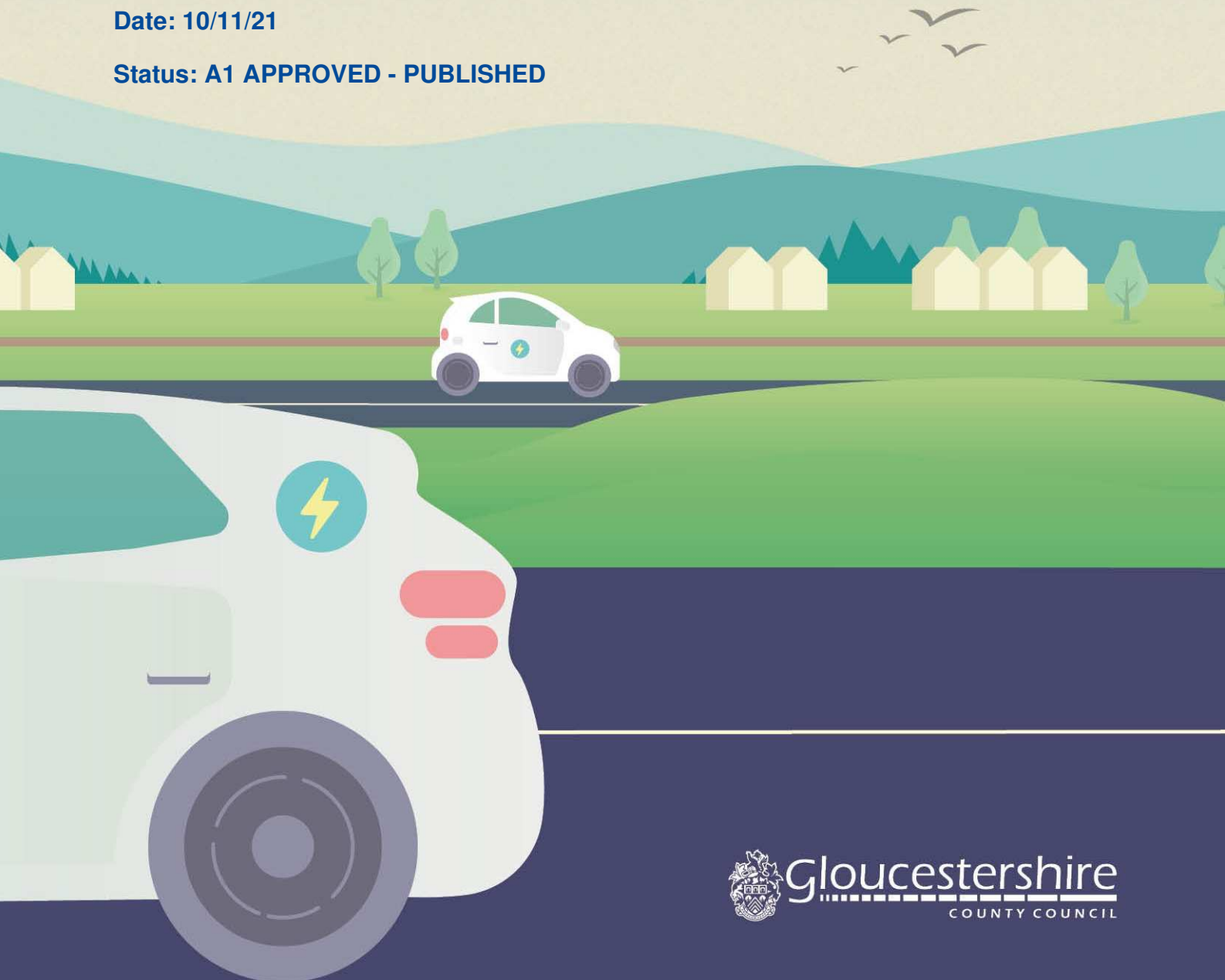


M5 Junction 10 Improvements Scheme

Preliminary Environmental Information Report (PEIR) Noise and Vibration chapter

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Document accessibility

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Glossary

Abbreviation	Definition
AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekday Traffic
AEP	Annual Exceedance Probability
ALC	Agricultural Land Classification
AMP	Archaeological Management Plan
AONB	Area of Outstanding Natural Building
ARN	Affected Road Network
ASPT	Average Score Per Taxon
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
BAP	Biodiversity Action Plan
BCT	Bat Conservation Trust
BEIS	Department of Business, Energy and Industrial Strategy
BGS	British Geological Survey
BMV	Best and Most Versatile
BoQ	Bill of Quantities
BS	British Standards
BTO	British Trust for Ornithology
CAMS	Catchment Abstraction Management Strategy
CBC	Cheltenham Borough Council
CBC	Common Birds Census
CCC	Committee on Climate Change
CD&E	construction, Demolition and Excavation
CEMP	Construction Environmental Management Plan
CIA	Cumulative Effects Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
CL:AIRE	Contaminated Land: Applications in Real Environments
CLP	Classification, Labelling and Packaging
CMS	Continuous Monitoring Station
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide Equivalent
COP	Conference of the Parties
COSHH	Control of Substances Hazardous to Health
CPS	Connecting Places Strategies
CRoW	Countryside and Rights of Way
CRTN	Calculation of Road Traffic Noise
CSZs	Core Sustenance Zones
DCO	Development Consent Order
DfT	Department for Transport
DM	Do Minimum
DMOY	Do Minimum Scenario in the Opening Year
DMFY	Do Minimum Scenario in the Future Assessment Year
DMRB	Design Manual for Roads and Bridges
DoE	Department of the Environment
DoWCoP	Definition of Waste: Development Industry Code of Practice
DS	Do Something
DSFY	Do Something in the Future Assessment Year
DSOY	Do Something Scenario in the Opening Year
EC	European Commission
ECoW	Ecological Clerk of Works
eDNA	environmental DNA

Abbreviation	Definition
EEA	European Economic Area
EFT	Emissions Factors Toolkit
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
END	Environmental Noise Directive
EPA	Environmental Protection Act
EPS	European Protected Species
EPUK	Environmental Protection UK
EQS	Environmental Quality Standards
EU	European Union
ES	Environmental Statement
FRA	Flood Risk Assessment
ES	Environmental Statement
GCC	Gloucester City Council
GCER	Gloucestershire Centre for Environmental Records
GCN	Great Crested Newt
GFirst LEP	Gloucestershire Local Enterprise Partnership
GHER	Gloucestershire Historic Environment Record
GHGs	Greenhouse Gases
GLNP	Gloucestershire Local Nature Partnership
GLVIA3	Guidelines for Landscape and Visual Impact Assessment
GLTA	Ground Level Tree Assessment
GPLC	Guiding Principles for Land Contamination
GWDTE	Groundwater Dependant Terrestrial Ecosystems
GWT	Gloucestershire Wildlife Trust
HDV	Heavy Duty Vehicles
HER	Historic Environment Record
HEWRAT	Highways England Water Risk Assessment Tool
HGVs	High Good Vehicles
HIF	Housing Infrastructure Fund
HLC	Historic Landscape Characterisation
HMC	Habitat Modification Class
HMS	Habitat Modification Score
HRA	Habitat Regulations Assessments
HSI	Habitat Suitability Index
IAQM	Institute of Air Quality Management
IDB	International Drainage Board
IPCC	International Panel on Climate Change
JCS	Joint Core Strategy
JNCC	Joint Nature Conservation Committee
LAQM	Local Air Quality Management
LCAs	Landscape Character Assessments
LCRM	Land Contamination: Risk Management
LCT	Landscape Character Type
LDV	Light Duty Vehicles
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserves
LOAEL	Lowest observed adverse effect level
LTP	Local Transport Plans
LVIA	Landscape and Visual Impact Assessment
MAFF	Ministry of Agriculture, Fisheries and Food
MCHW	Manual of Contract Documents for Highway Works
MHCLG	Ministry of Housing, Communities and Local Government
MMP	Materials Management Plan
MSA	Mineral Safeguarding Areas
MW	Minor Watercourse

Abbreviation	Definition
NCA	National Character Area
NERC	Natural Environment and Rural Communities
NHLE	National Heritage List for England
NIA	Noise Important Areas
NMP	National Mapping Programme
NMU	Non- Motorised User
NNR	National Nature Reserves
NPS NN	National Policy Statement for National Networks
NOEL	No Observed Effect Level
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPSE	Noise Policy Statement for England
NSIP	Nationally Significant Infrastructure Projects
NSR	Noise Sensitive Receptors
NVC	National Vegetation Classification
OS	Ordnance Survey
PAH	Polyaromatic Hydrocarbons
PAS	Portable Antiquities Scheme
PCBs	Polychlorinated Biphenyls
PCF	Project Control Framework
PCL	Potential Contaminant Linkage
PCM	Pollution Climate Mapping
PCSM	Preliminary Conceptual Site Model
PEAOR	Preliminary Environmental Assessment of Options Report
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PPE	Personal Protective Equipment
PPGs	Pollution Prevention Guidelines
PPG	Planning Practice Guidance
PPS10	Planning Policy Statement 10
PPGN	Planning Practice Guidance: Noise
PRA	Preliminary Roost Assessment
PRoW	Public Right of Way
Q ₉₅	The 5 percentile flow
RAMS	Risk Assessments, Method Statements
RBD	River Basin Districts
RBMP	River Basin Management Plans
RCP	Relative Concentration Pathway
RCS	River Corridor Survey
RFFPs	Reasonably Foreseeable Future Projects
RHS	River Habitat Survey
RNAG	Reason for not Achieving Good
RoWIP	Rights of Way Improvement Plan
SAC	Special Area of Conservation
SHMP	Soil Handling Management Plan
SM	Scheduled Monument
SOAEL	Significant Observed Adverse Effect Level
SoCC	Statement of Community Consultation
SPD	Supplementary Planning Document
SPA	Special Protection Area
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SWMP	Site Waste Management Plan
TAMP	Transport Asset Management Plan
TBC	Tewkesbury Borough Council

Abbreviation	Definition
TAR	Technical Appraisal Report
TSCS	Thin Surface Course System
UKCP18	United Kingdom Climate Projections 2018
UNFCCC	United Nations Framework Convention on Climate Change
UXO	Unexploded Ordnance
VfM	Value for Money
WCH	Walkers, Cyclists and Horse Riders
WEEE	Waste Electrical and Electronic Equipment
WER	Water Environment Regulations
WFD	Water Framework Directive
WHTP	Whalley, Hawkes, Paisley & Trigg
WSI	Written Scheme of Investigation
ZTV	Zone of Theoretical Visibility

Chapters 1-4 of this PEIR have been produced as a separate document.

1. Introduction

2. The Scheme

3. Assessment of Alternatives

4. Environmental Assessment Methodology

Table 4-1 - Significance Matrix

Sensitivity of receptor	Magnitude of impact				
	Major	Moderate	Minor	Negligible	No change
Very high	Very large	Large or very large	Moderate or large	Slight	Neutral
High	Large or very large	Moderate or large	Slight or moderate	Slight	Neutral
Medium	Moderate or large	Moderate	Slight	Neutral or slight	Neutral
Low	Slight or moderate	Slight	Neutral or slight	Neutral or slight	Neutral
Negligible	Slight	Neutral or slight	Neutral or slight	Neutral	Neutral

Table Source: DMRB LA 104 Environmental assessment and monitoring Table 3.8.1

Table 4-2 - Significance categories and typical descriptions

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

Table Source: DMRB LA 104 Environmental assessment and monitoring Table 3.7

The discipline specific chapters of this PEIR have been produced as separate documents.

