TRANSPORT

LCC 05(ii)

Scheme Name:
North Hykeham Relief Road

Promoting Authority:
Lincolnshire County Council

Orders:
The Lincolnshire County Council (A1461 North Hykeham Relief Road) Compulsory Purchase Order 2024; and **The Lincolnshire County Council (A1461 North Hykeham Relief Road) (Classified Road) (Side Roads) Order 2024.**

Document Reference:
LCC 05(ii)

Subject:
Noise and Vibration

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Date:
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NORTH HYKEHAM RELIEF ROAD

NOISE AND VIBRATION - PROOF OF EVIDENCE

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APPENDICES

1. INTRODUCTION

1.1. My name is Daniel Doherty, and I have prepared this Proof of Evidence in respect of the noise and vibration implications arising from the promotion of the North Hykeham Relief Road (the 'Scheme'), by the promoting authority.

1.2. This Proof of Evidence draws together relevant information in respect of the two Orders, namely The Lincolnshire County Council (A1461 North Hykeham Relief Road) Compulsory Purchase Order 2024 (the 'CPO') **[CD1.1]** and The Lincolnshire County Council (A1461 North Hykeham Relief Road) (Classified Road) (Side Roads) Order 2024 (the 'SRO') **[CD1.2]**. It is not presented in respect of the grant of planning permission, as that is not the purpose of the Inquiry. In terms of the CPO where land is to be acquired for a specific purpose the evidence will address that.

Structure of this Proof

1.3. This Proof of Evidence is set out as follows:

- In this section, I provide my professional details, qualifications and experience.
- In Section 2, I describe the Scheme and the relevant decisions that were made in relation to noise and vibration.
- In Section 3, I present my assessment of the noise and vibration impacts and effects of the Scheme.
- In Section 4, I draw conclusions in relation to noise and vibration.

1.4. To assist the reader, Appendix LCC 05(ii)A Parts 1 and 2 provide definitions of technical terminology used within this document and typical sound levels for common environments.

About the Author

1.5. My name is Daniel Doherty, and I am a specialist in the fields of acoustics, noise and vibration. I have been a full member of the Institute of Acoustics for 14 years. I hold a Masters degree (with Distinction) in Sound and Vibration Studies from the Institute of Sound and Vibration Research, University of Southampton (2005 to 2006). I also hold a Masters degree in Physics and Astronomy from the University of Sheffield (2000 to 2004).

1.6. I have a total of 18 years' experience in acoustic consultancy. I am currently an Associate Acoustic Consultant and the London lead for acoustics at Ramboll UK and have held this position since mid-2022. Previously, I worked in acoustic consultancy for Mott MacDonald (eight years), for WSP (four years), and for Sweco UK (four years).

1.7. I have completed over 25 noise and vibration impact assessments of highway schemes, typically for Local Authorities, Highways England / National Highways and Transport Scotland. My highway scheme experience in England includes A3 Hindhead, the Norwich Northern Distributor Road scheme, four A47 improvement schemes, and two M25 junction schemes. I have been the technical authority for noise and vibration in the examination of other highway schemes, including Development Consent Order (DCO) hearings for the A47 Blofield to North Burlingham scheme (for Norfolk County Council and Galliford Try).

1.8. I frequently apply the Design Manual for Roads and Bridges (DMRB, Ref. NV1, NV2, NV3) **[CD6.1]** in assessing developments that influence traffic on road networks. The DMRB is the UK standard methodology for assessing noise and vibration impacts of road schemes

1.9. I also frequently apply British Standard (BS) 5228 'Code of practice for noise and vibration control on construction and open sites' (Ref. NV4, NV5) **[CD6.21]** which is the key BS for assessing noise and vibration from demolition and construction activity. I defined project-specific adaptations of the BS when mediating in matters relating to noise impacts on a historic 5* luxury hotel in Westminster that arose from construction of an adjacent development.

1.10. I have been involved in the Scheme since 2022. I was the main author of the Chapter 12 of 2023 Environmental Statement (ES) **[CD7.1]**, titled 'Noise and Vibration', which accompanied the planning application. During the EIA period, I had following duties:

- Defining the scope of baseline noise monitoring and ensuring the survey was carried out to best practice standards;
- Carrying out and/or managing the noise and vibration assessments and liaison with the EIA team in relation to findings;
- Proposing suitable mitigation measures, where appropriate;
- Responding to relevant design changes during the EIA period; and
- Writing ES Chapter 12, presenting the residual effects of the Scheme.

2. THE DEVELOPMENT OF THE SCHEME

The Scheme

2.1. The Scheme comprises construction of an 8km of dual all-purpose carriageway with a 70mph speed limit (120kph design speed) between the A46 Hykeham Roundabout and the A15 Sleaford Road Roundabout at the end of the Lincoln Eastern Bypass. The Scheme also includes associated structures, earthworks, drainage, street lighting, traffic signals, utility diversions and installations, pipeline diversion, temporary materials processing, landscaping, and highway features.

2.2. The Scheme incorporates measures to mitigate environmental effects. In relation to road traffic noise, the mitigation measures embedded into the design are:

- Provision of a low noise road surface material for most of the dual carriageway; and
- Provision of acoustic barriers to reduce the propagation of road traffic noise to South Hykeham, Station Road, Grange Farm and to dwellings and land near the Sleaford Road.

2.3. To facilitate the construction and operation of the Scheme, including the acoustic barriers, it includes the acquisition of land and the alteration of the local road network, as described in the two Orders **[CD1.1 & CD1.2]**.

2.4. The assessment of noise and vibration resulting from the construction and operation of the Scheme was reported in ES Chapter 12 **[CD7.1]**, supported by four Technical Appendices and ten Figures. The locations of the embedded noise mitigating measures were shown in ES Volume 4 Figure 12.2 **[CD7.1]** and the Scheme general arrangements. The relevant figures are presented within Appendix LCC 05(ii)A Part 4 of this Proof of Evidence.

