3dB due to site noise. | | | |
| Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.<br>Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.<br>Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values. | | | |

Source: Adapted from BS 5228-1 Table E.1

8.3.7 Potential construction noise levels were predicted using typical road construction equipment in accordance with the guidance in BS 5228-1 (see assumptions in Appendix E.5). The prediction method used was that in BS 5228-1 Annex F.

## Construction vibration

8.3.8 Table 8-3 shows the levels where vibration can cause cosmetic damage to structures. For this assessment, the lowest vibration level with the potential to give rise to cosmetic damage has been used as a threshold for significant adverse effects in terms of damage to buildings (15mm/s). It should be noted that in most cases cosmetic damage would not be caused at these levels and much higher levels of vibration are required to cause structural damage.

**Table 8-3 Threshold of significant effects for construction vibration**

| Type of building | Peak component particle velocity in frequency range of predominant pulse | |
|---|---|---|
| | 4Hz to 15Hz | 15Hz and above |
| Reinforced or framed structures. Industrial and heavy commercial buildings. | 50mm/s at 4Hz and above | 50mm/s at 4Hz and above |
| Unreinforced or light framed structures. Residential or light commercial buildings. | 15mm/s at 4Hz increasing to 20mm/s at 15Hz | 20mm/s at 15Hz increasing to 50mm/s at 40Hz and above |

Source: BS 5228-2 Table B.2.4

8.3.9 Some adverse effects on human receptors may occur at lower levels of vibration. Table 8-4 shows potential adverse effect under the BS 5228-2 criteria on human response to vibration. The vibration levels are shown in terms of peak particle velocity (PPV). For this assessment, the onset of potential adverse effect, the LOAEL, has been taken to be 1mm/s. Vibration levels of around 10mm/s are likely to give rise to significant adverse effects, therefore the SOAEL has been defined at 10mm/s for construction vibration. The thresholds only indicate where there could be a potential significant effect as a result of the level of vibration; however, the duration of the impact and numbers of receptors affected also need to be taken into account in determining significance.

**Table 8-4 Threshold of adverse effects for construction vibration**

| Vibration level [A), B), C)] (PPV) | Effect |
|---|---|
| 0.14mm/s | Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration. |
| 0.3mm/s | Vibration might be just perceptible in residential environments. |
| 1.0mm/s | It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated with prior warning and explanation has been given to residents. |
| 10mm/s | Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments. |
| A) The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient.<br>B) A transfer function (which relates an external level to an internal level) needs to be applied if only external measurements are available.<br>C) Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 or -2, and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any | |

Source: BS 5228-2 Table B.1.

8.3.10 The potential construction vibration levels were predicted using typical piling equipment in accordance with the guidance in BS 5228-2 (see assumptions in Appendix E.5). The prediction method used was that in BS 5228-2 Table E.1.

## Operational road traffic noise

8.3.11 The assessment of operational road traffic noise impacts of the Proposed Scheme follows the detailed methodology in DMRB HD 213/11, which in turn references the calculation methodology produced by the Department of Transport's and Welsh Office's Calculation of Road Traffic Noise (CRTN)[45].

[45] Department of Transport/Welsh Office (1988), "Calculation of Road Traffic Noise".

8.3.12 The effects of operational noise are permanent. Table 8-5 shows the values adopted for the daytime and night-time SOAEL and LOAEL in this section. Both the $L_{A10,18h}$ façade noise level and $L_{Aeq,16h}$ free-field noise level are shown due to the different parameters used in different sources. Conversion from $L_{A10,18h}$ to $L_{Aeq,16h}$ uses the relationship as set out in TAG unit A3 ($L_{Aeq,16h} = L_{A10,18h} - 2dB$) with a further subtraction of 2.5dB for conversion from façade to free-field. Values of 67.5dB $L_{A10,18h}$ would be rounded up to 68dB $L_{A10,18h}$ for the purposes of the Noise Insulation Regulations and hence an additional 0.5dB has been allowed for in the conversion for both the LOAEL and the SOAEL.

**Table 8-5 SOAEL and LOAEL for long-term road traffic noise during day and night-time**

| Parameter | Value for daytime | Value for night-time |
|---|---|---|
| SOAEL | 68dB $L_{A10,18h}$ (façade)<br>63dB $L_{Aeq,16h}$ (free-field) | 55dB $L_{night, outside}$ (free-field) |
| LOAEL | 55dB $L_{A10,18h}$ (façade)<br>50dB $L_{Aeq,16h}$ (free-field) | 40dB $L_{night, outside}$ (free-field) |

Sources: Night-noise guidelines for Europe, WHO, 2009[46] for night-time values.
Noise Insulation Regulations[47] Relevant Noise Level for daytime SOAEL.
Guidelines for community noise, WHO, 1999[48] for daytime LOAEL (from the 50dB $L_{Aeq,16h(7-23),outdoors}$ for the onset of moderate community annoyance).

8.3.13 The thresholds only indicate where there could be a potential significant effect in policy terms as a result of the level of noise; however, the duration of the impact, character of the area, numbers of receptors affected and the existing acoustic climate also need to be taken into account in determining significance.

8.3.14 The objective of a detailed assessment is to understand the impact on the noise and vibration climate both with and without the Proposed Scheme, referred to as the Do Something (DS) and Do Minimum (DM) scenarios respectively. These scenarios are required to be assessed for the proposed opening and design year (used here to describe the 15th year after opening).

8.3.15 The proprietary software NoiseMap was used to predict noise levels at residential properties and other potentially sensitive receptor locations within the calculation area. The following scenarios were modelled:

- Opening year (2020), DM scenario (i.e. without Proposed Scheme).
- Opening year (2020), DS scenario (i.e. with Proposed Scheme).
- Design year (2035), DM scenario.
- Design year (2035), DS scenario.

8.3.16 There are four proposed Highways England SMP schemes in the north-west, which are all expected to open within 18 months of each other. These schemes are:

- M56 J6 to 8, the Proposed Scheme;
- M6 J21a to 26;
- M60 J24 to 4; and,
- M62 J10 to 12.

[46] World Health Organization (2009). "Night Noise Guidelines for Europe"
[47] Statutory Instrument, 1975, No. 1763. Building and Buildings. The Noise Insulation Regulations 1975. As amended by Statutory Instrument 1988 No. 2000. Building and Buildings. The Noise Insulation (Amendment) Regulations 1988
[48] World Health Organization, 1999. "Guidelines for Community Noise".

8.3.17 Given the likely interactions between these schemes, the DS scenarios in this assessment consider the cumulative effect of traffic from all four Schemes on noise. The traffic data assumes that all four north-west SMP schemes are implemented in the same opening year of 2020. This provides an assessment of the likely worst-case noise effects within the Proposed Scheme noise study area. Should there be a delay to one of the schemes, or one of the schemes not be taken forward the results presented within the study area are likely to similar to the results presented, considering all four SMP schemes.

8.3.18 The assessment of noise impacts involved a comparison of the predicted noise levels resulting from the Proposed Scheme for the following scenarios:

- Short-term (difference in noise levels between DS-2020 and DM-2020).
- Long-term DM (difference in noise levels between DM-2035 and DM-2020).
- Long-term DS (difference in noise levels between DS-2035 and DM-2020).

8.3.19 Calculation points representative of all sensitive receptors were defined 1m from external facades of dwellings and other non-residential sensitive receptors within the calculation area, except for free-field receptors such as playgrounds. Non-dwelling receptors in the calculation area include schools, health facilities and care homes among others (refer to Appendix E.5 for further details on the noise model assumptions). In accordance with HD 213/11, noise level predictions were undertaken at 1.5m above ground for all sensitive receptors, except for dwellings of two stories or greater, where predictions were undertaken at 1.5m and 4m above ground.

## Operational road traffic noise magnitude of impact

8.3.20 In line with DMRB HD 213/11, this section assesses the magnitude of impact by comparing the increase or decrease in noise levels between scenarios. A change in road traffic noise of 1 dB $L_{A10,18h}$ in the short-term is the smallest that is considered perceptible. In the long-term a 3 dB $L_{A10,18h}$ change is considered perceptible. The magnitude of impact should, therefore, be considered different in the short-term and long-term.

8.3.21 The magnitudes of noise impacts associated with road traffic noise are presented in Table 8-6 (short-term) and Table 8-7 (long-term).

**Table 8-6 Classification of magnitude of noise impacts in the short-term**

| Noise change LA10,18h (dB) | Magnitude of impact |
|---|---|
| 0 | No change |
| 0.1 – 0.9 | Negligible |
| 1 – 2.9 | Minor |
| 3 – 4.9 | Moderate |
| 5 + | Major |

Source: DMRB HD 213/11 Table 3.1.

**Table 8-7 Classification of magnitude of noise impacts in the long-term**

| Noise change LA10,18h (dB) | Magnitude of impact |
|---|---|
| 0 | No change |
| 0.1 – 2.9 | Negligible |
| 3 – 4.9 | Minor |
| 5 – 9.9 | Moderate |
| 10 + | Major |

Source: DMRB HD 213/11 Table 3.2.

8.3.22 Where noise levels are above SOAEL, negligible impacts in the long term are additionally separated out to identify if there are changes in noise of between 1dB and 3dB, as these changes are significant in policy terms.

## Operational road traffic night time assessment

8.3.23 In accordance with HD213/11 detailed assessment methodology, this section also undertakes an operational road traffic noise night time assessment through comparison of the Do-Something in the design year (2035) against the Do-Minimum in the year of opening (2020). Method 3 of the TRL report "Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping" [49] provides a formula for estimating night time noise levels based on the 18-hour daytime predicted noise levels and the type of road. Different corrections are provided for "motorway" and "non-motorway" type roads. For this assessment, the M56 was considered as a "motorway" and all other roads in the Calculation Area were considered as "non-motorway".

8.3.24 The assessment was undertaken for receptors where traffic noise levels are predicted to exceed 55dB $L_{night,\ outside}$ in any scenario as required by HD213/11.

## Operational road traffic noise nuisance assessment

8.3.25 The DMRB HD213/11 guidance notes that the nuisance caused by noise mainly affects people in their homes. Nuisance is measured in terms of the percentage of the population as a whole that is bothered "very much" or "quite a lot" by virtue of a specific traffic-related noise level. The correlation between specific levels and the percentage population bothered for the purposes of the assessment was developed from studies that focused on reported nuisance where traffic-related noise has changed over a relatively long period of time.

[49] Defra/TRL/Casella Stanger (2006). Method for Converting the UK Road Traffic Noise Index $L_{A10,18h}$ to the EU Noise Indices for Road Noise Mapping".

8.3.26 In line with DMRB HD 213/11, noise nuisance takes into account both the long-term and short-term impacts. The results are presented for the DM and DS comparisons. The noise nuisance level changes are directly calculated from the predicted noise level changes.

## Operational road traffic airborne vibration

8.3.27 DMRB HD 213/11 assessment methodology requires an assessment of traffic induced vibration, including the assessment of the numbers of people bothered by airborne vibration. It should be noted that the vibration assessments are for comparison only and, as such, are not specific to an individual's response, but are indicative of an average or community annoyance rating. Also, only properties within 40m of the carriageway edge of a modelled road within the Calculation Area are assessed. This is because the DMRB HD 213/11 vibration bother relationship is only validated up to a distance of 40m.

8.3.28 There are no properties within 40m of the Proposed Scheme and as such an airborne vibration nuisance assessment has not been undertaken.

## Mitigation, rectification and enhancement

8.3.29 In this section, mitigation refers to measures aimed to avoid or minimise the adverse effects as a result of the Proposed Scheme. They include the provision of insulation under the Noise Insulation Regulations 1975, as amended 1988.

8.3.30 Rectification applies to locations where an existing noise barrier may have degraded and there is a need to reinstate the barrier to the condition (performance specifications) for which it had been originally designed or to the new required performance after the implementation of the Proposed Scheme. The Proposed Scheme seeks to provide 5 years' free of major maintenance, including on noise barriers.

8.3.31 Enhancement is the provision of beneficial effects as a result of the Proposed Scheme. Within the Smart Motorways Programme, enhancement is focussed on NIA and other highly populated areas currently experiencing high noise levels.

## Noise Insulation Regulations (mitigation)

8.3.32 The policy of Highways England is to exercise its powers under the Noise Insulation Regulations 1975 (as amended 1988) and hence a property must meet the following four primary conditions to qualify for insulation:

- be within 300m of the Proposed Scheme;
- show a relevant noise level of at least 68dB $L_{A10,18h}$ (façade);
- show a noise increase between the relevant noise level and the prevailing noise level of at least 1dB(A); and
- the contribution to the increase in the relevant noise level from the Proposed Scheme must be at least 1dB(A).