5. Air Quality

6. Noise and Vibration

6.1. Introduction

- 6.1.1. This chapter presents the preliminary environmental assessment of the M5 Junction 10 Improvements Scheme (the Scheme) for Noise and Vibration based on the Scheme as it is described in Chapter 2 (and detailed in the Design Fix 2 drawings in Appendix 2.1). The chapter sets out the standards and methodologies that will be used to carry out the assessment of noise and vibration for the Environmental Statement. It contains information about the existing and the potential noise constraints, and describes the potential noise and vibration impacts related to the construction and operation of the Scheme.
- 6.1.2. The construction and operational noise assessments have been carried out in accordance with National Highways Design Manual for Roads and Bridges (DMRB) LA 111 'Noise and Vibration' - 2020 Revision 2.

6.2. Planning policy and topic legislative context

National Policy

- 6.2.1. 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 effects as a result of the Scheme;
 - Mitigate and minimise other adverse impacts on health and quality of life; and
 - Contribute to improvements to health and quality of life, where possible.
- 6.2.2. The Scheme is intended to adhere to the aims of the NPSE. These aims are considered with reference to the guidance contained within the:
- National Policy Statement for National Networks (NPS NN);
 - The Scheme falls within the definition of NSIP, making the NPS NN the primary planning policy against which an application for a DCO for the Scheme would be judged;
 - National Planning Policy Framework (NPPF) 2019;
 - Given that the Scheme is an NSIP, noise has the status of an important and relevant matter in planning terms; and
 - Planning Practice Guidance: Noise (PPGN).
- 6.2.3. The Explanatory Note to the NPSE assists in the definition of significant adverse and adverse with the following concepts:
- NOEL – no observed effect level. This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise; and
 - LOAEL – lowest observed adverse effect level. This is the level above which adverse effects on health and quality of life can be detected; and
 - SOAEL – significant observed adverse effect level. This is the level above which significant adverse effects on health and quality of life occur. The Government policy and guidance do not state values for the NOEL, LOAEL and SOAEL, rather, it considers that they are 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.

Local Policy

- 6.2.4. The 'Gloucester, Cheltenham and Tewkesbury Joint Core Strategy' (JCS) 2011-2031 (December 2017) includes a policy relating to noise emissions. Policy SD4 of this document states:
- 6.2.5. "New development should enhance comfort, convenience and enjoyment through assessment of the opportunities for light, privacy and external space, and the avoidance or mitigation of potential disturbances, including visual intrusion, noise, smell and pollution."

Legislation

- 6.2.6. The scheme will be designed to ensure compliance with relevant legislation relating to noise, with the following documents called upon as required:
- The Control of Pollution Act 1974 (as amended);
 - The Environmental Protection Act 1990 (as amended);
 - The Control of Noise (Code of Practice for Construction and Open Sites) (England) Order 2015; and
 - Noise Insulation Regulations 1975 (as amended).

6.3. Methodology

Construction

- 6.3.1. The calculation of construction noise levels will follow the methodology in BS 5228-1. The predicted noise levels from construction noise sources will be compared against the assessment criteria shown in the DMRB LA 111. These assessment criteria are influenced by the existing baseline noise levels. Baseline noise levels will be ascertained using a combination of:
- Strategic noise mapping (DEFRA);
 - Predicted 'do minimum opening year' noise levels;
 - Baseline noise survey data.
- 6.3.2. Noise sources that are considered during the assessment include:
- Construction plant in use on the project;
 - Construction compounds; and
 - Traffic on haul roads that are not part of the public highway.
- 6.3.3. Details of the construction plant, including the activities being carried out, the number and types of plant being used and the typical working hours will be required to undertake this assessment.

Determination of significance - Noise

- 6.3.4. The predicted construction noise levels in dB L_{Aeq} will be compared with the relevant LOAEL and SOAEL from Table 6-1 for the identification of impacts.

Table 6-1 - Construction noise LOAEL and SOAEL values

Time Period	LOAEL	SOAEL
Day (0700-1900 weekday & 0700-1300 Saturdays)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 BS 5228-1
Night (2300-0700)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 BS 5228-1
Evening and weekends (time periods not covered above)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 BS 5228-1

Source: Table 3.12, DMRB LA 111

- 6.3.5. As per DMRB LA 111, LOAEL values are determined using baseline noise levels. Where appropriate, the baseline noise level is identified using either baseline noise survey data, predicted noise levels or from the strategic noise mapping published by DEFRA, or a combination of all of these sources. A perceptible level of construction noise would be equal to or greater than the LOAEL value ascribed to a receptor.
- 6.3.6. SOAEL values are identified using the ABC methodology outlined in BS 5228-1 (Section E3.2). Using the ABC method (see below, Table 6-2), SOAEL values are generated using the baseline noise levels, characterised for daytime, evening, and night-time periods. A potential significant effect is indicated if the noise level in $L_{Aeq,T}$ arising from the works exceeds the threshold level for the category appropriate to the ambient noise level.

Table 6-2 - The ABC method, BS 5228-1

Assessment category and threshold value period	Threshold value, in decibels (dB) ($L_{Aeq,T}$)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (2300 – 0700)	45	50	55
Evenings and weekends ^{D)}	55	60	65
Daytime (0700-1900) and Saturdays (0700 - 1300)	65	70	75

Note 1 A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

Note 2 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 3 dB due to site noise.

Note 3 Applied to residential receptors only.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D) 1900-2300 weekdays, 1300-2300 Saturdays and 0700-2300 Sundays.

- 6.3.7. Once LOAEL and SOAEL values have been identified, the magnitude of potential noise impact is then assessed. To assess the magnitude of impact for construction noise at a given receptor, reference is made to DMRB LA 111, Table 3.16. 'Minor' magnitudes of impact are considered to represent the threshold of perceptibility (see Table 6-2).
- 6.3.8. Construction traffic basic noise level (BNL) changes shall be calculated for roads within the construction traffic study area using the methodology found in the 'Calculation of Road Traffic Noise', 1988 (CRTN).

6.3.9. Reference is made to DMRB LA 111 (Table 3.17) to identify the magnitude of impact on receptors. This is also included in Table 6-3.

Table 6-3 - Magnitude of impact and construction noise descriptions

Magnitude of Impact	Construction Noise Level (LAeq)	Change in Construction Traffic Noise Level (LA10,18h)
Major	Above or equal to SOAEL +5 dB	Greater than or equal to 5 dB
Moderate	Above or equal to SOAEL and below SOAEL +5 dB	Greater than or equal to 3 dB and less than 5 dB
Minor	Above or equal to LOAEL and below SOAEL	Greater than or equal to 1 dB and less than 3 dB
Negligible	Below LOAEL	Less than 1 dB

Source: Tables 3.16 & 3.17, DMRB LA 111

6.3.10. A significant effect is determined for construction noise, or construction traffic noise, where a major or moderate magnitude of impact will occur for:

- either 10 or more days or nights in any 15 consecutive days or nights; or
- a total number of days exceeding 40 in any 6 consecutive months.

Determination of significance – Vibration

6.3.11. Predictions on the level of vibration are made in accordance with the methodology found in BS 5228-2, 'Code of practice for noise and vibration control on construction and open sites. Vibration' as prescribed by the DMRB LA 111. The significance of potential impacts will be ascertained using the methodology contained in DMRB LA 111, which takes into account the magnitude of the vibration and whether threshold levels for the LOAEL or SOAEL are exceeded. Table 6-4 below shows the vibration LOAEL and SOAEL values determined by DMRB LA 111.

Table 6-4 - Construction vibration LOAELs and SOAELs for all receptors

Time period	LAOEL	SOAEL
All time periods	0.3 mm/s PPV	1.0 mm/s

Source: Table 3.31 DMRB LA 111

6.3.12. To assess the magnitude of impact of construction vibration reference is made to DMRB LA 111, Table 3.33. This is reproduced below in Table 6-5.

Table 6-5 - Magnitude of impact of vibration levels

Magnitude of Impact	Vibration level
Major	Above or equal to 10 mm/s PPV
Moderate	Above or equal to SOAEL and below 10 mm/s PPV
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

Source: Table 3.33, DMRB LA 111

6.3.13. A significant effect attributed to construction vibration is likely where it is determined that a moderate or major magnitude of impact shall occur for:

- either 10 or more days or nights in any 15 consecutive days or nights; or
- a total number of days exceeding 40 in any 6 consecutive months.

6.3.14. Any major vibration levels are considered a significant effect irrespective of duration of activities and should be avoided.

Operation

- 6.3.15. The noise assessment is carried out in line with DMRB LA 111, with predictions carried out using a 3D noise model of the Scheme. The road traffic noise calculations are undertaken in accordance with the modified CRTN methodology set out in DMRB LA 111 Appendix A2.
- 6.3.16. The predictions are undertaken at all 'Noise Sensitive Receptors' (NSR) within the study area, in order to identify the risks and constraints that noise imposes on the Scheme, as well as highlighting noise-sensitive areas that could be impacted by the potential Scheme. Both daytime noise levels ($LA_{10,18h}$) and night time levels (L_{night}) will be calculated using the noise model.
- 6.3.17. The results of the noise modelling are used to determine potential noise impacts, the requirement of noise mitigation, and overall significance.
- 6.3.18. Road traffic noise calculations are undertaken using the following outputs from the traffic model:
- Traffic flows in vehicles Annual Average Weekday Traffic (AAWT) 18hour, the average number of vehicles over a year, on weekdays from 6am until midnight;
 - Traffic composition (the proportion of heavy-duty vehicles (HDV)); and
 - Traffic speeds.
- 6.3.19. DMRB LA 111 requires that the following traffic scenarios are assessed for the Scheme for a quantitative assessment:
- Do Minimum scenario in the opening year (DMOY), in this case 2025;
 - Do Minimum scenario in the future assessment year (DMFY) (typically 15 years after opening) in this case 2041;
 - Do Something scenario in the opening year (DSOY) in this case 2025; and
 - Do Something in the future assessment year (DSFY), in this case 2041.
- 6.3.20. For this Scheme an additional traffic model was created which included the Scheme as well as the Scheme dependent development, a large housing development close to the Scheme. This will be considered in the cumulative section of the report.
- 6.3.21. The following datasets are used produce a technically robust 3D noise model:
- LIDAR topography data;
 - OS Master map data including building outlines and carriageways;
 - OS Address base Plus data; and
 - 3D alignment of the Scheme.
- 6.3.22. The Scheme has the potential to adversely affect noise and vibration sensitive receptors in the area. DMRB LA 111 notes that the definition of NSR is simply 'receptors which are potentially sensitive to noise'. A distinction is also made between 'dwellings' and 'other noise sensitive receptors', which may include:
- Hospitals;
 - Healthcare facilities;
 - Education facilities;
 - Community facilities;
 - Environmental Noise Directive (END) quiet areas or potential END quiet areas;
 - International and national or statutorily designated sites; and
 - Public rights of way and cultural heritage assets.

Determination of Significance

- 6.3.23. Using DMRB LA 111, the following comparisons are required in order to determine the impact of the Scheme in both the short and long term:

- DMOY against DSOY (short term);
- DMOY against DSFY (long term); and
- DMOY against DMFY (long term).

6.3.24. DMRB provides classifications for the magnitude of changes in predicted road traffic noise as outlined below:

- A change in road traffic noise of 1dB(A) (DM to DS in the baseline year) is considered to be the smallest perceptible change in the short term; and
- A change in road traffic noise of 3dB(A) (DM in the baseline year to DS in the future assessment year) is considered to be the smallest perceptible change in the long term.

6.3.25. The magnitudes of impact in the short and long term are therefore considered differently within the DMRB methodology. For road traffic noise, the classification of magnitude of impact is reproduced from DMRB in below for both the short and long terms in Table 6-6.