2.5. The method of assessment which resulted in these mitigation measures being embedded into the scheme design is set out in Section 3 of this Proof of Evidence. In summary:

- During the EIA period, I identified the potential for significant road traffic noise effects due to the Scheme.
- For this reason, a technical note was provided to the design team and Council with the recommendation that a low noise surface is embedded into the Scheme design, along with acoustic barriers in key locations. These were subsequently adopted into the Scheme design.
- Road traffic noise modelling was used to test the optimum positioning and extent of acoustic barriers. For example, in the vicinity of Station Road acoustic barriers were tested at the top of the cutting slope (further from the carriageway) and the bottom of the cutting slope (closer to the carriageway).
- Subsequent to the production of the ES, the design of the Scheme was amended to incorporate two additional acoustic barriers. These were proposed between the Grantham Road junction and the Sleaford Road

junction. These changes were made at the discretion of Lincolnshire County Council.

- The noise impacts of incorporating the two additional acoustic barriers were evaluated within the ES Addendum for Noise and Vibration **[CD7.1]**, which concluded the noise and vibration effects of the Amended Scheme remained the same as those within the ES.

2.6. Planning permission for the Scheme was granted originally in May 2024 and was issued subject to planning conditions. Subsequently, in early 2025, a Section 73 variation **[CD7.2]** was issued to the original planning consent, although that is of no direct relevance to noise and vibration (as it related to the geographic extent of one ecological survey).

2.7. The Scheme is to be carried out in accordance with the planning permission granted, supported as it is by the contents of the ES, Regulation 25 **[CD7.1]** information and approvals of details via the discharge of conditions. Planning condition 24 secures the implementation of a low noise surface. Planning condition 31 secures the provision of acoustic barriers.

2.8. Purpose-built acoustic barriers embedded in the Scheme design will achieve the acoustic performance (dB, insertion loss) specified in ES Table 12.24 **[CD7.1].** The detailed design of these acoustic barriers was informed by road traffic noise modelling of the Scheme and takes account of barrier offset from the carriageway edge and height.

Traffic Data

2.9. Since the ES was completed, as part of preparation of the business case for the Scheme, updated traffic data for the Core Scenario was provided by the Transport Consultant.

2.10. The business case has included consideration of road traffic noise from all roads within the study area. As part of this work, the likely operational noise effects have been evaluated for the Core Scenario ('Updated Core Scenario') and compared to ES Chapter 12 (the 'ES Core Scenario') **[CD7.1]**.

2.11. A summary of the findings is presented in Appendix LCC 05(ii)A Part 3. This demonstrates that, when accounting for the Updated Core Scenario traffic data, the residual operational effects of the Scheme are slightly better than those presented in ES Chapter 12 (ES Core Scenario) **[CD7.1]**. It is concluded that the number of receptors experiencing significant beneficial effects due to the Scheme is greater than the number of receptors experiencing significant adverse effects due to the Scheme. This is an improvement on the conclusions of ES Chapter 12 **[CD7.1]**.

3. ASSESSMENT OF SCHEME PROPOSALS

3.1. In evaluating the likely effects of the Scheme, it is necessary to refer to relevant policy and the methodology and assumptions stated within the ES **[CD7.1]** and supporting documents. These is set out in the first three parts of this section.

3.2. The following sections then present my opinion on the likely effects of the Scheme (a) during the demolition and construction stage; and (b) once the Scheme is operational.

3.3. Planning Permission for the Scheme has been with consent given in May 2024 **[CD7.1]** and a Section 73 consent in January 2025 **[CD7.2]**. The planning policy that applied at the time consent was issued was followed as is the necessary approach. The position has, however been updated since and this proof will consider matters as they apply at the time of the inquiry.

Relevant Policy Requirements

3.4. The National Planning Policy Framework (Ref. NV5) **[CD3.5]**, updated since the publication of the ES **[CD7.1]**, requires that planning policies and decisions should "*contribute to and enhance the natural and local environment*" and prevent "*new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of … noise pollution…".* It is also national policy to "*mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and quality of life*".

3.5. The NPPF refers to the Noise Policy Statement for England (Ref. NV6) **[CD3.16]**, which states the following aims "*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible contribute to the improvement of health and quality of life".*

3.6. The policy document introduces the concept of effect levels which are to be considered in the assessment of noise impact, as follows:

- No Observed Effect Level (NOEL): 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 noise.
- Lowest Observed Adverse Effect Level (LOAEL): The level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL): The level above which significant adverse effects on health and quality of life occur.

3.7. LOAEL and SOAEL values for each type of noise or vibration impact were defined within ES Chapter 12.

3.8. The Central Lincolnshire Local Plan (Ref. NV7) **[CD4.1]** contains general objectives or policies that are relevant to noise and vibration, as follows.

- Objective 8: Pollution: "To minimise pollution (air, noise and light) and improve air quality".

- Policy S53: Design and Amenity requires that development (not infrastructure) does "*Not result in adverse noise and vibration taking into account surrounding uses …*".
- Policy S69 requires that developers of the Lincoln Sustainable Urban Extension areas "*take account of the relationship between the site and the Lincoln Eastern Bypass […] ensuring that proposed residents are protected from noise […] that may be associated with the bypass*".

3.9. The LCC Local Transport Plan (Ref. NV8) **[CD4.3]** contains the following policies that are relevant to noise and vibration from the Scheme:

- Policy SH4: "Working in partnership we will seek to reduce … noise pollution created by the transport system. The focus will be areas … where impacts are felt by significant populations."
- "In new developments, we will seek to design out issues related to air, noise and light pollution using suitable materials and infrastructure to reduce the negative impact of transport".
- "Through the strategic development management process seeks the reduction in transport caused air, noise and light pollution by seeking suitable mitigation including through the use of travel plans to support more active travel."

Method of Assessment

3.10. The method of assessment applied during the EIA and since was presented in the EIA Scoping Report for the Scheme **[CD7.1]**. In summary, the methodology within DMRB LA111 **[CD6.1]** has been applied, accounting for the key assumptions set out below.

3.11. The applied method distinguishes between the *impacts* of the Scheme (the noise or vibration level) and the likely noise and vibration *effects* of the Scheme (e.g. effects of noise on humans, for example, annoyance, perception of change).

3.12. The noise and vibration impacts arising from the construction phase of the Scheme were evaluated at 12 representative receptor groups. Effect levels were determined to the BS 5228 **[CD6.21]** ABC Method which accounts for the baseline noise conditions at each receptor groups. Construction noise and vibration impacts were then predicted using the BS 5228 methodologies, and the assumptions set out below. Appropriate mitigation was then defined to reduce the impacts at receptor groups where the SOAEL would otherwise be exceeded.