8.3.33 The prevailing noise level is the noise level caused by traffic using any highway immediately before works for the alteration of a highway are begun. However, due to the relatively short duration of the construction works (1 to 2 years) for a SMP scheme, the prevailing noise level is estimated to be equal to the noise level in the DM opening year scenario. The only expected change in noise level between the noise level immediately before the works began and the DM opening year would be that attributed to normal traffic growth. Over a period of 1 or 2 years, this growth would be negligible (1 to 2%) in comparison to the current traffic flow on the motorway. Table 8-8 shows the parameters used to determine eligibility under the Noise Insulation Regulations (NIR) whereas Table 8-9 shows the NIR eligibility conditions.

**Table 8-8 Noise levels predicted for the Noise Insulation Regulations 1975 (as amended 1988)**

| NIR definition | Parameter used in this section |
|---|---|
| Prevailing noise level (PNL) | $L_{A10,18h}$ DM opening year 2020 |
| Relevant noise level (RNL) | $L_{A10,18h}$ DS future year 2035 |
| Maximum noise level from altered highways within 15 years (L'A) | $L_{A10,18h}$ DS future year 2035 from the Proposed Scheme |
| Maximum noise level from all other highways within 15 years (L'B) | $L_{A10,18h}$ DS future year 2035 from all the roads outside the Proposed Scheme |

Source: Noise Insulation Regulations 1975 (as amended 1988). For the acronyms, CRTN, Department of Transport, 1988, Annex 1.

**Table 8-9 Criteria to define whether a property qualifies for insulation under the Noise Insulation Regulations 1975 (as amended 1988)**

| Provision | Criteria |
|---|---|
| NIR 7(1) | Distance < 300m from the nearest point of the carriageway to alter. |
| NIR 2(1)/4(1) | RNL ≥ 68dB $L_{A10,18h}$ at 1m from the façade (with 67.5dB rounded up). |
| NIR 3(2)a/4(2)b | RNL – PNL ≥ +1dB(A) |
| NIR 3(2)b/4(2)b | RNL – L'B ≥ +1dB(A) |

Source: Noise Insulation Regulations 1975 (as amended 1988). For the acronyms see CRTN, Department of Transport, 1988, Annex 1.

### Cost-benefit analysis of enhancement measures

8.3.34 A value-for-money score has been used to assess whether each proposed enhancement measures is sustainable in line with Government policy. The assessment uses the ratio of the benefits (present value benefits) to the costs (present value costs) of an enhancement measure. A ratio greater than one indicates that the benefits outweigh the costs and represents a sustainable solution.

8.3.35 Further detail on the cost-benefit methodology and background including limitations can be found in Appendix E-6.

## 8.4 Baseline conditions

8.4.1 For the construction assessment, the approach adopted has defined LOAEL and SOAEL in the absence of measured baseline noise levels, assuming that the noise from construction activities is the dominant source of noise when active. Where baseline noise levels are higher than has been assumed, LOAEL and SOAEL values could theoretically be increased to take account of the higher baseline noise environment. The approach adopted is considered a reasonable worst case in the absence of measured baseline noise levels.

8.4.2 For the operational assessment, baseline noise levels have been predicted for all receptors within the Calculation Area, as shown on Figures 8.2 to 8.4.

8.4.3 At present, 4 properties are estimated to experience noise levels in excess of the daytime SOAEL of 68 dB $L_{A10,18hr}$ and 65 properties are estimated to experience noise levels in excess of the night-time SOAEL of 55 dB $L_{Aeq,8hr}$

8.4.4 There is one existing noise barrier located near to the Proposed Scheme. Appendix E.4. provides further information on this existing noise barrier. Given the uncertainty about the barrier it has not been included in the noise modelling process.

## 8.5 Sensitivity of resource

### Noise sensitive receptors

8.5.1 There are several communities and other potentially noise sensitive receptors within the noise and vibration study area for the Proposed Scheme.

- To the north of the M56 are Bowdon and Hale Barns within Trafford.
- Properties in Bowdon are at least 600m from Junction 7 of the M56 and are at least 1km from the M56 carriageway.
- Within Hale Barns the village of Warburton Green is nearest the M56. The closest properties in Warburton Green are 100-150m from the M56, to the west of Junction 6.
- To the south of the M56 is the village of Ashley, some 150-200m from the M56, between junctions 6 and 7 and other residential properties near to Ashley.

8.5.2 There are 701 dwellings and 6 other sensitive receptors within the Calculation Area of the Proposed Scheme, including places of worship, medical facilities, educational establishments, and hotels.

### Defra Noise Important Areas

8.5.3 Table 8-10 below shows the number of dwellings contained within NIA (road only) within the study area, with the number of dwellings shown for those NIA within the Calculation Area. These areas are shown on Figures 8.2 to 8.4.

**Table 8-10 Count of dwellings within road Noise Important Areas**

| Noise Important Areas by ID number | Location | Carriageway | Primary noise source | No of dwellings | Noise Making Authority |
|---|---|---|---|---|---|
| **M56 from J6 to J7** | | | | | |
| 7221 | Keepers Cottage | M56 Westbound | Road traffic | 1 | Highways England |
| 7214 | Tanyard Farm | M56 Westbound | Road traffic | 6* | Highways England |
| **M56 from J5 to J6** | | | | | |
| 7217 | Hasty Lane | M56 Westbound | Road traffic | 2* | Highways England |
| **A538 Hale Road, N of J6** | | | | | |
| 1492 | A538 Hale Road | A538 | Road Traffic | Outside calculation area | Trafford |
| 1493 | A538 Hale Road | M56 J6, A538 | Road traffic | 1 | Highways England, Trafford |
| **A556 S of J8** | | | | | |
| 7213 | Cherry Tree Lane | A556 | Road Traffic | Outside calculation area | Highways England |

*NIA 7214 is shown on the Design Fix 2 noise receptor plans (000000-XXJV—SWI-DR-YE-0) with one property within the boundary. However, there are a number of properties just outside the boundary, including one more exposed than the one within the boundary. It is considered that there are six properties in this NIA, although only one property, Tanyard Farm, is expected to be exposed to noise levels above the daytime SOAEL.

*NIA 7217 is shown on the Design Fix 2 noise receptor plans (000000-XXJV—SWI-DR-YE-0) with five properties on Hasty Lane within the boundary, however examination of mapping shows there are two (Rose

Cottage and The Cottage). Two residential properties (Breeze Hill and Ring a Roses) closer to the M56 were demolished in approximately 2013.

## 8.6 Assumptions and limitations

8.6.1 A number of assumptions and limitations have been identified during the assessment. The uncertainty associated with each limitation has been reduced as much as possible. The assessment is considered to represent a reasonable worst case using the best available information and is considered robust for the purposes of identifying likely significant effects.

### Construction noise

8.6.2 Planned construction methods and scheduling will not be known until a Delivery Partner is appointed, all relevant surveys have been completed and other engineering and environmental constraints have been taken into account. The methods and scheduling will also be subject to change during the construction period to deal with situations arising on site. A spatially specific risk based assessment has therefore been undertaken at this stage based on typical road construction activities and noise levels reported in BS 5228-1 Annexes C and D. A schedule of these activities and their associated noise level is provided in Table 8-16. These risks are detailed in the Outline Environmental Management Plan (OEMP) and specific clauses are applied depending on the assumed level of risk. The OEMP will be taken into account by the Delivery Partner in the development of the construction methodology and programme to avoid significant impacts during construction of the Proposed Scheme.

8.6.3 Appendix E.5 provides details of the construction noise assumptions and the source of the elements used in the construction noise calculations.

8.6.4 Table 8-11 below details each of the construction elements and shows the level of uncertainty related to each of them.

**Table 8-11 Uncertainty in relation to the construction noise assessment**

| Parameter | Description | Level of uncertainty | Comment/Actions to Resolve |
|---|---|---|---|
| Road traffic diversions | No traffic data has been used in assessing the temporary road traffic noise effects of diversions during the works. | Medium | Qualitative assessment has been made in this EAR of the potential for diversion route noise impacts. |
| Construction compound | At the time of writing the location for the construction compound has not yet been determined. | High | To be updated with emerging information via the OEMP. |
| Haul roads | At the time of writing the full details of the haul routes have not yet been determined, except that they would be routed along the existing motorway. | Medium | To be updated with emerging information via the OEMP. |
| Construction stages | Construction stages have been based on previous SMP scheme experience with confirmation from the engineering team. | Medium | To be updated with emerging information via the OEMP. |
| Construction plant and methods | Standard construction methods using plant and equipment details in BS 5228-1. | Medium | To be updated with emerging information and managed to minimise impacts via the OEMP. |
| Construction timings and duration | The timings and duration of the works have not yet been defined although the locations and timing for high risk activities such as ERA and gantry installations are known. | Medium | To be updated with emerging information and managed to minimise impacts via the OEMP. |
| Temporary removal of noise barriers | Decisions on where noise barriers may need to be temporarily removed during construction have not yet been made with the potential to affect road traffic noise levels for temporary periods at sensitive receptors. | High | To be updated with emerging information and managed to minimise impacts via the OEMP. |
| Noise sensitive receptors | Sensitive receptors identified through OS Addressbase data. | Low | Receptor addresses will be updated in response to new information. |

8.6.5 At this stage, the construction noise assessment has only considered the potential noise levels at different distance bands, without taking into account the actual topography or existing screening, such as existing noise barriers or other intervening buildings. Neither has it considered the likely ambient noise levels within the study area. The construction noise assessment should be viewed as indicative of potential impacts at this stage.

## Construction vibration

8.6.6 For the purposes of a worst case appraisal of potential vibration impacts, it has been assumed that percussive piling will be used to install gantries and Emergency Refuge Area (ERA) retaining walls; however, it is considered likely that lower vibration continuous flight auger piling can be used to install the majority of gantries. Alternative methods of installing ERA retaining walls, which generate lower levels of vibration, will be looked at on a case by case basis where there are particular sensitivities in the surrounding area. The OEMP ensures such action is taken. Table 8-12 below provides a summary of uncertainty relating to the construction vibration assessment.

**Table 8-12 Uncertainty in relation to the construction vibration assessment**

| Parameter | Description | Level of uncertainty | Comment/Actions to Resolve |
|---|---|---|---|
| Piling | Piling methods have yet to be determined. The assessment presented assumes a worst case of percussive piling at night-time. | High | The OEMP will set out a methodology for managing potential impacts due to piling. |

## Operational road traffic noise and vibration

8.6.7 Appendix E.5 provides details of the operational noise model assumptions and the source of the elements used in the operational road traffic noise model. Table 8-13 below provides a summary of uncertainty relating to the operational noise assessment.