Table 6-6 - Classification of Magnitude for Noise Impacts

Short term impact classification	Change road traffic noise level dB LA10,18h/Lnight	Long term impact classification
Negligible	0.0 dB and < 1.0 dB	Negligible
Minor	≥ 1.0 dB and < 3.0 dB	Negligible
Moderate	≥ 3.0 dB and < 5.0 dB	Minor
Major	≥ 5.0 dB and < 10.0 dB	Moderate
Major	≥ 10.0 dB	Major

Source: Modified from DMRB LA 111

6.3.26. In addition to this, the predicted noise levels at the NSR will be used to provide an indication of the number of properties that may potentially exceed the SOAEL and the LOAEL.

6.3.27. The thresholds assigned to the LOAEL and the SOAEL are set based upon the example thresholds for significance set out in DMRB LA 111 guidance, as provided in Table 6-7.

Table 6-7 - Operational Noise Levels of Significance for all Receptors (Daytime and Night Time)

Effect Level	Façade dB LA10, 18h (Daytime)	Free-field dB Lnight, outside
Adverse Effect (LOAEL)	≥ 55	40
Significant Adverse Effect (SOAEL)	≥ 68	55

Source: DMRB LA 111

6.3.28. The DMRB LA 111 states that moderate and major adverse impacts are to be considered as potential significant adverse effects as part of an initial assessment. Final operational significance is determined with reference to contextual factors. This process requires the assessor to consider a number of holistic points related to the receptor and the wider environment before determining whether a significant adverse effect has arisen (see Table 6-8 below).

Table 6-8 - Additional criteria for determining operational significance of effect

Magnitude of Impact	Long-term noise change (dB LA10,18h or Lnight)
Noise level change (is the magnitude of change close to the minor/moderate boundary?)	1) Noise level changes within 1 dB of the top of the 'minor' range can indicate that it is more appropriate to determine a likely significant effect. Noise level changes within 1 dB of the bottom of a 'moderate' range can indicate that it is more appropriate to consider a change is not a likely significant effect.

Magnitude of Impact	Long-term noise change (dB LA10,18h or Lnight)
	2) A similar change in the long term and non-project noise change can indicate that the change is not due to the project and not an indication of a likely significant effect.
Differing magnitude of impact in the long term to magnitude of impact in the short term	1) Where the long-term impact is predicted to be greater than the short-term impact, it can be appropriate to conclude that a minor change in the short term is a likely significant effect. Where the long-term impact is predicted to be less than the short term it can be appropriate to conclude that a moderate or major change in the short term is not significant.
Absolute noise level with reference to LOAEL and SOAEL (by design this includes sensitivity of receptor)	1) A noise change where all do-something absolute noise levels are below SOAEL requires no modification of the initial assessment. 2) Where any do-something absolute noise levels are above the SOAEL, a noise change in the short term of 1.0dB or over results in a likely significant effect.
Location of noise sensitive parts of a receptor	1) If the sensitive parts of a receptor are protected from the noise source, it can be appropriate to conclude a moderate or major magnitude change in the short term and/or long term is not a likely significant effect. 2) Conversely, if the sensitive parts of the receptor are exposed to the noise source, it can be more appropriate to conclude a minor change in the short term and/or long term is a likely significant effect. 3) It is only necessary to look in detail at individual receptors in terms of this circumstance where the decision on whether the noise change gives rise to a significant environmental effect is marginal.
Acoustic context	If a project changes the acoustic character of an area, it can be appropriate to conclude a minor magnitude of change in the short term and/or long term is a likely significant effect.
Likely perception of change by residents	1) If the project results in obvious changes to the landscape or setting of a receptor, it is likely that noise level changes will be more acutely perceived by the NSRs. In these cases, it can be appropriate to conclude that a minor change in the short term and/or long term is a likely significant effect. 2) Conversely, if the project results in no obvious changes for the landscape, particularly if the road is not visible from the receptor, it can be appropriate to conclude that a moderate change in the short term and/or long term is not a likely significant effect.

Source: Table 3.60, DMRB LA 111

- 6.3.29. The DMRB LA 111 advises that the threshold of perceptibility for change in operational road noise is 1dB LA10,18h in the short-term and 3dB LA10,18h in the long-term (typically 15 years from the planned opening of a Scheme).

6.4. Consultation

- 6.4.1. Consultation will be undertaken with relevant stakeholders from GCC, CBC and TBC to confirm noise assessment methodology and noise monitoring undertaken to date.

6.5. Baseline conditions

- 6.5.1. Information regarding the existing ambient noise climate i.e. baseline conditions, and identification of potential noise impact constraints of the Scheme, are determined through reference to the following sources:

- Ordnance Survey base mapping to identify locations of residential and non-

residential NSRs (residential properties, schools, hospitals and elderly care homes);

- DEFRA MAGIC website to identify boundaries of designated ecological sites that may be considered as sensitive to noise;
- Extrium Noise Map Viewer showing DEFRA NIA; and
- Extrium Noise Map Viewer showing DEFRA Strategic Noise Mapping for Environmental Noise Directive (Directive 2002/49/EC) and the Environmental Noise (England) Regulations 2006 (as amended) (2015).

6.5.2. Road traffic noise from the National Highways M5 motorway and GCC highways, such as the A4019, are the dominant source of ambient noise in the study area. The land use within 600 m of the Scheme is mainly agricultural, with clusters of properties located on the outskirts of Cheltenham. There are also areas of land near the Scheme which have been earmarked for almost 9000 properties, referred to as the Scheme dependent development throughout this chapter. .

6.5.3. Noise surveys were undertaken in May/June 2021, as it was considered that traffic was almost back to normal following the lifting of all but the final phase of lockdown restrictions. The survey carried out was a combination of four short term measurements, at Withybridge Lane Layby, Blenheim on Tewkesbury Road-Cheltenham, the layby on Tewkesbury Road-Uckington and Orchard House Coombe Hill. There was also one long term measurement location on Withybridge Lane, which was monitoring noise for seven days.

6.5.4. At all noise survey locations, the dominant source of noise was road traffic, plus aeroplanes on Withybridge Lane. The summary of the noise survey results is shown below, with the locations of the survey shown in Figure 6.1. Where sites called 'Sx' are measurements taken in accordance with CRTN 'Shortened Procedure' over one day. The site called 'L1' was the location of a logging sound level meter, which was measuring noise for seven days.

Table 6-9 - Summary of Noise Survey

Location	Location 1	Date(s) of measurement	LA10,18hour, dB	Dominant noise sources during the survey
S1	Withybridge Lane Layby, near 'House in the Tree' pub	27/05/2021	65.1	Road Traffic on Withybridge Ln, Aeroplanes
S2	Blenheim, Tewkesbury Road, Cheltenham, GL51 9SL	27/05/2021	80.4	Road Traffic on A4019
S3	Tewkesbury Road Layby	27/05/2021	74.5	Road Traffic on A4019
S4	Orchard House, Tewkesbury Rd, Coombe Hill, Gloucester GL19 4BA	27/05/2021	70.4	Road traffic on A38 and A4019
L1	1 Withybridge Ln, Cheltenham GL51 0TH	11/06/2021 - 18/06/2021	57.4	Road traffic on M5 and Withybridge Ln, Aeroplanes

6.5.5. It is expected that most receptors within the study area have day-time baseline noise levels in the range 40-45 dB LA10,18h. Receptors which are close to the motorway have baseline noise levels up to 75 dB LA10,18h. The measurements taken on the A4019 Tewkesbury Road show that noise in the front gardens of some of these properties already exceed 80dB.

- 6.5.6. Noise Important Areas (NIA) are identified to highlight any particular constraints on the Scheme. These are the areas where 1% of the population are affected by the highest noise levels from major roads are located according to the strategic noise mapping undertaken by DEFRA under the terms of the Environmental Noise (England) Regulations 2006, as amended.
- 6.5.7. There are a number of NIA near the Scheme. Close to the M5 there are two NIAs, NIA 3951 (National Highways) covers the existing junction and contains approximately 22 receptors, however these properties would be demolished with the Scheme. NIA 3952 (National Highways) is on the M5 approximately 800m north of the existing junction and contains 1 receptor.
- 6.5.8. On the A4019, to the West of the junction, is NIA 11921 (Gloucestershire). It represents one property between the M5 and Coombe Hill Junction.
- 6.5.9. On the A4019, East of the junction, there are 5 NIAs. NIA 3950 (Gloucestershire) represents 2 properties, NIA 3949 (Gloucestershire) represents 22 properties, NIA 3948 (Gloucestershire) represents 2 properties, NIA 11920 (Gloucestershire) represents 3 properties and NIA 3893 (Gloucestershire) represents 6 properties.
- 6.5.10. There are additional NIAs close to the study area which may also be affected by the Scheme, including those on the M5 north of Junction 11, the A4019, Princess Elizabeth Way, the A40 and a number of other roads within Cheltenham.

6.6. Potential impacts

- 6.6.1. The Scheme has the potential to affect the local noise climate, both during construction, and once in operation, in a number of ways, as discussed below.

Construction

- 6.6.2. Construction of Scheme has the potential to affect nearby receptors, either due to noise from demolition and construction activities themselves, or from additional HGVs associated with construction activities on the local road network.
- 6.6.3. In addition, the local road network may experience changes in traffic flows and speeds during construction, as a result of temporary traffic management measures or diversions. It should be noted, however, that any effects on the noise climate from construction activities, including construction traffic and traffic diversions, would be temporary i.e. during the period of construction works only.
- 6.6.4. The properties that are closest to the works, and therefore the most likely to be affected by construction noise, are alongside the A4019. Properties may also be affected that are close to the M5 or the new link road.

Operation

- 6.6.5. Once the Scheme is operational, the noise climate could be affected (positively or negatively) by changes in traffic flows, speeds and composition. Additionally, noise levels at nearby receptors could also be affected by any changes to the distance between carriageways and the NSR, as a result of a change to road alignment and road surfacing.
- 6.6.6. In particular, the changes to the layout of the A4019, the M5 Junction 10 itself and the new link road are the locations where the biggest changes in noise are expected, as a result of the changes to the layout as well as the traffic flows. Properties which are closer to the road are likely to experience an increase in noise, with those further away likely to experience a decrease.
- 6.6.7. In addition, there are likely to be changes in noise due to the traffic alone. On roads such as Princess Elizabeth Way in Cheltenham, the traffic that would have travelled through the town can now enter onto, and exit from, the south of the M5 at junction 10, reducing noise along the route. In contrast, the traffic from other areas will be drawn to junction 10, and will increase the traffic on local roads such as Stoke Road.

6.7. Potential mitigation measures

- 6.7.1. This section provides a summary of potential essential mitigation measures to be incorporated into the design of the proposed Scheme.

Construction

- 6.7.2. To mitigate potential noise impacts during the construction phase, the Environmental Health Departments at the relevant LPAs should be consulted to obtain guidance on their requirements for managing and controlling noise and vibration from construction works.
- 6.7.3. An Environmental Management Plan (EMP) for construction would be prepared and be approved by the Local Authorities as part of the DCO application, prior to the commencement of construction works. The EMP for construction would outline the following:
- Environmental management and responsibilities;
 - Monitoring and auditing processes;
 - Procedures that will be used to complete different construction activities;
 - Complaint response procedures; and
 - Community and stakeholder liaison processes.
- 6.7.4. A Section 61 application under the Control of Pollution Act 1974 may also be required and submitted for some of the construction works, especially if night-time working is proposed.
- 6.7.5. It is a requirement of GCC that contractors are part of the Considerate Contractors Scheme, that is recognised by industry and the Government for encouraging firms to be sensitive to the environment.
- 6.7.6. Good stakeholder relations are often the most effective way to manage potential noise impacts on site. Therefore, the contractor would be expected to keep local residents and other affected parties informed of the progress of the works, including when and where the noisiest activities will be taking place and how long they are expected to last. All noise complaints would be effectively recorded, investigated and addressed.
- 6.7.7. In addition, the following good working practices would be employed during construction:
- All vehicles and plant should be fitted with effective exhaust silencers which should be maintained in good and efficient working order;
 - All compressors and generators should be 'sound reduced' models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use;
 - All ancillary pneumatic percussive tools should be fitted with mufflers or suppressors as recommended by the manufacturers which should be kept in a good state of repair;
 - Machines in intermittent use should be shut down when not in use or where this is impracticable, throttled down to a minimum;
 - The site compound and static machines should be sited as far as is practicable from noise sensitive buildings;
 - Where practicable, plant with directional noise characteristics should be orientated to minimise noise at nearby properties;
 - Plant should be certified to meet the current EU legislation and should be not be louder than the noise levels provided in Annex C and D of BS 5228-1;
 - Where appropriate, temporary noise barriers or other noise containment measures should be installed to minimise construction noise levels;
 - The loading or unloading of vehicles and the movement of equipment or materials should be undertaken in a manner that minimises noise generation;
 - Concrete mixers should not be cleaned by hammering the drums; and
 - When handling materials, care should be shown not to drop materials from excessive heights.