3.13. The road traffic noise impacts of the Scheme for both the construction phase and operational phase, such as the changes in road traffic noise at a receptor, were predicted using the CRTN (Ref. NV9) **[CD6.55]** methodology, and the assumptions set out below. The assessment was iterative and used to evaluate mitigation measures in specific locations with the aim of avoiding or minimising the likely significant adverse effects of the Scheme.

3.14. The predicted operational noise impacts presented in ES Chapter 12 **[CD7.1]** included the effects of noise mitigation measures embedded into the Scheme design. The resulting effects of road traffic noise at individual receptors were then assessed in accordance with DMRB LA111 **[CD6.1]**. The evaluation of whether a significant effect occurs included consideration of the change in road traffic noise (with and without the Scheme), as well as the road traffic noise level expected in each scenario and followed Table 3.60 of DMRB LA111 **[CD6.1]**.

Key Assumptions

3.15. The ES assessments of noise and vibration incorporate the assumptions set out within this section.

3.16. In relation to the construction stage, assumptions about how the Scheme would be constructed were defined using information from the Contractor. This comprised the expected method of construction, the expected items of plant and machinery that would be used for each activity, the proportion of normal construction hours when this plant/machinery would be in operation and the likely noise output of the plant machinery. These were confirmed through multiple workshops during the EIA period and were presented in ES Chapter 12 Section 12.3 and ES Volume 3 Technical Appendix 12.4 **[CD7.1]**.

3.17. Construction noise and vibration predictions accounted for the expected location of each noise or vibration source. This included consideration of static sources (such as site compound generator or compactors), mobile sources moving within compounds (such as earth movements and treatment), mobile sources moving along haul routes (such as the transport of materials) and mobile sources moving within the Scheme corridor (such as earthworks, compaction, road surface construction). Construction noise and vibration predictions were precautionary in terms of the distance between the activity and receptor group. Noise impacts were predicted for activity at the closest point to the receptor as well as at a more typical distance (such as the centre-line of the Scheme). Vibration impacts were predicted for the activity at the closest point to the receptor.

3.18. The assessment of construction noise effects accounts for the existing noise climate at each sensitive receptor group. This was quantified through a thorough baseline noise survey (comprising 12 monitoring positions with each monitor in place for at least one week).

3.19. Construction vibration predictions were carried out for vibratory compaction and vibratory piling. These activities were deemed most likely to result in the highest level of vibration during construction of the Scheme. Construction vibration levels were presented as the reasonable worst-case level for which there was a 33% probability that the vibration level, mm/s, from the activity would exceed the stated value during the works.

3.20. Assessments of road traffic noise require the use of road traffic flow data for relevant scenarios. This data is an underlying assumption that influences the predicted road traffic noise effects. Details of the traffic data used were presented in ES Chapter 12 Table 12.11 **[CD7.1]**. The traffic flows used during the EIA were provided by the Transport Consultant for the Core Scenario (the 'ES Core Scenario').

3.21. The assessment of road traffic noise employed the use of a 3D road traffic noise model. This model was based on the input data stated within ES Chapter 12 Table 12.11 **[CD7.1]** and included the ground profile, building mapping, and building use-class data available during the EIA **[CD7.1]**.

3.22. The assessment of operational road traffic noise incorporates the effects of noise mitigation measures embedded into the Scheme design, comprises the use of a low noise surface and acoustic barriers in key areas.

Scheme Residual Effects: Temporary Effects

3.23. Mitigation to reduce the likelihood of adverse effects during the construction stage comprises:

- engaging in effective community liaison;
- application of Best Practicable Means for the works and applying specific ways of working;
- limiting the majority of works to the daytime, and carrying out further assessments of noise and vibration for any night works;

- provision of temporary acoustic barriers in key locations during key phases of works; and
- monitoring of noise and vibration at positions representing receptors in Station Road and South Hykeham during key phases of works, to include real-time alerts and Contractor response should thresholds be exceeded during the works.

3.24. The commitments for temporary acoustic barriers for the construction stage were set out within ES Chapter 12 Table 12.23 **[CD7.1]**.

3.25. Following implementation of these mitigation measures, the likelihood of adverse effects due to construction noise is reduced, as far as deemed practicable. Construction noise was expected to result in likely significant adverse residual effects (temporary, medium-term, direct & reversible) for the following works only, primarily due to proximity to the Scheme:

- Earthworks in the vicinity of 6 Wath Lane and South Hykeham Community Primary School; and
- Road removal works and earthworks in the vicinity of Station Road dwellings.

3.26. The effects of construction noise at all other receptors were not expected to be significant.

3.27. In relation to the effect of construction vibration (in terms of human perception) the residual effects were not expected to be significant.

3.28. In relation to road traffic noise effects during the construction stage, no significant effects were expected on all proposed routes with the exception of Wath Lane. Temporary significant effects were expected to arise at sensitive receptors adjacent to Wath Lane. These effects occur as road traffic noise from Wath Lane would change by a perceptible margin due to the quiet nature and low-traffic nature of this road.

3.29. Additional residual significant effects were expected to occur at receptors near to diversion routes for surfacing works at the A46 junction (western extent of the Scheme), tie-in works at the proposed South Hykeham Road junction and at the proposed Brant Road junction. These were expected to occur for three weeks of night-time closures for each location.

3.30. Since the publication of the ES **[CD7.1]**, additional assessments of construction noise have been carried out. These assessments have informed the form and positioning of temporary barriers to be implemented during the construction stage. This information was required to be submitted in relation to planning condition 3 **[CD7.1]**.

Scheme Residual Effects: Permanent Effects

3.31. Mitigation to reduce the likelihood of adverse effects due to changes in road traffic noise comprises provision of a low noise surface material and acoustic barriers in key areas. As noted in Section 2, this mitigation was developed to reduce the operational noise impacts that would otherwise occur.

3.32. The Scheme incorporates acoustic barriers to reduce the operational noise impacts at South Hykeham (for receptors north of Scheme) and Station Road (for receptors both sides of Scheme), as presented in Appendix LCC 05(ii) Part 4 Figure 1. Additional acoustic barriers were later embedded into the design at the discretion of the Council, located at Grange Farm (north of Scheme) and on the approach to the Sleaford Road roundabout (north of the east end of the Scheme) as presented in Appendix LCC 05(ii) Part 4 Figures 2 to 4.