**Table 8-13 Uncertainty in relation to the operational road traffic noise assessment**

| Parameter | Description | Level of uncertainty | Comment/Actions to Resolve |
|---|---|---|---|
| Future development | In addition to receptors that are currently shown in the OS Addressbase data, several planning applications have been included for in the noise model. Where possible, masterplan layouts have been obtained from the relevant Local Authority planning portal website and included for, however, there may be developments that have been missed, or received by the local authority after our searches were undertaken. | Low | Planning applications have been identified including commercial and industrial (within 200m of the Proposed Scheme) and residential developments (within 600m of the Proposed Scheme) for the period August 2013 to August 2016. Masterplan layouts for these planning applications have been reviewed and included for in the noise modelling where possible. This includes developments registered up to the end of October 2017. This cumulative assessment is provided in chapter 9. |
| Height and extent of existing environmental barrier | The length and height of the existing noise barrier within the study area has been extracted from AEDS data. | Medium | Given the uncertainty over the dimensions and location of the barrier it has not been included in the noise modelling process. |
| Condition and performance of the existing environmental barrier | The likely integrity and absorption of the existing environmental barrier as well as its potential to act as a noise barrier has been examined from Google street view. | Medium | Given the uncertainty over the conditions of the barrier it has not been included in the noise modelling process. |
| Motorway pavement in opening year scenarios | At the time of the assessment a detailed breakdown of the road surfacing on the existing M56 was not available, although data from the Highways Agency Pavement Management System (HAPMS) suggests that the motorway is a mix of low noise thin wearing course (TWC) and hot rolled asphalt (HRA). As such, assumptions have been made for road surfacing, as described in Appendix E.5 | Low | Check assessment conclusions are not compromised by any additional information which may arise in DF4/DF5 |

| Parameter | Description | Level of uncertainty | Comment/Actions to Resolve |
|---|---|---|---|
| Motorway pavement in future year scenarios | It is assumed that the motorway would have been resurfaced with a low noise surface by the design year even without the Proposed Scheme, using the assumptions detailed in Appendix E.5.<br><br>The use of -3.5 dB for relatively new LNRS in the DM scenario is not strictly in accordance with the guidance in HD 213/11, however it is considered more representative of the likely influence of LNRS in the real world and would also provide for a more worst case assessment. | Medium | Check assessment conclusions are not compromised by any additional information which may arise in DF4/DF5 |
| Temporary reduction in noise levels during construction | The DMRB HD 213/11 assessment methodology requires an assessment of the short-term impact to be undertaken. This is represented by the comparison of noise levels in the Do Minimum 2020 and Do Something 2020 scenarios. It is however recognised that during the construction of the Proposed Scheme, traffic management, including a 50mph speed limit, will be in place on the M56 for the duration of the works, approximately 2 years. During this two-year period, it may be perceived that noise levels have reduced compared to what they were before construction began, due to the temporary reduction in speed limit. CRTN Chart 4 can be used to provide an indication of the expected reduction in noise level when traffic speed is reduced from 70mph to 50mph, to estimate the temporary reduction in noise level which might be perceived during construction. Using this chart, a temporary 2.5 dB reduction in noise level could be expected when the M56 is operating under traffic management with a 50mph speed limit. Once the Proposed Scheme is opened to road traffic, the impact of the Proposed Scheme in the short-term may feel larger than that predicted in the short-term assessment due to the combined impact of the speed limit returning to 70mph as well as the impact of the Proposed Scheme. This effect cannot be considered in the assessment of the Proposed Scheme as it would deviate from the approach required in DMRB HD 213/11, and would also require further traffic data analysis to undertaken by others. | Low | Ensure that this effect is well communicated to anyone who might be living or working near to the Proposed Scheme, including at Public Information Exhibitions and in any correspondence associated with the Proposed Scheme. |

| Parameter | Description | Level of uncertainty | Comment/Actions to Resolve |
|---|---|---|---|
| Traffic data, scheme opening year | The Proposed Scheme is expected to open is 2021, although the traffic model and thus this assessment is based on an opening year of 2020. Growth rate data (sourced from NTEM v7.2 growth factored by NTM AF15 dataset) suggests that traffic growth between 2020 and 2021 would be of the order of 1%, and would apply to both the DM and DS scenarios. Differences between the two year are considered to be non-material to the assessment, and would therefore no affect the overall conclusions. | Low | No change required |
| Traffic data, combined effects | The traffic data used for the assessment assumes that the four SMP schemes in the north west open together in 2020. The results presented in the scheme study area are predominantly due to the effects of this scheme.<br>Should the schemes open at different times, or should one or more scheme not be taken forward this is unlikely to result in significantly different effects in the study area.<br>Should the schemes open at different times, or should one or more scheme not be taken forward the assessment of traffic outside the study area is more uncertain, and impacts may be greater or smaller than shown. | Low | No change required. |

### Cost-benefit analysis of mitigation measures

8.6.8 The cost-benefit analysis of noise barriers took the marginal values reported in Defra's report *"Environmental noise: valuing impacts on sleep disturbance, annoyance, hypertension, productivity and* quiet." These values consider average figures for the UK population and omit specific health statistic figures from the communities being assessed.

8.6.9 This is considered appropriate for the Proposed Scheme since, as recommended in Defra's report, "marginal values are intended for use where noise is not expected to be a significant factor in decision making. These simplified tools provide a direct link between the exposure to noise and monetised impacts, without the need for detailed assessment. As such these tools are only recommended for use when the total noise impact is below £50 million and noise impacts are not expected to materially change the assessment of different options."

## 8.7 Design and mitigation measures

### Construction

8.7.1 Construction noise and vibration will be fully managed through detailed assessments in line with the requirements of the OEMP. It is also expected that the Delivery Partner consults with the Environmental Health Officer (EHO) responsible for noise and vibration matters at the relevant Local Authority(s) (LA) at the earliest convenience during the construction works planning stage. Additionally, it would also be expected that a formal Section 61 (of Control of Pollution Act 1974

(CoPA) agreement for prior consent for work on construction sites is entered into with the LA. The LA has 28 days from the receipt of the application to inform the application of its decision.

8.7.2 Noise and vibration monitoring locations and limits will be identified in the OEMP, where necessary, to enable the delivery partner to monitor and amend working practices where there is a risk of noise or vibration significance limits being breached (in combined level and duration).

8.7.3 The potential impacts of the construction activities can be minimised by use the of noise and vibration control measures, as suggested in BS5228 parts 1 and 2, including temporary noise screens and partial enclosures. General principles for the control of noise and vibration during the construction works include:

- use of best practicable means during construction works under Section 72 of CoPA 1974 and follow good practice under BS 5228-1;
- switch off plant, equipment and vehicles when they are not in use for longer periods of time;
- establish agreed site working hours for "normal" construction activities;
- establish agreed criteria for the undertaking significantly noisy or vibration-causing operations near to sensitive locations;
- programme works such that the requirement for working outside of normal working hours is minimised and so noisy works are undertaken during the daytime where possible;
- limitation of high noise level durations in the vicinity of individual sensitive receptors;
- ensure that all staff and operatives are briefed on the requirement to minimise nuisance from site activities;
- advanced communication of the works to local environmental health departments and to the affected properties;
- use temporary noise screens or partial enclosures around particularly noisy activities used in proximity to dwellings;
- use silenced compressors, generators and fans at site locations;
- maintain plant regularly;
- only remove the minimum length of noise barrier required for the construction activity, and replace immediately once the construction activity is finished;
- where land constraints allow, the Delivery Partner should use temporary noise barriers in the area where an existing noise barrier is removed, for the duration of the construction activity. The temporary noise barrier should run parallel to the existing noise barrier, and overlap in a staggered fashion such that there is no direct line of sight created between the noise sensitive receptor and the noise sources (both motorway and construction plant); and
- ensure that any residents likely to be affected by the temporary removal of noise barriers are notified of the construction activity and temporary noise barrier removal prior to the works being undertaken.

## Operation

### Design measures and mitigation measures to minimise adverse effects

8.7.4 It has been assumed that the Proposed Scheme will incorporates the design measure of a Low Noise Road Surface (LNRS) in the opening year across lanes 1 and 4 between J6 and J8, with lanes 2 and 3 remaining as the current surface, which is a mixture of hot rolled asphalt and low noise surfaces. The use of LNRS on lanes 1 and 4 results in a benefit over the DM situation in the opening year, with a greater benefit for sections where the existing carriageway is hot rolled asphalt. The noise effects of mixed road surfaces are calculated using the procedure described in Table E-6.

8.7.5 It is assumed that all of the motorway would have been resurfaced with LNRS by the design year without the Proposed Scheme (DM 2035) and hence no additional benefit of LNRS is assumed in the design year (DS 2035). The OEMP will record a requirement to undertake an acoustics assessment prior to considering an alternative surface in the future to any LNRS lain as part of the Proposed Scheme must be maintained appropriately. Any resurfacing works in areas of LNRS must use surfacing materials with similar or improved noise reduction properties. This assessment assumes that any surface laid has an $RSI_H$ of at least -5dB.

8.7.6 The existing environmental barrier will be retained unless it is identified that it is damaged or needs to be removed to carry out the works when it will be replaced. If sections are removed they must be replaced as soon as possible after completion of the works.

### Measures to enhance the existing noise environment

8.7.7 No additional measures have been incorporated to provide enhancements to the noise environment in the vicinity of the Proposed Scheme. The decision on whether to provide noise barriers has taken account of the value-for-money that would be provided by the barriers using the cost benefit analysis procedure described in Section 8.3 and Appendix E-6.

8.7.8 All of the noise barriers considered at the scoping stage have been ruled out as not providing value-for-money (see Appendix E.6 for further details). Table 8-14 below details a summary of the analysis undertaken and justification for the scoping out of each potential noise barrier. Further information for each noise barrier proposed is provided in Table E-9 of Appendix E-6.

**Table 8-14 Scoped out enhancement measures**

| Mitigation Measure | Location | Justification |
|---|---|---|
| NNB1 | 8725-9100 | Value for money ratio significantly smaller than 1. |
| NNB2 | 8400-8725 | Value for money ratio significantly smaller than 1. |
| NNB3 | 8725-9025 | Value for money ratio significantly smaller than 1. |
| NNB4 | 7125-7300 | Value for money ratio significantly smaller than 1. |

8.7.9 Table 8-15 below presents a summary of the mitigation/enhancement applied to each NIA on the M56 J6 to J8, and a comment as to whether the NIA is considered to be "mitigated" or "not mitigated" as per Highways England's obligations to deliver the Road Investment Strategy (RIS) and its Licence objectives.

**Table 8-15 Enhancement measures during operation in NIA**

| NIA ID | Mitigation/enhancement proposed | Mitigated/Not Mitigated |
|---|---|---|
| 7221 | New LNRS to lanes 1 and 4<br>Lanes 2 and 3 have existing HRA and LNRS | Not mitigated due to Lanes 2 and 3 being HRA and LNRS |
| 7214 | New LNRS to lanes 1 and 4<br>Lanes 2 and 3 have existing HRA and LNRS | Not mitigated due to Lanes 2 and 3 being HRA and LNRS |
| 7217 | None, beyond limit of the Proposed Scheme works | Not mitigated |
| 1492 | None, affected by traffic on A538 | Not mitigated |
| 1493 | None, affected by traffic on A538/ M56 J6 | Not mitigated |
| 7213 | None, affected by traffic on A556 | Not mitigated |

8.7.10 In terms of Highways England delivering the obligations of the RIS and to its Licence, the Proposed Scheme does not mitigate the two NIA within the scheme extents (7221 and 7214) as a result of the decision to not resurface lanes 2 and 3. Changes in noise in these NIA are expected to be negligible in the long term. Full effects at the NIA are described in Tables 8-28 and 8-29. The

other NIA in the study area are affected by roads which are outside the works for the Proposed Scheme.

## 8.8 Potential construction effects

8.8.1 While details of the location, duration and construction methods are to be explored to define the OEMP following completion of the Environmental Assessment Report, the following activities have been considered as part of the construction phase assessment to ensure that appropriate design and management activities are in place to avoid unnecessary adverse impacts:

- Central reserve phase, including the replacement of existing structures and the construction of the central reserve barrier;
- Verge phase, including vegetation clearance, stripping out of noise barrier, demolitions, gantry foundation and ERA construction;
- Resurfacing works, including removal of existing surface and laying of new surface;
- Drainage works;
- Road marking works;
- Signage works; and,
- Construction of works compound.

8.8.2 At the present time, it is not anticipated that any bridge demolition works will be required as part of the Proposed Scheme.

8.8.3 A risk based worst case assessment of the construction noise impacts at zero to 300m from the works has been undertaken for the above activities. The calculated noise levels are shown in Table 8-16. A list of the equipment used during the assessment is provided in Appendix E.5.

8.8.4 The calculations do not take into account existing noise barriers or other screening. Where properties are screened from the works it would be expected that noise levels could be up to 10 dB lower. Similarly, where noise propagates over soft ground predicted noise levels would be lower. In order to assess the worst-case situation, it has been assumed that the roadworks may be carried out at night. The noise levels expected to be in excess of the SOAEL threshold noise level (55 dB $L_{Aeq,8h}$) are highlighted in yellow in Table 8-16, although it should be noted that some receptors near to the M56 are already subject to noise levels in excess of the SOAEL.

8.8.5 It is acknowledged that during the construction phase, it may be necessary for the Delivery Partner to temporarily remove sections of existing noise barriers in order to create working room for construction activities. Whilst the Delivery Partner is working within the verge (where existing noise barriers are located) it would be expected that the existing hard shoulder would be closed to traffic and the motorway would be under traffic management conditions. As such, it is likely that the motorway would be subject to a reduced speed limit (normally 50 mph) and road traffic would potentially be located slightly further from noise sensitive receptors adjacent to the motorway. The traffic management set up would therefore act to reduce noise levels from road traffic for the nearest noise sensitive receptors. However, the temporary removal of noise barriers would likely result in an increase in noise levels at those receptors behind the noise barriers. Although this increase would likely be offset somewhat by the traffic management set up, the Delivery Partner should ensure that the following measures are followed to avoid significant adverse effects due to temporary noise barrier removal:

- Only remove the minimum length of noise barrier required for the construction activity, and replace immediately once the construction activity is finished;
- Where land constraints allow, the Delivery Partner should use temporary noise barriers in the area where an existing noise barrier is removed, for the duration of the construction activity. The temporary noise barrier should run parallel to the existing noise barrier, and overlap in a staggered fashion such that there is no direct line of sight created between the noise sensitive receptor and the noise sources (both motorway and construction plant);

- Ensure that any residents likely to be affected by the temporary removal of noise barriers are notified of the construction activity and temporary noise barrier removal prior to the works being undertaken.