- 6.7.8. In addition to the above good working practices, where piling is required, the piling method should be carefully selected to minimise noise and vibration impacts at NSR. Where practicable, piling methods that result in low levels of vibration, such as rotary bored piling should be used. Methods that cause much higher levels of vibration, such as percussive piling, can cause cosmetic damage to buildings within 50 m of the construction works and would be expected to be avoided wherever possible.
- 6.7.9. Even with appropriate mitigation in place, it may not be possible to eliminate all noise impacts. However, best practice, considerate working hours as well as frequent and open communications with stakeholders will help to reduce the residual impact of construction noise.

Operation

Essential Mitigation

- 6.7.10. Noise mitigation regarding operational road traffic noise can consist of noise barriers, earth bunds, or low noise road surfacing, and may include any existing noise mitigation in-situ that will be retained by the Scheme.
- 6.7.11. The M5 includes low noise surfacing on all new and altered sections of the road, within 600m of NSRs, in line with National Highways guidance. However, the Gloucester County Council roads, such as the A4019 and new link, would not be surfaced with a low noise surfacing. The surface correction used for the low noise surfacing on the M5 was -3.5dB for speeds exceeding 75kph, and the correction for hot rolled asphalt on higher speed roads, such as the A4019, was -0.5dB. All roads with speeds below or equal to 75kph used a surface correction of -1.0dB.
- 6.7.12. The assessment includes indicative noise mitigation (environmental bunds or barriers) for the Scheme to improve the noise climate close to the Scheme, including those within NIA. Information regarding these noise mitigation measures have been included in Table 6-10 and shown in Figure 6.1.

Table 6-10 - Essential Scheme Mitigation

Mitigation no.	Location	Description
M1	Church View NIA 3950	150m long, 2m tall reflective noise barrier located adjacent to properties within Church View and alongside the A4019 WB Carriageway
M2a	The Green NIA 3949	100m long, 2m tall absorptive noise barrier located adjacent to properties West of the Green and alongside the A4019 EB Carriageway.
M2b	The Green NIA 3949	Up to 250m long, 2m tall absorptive noise barrier located adjacent to properties West of the Green and alongside the A4019 EB Carriageway.
M3	Tewkesbury Road NIA 3948	500m long, 2m tall reflective noise barrier located adjacent to properties alongside Tewkesbury Road and alongside the A4019 WB Carriageway. Barrier includes a gap for access to Sandpiper Drive.

- 6.7.13. The EMP, which will be produced and submitted as part of the DCO application, will ensure implementation of these operational noise controls.
- 6.7.14. This noise mitigation results in improvements at a number of NIA, on the A4019. This responds to Aim 3 as set out in the 'England National Application Annex to LA 111' to improve the noise environment.
- 6.7.15. A further review of mitigation will be undertaken at design fix 3 and the inclusion of other mitigation will be confirmed as part of the ES.

Enhancement

- 6.7.16. In addition to the measures provided Table 6-10, additional enhancement measures may be introduced during the detailed design of the Scheme. This could include the extension of environmental mitigation.
- 6.7.17. Further sites for potential noise mitigation have been identified. Additional conversations with landowners would be required before these can be included as part of the Scheme, as the mitigation would need to be installed outside the red line boundary of the Scheme. This mitigation is not shown in Figure 6-1.

Table 6-11 - Essential Scheme Mitigation

Mitigation no.	Location	Description
M4	Stanboro Cottage	200m long, 2m tall reflective noise barrier located adjacent to Stanboro Cottage and alongside the A4019 EB Carriageway.
M5	Tewkesbury Road NIA 3948	Amendments to Barrier 4, which includes an amendment to the extent and position of the noise fence east of Fire Station, to further benefit the residents

6.8. Residual impacts

Construction

- 6.8.1. The potential for significant effects arising from the construction phase of the Scheme will be established once construction methodologies, plant itineraries and schedules, and proposed hours of operation, are available to inform the assessment. However, a high level assessment has been carried out based on typical construction activities.
- 6.8.2. The main construction activities that are likely to take place are site preparation, demolition, earthworks, retaining wall construction and road works. All activities have the

potential to cause some disturbance at nearby sensitive receptors. Demolition works and piling works (e.g. for new slip roads or retaining walls) are likely to cause some of the highest noise levels dependent on the construction methods chosen. Should it be required to close the M5 or A4019 to undertake any part of the works then the potential for adverse noise impacts at night is very high. This would also be coupled with the potential wider impacts of re-routed traffic during the night-time.

- 6.8.3. From BS5228, it can be shown that typical construction activities are around 80 dB to 85 dB at 10 m from the works. The approximate distance that a significant adverse effect could occur can be determined using the Category C construction noise limits from Table 6-2, i.e. 75dB L_{Aeq} during the daytime, 65dB L_{Aeq} for weekends and evenings and 55dB L_{Aeq} at night.
- 6.8.4. Therefore, it is expected that works are less likely to cause a significant adverse effect at properties that are beyond 50 m during the daytime, beyond 100 m during evenings and weekends, and beyond 300 m at night; if no temporary noise mitigation, such as a noise barrier, were in place. Properties that are close to the M5 and A4019, including the junctions, are most likely to be affected.
- 6.8.5. Properties within 50 to 100m of the works include properties on the A4019, Tewkesbury Road, Barn Farm and Old Gloucester Road. The properties that are up to 300m from the works also include Withybridge Lane and additional properties, further back from the A4019.
- 6.8.6. Therefore, where possible, weekend, evening and night time works should be limited to essential works only.
- 6.8.7. The need for temporary noise mitigation during the construction phase will be determined for the Environmental Statement by undertaking a BS 5228-1:2009+A1:2014 assessment that takes into account the following factors:
- The ambient noise environment at the closest NSRs to the construction works;
 - The distance between the nearest NSRs and the construction works;
 - The duration and time of day that the construction works occur; and
 - The noise produced by the plant or equipment involved in the construction activities, which is influenced by the sound power of the equipment and its usage pattern.
- 6.8.8. A temporary increase in vehicle movements is expected during the construction period, as a result of workers and HDVs travelling to and from site. At this stage, the numbers of expected vehicle movements are not yet known, and cannot be quantitatively assessed. It is also not yet known if existing traffic will need to be diverted during the construction phase.
- 6.8.9. A detailed construction vibration assessment has not been carried out at this stage. However, the Scheme is unlikely to include any plant that would cause high levels of vibration. However, properties situated along the A4019, have the potential for vibration impacts from the road construction plant; such as planning, milling, breaking, rolling and paving. If piling is required, piling methods that result in low levels of vibration, such as rotary bored piling rather than impact driven piling rigs, are favoured.

Operation

- 6.8.10. To appraise the opening year noise impacts of the Scheme, a comparison has been made between the noise model results of the Do-Something 2025 scenario vs the Do-Minimum 2025 scenario for daytime only. The magnitude of these opening year (short-term) noise impacts are summarised in Table 6-12 below.

Short Term Impacts

Table 6-12 - Short term daytime traffic noise impacts

Increase/ decrease in noise	Change in noise level dB LA10, 18h	Magnitude of Impact	Number of Dwellings	Number of other sensitive receptors
Increase	1 - 2.9	Minor	420	17
Increase	3 - 4.9	Moderate	6	2
Increase	>=5	Major	0	0
Negligible	-0.9 - 0.9	Negligible	9933	368
Decrease	1 - 2.9	Minor	1475	58
Decrease	3 - 4.9	Moderate	30	1
Decrease	>=5	Major	44	1

- 6.8.11. Table 6-12 demonstrates that most receptors will experience a negligible change in road traffic noise level over the short-term due to the Scheme.
- 6.8.12. There are 1475 dwellings predicted to experience a minor beneficial impact upon opening, due to traffic using the new M5 J10 junction, rather than the local roads such as the B4634, B4063, A4013, A38 and A435. The 30 dwellings predicted to experience a moderate beneficial impact upon opening are located at alongside the A4019, due to the new alignment and noise barriers, and on Bamfurlong Lane, due to changes in traffic distribution. There are 44 dwellings predicted to experience major beneficial impacts upon opening of the Scheme, and these are located along the A4019, and on Hayden Lane and Withybridge Lane, all as a result of the changes to the Scheme, including the new link road.
- 6.8.13. There are 58 non-residential sensitive receptors predicted a minor beneficial impact, one predicted to have a moderate beneficial impact and one predicted major beneficial impact due to the Scheme.
- 6.8.14. Adverse impacts are predicted in the short-term upon opening of the Scheme due to changes in traffic flow and alignment
- 6.8.15. There are 420 dwellings that are predicted to experience a minor adverse impact due to the Scheme upon opening. These are located on A4019, A38 Tewkesbury Road, Stoke Road, and Hesters Way. Six dwellings are predicted to experience a moderate adverse impact due to the Scheme upon opening, these are located on A38 Tewkesbury Road and the A4019. There are no major increases predicted at residential NSRs.
- 6.8.16. There are 17 minor and 2 moderate increase predicted at non-residential sensitive receptors upon opening due to the Scheme.
- 6.8.17. The assessment of the significance of effect at these NSR will be discussed later in the chapter, within Table 6.16.
- 6.8.18. Figure 6.2 and Figure 6.4 provide the opening year noise contour maps, with the opening year noise difference contours shown in Figure 6.12.

Long Term Impacts

- 6.8.19. To appraise the future year noise impacts of the Scheme a comparison has been made between the noise model results of the Do-Something 2041 scenario vs the Do-Minimum 2025 scenario. The magnitude of these future year (long-term) noise impacts are summarised in Table 6-13 below.

Table 6-13 - Long term daytime traffic noise impacts

Increase/ decrease in noise	Change in noise level dB LA10, 18h	Magnitude of Impact	Number of Dwellings	Number of other sensitive receptors
Increase	3 - 4.9	Minor	4	2
Increase	5 - 9.9	Moderate	0	0
Increase	>=10	Major	0	0
Negligible	-2.9 - 2.9	Negligible	11831	443
Decrease	3 - 4.9	Minor	30	1
Decrease	5 - 9.9	Moderate	43	1
Decrease	>=10	Major	0	0

- 6.8.20. Table 6-13 demonstrates that, within the study area, the majority of receptors are predicted to experience a negligible change due to the Scheme over the long-term.
- 6.8.21. There are 30 dwellings that are predicted to experience a minor beneficial impact due to the Scheme over the long-term, located alongside the A4019, due to the new alignment and noise barriers, and on Bamfurlong Lane, due to changes in traffic distribution. There are 43 dwellings predicted to experience moderate beneficial impacts upon opening of the Scheme, and these are located along the A4019, and on Hayden Lane and Withybridge Lane, all as a result of the changes to the Scheme, including the new link road.
- 6.8.22. There is one non-residential sensitive receptor predicted to have a minor beneficial impact and one predicted moderate beneficial impact due to the Scheme.
- 6.8.23. Adverse impacts are predicted in the long-term with the Scheme due to changes in traffic flow and alignment, when compared with the Do Minimum in the opening year.
- 6.8.24. There are 4 dwellings that are predicted to experience a minor adverse impact due to the Scheme upon opening. These are all located on the A4019. No further dwellings are predicted to experience a moderate or major adverse impact due to the Scheme upon by the future year.
- 6.8.25. There are 2 minor increases predicted at non-residential sensitive receptors by the future year due to the Scheme.
- 6.8.26. Figure 6.3 and Figure 6.5 provide the future year noise contour maps, with the future year noise difference contours shown in Figure 6.13.