3.33. As noted in Section 2, road traffic noise modelling was used to test the optimum positioning and extent of the acoustic barriers presented in ES Chapter 12 **[CD7.1]**. The acoustic barriers ultimately embedded into the Scheme design were a compromise between optimum noise benefit and other design constraints (such as earth slope profiles, landscape-visual impact). In locations where sufficient land was available, the acoustic barrier is to be formed of an earth bund. In other locations with space constraints (such as drainage features), the acoustic barrier is to be formed of a purpose-built acoustic fence (e.g. timber fence of sufficient specification, see Appendix LCC 05(ii)A Part 1). The acoustic performance requirements of the acoustic barriers are specified in ES Chapter 12 Table 12.24 **[CD7.1]**.

3.34. Most of the Scheme dual carriageway will incorporate a low noise surface, as presented in green within Appendix LCC 05(ii) Part 4 Figure 1. The acoustic performance requirements of this surface material are specified in ES Chapter 12 para 12.6.19 **[CD7.1]**.

3.35. The changes in road traffic noise that result from the Scheme were reported in accordance with DMRB LA 104 **[CD6.1]** and DMRB LA111 **[CD6.1]**. Predicted changes in road traffic noise include the embedded noise mitigation measures described above.

3.36. In summary, over the long-term, the Scheme would result in road traffic noise decreases of 5 dB or more at 233 dwellings, balanced against road traffic noise increases of 5 dB or more at 263 dwellings. These changes in road traffic noise are classed as "moderate" or "major" when applying the DMRB LA111 **[CD6.1]** methodology.

3.37. When evaluating the likely road traffic noise effects, it is important to consider not only the change in road traffic noise (with and without the Scheme), but also the road traffic noise level expected in each scenario (with and without the Scheme). This is fundamental to the DMRB methodology and the consideration of context, as per Table 3.60 of DMRB LA111 **[CD6.1]**.

3.38. Once all relevant context and local circumstances were accounted for, the following residual effects were expected:

- Significant beneficial residual effects (permanent, long-term, direct & irreversible) due to redistributed traffic at a total of 252 dwellings and 4 non-residential receptors. These receptors are primarily located in Bracebridge Heath.
- Significant adverse residual effects (permanent, long-term, direct & irreversible) due to redistributed traffic at a total of 226 dwellings and 2

non-residential receptors. These are primarily located along the B-roads between the A15 at Waddington to the A158 at Horncastle Bracebridge Heath.

- Significant adverse residual effects (permanent, long-term, direct & irreversible) due to road traffic noise from the Scheme itself (with embedded mitigation) at a total of 49 dwellings.

3.39. The assessment also identified that no properties are expected to be eligible for insulation under the Noise Insulation Regulations.

3.40. Since the publication of the ES, additional assessments of road traffic noise have been carried out, as detailed in Section 2. These assessments have informed the form and positioning of the permanent acoustic barriers to be implemented. This information was required to be submitted in relation to planning condition 31 **[CD7.1]**.

4. SUMMARY AND CONCLUSIONS

Summary

4.1. The planning application for the Scheme included an extensive and comprehensive Environmental Statement. The ES **[CD7.1]** reported the outcome of environmental impact assessment, including in relation to noise and vibration resulting from the construction and operation of the Scheme.

4.2. The noise and vibration assessments were carried out in accordance with best practice methods and the guidance set out by the Department for Transport in the Design Manual for Roads and Bridges **[CD6.1]**, and followed the approach agreed through the EIA scoping process.

4.3. The assessments were informed by a thorough baseline noise survey that was appropriate in duration and spatial extent.

4.4. Key assumptions were presented within the ES **[CD7.1]** documents for transparency and the precautionary principle was adopted when predicting noise and vibration impacts in the context of uncertainty.

4.5. Noise mitigation measures were developed and incorporated into the Scheme design, optimised through iterative assessment, with the aim of avoiding or minimising the likely significant adverse effects.

4.6. Mitigation measures for construction noise and vibration include the application of Best Practicable Means of noise control, provision of temporary acoustic barriers, community liaison and proactive monitoring of noise and vibration in the most impacted areas of Station Road and South Hykeham.

4.7. Mitigation measures for road traffic noise comprise the provision of a low noise surface material and acoustic barriers in key areas. Proposals for acoustic barriers were developed accounting for local circumstance, with specification and location optimised for acoustic performance through road traffic noise modelling. In locations where sufficient land was available, the acoustic barrier is to be formed of an earth bund. In other locations with space constraints (such as drainage features), the acoustic barrier is to be formed of a purpose-built acoustic fence.

4.8. Planning permission for the Scheme was granted originally in May 2024 **[CD1.1]** and was issued subject to planning conditions. Subsequently, a Section 73 variation **[CD1.2]** was issued to the original planning consent, but this had no influence on the noise and vibration impacts and effects of the Scheme. Planning conditions relating to noise and vibration secure the implementation of noise and vibration mitigation measures detailed above. The mitigation will achieve the acoustic performance requirements specified within ES Chapter 12 **[CD7.1]**.

4.9. With the mitigation measures incorporated into the construction and design of the Scheme, some significant effects are likely to remain, both in terms of adverse effects during the construction stage and beneficial and adverse effects during the operational stage.

Construction Stage Residual Effects

4.10. With mitigation, significant effects due to daytime construction noise are expected during a limited number of construction phases. These are expected at dwellings and a school in South Hykeham and at some dwellings in Station Road.

4.11. Temporary significant effects are expected due to construction traffic noise. These are expected at dwellings near Wath Lane (South Hykeham) and those near temporary diversion routes for tie-in works at three junctions.

Operational Stage Residual Effects

4.12. Beneficial road traffic noise effects are expected in areas such as Bracebridge Heath, parts of Waddington and the villages south of the Scheme. These effects would occur due to the redistribution of traffic with the Scheme.

4.13. Adverse road traffic noise effects are expected in areas such as South Hykeham, parts of Station Road and near to the B roads between the A15 at Waddington and the A158 at Horncastle. These effects would occur either due to the Scheme itself or due to the redistribution of traffic with the Scheme.

Conclusions

4.14. Adverse effects due to construction noise are expected due to proximity of some works to sensitive receptors, and due to the relatively quiet baseline noise climate for some receptors. Construction noise and vibration monitoring and proactive response by the Contractor will help to minimise the likelihood of adverse effects occurring in practice.