**Table 8-16 Indicative construction noise levels – road works**

| Phase | Activity | Noise level dB $L_{Aeq,8h}$ for night-time from construction noise at various distances (m) from the works | | | | | |
|---|---|---|---|---|---|---|---|
| | | 10m | 20m | 50m | 100m | 200m | 300m |
| Central reserve phase (night-time) | Removal of existing structures and installation of RCB. | 78 | 72 | 64 | 58 | 52 | 48 |
| Verge phase (most at night-time) | Demolition, clearance and stripping out of noise barriers (if required) | 83 | 77 | 69 | 63 | 57 | 54 |
| | Gantry installation (assumes percussive piling required) | 80 | 74 | 66 | 60 | 54 | 51 |
| | ERA construction (assumes percussive piling required) | 83 | 77 | 69 | 63 | 57 | 53 |
| Resurfacing works (night-time) | Removal of existing surface | 85 | 79 | 71 | 65 | 59 | 55 |
| | Laying new surface | 77 | 71 | 63 | 57 | 51 | 48 |
| Drainage works (night-time) | Drainage works | 79 | 73 | 65 | 59 | 53 | 49 |
| Road marking works (night-time) | Road marking works | 75 | 69 | 61 | 55 | 49 | 45 |
| Signage works (night-time) | Signage works | 80 | 74 | 66 | 60 | 54 | 50 |
| Number of residential properties within distance bands | | 0 | 0 | 0 | 3 | 73 | 254 |
| Number of non-residential sensitive receptors within distance bands | | 0 | 0 | 2 | 1 | 1 | 1 |

8.8.6 A significant effect due to construction noise would only arise where noise levels are predicted to be above trigger thresholds for long durations (e.g. 10 or more days/nights in any 15-consecutive day/night periods, or more than 40 days/nights in any six-month period), or where very high noise levels prevail for short periods (e.g. for a few days/nights).

8.8.7 Most of the activities listed in Table 8-16 would be of very short duration in a single location (e.g. gantry installation) or transient in the case of linear activities (e.g. resurfacing/road markings) and therefore are unlikely to give rise to significant effects, so have not been considered further in this assessment. However, construction of ERAs is likely to have a longer works duration for nearby individual receptors, and these have been assessed in more detail below.

8.8.8 The adverse impacts of temporary high noise levels would be managed and reduced to the lowest levels/durations possible as set out in the OEMP.

8.8.9 In addition to the works on the motorway, a construction compound will be required, at present the exact location of the compound or construction methods are not yet known, however, an overview assessment of the construction impacts at noise sensitive receptors has been undertaken for the activities that are likely to be the noisiest to represent a "worst-case" (Table 8-17). It would be expected that the compound construction will only be undertaken during the day and those levels expected to be in excess of the SOAEL (75dB $L_{Aeq,12h}$) are highlighted. As the proposed location of the site compound was not confirmed at the time of the assessment, it has not been possible to give an indication of the numbers of properties within each distance band from the works. It is noted that this impact is from the construction of the compound, rather than the use of the compound during the construction of the Proposed Scheme.

**Table 8-17 Indicative construction noise levels – compound**

| Activity | Noise level dB $L_{Aeq,12h}$ at distance (m) from compound | | | | | |
|---|---|---|---|---|---|---|
| | 10m | 20m | 50m | 100m | 200 m | 300 m |
| Site clearance | 81 | 75 | 67 | 61 | 55 | 51 |
| Compound construction | 85 | 79 | 71 | 65 | 59 | 55 |

## Construction noise effects - retaining walls

8.8.10 The construction of some ERA will require retaining walls which may require percussive piling. In addition to ERA, retaining wall solutions are likely to be required. Piling to construct retaining walls is likely to require the longest periods of noisy works in the vicinity of individual receptors, and has been assessed in more detail.

8.8.11 There are four proposed new ERA's for the Proposed Scheme; however, at the time of writing all four have the potential to require piled retaining walls.

8.8.12 Each of the potential retaining wall locations is listed in Table 8-18 below together with the numbers of properties within relevant distance bands. The 200 to 300m band is included; however, it is not anticipated that noise levels will exceed the night-time SOAEL of 55 dB $L_{Aeq,8h}$ at this distance (using the ERA construction scenario of Table 8-16 above).

**Table 8-18 Sensitive receptor distance bands – Retaining Walls**

| Ref | Approx. Chainage | Nos. of Noise Sensitive Properties within Distance Bands | | | | |
|---|---|---|---|---|---|---|
| | | <20m | 20 to 50m | 50 to 100m | 100 to 200m | 200 to 300m |
| ERA WB5 | 5700-5800 | 0 | 0 | 0 | 1 | 3 |
| ERA EB1 | 5900-6000 | 0 | 0 | 0 | 1 | 7 |
| ERA EB2 | 7000-7100 | 0 | 0 | 0 | 4 | 7 |
| ERA WB4 | 7350-7450 | 0 | 0 | 0 | 0 | 0 |

Note that all distances are to property facades and therefore gardens may be in closer proximity to the works.

8.8.13 There are a total of six noise sensitive receptors that are located within 200m of a location that potentially requires piling, and could therefore be subject to noise levels in excess of the SOAEL if piling occurred during the night-time period, based on the noise level predictions for ERA construction provided in Table 8-16. Noise levels of this magnitude are potentially significant depending on other factors such as the timing of the works, the duration and the existing acoustic climate.

8.8.14 In order to reduce potential significant adverse effects at these six noise sensitive receptors, Best Practicable Means should be considered, including:

- the use of alternative quieter piling methods (e.g. rotary bored) where ground conditions permit;
- the use of temporary noise barriers and piling shrouds;
- managing the timing of and durations of working such that noise sensitive receptors are not exposed to noise levels in excess of the SOAEL for more than 10 nights in any 15 consecutive night-time periods; and,
- engage with the local community to ensure they are aware of the works to be undertaken and are notified well in advance of them beginning. The Delivery Partner should also engage the community to inform their method of working, i.e. do the community want a continuous noise for a shorter number of nights, or an intermittent noise for a longer number of nights?

8.8.15 Implementation of the above measures would ensure that there are no significant effects for these six noise sensitive receptors.

## Construction vibration effects

8.8.16 Percussive piling may be used during the installation of gantries and noise barriers, as well as during the construction of ERAs or other structures such as retaining walls. Table 8-19 shows the expected vibration levels at different distance bands from all locations where percussive piling may be required (ERAs, gantry foundations and retaining walls). The vibration levels were calculated in accordance with the formula in BS 5228-2 Table E.1. The local ground type has not been confirmed at the present time; however, for the purpose of this assessment the factor ($K_p$) for the type of soil was taken as 1.5, in line with the descriptions in BS 5228-2 Table E.2. Vibration levels above the SOAEL are highlighted in orange.

**Table 8-19 Indicative construction vibration levels – percussive piling**

| Activity | Vibration level PPV (mm/s) at distance (m) | | | |
|---|---|---|---|---|
| | <10m | 10 to <20m | 20 to <50m | 50 to <100m |
| PPV from Percussive piling | 18.4 | 18.4 to 7.5 | 7.5 to 2.3 | 2.3 to 0.9 |
| Number of residential properties within distance bands | 0 | 0 | 0 | 1 |

8.8.17 Table 8-19 illustrates that that there are no residential properties that lie within 50m of a percussive piling location. There is one property that lies approximately 75m from a percussive piling location for a gantry, where vibration levels between 0.9mm/s and 2.3mm/s are predicted. Vibration levels of this magnitude are above the LOAEL but are below the SOAEL, so are also considered to be non-significant adverse effects.

8.8.18 The adverse vibration effects of piling activities will be minimised as set out in the OEMP so that significant effects do not occur.

## Motorway closures during construction

8.8.19 Carriageway closures will generally be avoided by use of traffic management; however, it is likely they will be required on rare occasions overnight for activities such as the removal of existing gantries, and installation of superspan or cantilever gantries. During any potential night-time carriageway closures for construction works, road traffic would be re-routed from the motorway onto the tactical diversion routes, causing uplift in traffic volumes using these routes during this period. Provisional diversion routes are shown on Figure 8.5. As such, for noise sensitive receptors located in close proximity to the diversion routes, night-time noise levels would likely be increased whilst carriageway closures are in force; although it is difficult to predict what the level of noise change would be at this stage. Given the relatively large volumes of road traffic that normally uses the motorway at night, it is considered that when the diversion routes are in use due

to carriageway closures, adverse impacts are likely to occur; however, the likely frequency of those impacts can be restricted.

8.8.20 Works requiring closures are predominantly on the section between junctions 6 and 7. The diversion routes for both M56 carriageways use the same diversion route, the A56, A560, A538 going through Altrincham. The Proposed Scheme requires 4 superspan gantries, which are assumed to require one closure for each. The Proposed Scheme also requires 4 cantilever gantries, and it is assumed that 2 gantries could be installed in one closure. Therefore, a total of 6 closures are estimated, and these would be non-consecutive. Partial closures may also be required for other construction activities. Closure of either carriageway would require the Delivery Partner to provide a diversion route for motorists, using the local road network. It is estimated that there are approximately 1700 noise sensitive receptors within 50m of the diversion route shown in Figure 8.5, which may be affected by increases in noise from the diversion.

8.8.21 Should the number of closures increase, the Delivery Partner would plan the works so there would be no more than 10 uses of a diversion route in any 15 night period in order to mitigate these potential impacts arising from carriageway closures at night. This number of closures would warrant the provision of noise insulation to properties along diversion routes following the criteria detailed in BS 5228-1.

8.8.22 Carriageway closures would be advertised well in advance of the works to ensure regular users of the M56 at night are aware of when closures are going to occur. This would act to deter some drivers from using the M56 on those nights, but not all.

8.8.23 Additionally, the Delivery Partner would liaise with local authorities regarding planned carriageway closures in order to ensure that they do not coincide with planned maintenance works on the diversion route, for example. Consideration should also be given to alteration of timings of signal controlled junctions to avoid queuing traffic and to allow diverted motorway traffic to pass through the diversion route quicker.

8.8.24 Finally, consideration should also be given to use of several diversion routes simultaneously (e.g. so westbound traffic is taken one route, and eastbound traffic is taken another), which will act to split traffic volumes into different geographical areas, lessening the impact in one single area.

8.8.25 With all of the above mitigation in place, it is considered that the impact caused by carriageway closures during construction would not require noise insulation for properties on any of the proposed diversion routes.

## 8.9 Potential operational effects

### Operational road traffic noise – HD 213/11 assessment

8.9.1 Detailed predictions have been carried out for a total of 701 residential receptors within the calculation area; together with 6 non-residential noise sensitive receptors, including schools, health, community and leisure facilities.

8.9.2 All noise levels and noise changes are presented both in the short-term and the long-term. For the long-term noise impacts, a comparison is made between the noise levels with the Proposed Scheme in the design year (DS 2035) and- the noise levels without the Proposed Scheme in the opening year (DM 2020), shown in Table 8-21. This comparison includes the effects of the Proposed Scheme as well as general traffic growth. A parallel comparison is also made for the DM scenario assuming that the Proposed Scheme did not go ahead (i.e. noise change between DM 2020 and DM 2035 including general traffic growth). This comparison is presented in Table 8-20. The short-term comparison is shown in Table 8-21.

8.9.3 It should be noted that in the commentary that follows Tables 8-20, 8-21 and 8-22, emphasis is placed on discussion of noise changes which are considered to be perceptible (1 dB in the short-term and 3 dB in the long-term) at the sensitive receptor location, as opposed to changes which are considered to be imperceptible.

8.9.4 Table 8-20 shows the noise changes for all modelled sensitive receptors within the Calculation Area in the long-term assuming the Proposed Scheme does not go ahead. Noise changes have been categorised into the noise change bands following the DMRB HD213/11 magnitude impact ratings as shown in Table 8-7. It should also be noted that for night-time noise, DMRB HD 213/11 only requires assessment of properties that are predicted to experience noise levels >55dB $L_{night, outside}$.