Do Minimum Impacts

- 6.8.27. The Do-Minimum changes in noise between the opening year 2025 and the future year 2041 have been compared and the magnitude of these do-minimum noise impacts are summarised in Table 6-14.

Table 6-14 - Do Minimum daytime traffic noise impacts

Increase/ decrease in noise	Change in noise level dB LA10, 18h	Magnitude of Impact	Number of Dwellings	Number of other sensitive receptors
Increase	3 - 4.9	Minor	0	0
Increase	5 - 9.9	Moderate	0	0
Increase	>=10	Major	0	0
Negligible	-2.9 - 2.9	Negligible	11956	447
Decrease	3 - 4.9	Minor	0	0
Decrease	5 - 9.9	Moderate	0	0
Decrease	>=10	Major	0	0

6.8.28. The results of the Do-minimum 2025 vs Do-Minimum 2041 comparison, in Table 6-14 show that all predicted changes in noise are negligible.

6.8.29. The long term Do Minimum noise difference contours are shown in Figure 6.15.

Assessment of Significance

6.8.30. The changes in road traffic noise predicted to result from the Scheme have been reported in accordance with DMRB LA 111 and include the mitigation measures described in Section 6.7.

6.8.31. An initial assessment of operational noise significance at NSRs is summarised in this section and in Table 6-15. DMRB LA 111 states that for this initial assessment a moderate or major magnitude of impact at NSRs are classed as 'Significant'.

Table 6-15 - Summary of the initial assessment of daytime operational noise significance

Initial assessment of operational noise significance	Number of receptors at which the initial assessment of operational noise is significant or not significant - Adverse	Number of receptors at which the initial assessment of operational noise is significant or not significant - Beneficial
Significant	6	74
Not Significant	1555	8636

6.8.32. Table 6-15 demonstrates that, for most of the NSRs within the operational study area, the effects associated with the change in road traffic noise due to the Scheme are not significant.

6.8.33. The predicted changes in noise have been reviewed alongside the absolute noise levels at the receptors and the overall site context, to arrive at a conclusion on the potential significance of the predicted changes in noise.

6.8.34. This assessment of the significance of environmental effects is summarised in Table 6-16 below.

Table 6-16 - Assessment of Significant Environmental Effects

Receptor (or group of receptors)	Magnitude of Impact	Conclusion of Significance of Environmental Effect	Justification of Significance conclusion
5920 residential properties exposed to noise levels <LOAEL	No change or Negligible opening year changes in noise <+/- 1dB.	Not Significant	No change or negligible changes in noise are not a significant environmental effect.

Receptor (or group of receptors)	Magnitude of Impact	Conclusion of Significance of Environmental Effect	Justification of Significance conclusion
3149 residential properties exposed to noise levels between <LOAEL and >SOAEL.	No change or Negligible opening year changes in noise <+/- 1dB.	Not Significant	No change or negligible changes in noise are not a significant environmental effect.
863 residential properties exposed to noise levels >SOAEL.	No change or Negligible opening year changes in noise <+/- 1dB.	Not Significant	No change or negligible changes in noise are not a significant environmental effect.
21 residential properties exposed to noise levels <LOAEL	Minor adverse changes in noise between -1 to -2.9dB in the opening year.	Not Significant	No change or negligible changes in noise are not a significant environmental effect.
324 residential properties exposed to noise levels between <LOAEL and >SOAEL.	Minor adverse changes in noise between -1 to -2.9dB in the opening year.	Not Significant	No change or negligible changes in noise are not a significant environmental effect.
6 residential properties exposed to noise levels between <LOAEL and >SOAEL	Moderate adverse changes in noise between -3 to -4.9dB in the opening year.	Potentially Significant	Change in noise is moderate and so potentially significant, but are minor or negligible in the future assessment.
75 residential properties exposed to noise levels between <LOAEL and >SOAEL or >SOAEL	Minor adverse changes in noise between -1 to -2.9dB in the opening year to above SOAEL.	Potentially Significant	Noise levels exceed SOAEL and experience a minor adverse increase in noise in the opening year. Changes in noise on 6 properties remain in the future year assessment.
99 residential properties exposed to noise levels <LOAEL	Minor beneficial changes in noise between -1 to -2.9dB in the opening year.	Not Significant	No change or negligible changes in noise are not a significant environmental effect.
964 residential properties exposed to noise levels between <LOAEL and >SOAEL.	Minor beneficial changes in noise between -1 to -2.9dB in the opening year.	Not Significant	Reduction in noise is only minor beneficial, reducing to negligible in the future year.
39 residential properties exposed to noise levels between <LOAEL and >SOAEL.	24 moderate (between 3 to 4.9dB) and 15 major (5dB+) beneficial changes in noise in the opening year.	Potentially Significant	Reduction in noise is moderate to major in the opening year, with 14 moderate beneficial changes remaining by the future assessment year

Receptor (or group of receptors)	Magnitude of Impact	Conclusion of Significance of Environmental Effect	Justification of Significance conclusion
413 residential properties exposed to noise levels >SOAEL.	Minor beneficial changes in noise between -1 to -2.9dB in the opening year.	Potentially Significant	Noise levels exceed SOAEL and experience a minor beneficial change in noise in the opening year. In the future year there are 732 properties with a 1-5dB benefit.
38 residential properties exposed to noise levels >SOAEL.	9 moderate (between 3 to 4.9dB) and 29 major (5dB+) beneficial changes in noise in the opening year.	Potentially Significant	Reduction in noise is moderate to major, with 3 moderate beneficial changes remaining by the future assessment year

- 6.8.35. The above findings summarise the operational noise assessment and demonstrate that the Scheme has the potential to result in significant environmental effects. In particular, the traffic rerouting onto Stoke Road is predicted to lead to an adverse increase of 1dB where noise levels already exceed the SOAEL, at 6 properties. The majority of the properties on this road are accessed from the road, making mitigation difficult at all but Stanboro Cottage, which has the potential to benefit from barrier M4. Design measures will be considered as part of the design development process, prior to the publication of the ES.
- 6.8.36. The other potentially significant adverse changes in the opening year are no longer significant by the future year.
- 6.8.37. There are some potentially significant beneficial changes in noise due to the Scheme, particularly on Hayden Lane, Withybridge Lane and the A4019.

Noise Important Areas Assessment

- 6.8.38. The NIAs have been identified as areas where noise levels are already very high and ameliorative action is required by the responsible authority.
- 6.8.39. However, the changes in noise at all of the NIA, with the Scheme, were predicted to be negligible or better. The properties within the NIA3949 and NIA3948, situated alongside the A4019, are predicted a moderate benefit by the future year, due to the Scheme alignment and noise barriers.
- 6.8.40. The NIA 11921, on the A4019, close to Stoke Road, is predicted a minor increase in noise. However, the potential for a barrier at this location has been discussed in Section 6.7.

6.9. Cumulative effects

- 6.9.1. There is a Scheme dependent development proposed within the study area of the M5 J10 Scheme, which has the potential to lead to cumulative noise effects.

Construction

- 6.9.2. It is understood that the construction of the Scheme will be completed prior to the construction of the Scheme dependent development.
- 6.9.3. However, if there were to be any construction phase overlap of the two schemes, this could lead to cumulative construction impacts, including the construction activity itself, and the combination of additional construction vehicles on the road.
- 6.9.4. The construction work should be planned to minimise noise impacts at NSRs, including mitigation as discussed in Section 6.7.

Operation

- 6.9.5. An additional traffic model has been provided for 2041, which includes the Scheme dependent development, in order to determine the cumulative impact of both schemes in the future year.
- 6.9.6. To appraise the cumulative future year noise impacts of the Scheme a comparison has been made between the noise model results of the cumulative Do-Something 2041 scenario vs the Do-Minimum 2025 scenario. The magnitude of these future year (long-term) noise impacts are summarised in Table 6-17 below.

Table 6-17 - Long term daytime traffic noise impacts - Cumulative

Increase/decrease in noise	Change in noise level dB LA10, 18h	Magnitude of Impact	Number of Dwellings	Number of other sensitive receptors
Increase	3 - 4.9	Minor	46	3
Increase	5 - 9.9	Moderate	22	0
Increase	>=10	Major	0	0
Negligible	-2.9 - 2.9	Negligible	11787	442
Decrease	3 - 4.9	Minor	26	2
Decrease	5 - 9.9	Moderate	27	0
Decrease	>=10	Major	0	0

- 6.9.7. Table 6-17 demonstrates that, within the study area, the majority of receptors are predicted to experience a negligible change due to the Scheme over the long-term.
- 6.9.8. There are 26 dwellings that are predicted to experience a minor beneficial impact due to the Scheme over the long-term, located alongside the A4019, Hayden Lane and Withybridge Lane, due to the new alignment. There are 27 dwellings predicted to experience moderate beneficial impacts upon opening of the Scheme, and these are located along the A4019, all as a result of the changes to the Scheme and noise barriers.
- 6.9.9. There are two non-residential sensitive receptors predicted to have a minor beneficial impact due to the Scheme.
- 6.9.10. Adverse impacts are predicted in the long-term with the Cumulative Scheme due to changes in traffic flow and alignment, when compared with the Do Minimum in the opening year.
- 6.9.11. There are 46 dwellings that are predicted to experience a minor adverse impact due to the Scheme upon opening. These are all located on the A4019, Tewkesbury Road or Telstar Way. There are 22 further dwellings which are predicted to experience a moderate adverse impact at Telstar Way due to the cumulative Scheme in the future year. There are no predicted major impacts due to the cumulative Scheme.
- 6.9.12. There are 3 minor increases predicted at non-residential sensitive receptors by the future year due to the Scheme.
- 6.9.13. The principal difference between the Scheme with and without the Scheme dependent development is the minor to moderate increase in noise along Telstar Way. However, the cumulative impact has reduced the overall number of benefits from the Scheme. The increase in noise at Telstar Way is as a result of the new development traffic, and not the Scheme, so is not considered to be significant.
- 6.9.14. Figure 6.3 and Figure 6.6 provide the future year noise contour maps, with the cumulative long term noise difference contours shown in Figure 6.14.

6.10. NPS compliance

6.10.1. The NPS NN requirements for noise and vibration are detailed in paragraphs 5.186 to 5.200 of the policy document, which cover the following themes:

- Using relevant technical guidance and standards (such as CRTN and BS 5228) to undertake the assessment;
- Incorporation of good design measures to minimise noise and vibration emissions;
- Reporting requirements, including the identification of sensitive receptors, description and operating characteristics of noise and vibration sources, noise modelling outcomes and details of mitigation measures;
- Consideration of noise and vibration impacts to ecological receptors and sharing of information with ecologists and relevant organisations;
- Consideration of impacts directly associated with the development located elsewhere on the national network; and
- Paying due regard to the NPSE and NPPF to ensure that their policy aims are met in the context of government policy on sustainable development.

6.10.2. The aims of the NN-NPS and associated actions are listed in DMRB LA111 Table E/1.3 in the Annex E/1. A summary of responses is set out in Table 11-23.