4.15. The majority of the road traffic noise effects would occur due to the redistribution of traffic as a result of the Scheme. While significant adverse effects are expected, this is not unusual for a Scheme of this nature and should be considered within the context of sustainable development and weighed against the other environmental, economic and social effects of the Scheme.

4.16. It is concluded that proportionate and reasonable actions have been taken to avoid the majority of the expected significant adverse effects on health and quality of life that would result from noise and vibration associated with the Proposed Scheme. This is considered to be consistent with the relevant objectives of the National Planning Policy Framework **[CD3.5]**, Noise Policy Statement for England **[CD3.16]**, and Planning Practice Guidance on noise **[CD3.12]**.

4.17. There are no developments in design or changes to policy since permission was granted that change the conclusions of the ES (and accompanying documents) for noise and vibration.

APPENDIX LCC 05(ii)A

APPENDIX LCC 05(ii)A-1: NOISE AND VIBRATION TERMINOLOGY

4.18. This Proof of Evidence includes the use of technical terminology. To assist the reader, these terms are defined below.

Term	Definition
A-weighting	A process of weighting the observed sound pressure level at each frequency band, to mimic the sensitivity of the human ear to sounds of different frequencies. A-weighted sound pressure levels are expressed as dB(A) or dB L_{Ap}.
Acoustic barrier	Design feature embedded specifically to reduce the propagation of sound from source to receptor. Can be formed of either an earth bund or a purpose-built acoustic barrier (e.g. a timber fence of sufficient mass and suitable construction).
Ambient sound level	The total sound pressure level in a given position from all surrounding sources of noise, both near and far.
Construction noise	Noise arising from construction (or demolition) activities, plant and machinery.
Decibel	The unit of measurement for sound pressure levels.
Do-minimum	The do-minimum scenario includes and changes to the highways infrastructure that would occur even if the project does not go ahead, and any other developments in the surrounding area that would influence the movement of traffic.
Do-something	The do-something scenario includes changes in traffic flows caused by the project as well as any other developments in the surrounding area that would influence the movement of traffic.
$L_{A10,T}$	The A-weighted sound pressure level exceeded during 10% of the time interval, T. This is the standard index used within the UK to describe traffic noise.
$L_{A10,18hr}$	The arithmetic average of the A-weighted sound pressure levels exceeded for 10% of each hour, dB $L_{A10,1hr}$, determined between the hours of 06:00 and 24:00. This is the standard metric used in the UK to describe daytime road traffic noise.

Term	Definition
$L_{Aeq,T}$	The equivalent continuous A-weighted sound pressure level over a time interval, T.
Long-term	Noise change based on the +15 year assessment (for example Do-minimum opening year scenario (DMOY) against Do-minimum future year scenario (DMFY) and DMOY against Do-something future year scenario (DSFY)).
LOAEL	Lowest observed adverse effect level. Level above which adverse effects on health and quality of life can be detected.
Low noise surface	A road surface material that results in a lower level of road traffic noise when compared to a hot rolled asphalt surface under the same traffic conditions.
Noise	Unwanted or undesirable sounds observed by a listener.
Opening year	The first year of operation of the project.
Road traffic noise	Noise arising from the use of a road including the contribution from individual vehicles (engine and exhaust noise, aerodynamic noise) and from the road/tyre interface.
Sensitive receptor	Receptors which are potentially sensitive to noise. Examples include dwellings, hospitals, healthcare facilities, education facilities, community facilities, END quiet areas or potential END quiet areas, international and national or statutorily designated sites, public rights of way and cultural heritage assets.
Short-term	Noise change based on parallel assessment year (for example DMOY against Do-something opening year scenario (DSOY)).
SOAEL	Significant observed adverse effect level. Level above which significant adverse effects on health and quality of life occur.
Sound	The vibration, or oscillation, of particles in a medium, such as air, which may be detected by the human ear.
Sound pressure level	A logarithmic measurement that quantifies the sound pressure at a specified position relative to a reference sound pressure (p_{ref} = 20 µPa). Equal to 20 $\log_{10}$ (p / p_{ref}) and expressed in decibels.
Vibration	A to-and-fro oscillation motion of a particle about a fixed equilibrium position.

APPENDIX LCC 05(ii)A-2: TYPICAL SOUND LEVELS

4.19. To assist the reader, sound pressure levels (SPLs) for typical environments are set out below.

Typical environment or source of sound	**Typical SPL, dB(A)**
Inside a sealed anechoic chamber (acoustic test chamber)	Around 20 or less
A quiet bedroom at night	Around 30
A library	Around 40
A busy office environment	Around 50
Beside an urban street	Around 60
Beside a busy urban trunk road	Around 70
In a cinema during an action sequence; vacuum cleaner in the home	Around 80
Pneumatic drill breaking concrete at a few metres	Around 90
In the audience at a rock concert	Around 100
Dance floor of a modern nightclub	Around 110
Threshold of pain	120

4.20. The sound insulating effect of a building envelope, in terms of residential building constructions within the United Kingdom, is typically as set out below:

- With windows fully open during the peak of summertime, indoor sound levels would be around 5 to 10 dB less than outdoor sound levels;
- With windows partially open for normal ventilation throughout the year, indoor sound levels would be around 10 to 15 dB less than outdoor sound levels;
- With typical single-glazed windows closed and trickle ventilators open, indoor sound levels would be around 20 dB less than outdoor sound levels;

- With typical double-glazed windows closed and acoustic trickle ventilators open, indoor sound levels would be around 30 dB less than outdoor sound levels; and
- For well-insulated modern buildings with enhanced glazing and mechanical ventilation, indoor sound levels could be up to around 45 dB less than outdoor sound levels.

APPENDIX LCC 05(ii)A-3: CORE TRAFFIC COMPARISON FOR NOISE

4.22. As part of the preparation of the business case for the Scheme, additional road traffic noise modelling has been carried out. This has accounted for updated traffic data for the Core Scenario which was provided by the Transport Consultant.

4.23. Preparation of the business case has included consideration of road traffic noise from all roads within the study area. As part of this work, the operational noise assessment has been updated to account for the Updated Core Scenario traffic data. The likely operational noise effects have been evaluated and then compared to ES Chapter 12 (which accounted for the 'ES Core Scenario' traffic data) **[CD7.1]**.