**Table 8-20 Long-term DM traffic noise changes**

| Change in noise level | | Daytime | | Night-time |
|---|---|---|---|---|
| | | Number of dwellings | Number of other sensitive receptors | Number of dwellings |
| Increase in noise level, $L_{A10,18h}$ | 0.1 - 2.9 | 1 | 1 | 0 |
| | 3 - 4.9 | 0 | 0 | 0 |
| | 5 - 9.9 | 0 | 0 | 0 |
| | >=10 | 0 | 0 | 0 |
| No change | = 0 | 5 | 0 | 0 |
| Decrease in noise level, $L_{A10,18h}$ | 0.1 - 2.9 | 422 | 5 | 61 |
| | 3 - 4.9 | 275 | 0 | 19 |
| | 5 - 9.9 | 0 | 0 | 0 |
| | >=10 | 0 | 0 | 0 |

8.9.5 In the long-term without the Proposed Scheme in place, during both the daytime and night-time periods, the majority of dwellings and other sensitive receptors are predicted to experience negligible impacts or perceptible decreases in noise. Changes in noise are due to lower noise surfacing which would be laid on the motorway by this time.

## Proposed Scheme noise changes

8.9.6 Table 8.21 shows the noise changes for all modelled receptors within the Calculation Area in the short-term with the Proposed Scheme and proposed noise mitigation in place, categorised into the noise change bands following the DMRB HD213/11 magnitude impact ratings as provided in Table 8-6. A full set of calculations, showing the results at all sensitive receptors can be found in Appendix E-7.

**Table 8-21 Short-term traffic noise changes (DMRB HD213/11 Table A1.1)**

| Change in noise level | | Number of dwellings | Number of other sensitive receptors |
|---|---|---|---|
| Increase in noise level, $L_{A10,18h}$ | 0.1 - 0.9 | 1 | 0 |
| | 1 - 2.9 | 1 | 0 |
| | 3 - 4.9 | 0 | 0 |
| | >=5 | 0 | 0 |
| No change | = 0 | 8 | 2 |
| Decrease in noise level, $L_{A10,18h}$ | 0.1 - 0.9 | 667 | 4 |
| | 1 - 2.9 | 24 | 0 |
| | 3 - 4.9 | 0 | 0 |
| | >=5 | 0 | 0 |

8.9.7 There is one dwelling that is predicted to experience a minor perceptible increase in noise level on scheme opening. Conversely, there are a total of 24 dwellings that are predicted to experience minor perceptible decreases in noise level. All other dwellings and other sensitive receptors are predicted to experience negligible noise impacts or no change in noise level.

8.9.8 In summary, in the short-term with the Proposed Scheme in place, the total number of receptors experiencing perceptible beneficial impacts, 24 outweighs the number of receptors experiencing perceptible adverse impacts, one.

8.9.9 The 24 dwellings that are predicted to experience perceptible minor beneficial impacts are in locations where the existing hot rolled asphalt surface in the current lane 3 is replaced with lower noise surfacing, noting that this becomes lane 4 with the Proposed Scheme in place.

8.9.10 The dwelling with the perceptible minor adverse impact is the property within NIA 7221, and the increase in noise is a result of the average traffic speed increasing on the section of the M56 nearest this property. The property is predicted to receive a 1.0dB increase in noise, which would be right on the threshold of perceptibility. However, the increase in traffic speed is a result of the average traffic speed moving from one speed band up into the next speed band. If the actual speeds increase by less than the speed band shows the increase in noise would be smaller than 1dB and be imperceptible.

8.9.11 Table 8-22 shows the noise changes for all modelled sensitive receptors within the Calculation Area in the long-term with the Proposed Scheme and mitigation measures in place. Noise changes have been categorised into the noise change bands following the DMRB HD213/11 magnitude impact ratings as shown in Table 8-7. It should be noted that for night-time noise, DMRB HD 213/11 only requires assessment of properties that are predicted to experience noise levels >55dB $L_{night, outside}$.

**Table 8-22 Long-term traffic noise changes (DMRB HD213/11 Table A1.2)**

| Change in noise level | | Daytime | | Night-time |
|---|---|---|---|---|
| | | Number of dwellings | Number of other sensitive receptors | Number of dwellings |
| Increase in noise level, $L_{A10,18h}$ | 0.1 - 2.9 | 0 | 0 | 0 |
| | 3 - 4.9 | 0 | 0 | 0 |
| | 5 - 9.9 | 0 | 0 | 0 |
| | >=10 | 0 | 0 | 0 |
| No change | = 0 | 0 | 0 | 0 |
| Decrease in noise level, $L_{A10,18h}$ | 0.1 - 2.9 | 701 | 6 | 65 |
| | 3 - 4.9 | 0 | 0 | 0 |
| | 5 - 9.9 | 0 | 0 | 0 |
| | >=10 | 0 | 0 | 0 |

8.9.12 During the daytime period, there are no dwellings or other sensitive receptors that are predicted to experience perceptible changes in noise level. Similarly, during the night-time period, there are no dwellings that are predicted to experience perceptible changes in noise level.

8.9.13 The results show that noise levels decrease by the design year because the motorway would have been resurfaced with LNRS by this time. When contrasted with the DM situation in the long-term shown in Table 8-20 the result is similar, however increased traffic levels or speeds with the scheme show that decreases in noise from resurfacing would no longer be perceptible at some properties. The changes in noise on each section of the M56 in the design year are shown in Appendix E3.

8.9.14 Table 8-23 presents the traffic noise nuisance changes for all receptors within the Calculation Area, showing the proportion of people that would be bothered by traffic noise. It should be noted that, based on the noise nuisance assessment methodology in Annex 6 of DMRB HD 213/11, the DM comparison is based on the steady state change in noise level over the long-term period, whilst the DS comparison is largely driven by the abrupt change in noise level observed in the year of opening of the Proposed Scheme opposed to the long-term steady state change.

**Table 8-23 Traffic noise nuisance changes (DMRB HD213/11 Table A1.3)**

| | | DM | DS |
|---|---|---|---|
| **Change in nuisance level** | | **Number of dwellings** | **Number of dwellings** |
| Increase in nuisance level | >0 - <10% | 1 | 1 |
| | 10 - <20% | 0 | 0 |
| | 20 - <30% | 0 | 1 |
| | 30 - <40% | 0 | 0 |
| | >=40% | 0 | 0 |
| No change | =0% | 5 | 0 |
| Decrease in nuisance level | >0 - <10% | 695 | 699 |
| | 10 - <20% | 0 | 0 |
| | 20 - <30% | 0 | 0 |
| | 30 - <40% | 0 | 0 |
| | >=40% | 0 | 0 |

8.9.15 The Proposed Scheme is predicted to result in one dwelling experiencing 0 to 10% increases in traffic noise nuisance, the same as in the DM scenario, and there is one additional dwelling predicted to experience 20 to 30% increases in traffic noise nuisance, Keepers Cottage in NIA 7221.

8.9.16 Although the assessment shows one property with an increase in nuisance levels greater than 10% in the DS scenario, this is largely due to short-term changes in noise resulting in a larger percentage increase in nuisance levels. For example, a 0.9 dB increase in noise level is equivalent to 20% increase in the noise nuisance level in the short-term, although in terms of noise change, a 0.9 dB increase is considered to be imperceptible. As noted in Annex 6 of DMRB HD 213/11, people are more sensitive to abrupt changes in traffic noise than gradual changes. Therefore, the sensitivity to new schemes is an effect that can last for several years, when in fact gradual changes in noise levels can represent higher overall noise level increases but lower nuisance levels.

8.9.17 Comparing with the situation without the scheme in place, the results are broadly the same, with most properties experiencing decreases in nuisance of up to 10%.

8.9.18 In summary, given that the DS comparison is largely by the short-term assessment, and short-term changes in nuisance level of less than 20% are equivalent to imperceptible changes in noise level, the Proposed Scheme is considered to have a neutral impact in terms of noise nuisance. There is only one dwelling experiencing a 20 to 30% increase in nuisance level.

8.9.19 There are no properties within 40m of the Proposed Scheme and as such an airborne vibration nuisance assessment has not been undertaken.

## Effects Outside the Study Area.

8.9.20 The assessment approach described in HD 213/11 requires an assessment of impacts outside the Proposed Scheme Study Area, and identification of property counts along routes with perceptible changes in noise. As the traffic data used in this assessment is the cumulative traffic data for this scheme, the M60, M6 and M62 schemes, the assessment looks at links which are outside the study areas for all four schemes. This provides an assessment of the likely worst-case cumulative effects outside of the study areas for the north-west SMP schemes.

8.9.21 The assessment uses the traffic data to work out the roadside noise levels, which are presented in Table 8-24.

**Table 8-24 Affected routes outside 1km scheme buffer**

| I.D. (Location) | Number of Receptors within 50 metres | | Basic Noise Level (dB LA10,18h) | | | |
|---|---|---|---|---|---|---|
| | Residential | Non Residential | DM2020 | DM2035 | DS2020 | DS2035 |
| 87021_82212 Oakwood Gate (roundabout to A574) | 0 | 0 | 70.5 | 71.1 | 69.2 | 70.4 |
| 86533_86144 A57 roundabout with B5471 to B5311 | 0 | 0 | 72.4 | 72.7 | 71.1 | 71.7 |
| 87173_87021 Southbound road between either side of the A574 at Birchwood | 0 | 0 | 63.8 | 64.6 | 62.5 | 64.3 |
| 86092_87021 A574 Westbound (Birchwood Way) | 0 | 0 | 68.5 | 69.0 | 67.1 | 68.0 |
| 86025_86012 A574 Warrington Road from Glaziers Lane to Common Lane B5207 | 88 | 5 | 69.1 | 69.9 | 68.0 | 69.3 |
| 86992_85858 A57 bridge over M6 at Jct 21 | 0 | 0 | 71.2 | 70.9 | 69.7 | 69.2 |
| 85866_85859 M6 Jct 21 Southbound exit slip | 0 | 0 | 64.2 | 65.0 | 67.4 | 68.9 |
| 85858_85865 M6 Jct 21 Southbound entry slip | 2 | 0 | 70.6 | 71.3 | 69.5 | 70.8 |
| 85882_85884 A57 from B5212 (Glazebrook Lane) to Warburton Bridge Road | 36 | 0 | 67.9 | 69.0 | 66.8 | 67.9 |
| 85861_86992 B5210 from Chesford Grange Industrial Estate Roundabout to Northbound Roundabout at M6 Jct 21 | 3 | 0 | 68.7 | 69.6 | 67.3 | 68.7 |
| 86606_85800 A50 Orford Road from A57 to A574 Birchwood Way | 219 | 2 | 56.2 | 54.8 | 57.7 | 55.2 |
| 86025_80608 B5207 Lane Head to Culheth | 156 | 9 | 66.9 | 67.3 | 65.3 | 66.1 |
| 85978_85820 A43 Warwick road / Networn Road to Winwick | 57 | 1 | 65.7 | 66.1 | 62.0 | 63.3 |
| 85871_87173 A574 Birchwood Park Avenue to Birchwood Way | 6 | 1 | 64.4 | 65.2 | 63.2 | 64.7 |

8.9.22 It is noted that these links are principally near the M6 and M62 schemes, indicating that the effects are more likely to be a result of those schemes rather than this scheme. The effects from the table are described for completeness.

8.9.23 In the short term, this table shows that there is one link where there is a perceptible increase in noise with residential properties within 50m, the A50 Orford Road from A57 to A574 Birchwood Way, where noise levels go up by 1.5dB, affecting 219 properties, which is a minor adverse effect.

8.9.24 There are seven links where there is a perceptible decrease in noise on opening, with 405 properties within 50m. 57 of these properties are on A43 Warwick road / Networn Road to Winwick which is expected to receive a decrease in noise of 3.7dB, giving rise to a moderate beneficial effect.

8.9.25 In the long term there are no perceptible changes in noise.

## Comparison of the operational noise effects to the aims of the Noise Policy Statement for England

8.9.26 The Proposed Scheme does not give rise to any significant noise increases, and therefore, no significant adverse effects are expected and the first aim of NPSE is met. In the long-term there are no perceptible increases in noise and therefore the second aim of NPSE, to avoid adverse effects, is met. The Proposed Scheme has been designed to provide further improvements to health and quality of life where feasible and where the interventions provide value-for-money. This has been achieved through new LNRS to be applied to Lanes 1 and 4 of the motorway

8.9.27 Table 8-25 and 8-26 show the comparisons between the numbers of people (considering an average of 2.3 people per household) above and below the operational SOAEL and LOAEL in the short-term and the long-term respectively (note that rounding differences result in some small anomalies in the calculated differences in numbers).