Table 6-18 - Scheme Compliance with NN-NPS

NN-NPS Aims	Action
<p>Aim 1: Avoid significant adverse impacts on health and quality of life from noise as a result of the new development.</p> <p>NOTE: Significant adverse noise effects occur when noise levels are above SOAEL.</p>	<p>Table E/1.3 of DMRB LA111 defines a significant adverse noise effect in NPS NN policy terms as a noise level above SOAEL.</p> <p>Construction noise will be limited where possible through the programme and will include the mitigation measures detailed in Section 6.7.</p> <p>Existing operational noise within the study area exceeds the SOAEL at some receptors. Operational noise from the Scheme, considering the mitigation measures detailed in Section 6.7, is not predicted to result in moderate or major increases in noise by the future year.</p> <p>Changes in traffic on Stoke Road is expected to lead to a 1dB+ increase in noise at 6 receptors with noise levels which currently exceed the SOAEL.</p> <p>Mitigating these minor increases where noise levels already exceed the SOAEL would be difficult due to property access requirements.</p> <p>Therefore, the Scheme meets this policy aim of NN NPS, as significant effects have been avoided where possible.</p>
<p>Aim 2: Mitigate and minimise other adverse impacts on health and quality of life from noise from the new development.</p> <p>NOTE: Other adverse impacts occur when noise levels are between LOAEL and SOAEL.</p>	<p>All design and mitigation measures (actions) to minimise adverse impacts are detailed in section 6.7.</p> <p>Measures include a noise reducing surface along high-speed sections of the M5, plus noise barriers alongside the A4019, to mitigate operational noise. With temporary noise barriers and use of best practicable means to mitigate construction noise.</p> <p>Therefore, the Scheme meets this policy aim of NN NPS.</p>

NN-NPS Aims	Action
<p>Aim 3: Contribute to improvements to health and quality of life through the effective management and control of noise, where possible.</p> <p>NOTE: Applies to all noise levels.</p>	<p>As a result of the measures (actions) proposed in section 11.9, noise emissions from construction and operation are reduced.</p> <p>Noise Important Areas within the Scheme provided with noise mitigation where possible.</p> <p>Reductions in operational noise occur at some receptors as a result of the Scheme.</p> <p>Therefore, the Scheme meets this policy aim of NN NPS.</p>

6.11. Assumptions and limitations

- 6.11.1. The noise assessment has been carried out using the Scheme information available at the time, including both the design and traffic information.

Construction Noise

- 6.11.2. Several assumptions and limitations have been identified during the construction assessment. The assessment is considered to represent a reasonable worst case using noise levels from generic construction plant and is considered robust for the purposes of identifying the potential for likely significant adverse effects.
- 6.11.3. The construction noise assessment has predicted the distances at which daytime, evening/weekend and night time works could be carried out, before exceeding the limit for a Significant Effect. These distances are considered representative of the worst case for potential noise and vibration impacts for the Scheme route.

Construction Vibration

- 6.11.4. The properties situated along the A4019, which are very close to the scheme, have the potential for vibration impacts from the road construction plant, such as planning, milling, breaking, rolling and paving.
- 6.11.5. For the M5, 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, can be looked at on a case-by-case basis where there are sensitivities in the surrounding area.

Operational noise

- 6.11.6. Table 6-19 describes the assumptions and limitations associated with the noise model and the operational noise assessment.

Table 6-19 - Uncertainty in relation to the operational noise assessment

Model element	Assumption and limitations
Traffic data	<ul style="list-style-type: none"> The level of road traffic noise from the road network has been predicted using traffic data provided. LA_{10,18hr} traffic noise levels have been predicted using NoiseMap v5.2 noise modelling software, in accordance with CRTN methodology and the modifications and guidance stated in DMRB LA 111. The noise predictions contain the same inherent assumptions that were built into the traffic model to predict traffic flows, composition, and speed at each link. For a 1dB change to occur, traffic flows need to

Model element	Assumption and limitations
	<p>increase by 25% or decrease by 20% (all other variables being equal). Therefore, small errors in traffic flow forecasts are unlikely to significantly affect results.</p> <p>The Scheme opening year is assumed to be 2025 and the future year is assumed to be 2041.</p>
Road alignments	<ul style="list-style-type: none"> The road alignments have been modelled based on geo-referenced shapefiles that reflect the design as provided by the project team. <p>These have been supplemented by OS MasterMap and Google Maps Satellite data.</p>
Road surfaces	<ul style="list-style-type: none"> All rural roads have been assumed to have a hot-rolled asphalt surface. Existing road surfacing (pavement) information was obtained from the National Highways Pavement Management System (HAPMS). Areas of proposed surface changes (re-surfacing) have been provided by the project pavement team and include the M5. i.e., the M5 includes low noise surfacing on all new and altered sections of the road. However, the Gloucester County Council roads, such as the A4019 and new link, would not be surfaced with a low noise surfacing. <p>Surface noise corrections have been implemented in accordance with DMRB LA 111.</p>
Topography	<ul style="list-style-type: none"> The topography for the study area has been modelled based on a Digital Terrain Model (DTM) supplied by National Highways through the GeoStore. Digital Terrain/Surface Model - ©Astrium Ltd and Bluesky International Ltd. The contours created from the DTM are at 1 metre intervals (vertical resolution). The topography contours modelled for the Scheme were produced based on 3D drawings provided by the Highways engineering team. <p>The topography contours modelled for the Scheme replace the DTM topography at areas within the Scheme boundary for all Do-Something scenarios.</p>
Buildings	<ul style="list-style-type: none"> Buildings have been modelled based on OS Mastermap (National Highways Geostore) data. <p>Where possible, building heights have been derived from eave height data from the above dataset and combined with Google Maps data or taken to be 6m above ground height.</p>
Noise barriers & fences	<p>Scheme noise barriers were included in the noise model, as described in Section 6.7.</p>
Ground cover	<p>Due to the nature of the area surrounding the Scheme, the ground has been modelled as soft and acoustically absorptive.</p>

Model element	Assumption and limitations
Address data	Address and receptor sensitivity data has been defined from OS AddressBase Plus data.
Survey data	The noise survey undertaken in May/June 2021 has been used to inform the noise model and for characterising the sound climate.
Night Time Assessments	The night time assessment has not been included at this stage, as the daytime assessment provides a good indication of the likely noise impacts with the scheme. The night time operational assessment will be included in the ES.

- 6.11.7. Data collection and analysis complemented by the assumptions stated above ensure the robustness of the assessment.

6.12. Chapter summary

- 6.12.1. A preliminary construction and operational noise assessment has been carried out for the M5 Junction 10 Scheme.
- 6.12.2. The construction noise assessment determined that daytime works within 50m of a noise sensitive property, evening or weekend works within 100m of a noise sensitive property or night time works within 300m of a noise sensitive property has the potential to lead to a significant noise effect. Properties that are particularly at risk are those close to the A4019, East of the M5.
- 6.12.3. With mitigation in place, as well as good community engagement, the impact of the construction noise can be reduced. Where it is not possible to reduce noise at these locations, it may be necessary to consider noise insulation or temporary rehoming.
- 6.12.4. The levels of construction vibration are unlikely to lead to a significant effect, but will be assessed when data is available.
- 6.12.5. The operational assessment considered the changes in noise due to traffic and Scheme layout, in both the short term and long term. Mitigation was included in the assessment where possible, to improve noise levels in NIA.
- 6.12.6. It was determined that a potential significant adverse noise effect was only predicted on Stoke Road, due to minor increases in noise where noise levels already exceed the SOAEL threshold. As this road is outside the Scheme boundary, additional work will be required to investigate the potential for noise mitigation at these properties for the ES.
- 6.12.7. In addition to the adverse impacts predicted, there were 732 noise benefits of a 1dB+ change in areas which exceeded the SOAEL threshold, plus 17 properties with a moderate noise benefit due to the Scheme.
- 6.12.8. The cumulative assessment was broadly similar, with additional properties on Telstar Way affected by moderate increases in noise due to the Scheme and the Scheme dependent development.

The discipline specific chapters of this PEIR have been produced as separate documents.

7. Biodiversity
8. Road Drainage and the Water Environment
9. Landscape and Visual
10. Geology and Soils
11. Cultural Heritage
12. Materials and Waste
13. Population and Human Health
14. Climate
15. Cumulative Effects Assessment