4.24. The findings of this revised assessment are presented in summary in Table A.1 and A.2 below, both in terms of the long-term road traffic noise impacts and the likely road traffic noise effects of the Scheme (Updated Core Scenario).

4.25. Over the long-term, the Scheme (Updated Core Scenario) would result in road traffic noise decreases of 5 dB or more at 233 dwellings, balanced against road traffic noise increases of 5 dB or more at 144 dwellings. These changes in road traffic noise are classed as "moderate" or "major" when applying the DMRB LA111 **[CD6.1]** methodology. This is a reduction in the number of dwellings with adverse changes and no change in the number of dwellings with beneficial changes when compared to the ES Core Scenario.

4.26. When evaluating the likely road traffic noise effects of the Scheme (Updated Core Scenario), the following residual effects are expected:

- Significant beneficial residual effects (permanent, long-term, direct & irreversible) due to redistributed traffic at a total of 488 dwellings and 5 non-residential receptors. These receptors are primarily located in Bracebridge Heath and Station Road.
- Significant adverse residual effects (permanent, long-term, direct & irreversible) due to redistributed traffic at a total of 220 dwellings and 3 non-residential receptors. These are primarily located along the B-roads between the A15 at Waddington to the A158 at Horncastle Bracebridge Heath.
- Significant adverse residual effects (permanent, long-term, direct & irreversible) due to road traffic noise from the Scheme itself (with embedded mitigation) at a total of 58 dwellings.

4.27. In summary, when compared to ES Core Scenario, the Updated Core Scenario results in a small increase in the number of receptors experiencing significant adverse effects due to the Scheme. However, this outweighed by a greater increase in the number of receptors experiencing significant beneficial effects due to the Scheme.

Assessment Summary Tables: Updated Core Scenario

Table A.1: Summary of long-term noise changes, with the Proposed Scheme (Updated Core Scenario)

Scenario/Comparison: Do-Minimum Opening Year 2028 versus Do-Something Future Year 2043						
			Daytime, dB $L_{A10,18hr}$		Night-time, dB $L_{night,outside}$	
Change in Noise Level (dB(A))		Magnitude of Impact	No. of Dwellings (Change vs ES Core Scenario)	No. of non-residential Sensitive Receptors (Change vs ES Core Scenario)	No. of Dwellings (Change vs ES Core Scenario)	No. of non-residential Sensitive Receptors
Increase in noise level dB	<3.0	Negligible	1958 (+558)	12 (+1)	2037 (-547)	N/A
	3.0 – 4.9	Minor	521 (-168)	5 (+1)	452 (-190)	N/A
	5.0 – 9.9	**Moderate**	**118 (-125)**	**3 (-1)**	**112 (-92)**	**N/A**
	>10.0	**Major**	**23 (+3)**	**0 (0)**	**16 (+2)**	**N/A**
No Change	0.0	No Change	10 (-22)	0 (0)	22 (-17)	N/A
Decrease in noise level	<3.0	Negligible	1158 (+14)	8 (-1)	1210 (-18	N/A
	3.0 – 4.9	Minor	216 (+39)	2 (-1)	215 (+83)	N/A
	5.0 – 9.9	**Moderate**	**141 (-62)**	**3 (+1)**	**96 (-72)**	**N/A**
	>10.0	**Major**	**92 (+62)**	**1 (0)**	**77 (+56)**	**N/A**

Table A.2: Summary of Final Operational Significance: Updated Core Scenario

Type of Effect	Effect Significance	No. of Receptors and Location	Location of Receptors with Likely Significant Operational Effects
Adverse	**Significant**	Dwellings: 278 Non-Residential: 3	29 dwellings in South Hykeham. 7 dwellings in Waddington. 14 dwellings near Station Road. 3 dwellings near Somerton Gate Lane. 7 dwellings near South Hykeham Road. 2 dwellings at Grange Farm. 12 dwellings near the A46 Newark Road junction and Thorpe Lane. 13 dwellings adjacent to the A607 near Coleby. 9 dwellings adjacent to Bloxholme Lane. 3 dwellings in Thorpe on the Hill. 179 dwellings adjacent to B roads between the A15 at Waddington to the A158 at Horncastle. 3 NRRs near the A46 Newark Road junction.
Adverse	Not Significant	Dwellings: 2342 Non-Residential: 16	-
No Change	Not Significant	Dwellings: 10 Non-Residential: 0	-

Type of Effect	Effect Significance	No. of Receptors and Location	Location of Receptors with Likely Significant Operational Effects
Beneficial	**Significant**	Dwellings: 488 Non-Residential: 5	68 dwellings near Station Road (further from new routing, or due to redistributed traffic), 2 dwellings near Somerton Gate Lane. 39 dwellings and 1NRR near Manor Lane, High Street and Mere Road, Waddington. 1 dwelling near Mill Lane. 25 dwellings near Coult Avenue. 10 dwellings and 1NRR near Boundary Lane. 99 dwellings and 1 NRR near Heath Road / Clover Road / Meadow Way / Oakdene Avenue / Sycamore Grove in Bracebridge Heath. 58 dwellings and 2 NRRs near Harmston. 74 dwellings near Aubourn / Haddington. 2 dwellings near Thurlby / Bassingham. 110 dwellings in Moor Lane.
Beneficial	Not Significant	Dwellings: 1119 Non-Residential: 9	-