**Table 8-25 Short-term NPSE significance summary**

| Noise level | Daytime (population) | | | Night (population) | | |
|---|---|---|---|---|---|---|
| | DM 2020 | DS 2020 | Difference | DM 2020 | DS 2020 | Difference |
| Above SOAEL | 9 | 9 | 0 | 150 | 136 | -14 |
| Between LOAEL and SOAEL | 1040 | 911 | -129 | 1463 | 1477 | 14 |
| Below LOAEL | 564 | 692 | 129 | 0 | 0 | 0 |

8.9.28 In the short-term daytime there are predicted to be no more people exposed to noise levels above the SOAEL. It is expected that 129 fewer people exposed to noise levels above the LOAEL, but below the SOAEL, all of which are expected to experience noise below the LOAEL during the daytime.

8.9.29 In the short-term night-time there are predicted to be 14 fewer people exposed to noise levels above the SOAEL, all of which are expected to experience noise levels between the LOAEL and the SOAEL with the Proposed Scheme in place.

8.9.30 There are four properties which exceed SOAEL in the daytime with and without the Proposed Scheme. One receives an increase between 1dB and 2dB, and the other three have changes smaller than 1dB, During the night all properties above SOAEL receive a change in noise smaller than 1dB except for 4 which receive a decrease between 1dB and 2dB.

**Table 8-26 Long-term NPSE significance summary**

| Noise level | Daytime (population) | | | Night (population) | | |
|---|---|---|---|---|---|---|
| | DM 2020 | DS 2035 | Difference | DM 2020 | DS 2035 | Difference |
| Above SOAEL | 9 | 7 | -2 | 150 | 85 | -64 |
| Between LOAEL and SOAEL | 1040 | 681 | -359 | 1463 | 1527 | 64 |
| Below LOAEL | 564 | 925 | 361 | 0 | 0 | 0 |

8.9.31 In the future assessment year daytime there is predicted to be two fewer people experiencing noise levels above the SOAEL and 359 fewer experiencing noise levels above the LOAEL, but below the SOAEL. Daytime predictions show that 361 additional people are expected to experience noise at a level below the LOAEL.

8.9.32 In the future assessment night-time there are predicted to be 64 fewer people exposed to noise levels above the SOAEL, all moving to the between LOAEL and SOAEL band.

8.9.33 There are three properties exceeding SOAEL in 2035 in the daytime with the scheme. Two have changes smaller than 1dB and one has a decrease between 1dB and 2dB. During the night there are 39 properties in 2035 above SOAEL with the scheme. 24 of these receive a decrease in noise greater than 1dB and the remaining 15 properties have changes smaller than 1dB.

8.9.34 It should be noted that the results for the long-term assessment considers the impact of traffic growth between DM 2020 and DM 2035, which would occur even if the Proposed Scheme did not go ahead. A similar comparison to that performed in Table 8-26 has therefore been undertaken using the DM 2035 and DS 2035 scenarios to illustrate the impact of the Proposed Scheme in the future assessment year. This assessment is presented in Table 8-27 below.

**Table 8-27 Future Year NPSE significance summary**

| Noise level | Daytime (population) | | | Night (population) | | |
|---|---|---|---|---|---|---|
| | DM 2035 | DS 2035 | Difference | DM 2035 | DS 2035 | Difference |
| Above SOAEL | 7 | 7 | 0 | 48 | 85 | 37 |
| Between LOAEL and SOAEL | 566 | 681 | 115 | 1562 | 1527 | -35 |
| Below LOAEL | 1040 | 925 | -115 | 2 | 0 | -2 |

8.9.35 In the future assessment year daytime period, there are predicted to be the same number of people exposed to noise levels above the SOAEL and 115 more people exposed to noise levels above the LOAEL, but below the SOAEL. There are 115 fewer people that are expected to experience noise at a level below the LOAEL during the daytime.

8.9.36 There would be three properties exceeding SOAEL in 2035 in the daytime without the Proposed Scheme. Two have increases between 1dB and 2dB. One property has a change smaller than 1dB. During the night there are 21 properties above SOAEL in 2035 without the scheme. 14 of these receive an increase in noise greater than 1dB and the remaining 10 properties have changes smaller than 1dB.

8.9.37 In the future assessment year night-time period, there are predicted to be 37 more people exposed to noise levels above the SOAEL, all of whom would experience noise levels between the LOAEL and the SOAEL without the Proposed Scheme in place. There would also be two fewer properties with levels below SOAEL with the Proposed Scheme in place.

8.9.38 Whilst this comparison shows that future year noise levels with the Proposed Scheme (DS 2035) would be higher than future year noise levels without the Proposed Scheme (DM 2035), both sets of future year noise levels are lower than the existing noise levels. By the future year the whole surface of the M56 would be resurfaced as part or normal maintenance, brining noise levels down from current levels. The future year with the Proposed Scheme scenario has higher traffic levels and higher speeds than the future year without the Proposed Scheme scenario.

8.9.39 In summary, the Proposed Scheme is considered to have a positive effect in the short-term and long-term on people living near to the M56, as it reduces the number of people exposed to noise levels above the LOAEL and the SOAEL during both the daytime and night-time periods.

## Defra Noise Important Areas

8.9.40 A summary of the noise changes in NIA within the calculation area, for both the short-term and long-term periods, is shown in Tables 8-28 and 8-29.

**Table 8-28 Short-Term Noise Changes in Noise Important Areas**

| Noise Important Areas by ID number | Total Number of dwellings | Numbers of Dwellings experiencing Noise Changes in the Opening Year with Proposed Scheme | | | | |
|---|---|---|---|---|---|---|
| | | Noise Level Increase | | Noise Level Decrease | | |
| | | >0 to 1 dB (negligible) | 1 to 3 dB (minor) | >-1 to 0 dB (negligible) | >-3 to -1 dB (minor) | -5 to -3 dB (moderate) |
| **M56 from J6 to J7** | | | | | | |
| 7221 | 1 | 0 | 1 | 0 | 0 | 0 |
| 7214 | 6 | 0 | 0 | 6 | 0 | 0 |
| **M56 from J5 to J6** | | | | | | |
| 7217 | 2 | 0 | 0 | 0 | 0 | 0 |
| **A538 Hale Road, N of J6** | | | | | | |
| 1493 | 1 | 0 | 0 | 1 | 0 | 0 |

8.9.41 In the short-term there is one dwelling which is predicted to experience a perceptible increase of 1.0dB, in NIA 7221. This property is shown to have noise levels above both daytime and night time SOAEL.

8.9.42 Of the remaining properties within NIA, nine are predicted to experience no change or negligible noise decreases. Therefore, in the short-term, the Proposed Scheme is considered overall to have a neutral impact for dwellings located in NIA.

8.9.43 Within NIA 7214 one property has noise levels above both daytime and night-time SOAEL which would receive a decrease between 1dB and 2dB. Changes at NIA 7217 and NIA 1493 are smaller than 1dB.

**Table 8-29 Long-Term Noise Changes in Noise Important Areas**

| Noise Important Areas by ID number | Total Number of dwellings | Numbers of Dwellings experiencing Noise Changes between Opening Year and Design Year with Proposed Scheme (Do-Min comparison shown in brackets) | | | |
|---|---|---|---|---|---|
| | | Noise Level Increase | Noise Level Decrease | | |
| | | >0 to +3 dB (negligible) | >-3 to 0 dB (negligible) | >-5 to -3 dB (minor) | -10 to -5 dB (moderate) |
| **M56 from J6 to J7** | | | | | |
| 7221 | 1 | 0 | 1 (1) | 0 | 0 |
| 7214 | 6 | 0 | 6 (5) | 0 (1) | 0 |
| **M56 from J5 to J6** | | | | | |
| 7217 | 2 | 0 | 2 (2) | 0 | 0 |
| **A538 Hale Road, N of J6** | | | | | |
| 1493 | 1 | 0 | 1 (1) | 0 | 0 |

8.9.44 In the long-term all properties within NIA are predicted to experience no change or negligible (less than 3dB) noise decreases. Within NIA 7221 the increase is less than 1dB, and within NIA 7214 there is one property above both daytime and night-time SOAEL which would receive a decrease between 1dB and 2dB. There would be a decrease of 2.0dB at both properties in NIA 7217, and changes at NIA 1493 would be smaller than 1dB.

8.9.45 If the Proposed Scheme did not go ahead the results would be broadly the same, although one of the properties in NIA 7214 would receive a minor decrease in noise rather than a negligible decrease as a result of lower noise surfacing. The perceptible decrease would occur at the one property above both daytime and night time SOAEL.

8.9.46 In the long-term, the Proposed Scheme is considered to have a neutral impact for dwellings located in NIAs as all changes are negligible.

## 8.10 Further mitigation

### Noise Insulation Regulations

8.10.1 An assessment using the parameters as set out in Table 8-8 and the methodology in Table 8-9 indicates that no properties are likely to qualify under the NIR.

## 8.11 Residual effects

8.11.1 The Proposed Scheme includes provision of a new LNRS on lanes 1 and 4 of the M56.

8.11.2 The construction phase of the Proposed Scheme has the potential to result in significant noise effects at some of the nearest sensitive receptors to the Proposed Scheme during the worst case activities such as piling at proposed ERA and gantry locations. The Delivery Partner is expected to demonstrate, through provision of method statements and mitigation measures in the OEMP, that no significant effects will arise during the construction phase of the Proposed Scheme.

8.11.3 During the operational phase, 24 out of a total of 707 sensitive receptors in the calculation area are predicted to experience minor noise decreases in the opening year and one receptor is predicted to experience a minor increase in noise. The noise changes at the remaining sensitive receptors are shown to be negligible or no change.

8.11.4 In the long term, all sensitive receptors are predicted to experience negligible changes in noise or no changes in noise, with both the daytime and night time assessments. The Proposed Scheme is also considered to have a neutral effect for dwellings located within NIA, as no perceptible impacts are predicted. However, there is one receptor within an NIA where a short-term minor daytime adverse effect is predicted.

8.11.5 Overall the Proposed Scheme is predicted to reduce the number of people exposed to noise levels in excess of the daytime and night-time Significant Observed Adverse Effect Levels. The Proposed Scheme is therefore not expected to give rise to significant residual effects during either the construction or operational phases.

## 8.12 Summary

### Construction noise and vibration

8.12.1 Table 8-30 summarises the temporary effects on noise and vibration of the Proposed Scheme during its construction phase.

**Table 8-30 Summary table of temporary effects on noise and vibration during construction**

| Potential environmental effects | Proposed mitigation, enhancement or monitoring measures | Residual impact |
|---|---|---|
| Construction noise:<br>• Significant adverse effects during daytime.<br>• Significant adverse effects during evening time.<br>• Significant adverse effects at night. | The OEMP to manage construction noise will include:<br>• Use of best practicable means under S72 of CoPA 1974 and follow good practice under BS 5228-1.<br>• Switch off plant, equipment and vehicles when they are not in use for longer periods of time.<br>• Undertaking noisy works during the daytime where feasible.<br>• Use of lower noise equipment and methods where possible/necessary.<br>• Limitation of high noise level durations in the vicinity of individual sensitive receptors.<br>• Ensure that all staff and operatives are briefed on the requirement to minimise nuisance from site activities.<br>• Use silenced compressors, generators and fans at site locations.<br>• Maintain plant regularly.<br>• Advanced communication of the works to local environmental health departments and to the affected properties.<br>• Ensuring that any sections of existing noise barrier temporarily removed for construction activity are replaced as soon as reasonably practicable.<br>• Where possible, temporary noise barriers should be erected in the place of existing noise barriers that are temporarily removed for construction activity.<br>• The use of low noise piling plant, temporary noise barriers, piling shrouds and working time restrictions during the construction of retaining walls at the four ERA's.<br>• The Delivery Partner must effectively manage the use of diversion routes to ensure that there would be no more than 10 uses of a diversion route in any 15 night period as this number of closures would warrant the provision of noise insulation to properties along diversion routes following the criteria detailed in BS 5228-1.<br>• In the event that noise levels and durations cannot be kept below significance triggers, noise insulation or temporary re-housing may be considered as a last resort. | Non-significant adverse effects. |
| Construction vibration:<br>• Adverse effects at properties within around 50 to 100m from piling works. | The OEMP to manage construction noise will include:<br>• Use of best practicable means under S72 of CoPA 1974.<br>• Good practice under BS 5228-2.<br>• Advanced communication of the works to local environmental health departments and to the affected properties. | Non-significant adverse effects. |

## Operational noise

8.12.2 Table 8-31 summarises the permanent effects on noise of the Proposed Scheme during its operational phase.

**Table 8-31 Summary table of permanent effect on noise during operation**

| Potential environmental Effects | Proposed mitigation, enhancement or monitoring measures | Residual impact |
|---|---|---|
| Operational road traffic noise:<br>• Negligible effect. | New noise barriers: None | Negligible effect |

# 9. Assessment of Cumulative Effects

## 9.1 Introduction

9.1.1 There are two types of cumulative effects covered in this section:

- Those caused only by the Proposed Scheme, and arise when an individual receptor or group of receptors would experience multiple effects as a result of the Proposed Scheme; for example, an individual property experiencing combined noise, air quality and visual amenity effects. These are termed intra-project cumulative effects.
- Those caused by a combination of the Proposed Scheme with other relevant schemes. These are termed inter-project cumulative effects.