Appendices

Appendix 6.1 – Noise chapter figures

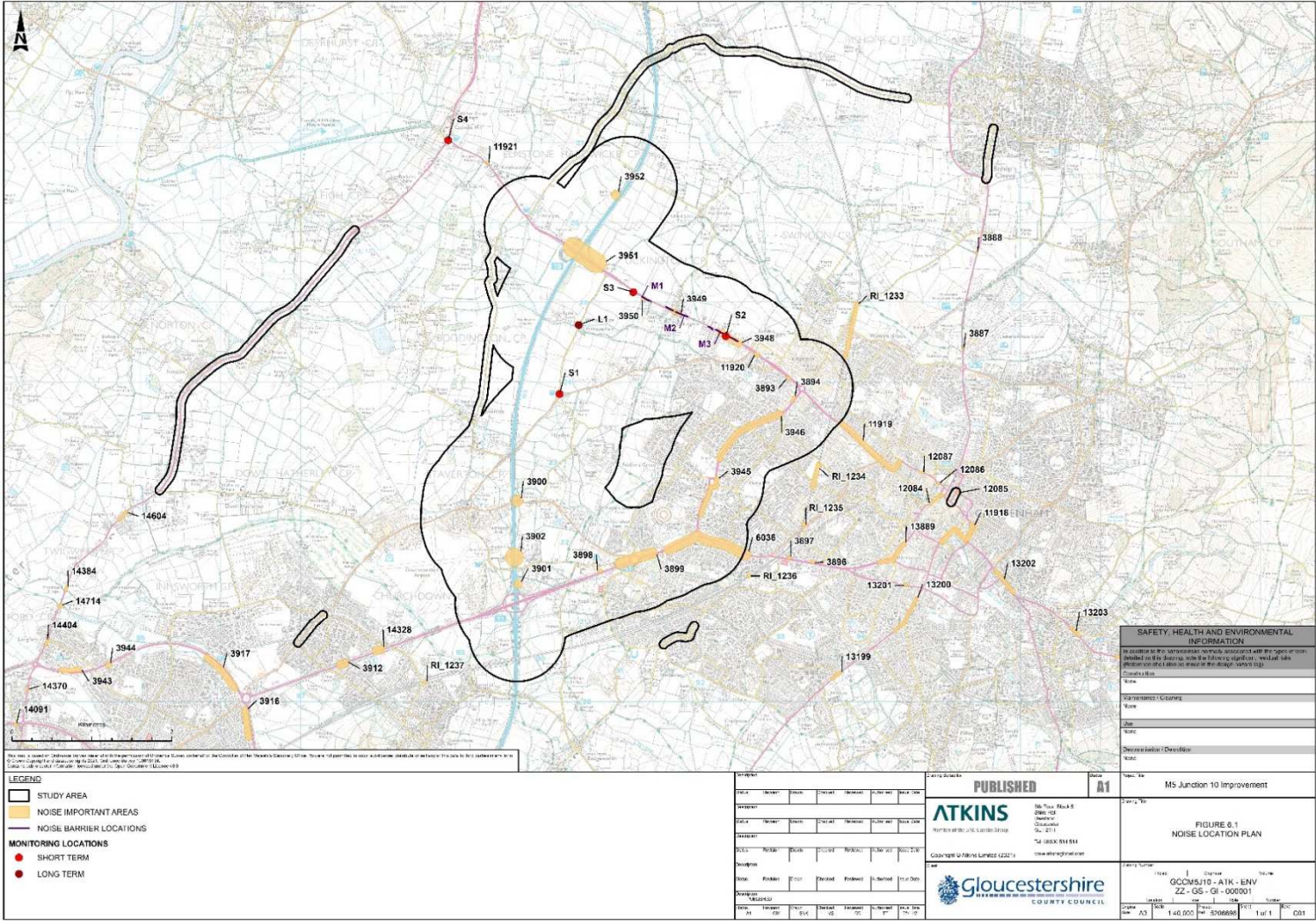


Figure 6-1 – Noise Location Plan

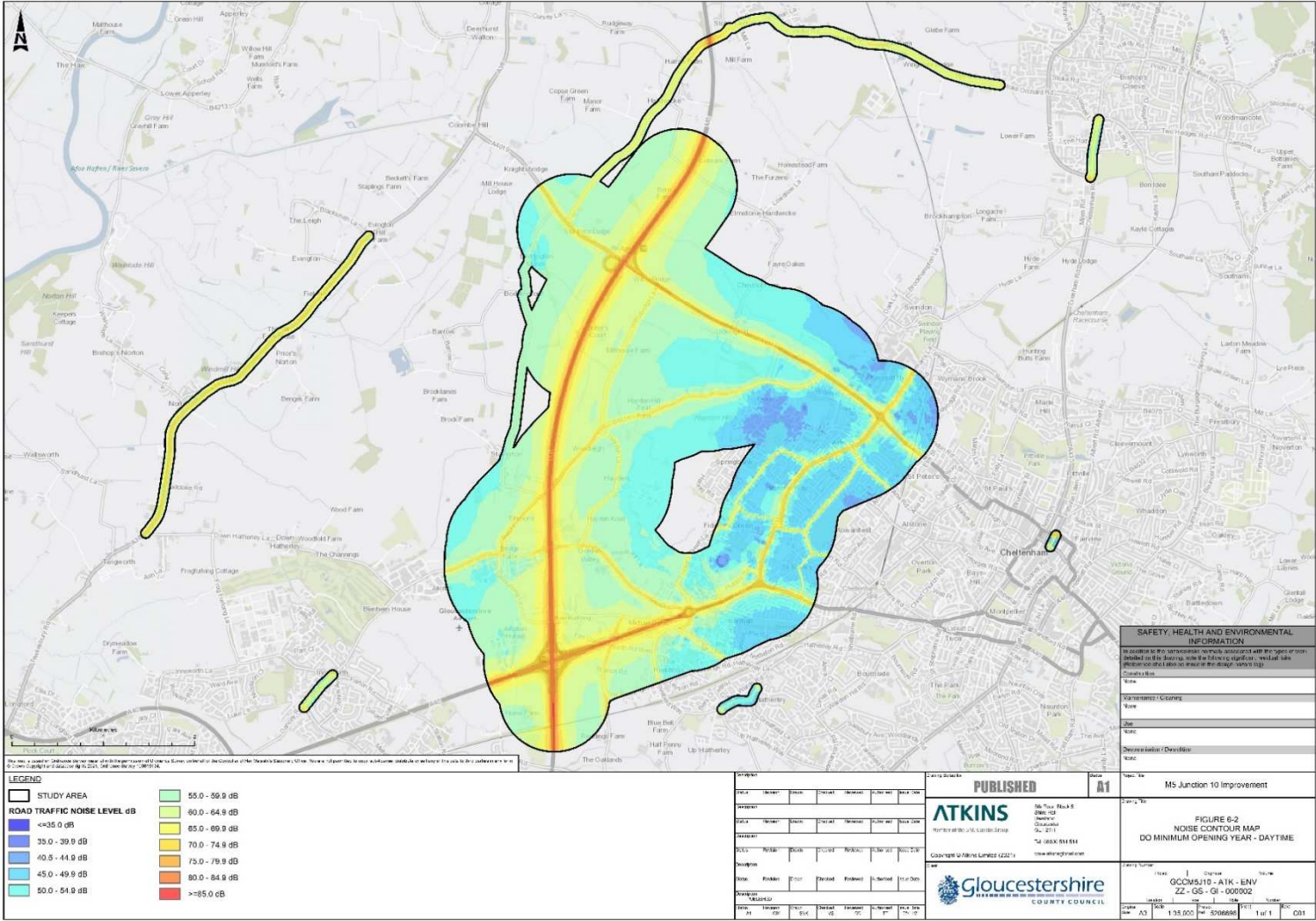


Figure 6-2 – Noise Contour Map – Do Minimum Opening Year – Daytime

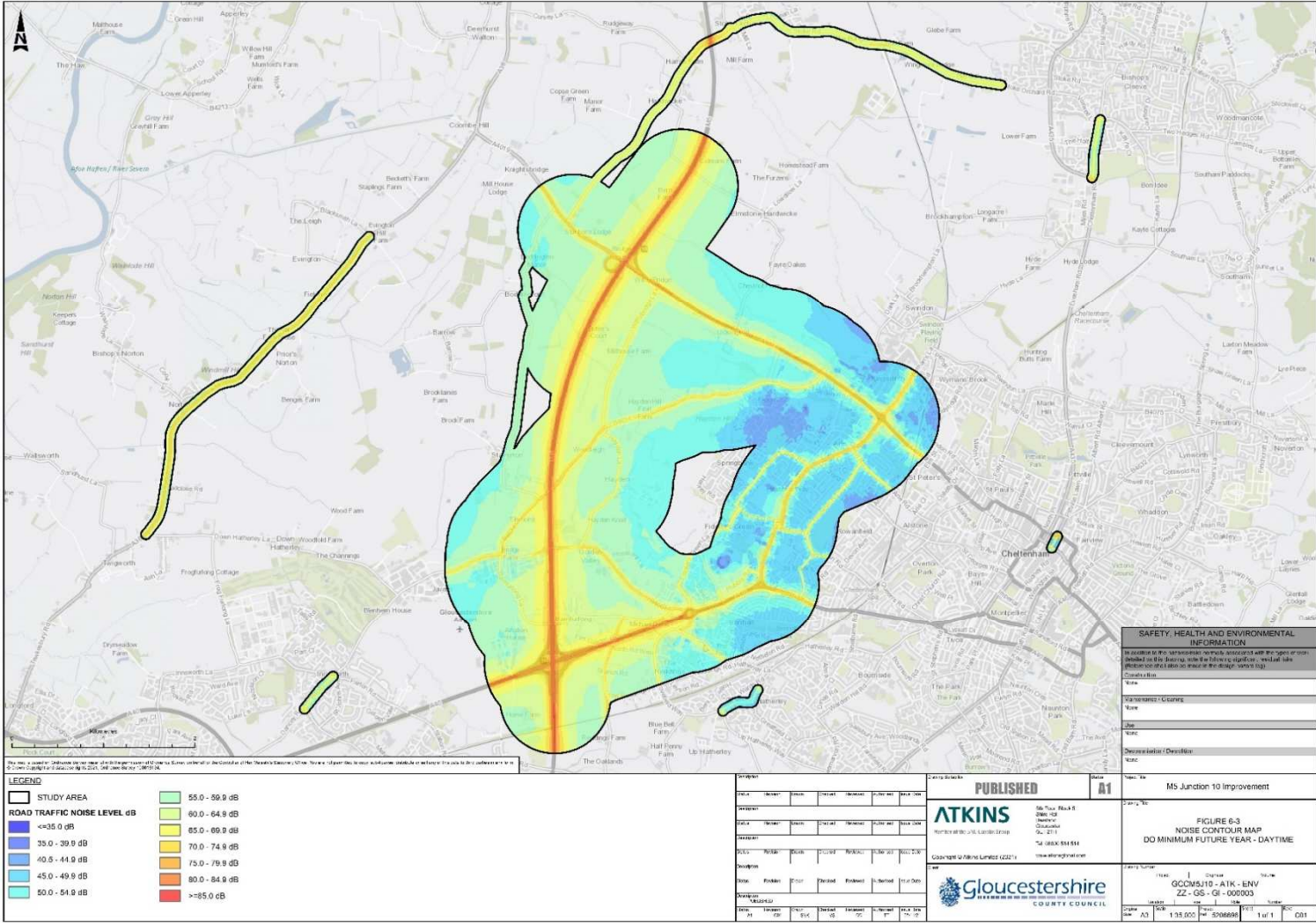


Figure 6-3 – Noise Contour Map – Do Minimum Future Year – Daytime



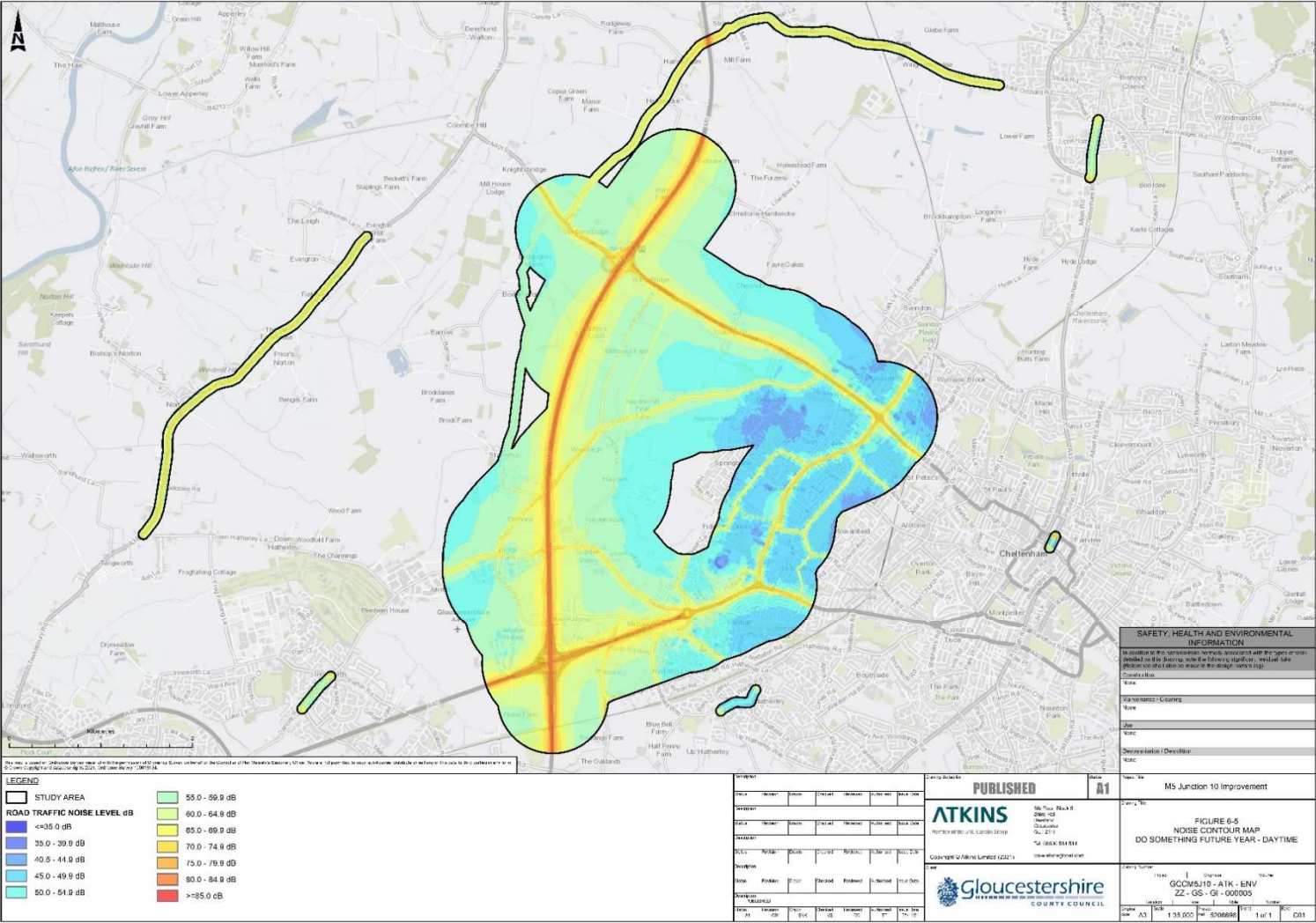


Figure 6-5 – Noise Contour Map – Do Something Future Year – Daytime