APPENDIX LCC 05(ii)A-4: FIGURES

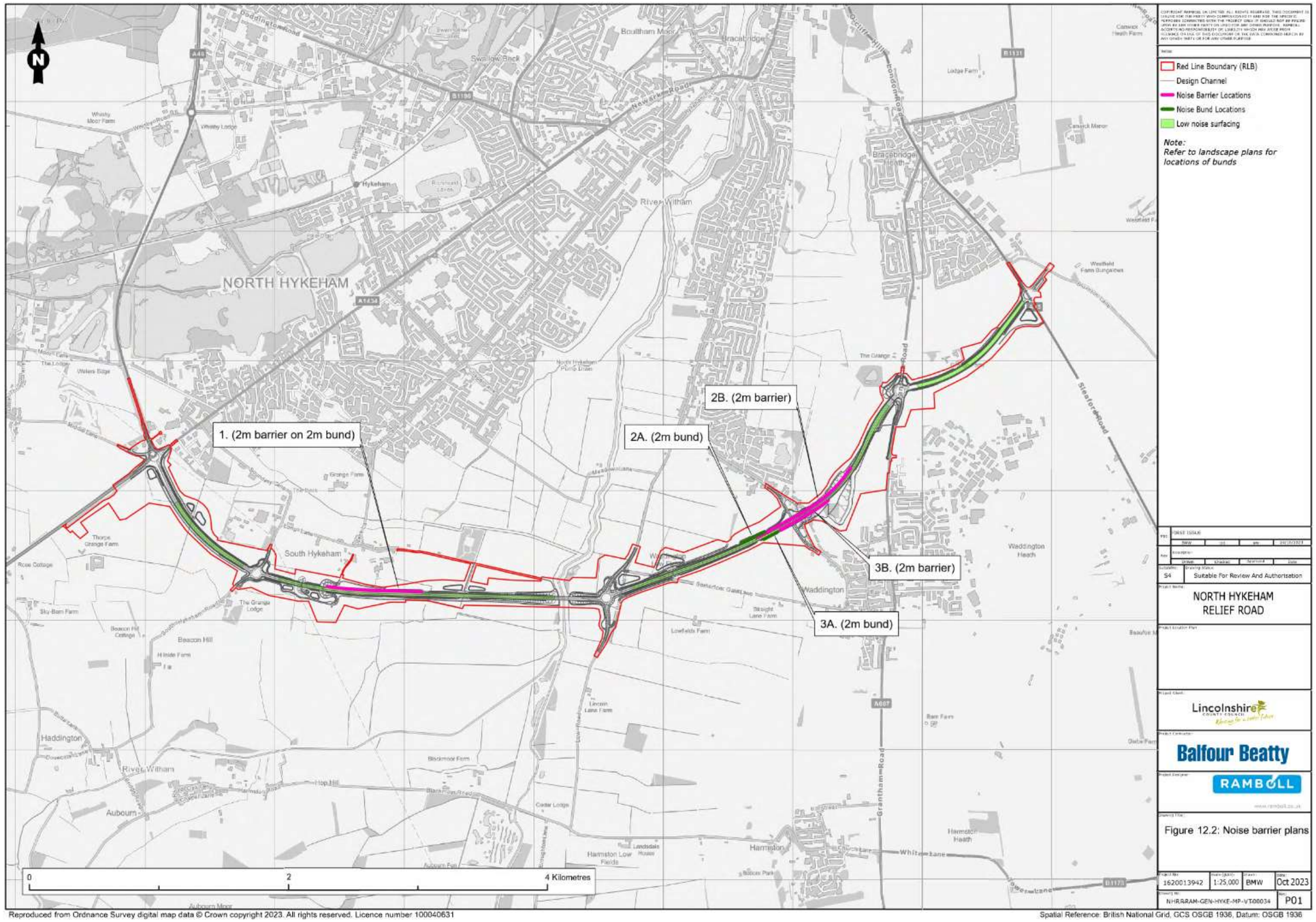
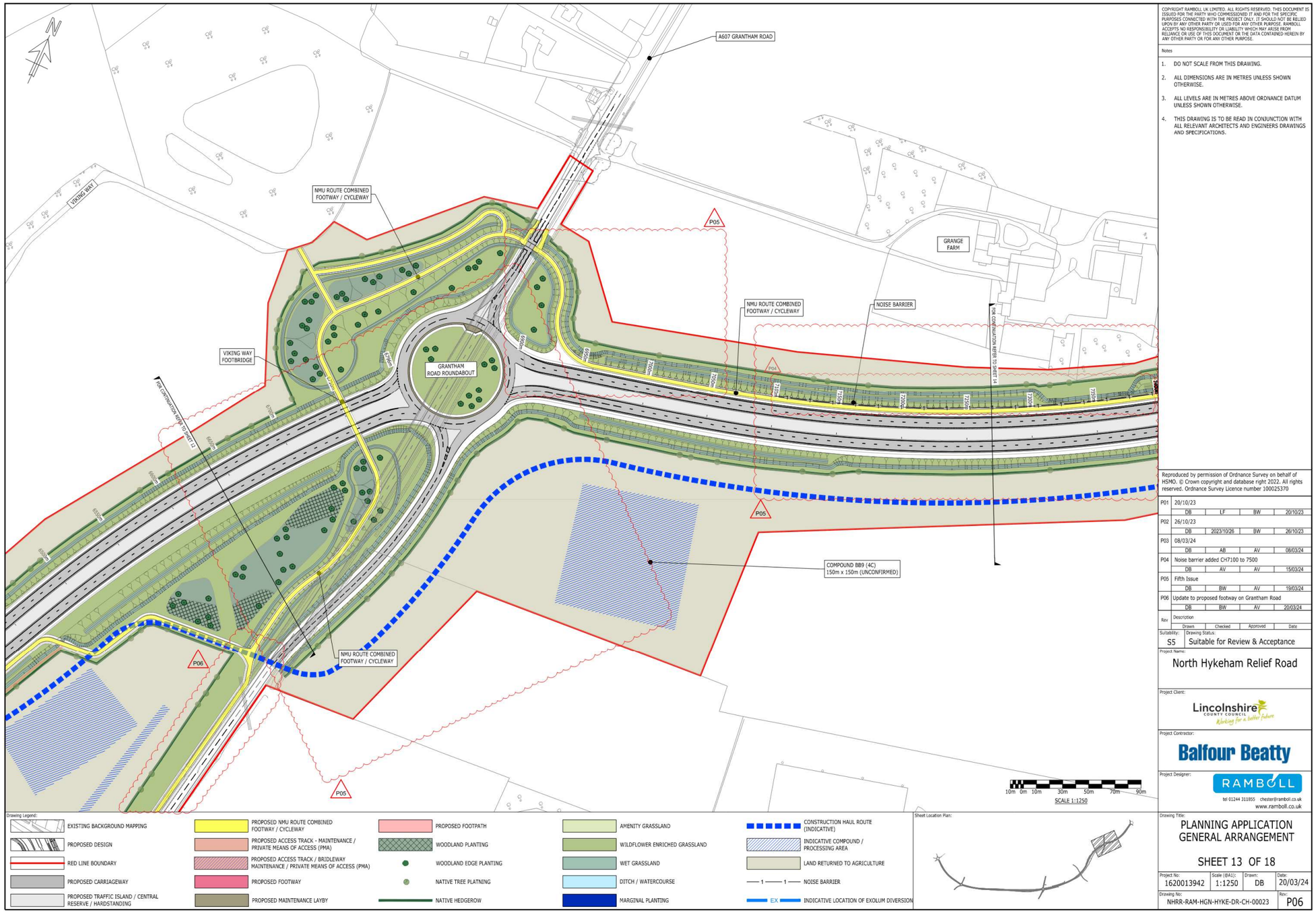