9.1.2 In both cases, cumulative effects may be of greater significance than the individual significance of any of the identified non-cumulative effects as reported in chapters 5 to 8. The intra-project effects assessment focuses on key sensitive receptors, including properties and communities.

9.1.3 In accordance with IAN 125/15, the assessments cover the main likely significant cumulative effects, rather than trying to report every interaction.

## 9.2 Methodology

### Intra-project cumulative effects

9.2.1 The potential cumulative effects of different aspects of the Proposed Scheme have been determined by identifying any individual receptors, or categories of receptors, affected by multiple impacts under more than one specialist topic.

9.2.2 The intra-project cumulative study area has been dictated by the study areas adopted for the specialist topics with the potential to interact. These are as detailed in the respective assessment chapters. For all potential interactions, the smaller study area has been adopted as the study area for potential intra-project cumulative environmental effects as; possible interactions will not exist outside the scope of one interacting aspect.

9.2.3 In order to consider impacts on people and communities, particular attention is given to whether there are particular sensitivities within local communities, for example if there are proportionally higher numbers of elderly people, young people, people with health problems such as respiratory problems.

9.2.4 There is also the potential for an individual receptor, or groups of receptors, to be affected by adverse impacts under one topic and beneficial impacts under another, sometimes as a result of the same feature of the Proposed Scheme. In such cases, it is necessary to determine the balance between the two. The intra-project effects assessment focuses on key sensitive receptors, including properties and communities.

9.2.5 The ecology and nature conservation assessment presented in chapter 6 considers impacts on ecological resources and receptors in terms of land take, changes to the local hydrology, water quality, air quality, noise, light or other visual stimuli. It is therefore considered that the ecological assessment inherently considers combined effects from these different sources, and therefore there are no additional effects which require consideration in this cumulative effects assessment and equally those topics so addressed under the ecological assessment have their cumulative impacts addressed.

## Inter-project cumulative effects

9.2.6 The first step in identifying inter-project effects was to identify other relevant projects using a selection criteria methodology. The criteria focused on identifying major developments within 1km of the Proposed Scheme, which reflects the greatest distance of an environmental receptor scoped into the assessment i.e. Watch Hill Motte and Bailey Castle Scheduled Monument, a cultural heritage asset. This initial study area is then revised to the study area of each individual discipline to ensure assessment proportionality.

9.2.7 Diversion routes have not been considered within this cumulative assessment as these will only be used periodically, with total closures of the carriageway only taking place at night. Assessment of the diversion routes has been scoped out of the air quality assessment as they are not expected to be an issue, the ecology assessment states that the frequency of use of diversion routes is small, and significant impacts are not anticipated and are therefore not considered further and the noise assessment concludes that temporary noise impacts are likely to occur at residential properties along the diversion routes, however, with measures in place to minimise the need for diversions no significant effects are anticipated. As the diversion routes are scoped out of the M56 assessment or are concluded to have temporary non-significant effects it is unlikely that significant cumulative effects will occur and are therefore are not considered further in this cumulative assessment.

9.2.8 The identification of other relevant projects was limited to the period August 2013 to October 2017, the full set of criteria employed to identify other relevant projects were as follows:

- Smaller scale housing developments within 200m of the Proposed Scheme; considered as these may represent new sensitive receptors.
- Employment land (B1, B2 and B8 only): 3ha + within 1km of the Proposed Scheme.
- Residential: 200 + dwellings within 1km of the Proposed Scheme.
- Residential: any site area and any number of dwellings within 200m of the Proposed Scheme.
- Major Minerals and Waste applications within 1km of the Proposed Scheme.
- Nationally Significant Infrastructure Projects within 1km of the Proposed Scheme.
- Transport infrastructure proposals within 1km of the Proposed Scheme (trunk roads or motorways only).

9.2.9 The criteria above cover the two types of development projects recommended for assessment by Highways England guidance (DMRB, Volume 11, Section 2, Part 5 (HA205/08)), which are:

- Trunk road and motorway projects that have been confirmed (have gone through the relevant statutory process). It should be noted that in the main these projects have been taken account of in the traffic model. As a result of this, the air quality and noise are inherently cumulative.
- Development projects with valid planning permissions, for which a formal EIA is a requirement or for which non-statutory environmental impact assessment has been undertaken.

9.2.10 Relevant projects were identified by searching Local Planning Authority Planning Registers and gathering information on the following:

- Planning permissions yet to be implemented.
- Planning permission under construction.
- Nationally Significant Infrastructure Project applications at the pre-application stage onwards. This is due to the Planning Act process making these developments reasonably foreseeable. It is likely due to construction timescales that cumulative effects will be limited to the operational phase.
- Submitted planning applications not yet determined.

9.2.11 Whilst information has been gathered from local authority websites, no consultation with local authorities has taken place to confirm this development schedule at this time.

9.2.12 Projects fitting the above definitions represent projects about which there can be a high degree of certainty that they will be implemented. However, site allocations identified by local councils (for example in their local development plans) have been scoped out of the cumulative effects assessment on the basis that there is uncertainty around the nature and timeframes for development and that they are therefore not reasonably foreseeable. This assessment also excludes developments that are conditional on another development that does not have consent, conjectural or conceptual projects and policy aspirations.

9.2.13 Although the preferred route for Manchester Airport station and high speed rail line on the Western leg of High Speed 2 (HS2) Phase 2b has been announced, the project remains within assessment stages. Given that the project is yet to gain development consent, the project is not included within the scope of this inter-project cumulative assessment.

9.2.14 Following the approach described above, the following developments have been identified. Further information can be found in Appendix F.1. These developments are represented in the Figure 8.5:

- Manchester Airport, Ringway Road, Manchester, M90 1QX; extension to the north-west elevation of Terminal 2.
- 4 Dobb Hedge Close, Hale Barns, WA15 0AT; Erection of a new detached dwelling following demolition of existing.
- Land at Greenbrow Road, Baguley, Wythenshawe, Manchester, M23 2ZA; erection of 52 dwellinghouses and 78 apartments, together with new access roads, landscaping and parking.
- Plot 318 World Logistics Hub, Sunbank Lane, Manchester, WA15 8XL; four storey extension to a Class B8 warehouse building.
- 17 Warbuton Close, Hale Barns, WA15 0SJ; erection of a detached two and a half storey replacement dwelling.
- World Logistics Hub, Sunbank Lane, Woodhouse Park, Manchester, WA15 0PT; erection of warehouse and distribution units with ancillary offices.

9.2.15 The applications above include reserved matters and amendments relating to bigger applications. In order to take a reasonable worst case, the whole application has been taken into account and not just the reserved matters and amendments.

9.2.16 The developments identified above have been cross-checked against those included in the traffic model. The traffic model takes account of large-scale developments in the wider region around the Proposed Scheme in terms of the volumes of traffic that they are expected to generate and any expected change in the pattern of traffic flows on the highway network. The traffic model has not included any of the above listed land developments as they are too small for the regional traffic model setup. For the air quality assessment, the main scenario is the cumulative scenario assuming that the traffic from all four North West SMP schemes proceed in parallel, with the M56 Do Something provided to illustrate the range of outcomes and because the direction of effects is different in some locations between these cases. On that basis, the additional traffic on the network in the cumulative worst case would outweigh any additional traffic from identified developments in this cumulative effects assessment, and so the worst case has already been considered in impacts on receptors (impacts of new receptors are considered below).

9.2.17 Having identified relevant projects, the next step was to identify potential significant effects. The following questions have been considered in making this judgement:

- Does the development project/application present the potential for a source of impact that could affect an environmental receptor also affected by the Proposed Scheme? Examples of sources would be a structure that is particularly visible or a process that creates significant emissions or noise.

- Is there a potential pathway by which that impact could travel from the source to the receptor? For example, a line of sight to a viewpoint, a distance across which noise could be heard, or a flow path for a contaminated discharge.

9.2.18 For a cumulative effect to be identified, there would need to be an identified pathway between the impact source (or one of the development projects) and a receptor (one of the receptors or groups of receptors identified in this report as affected by the Proposed Scheme). This is referred to as the 'source-pathway-receptor' model.

9.2.19 Any identified cumulative impacts are further defined as construction or operation phase effects or short or long term effects (based on whether they would remain 15 or more years after construction) and beneficial or adverse. Highways England guidance (DMRB, Volume 11, Section 2, Part 5 (HA205/08)) sets out a specific methodology for the assessment of the significance of cumulative effects. Following this, the significance of cumulative effects is categorised as set out in Table 9-1.

**Table 9.1 Significance of cumulative effects**

| Significance | Effect |
|---|---|
| Not significant | Effects that are beyond current forecasting ability or within the ability of the affected resource to adapt to the change. |
| Minor | Effects that are locally significant. |
| Moderate | Effects that are unlikely to become issues upon which project design should be selected, but where future work may be necessary to improve current performance. |
| Major | Effects that may become key decision-making issues. |
| Severe | Effects that the decision-maker must take into account as the receptor/ resource is irretrievably compromised. |

## 9.3 Potential effects

### Intra-project cumulative effects

9.3.1 In assessing the potential for intra-project cumulative effects, each topic has been reviewed in terms of the sensitive receptors it identifies and the likely effects. These are included in full in the topic chapters 5 to 8 but are summarised as follows:

- Air quality - The overall conclusion regarding the effect of the Proposed Scheme on local air quality is that there would be no significant adverse effect on local air quality. For the M56 corridor, this is the case whether considering the cumulative worst case (all four of the NW SMP schemes) or the M56 Do Something. As the overall effect of the Proposed Scheme is "no significant impacts" then the intra-project effects are also not significant.
- Visual amenity – The visual assessment looked at a wide range of representative receptors. It noted that there would be some moderate adverse localised effects during construction. The visual assessment noted that there would be some localised operational visual effects of moderate adverse significance at year 1 for two PRoW's and from housing on the south east edge of Warburton Green and Sunbank Lane at the eastern end of the scheme and along Castle Mill Lane and Thorns Green to the east of Ashley. There would be no moderate adverse effects at year 15.
- Noise and Vibration – The assessment identified sensitive communities such as those at Warburton Green, Ringway, Ashley and Thorns Green. The noise and vibration assessment has assessed 701 dwellings and 6 non-residential sensitive receptors within the calculation area of the Proposed Scheme. In terms of impacts during the construction phase, adverse effects may occur at up to 7 properties. In terms of impacts during the operational phase, the long term effects of the Proposed Scheme are negligible.

9.3.2 The four North-West SMP Schemes (M6 J21a-26, M62 J10-12, M56 J6-8 and M60 J24-4) were all planned to be open within 18 months of each other and hence, to present a robust environmental assessment, these four schemes were initially assessed as one cumulative scheme. The findings of the initial air quality assessment work indicated that the M6 J21a-26 Scheme may be considered significant for air quality. The M6 J21a-26 Scheme will therefore not be progressed by Highways England until a suitable mitigation solution is identified. The remaining three North-West SMP Schemes (M62 J10-12, M56 J6-8 and M60 J24-4) are being progressed by Highways England because together these schemes do not generate significant air quality effects.

9.3.3 The assessments have therefore been undertaken for the three North-West SMP Schemes being progressed however the assessment largely utilises the traffic flows and predictions developed for all four Schemes. There are two locations, where the four Scheme traffic data would result in unrealistic large predicted changes in air quality and hence an incorrect evaluation of the significance of effects. In these areas, air quality modelling has been carried out using the specific 3 scheme scenario traffic data.