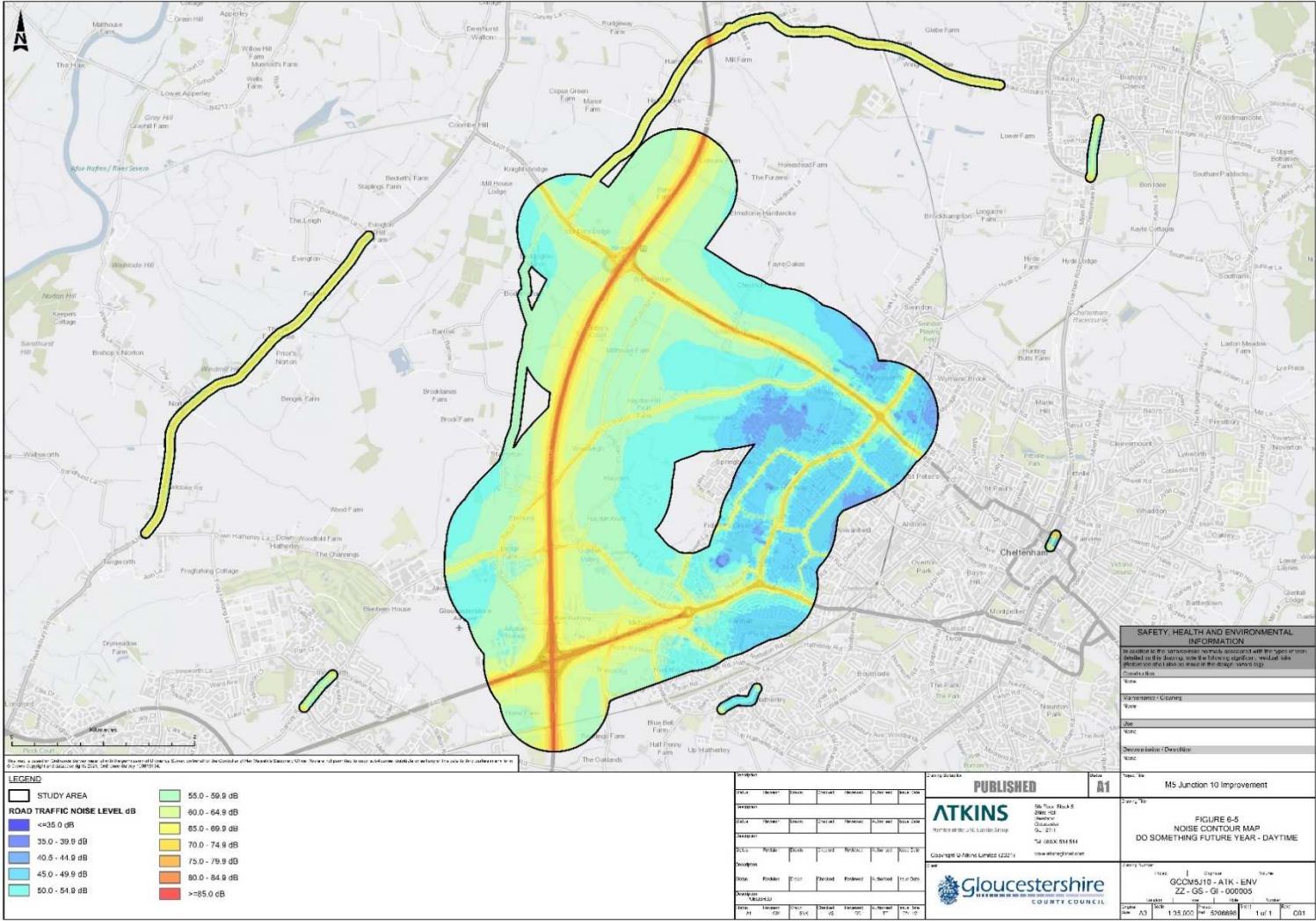


Figure 6-6 – Noise Contour Map – Do Something Future Year Cumulative – Daytime







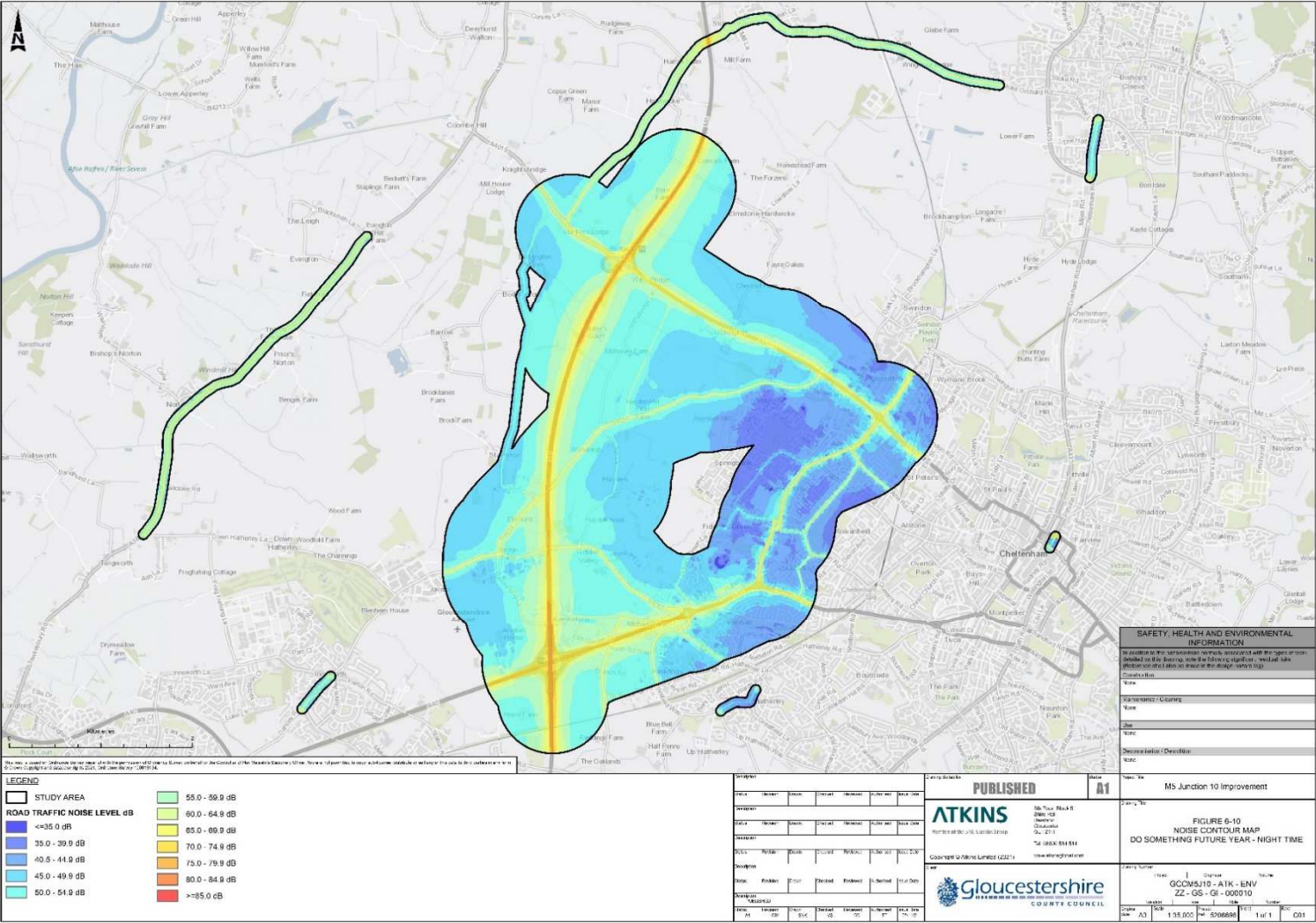


Figure 6-10 – Noise Contour Map – Do Something Future Year – Night Time



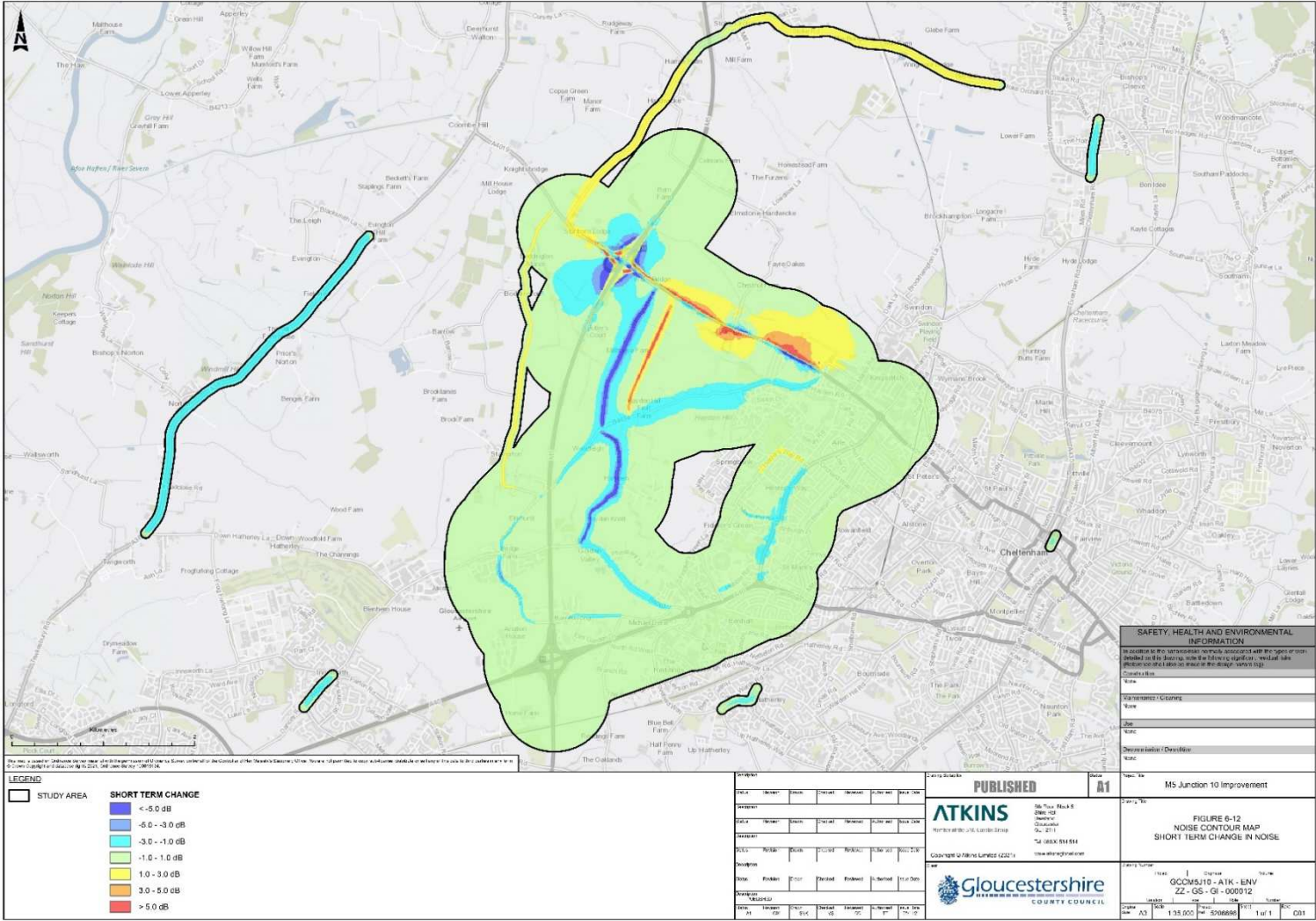


Figure 6-12 – Noise Contour Map – Short Term Change in Noise









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