9.3.4 Whilst the topic assessments have in many cases considered the same receptors, it is considered that there would be no combined effects that would be significant. During construction, it is considered that mitigation measures would be sufficient to mitigate any single effects in relation to noise, air pollution and visual amenity to such a level that no significant combined effects would arise. During operation, whilst it is acknowledged that there would be localised adverse effects on visual amenity, the fact that changes in air quality and noise would not be significant, no cumulative significant effects are expected to be a result of the Proposed Scheme.

## Inter-project cumulative effects

9.3.5 An assessment of each relevant development has been made against each environmental topic in Table 9.2 below.

## 9.4 Summary

9.4.1 Based on the methodology outlined above, no significant cumulative effects have been identified.

# 10. Environmental Management

## 10.1 Overview

10.1.1 This section sets out arrangements for environmental assessment and management going forwards.

10.1.2 Environmental management will be implemented in line with DMRB and IAN 183/14 Environmental Management Plans (June 2014).

10.1.3 As part of this EAR, an Outline Environmental Management Plan (OEMP) has been produced as a separate document. The OEMP sets out environmental commitments and actions to be taken forwards as part of the detailed design, construction and operation of the Proposed Scheme.

10.1.4 The OEMP will be developed into a Construction Environmental Management Plan (CEMP) prepared in collaboration with the Delivery Partner as more information becomes available and there is more certainty in terms of the Proposed Scheme layout, construction methods and programme. Towards the end of the construction period the CEMP will be refined into a Handover Environmental Management Plan (HEMP), which will contain essential environmental information needed by the body responsible for the future maintenance and operation of the asset.

10.1.5 The purpose of an OEMP is to manage the environmental effects of the Proposed Scheme. Over the lifetime of the Proposed Scheme the OEMP will be built upon to manage the environmental effects of the Proposed Scheme during the construction and maintenance and operation phases of the Proposed Scheme. The OEMP will be a live document, and will be updated as required over the life of the project should the Proposed Scheme, predicted effects or legislation change. Throughout the construction, maintenance and operation phases the OEMP will be used to:

- Act as a continuous link and main reference document for environmental issues between the design, construction and the maintenance and operation stages of a project.
- Demonstrate how construction activities and supporting design will properly integrate the requirements of environmental legislation, policy, good practice and those of the environmental regulatory authorities and third parties.
- Record the objectives, commitments and mitigation measures to be implemented together with programme and date of achievement.
- Identify the key staff structures and responsibilities associated with the delivery of the Proposed Scheme and environmental control and communication and training requirements as necessary.
- Describe the contractor's proposals for ensuring that the requirements of the environmental design are achieved, or are in the process of being achieved, during the Contract Period.
- Act as a vehicle for transferring key environmental information at handover to the body responsible for operational management. This will include details of the asset, short and long term management requirements and any monitoring or other environmental commitments.
- Provide a review, monitoring and audit mechanism to determine effectiveness of and compliance with environmental control measures and how any necessary corrective action will take place.

10.1.6 The identification of environmental actions and population of an OEMP is critical to the environmental performance of a project.

10.1.7 In relation to the Proposed Scheme the sources of information from which environmental actions have been identified include the M56 Junction 6 to 8 (M56 J6-8) Environmental Scoping Report and additional surveys undertaken for this EAR.

10.1.8 At this stage it is only possible to indicate in outline the persons responsible and the timings associated with these. When the CEMP is prepared further commitments and actions will be added and more specific responsibilities attributed and timings identified.

10.1.9 The OEMP does not cover any further surveys that may be required as part of the Proposed Scheme. Nevertheless, the OEMP identifies areas of risk where surveys or other precautionary measures may be required at a later date. The OEMP does not cover embedded mitigation

measures that are part of the design; for example, gantry and Emergency Refuge Area relocations. The OEMP largely consists of tertiary mitigation during construction and operation, however, secondary mitigation is included as appropriate.

# 11. References

British Geological Society. (2015). Geology of Britain Viewer. http://mapapps.bgs.ac.uk/geologyofbritain/home.html..

Charles, P, Edwards, P (eds). 2015. CIRIA Environmental Good Practice on Site Guidelines

CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester

Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London. ISBN 13 978 1 872745 96 1.

Department for Environment Food & Rural Affairs. (2009). Local Air Quality Management Technical Guidance (LAQM TG16), London.

Department for Environment Food & Rural Affairs. (2010). Noise Policy Statement for England (NPSE).

Department for Environment Food & Rural Affairs. (2014) The National Pollinator Strategy: for bees and other pollinators in England. Available from: www.gov.uk/government/publications.

Department for Environment Food & Rural Affairs. (2016). MAGIC. http://magic.defra.gov.uk/..

Department for Environment Food & Rural Affairs /TRL/Casella Stanger (2006). Method for Converting the UK Road Traffic Noise Index LA10,18h to the EU Noise Indices for Road Noise Mapping

Department for Transport (2012) Department for Transport Business Plan 2012 to 2015. Available from: https://www.gov.uk/government/publications/department-for-transport-business-plan

Department of Transport/Welsh Office (1988), "Calculation of Road Traffic Noise

Environment Agency (2010) Fifth otter survey of England 2009-2010 Technical Report. Environment Agency, Bristol

Environment Agency (2010) Fifth otter survey of England 2009-2010 Technical Report. Environment Agency, Bristol

Environment Agency (2014) Pollution prevention advice and guidance. http://webarchive.nationalarchives.gov.uk/20140328090931/http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx

Highways England. (1993) Design Manual for Roads and Bridges (DMRB) Ecology & Nature Conservation Vol. 11, Section 3, Part 4, UK.

Highways England. (2007). Design Manual for Roads and Bridges (DMRB): Cultural Heritage (HA 208/07), Vol. 11, Section 3, Part 2, UK.

Highways England. (2007). Design Manual for Roads and Bridges (DMRB): Air Quality HA207/07 DMRB Volume 11 Section 3 Part 1 UK.

Highways England (2010) DMRB Interim Advice Note (IAN) 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment

Highways England. (2010). DMRB Interim Advice Note 135/10: Landscape and Visual Effects Assessment, UK.

Highways England. (2013). DMRB Interim Advice Note 170: Air Quality

Highways England. (2013). DMRB Interim Advice Note 174: Air Quality effects

Highways England. (2013). DMRB Interim Advice Note 175: EU Directive on ambient air quality

Highways England (2013) Note on HA's Interim Alternative Long Term Annual Projection Factors (LTTE6) for Annual Mean NO2 and NOx Concentrations Between 2008 and 2030. Department for Transport.

Highways England (2013) Interim Advice Note 161/13 Managed Motorways – All lane running.

Highways England. (2014). DMRB Interim Advice Note 183/14: Environmental Management Plans, UK.

Highways England. (2015). DMRB Interim Advice Note 185: Traffic, air quality and noise advice

Highways England. (2015). DMRB Interim Advice Note 125/15: Environmental Assessment Update, UK.

Highways England (2015) Our plan to protect and increase biodiversity.

Highways England (2015) Highways England Delivery Plan 2015-2020.

Highways England (2017) Smart Motorways Programme M56 Junction 6 to 8 Environmental Scoping Report, July 2017.

Highways England (2017) MPI-57-052017: Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive)

Historic England. (2015). Historic Environment Good Practice Advice in Planning; Note 3: The Setting of Heritage Assets. https://historicengland.org.uk/images-books/publications/gpa3-setting-of-heritage-assets/ Accessed 20th July 2016.

HM Treasury (2010) HM Treasury Business Plan 2011 to 2015.

JNCC (2010) Handbook for Phase 1 Habitat Survey – A technique for environmental audit. ISBN 0 86139 636 7

Landscape Institute. (2013). Institute of Environmental Management and Assessment Guidelines for Landscape and Visual Impact Assessment (GLVIA) (3rd Edition), London.

Natural England, (2017). NCA Profile: 55 Manchester Conurbation (NE463). http://publications.naturalengland.org.uk/publication/5989113924681728?category=587130

Powell, A. Milburn, K. (2011) Northwest Lowlands Water Vole Project, June 2011. The Wildlife Trust.

WebTAG. (2016). Transport Analysis Guidance: WebTAG. https://www.gov.uk/guidance/transport-analysis-guidance-webtag. Accessed 20th July 2016.

Wilkinson, J.W., Wright, D., Arnell, A. & Driver, B. 2011. Assessing population status of the great crested newt in Great Britain. Natural England Commissioned Reports, Number 080

World Health Organization, 1999. "Guidelines for Community Noise

World Health Organization (2009). "Night Noise Guidelines for Europe" Statutory Instrument, 1975, No. 1763. Building and Buildings. The Noise Insulation Regulations 1975. As amended by Statutory Instrument 1988 No. 2000. Building and Buildings. The Noise Insulation (Amendment) Regulations 1988.

# 12. Abbreviations

| Abbreviation | Full Term |
|---|---|
| ADMS | Atmospheric Dispersion Modelling System |
| ADS | Advanced Directional Signs |
| ALC | Agricultural Land Classification |
| ALR | All Lane Running |
| AMIs | Advanced Motorway Indicators |
| AONB | Area of Outstanding Natural Beauty |
| AQMA | Air Quality Management Area |
| ARN | Affected Road Network |
| BCT's | The Bat Conservation Trust's |
| CIEEM | Chartered Institute of Ecology and Environmental Management |
| CEMP | Construction Environmental Management Plan |
| CMS | Continuous Monitoring Stations |
| DEFRA | Department for Environment, Food and Rural Affairs |
| DMRB | Design Manual for Roads and Bridges |
| eDna | Environmental DNA |
| EFT | Defra's Emission Factor Toolkit |
| EIA | Environmental Impact Assessment |
| EMS | Enhanced Messaging Signs |
| ERAs | Emergency Refuge Areas |
| ERTs | Emergency Roadside Telephones |
| ESR | Environmental Study Report |
| EU | European Union |
| GLVIA | Guidelines for Landscapes and Visual Impact Assessment |
| HE | Highways England |
| HER | Historic Environment Record |
| HMWB | Heavily Modified and Artificial Water Bodies |
| IAN | Interim Advice Note |
| LAQM.TG | Defra's Local Air Quality Management Technical Guidance |
| LCA | Landscape Character Areas |
| LNR | Local Nature Reserve |
| MIDAS | Motorway Incident Detection and Automatic Signalling |
| NCA | National Character Area |
| NERC | The Natural Environment and Rural Communities |
| NIAs | Noise Important Areas |
| $NO_2$ | Nitrogen Dioxide |
| NOx | Oxides of Nitrogen |
| NPPF | National Planning Policy Framework |
| OEMP | Outline Environmental Management Plan |
| OS | Ordinance Survey |
| PCM | Pollution Climate Mapping |
| $PM_{10}$ | Particulate Matter smaller than 10µm |
| PRoW | Public Right of Way |
| RCB | Rigid Concrete Barrier |

| | |
|---|---|
| SAC | Special Areas of Conservation |
| SMP | Smart Motorways Programme |
| SSSI | Site of Special Scientific Interest |
| WFD | Water Framework Directive |
| ZTV | Zone of Theoretical Visibility |

# 13. Figures

# 14. Appendices

## Appendix A – DF3 drawings

## Appendix B – Air quality

- Appendix B.1. Regulatory / Policy Framework
- Appendix B.2. Baseline and Constraints
- Appendix B.3. Air Quality Assessment Methodology
- Appendix B.4. Model Verification
- Appendix B.5. Assessment of impact
- Appendix B.6. Traffic Data
- Appendix B.7. Figures provided by Aecom/WSP for the M62 and by the JAJV for the M60 Air Quality Assessments

## Appendix C – Ecology

- Appendix C.1 - M256 Junction 6 - 8 Smart Motorway Protected Species Report
- Appendix C.2 – M56 Junction 6 to 8: Smart Motorway Habitat Regulations Assessment

## Appendix D – Landscape and visual

- Appendix D.1 - Landscape, Visual and Cultural Heritage Effects Schedule

## Appendix E – Noise and vibration

- Appendix E.1. Regulatory/policy framework
- Appendix E.2. List of figures
- Appendix E.3. Basic noise levels in order to define the operational noise calculation area
- Appendix E.4. Baseline conditions
- Appendix E.5. Noise calculation assumptions
- Appendix E.6. Analysis of noise mitigation, rectification and enhancement measures
- Appendix E.7. Full Assessment Results

## Appendix F – Assessment of Cumulative Effects

- Appendix F.1. Relevant Development Proposals for Cumulative Effects Assessment