Figure 1: Environmental Statement Noise Mitigation Proposals (ES Volume 4 Figure 12-2)



Notes

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Rev	Description	Drawn	Checked	Approved	Date
P01	20/10/23	DB	LF	BW	20/10/23
P02	26/10/23	DB	2023/10/26	BW	26/10/23
P03	08/03/24	DB	AB	AV	08/03/24
P04	Noise barrier added CH7100 to 7500	DB	AV	AV	15/03/24
P05	Fifth Issue	DB	BW	AV	19/03/24
P06	Update to proposed footway on Grantham Road	DB	BW	AV	20/03/24

Suitability: S5 — Drawing Status: Suitable for Review & Acceptance

Project Name: North Hykeham Relief Road

Project Client: Lincolnshire County Council — Working for a better future

Project Contractor: Balfour Beatty

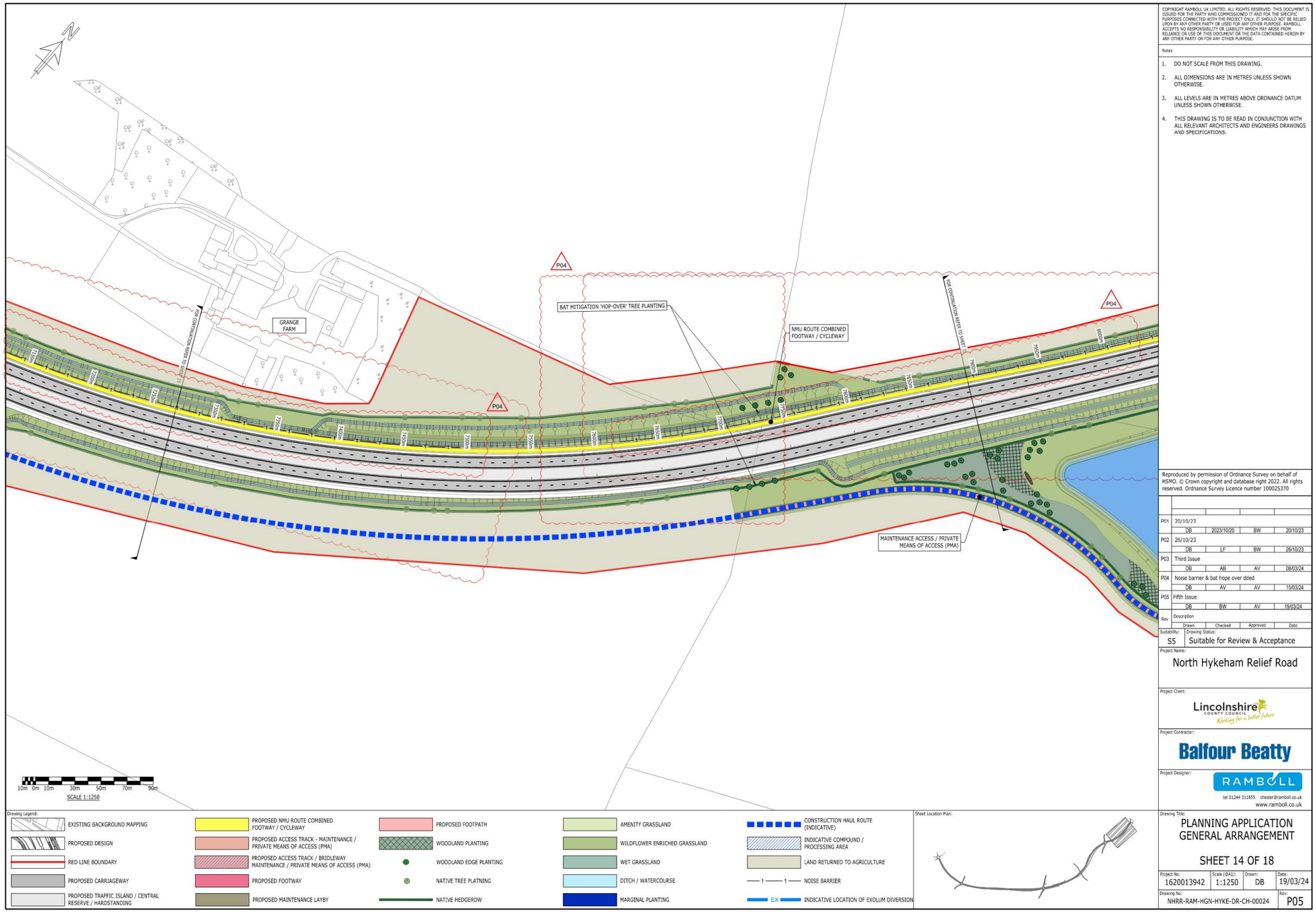
Project Designer: RAMBOLL — tel 01244 311855 chester@ramboll.co.uk www.ramboll.co.uk

Drawing Title: PLANNING APPLICATION GENERAL ARRANGEMENT SHEET 13 OF 18

Project No:	Scale (@A1):	Drawn:	Date:
1620013942	1:1250	DB	20/03/24

Drawing No: NHRR-RAM-HGN-HYKE-DR-CH-00023 — Rev: P06

Figure 2: Subsequent Additional Acoustic Barriers: Grantham Road junction and the Sleaford Road junction, Part 1 (Planning Application General Arrangements: Sheet 13 of 18)



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Rev		Drawn	Checked	Approved	Date
P01	20/10/23	DB	2023/10/20	BW	20/10/23
P02	26/10/23	DB	LF	BW	26/10/23
P03	Third Issue	DB	AB	AV	08/03/24
P04	Noise barrier & bat hope over dded	DB	AV	AV	15/03/24
P05	Fifth Issue	DB	BW	AV	19/03/24

Suitability: S5 — Drawing Status: Suitable for Review & Acceptance

Project Name: North Hykeham Relief Road

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Project Designer: RAMBOLL

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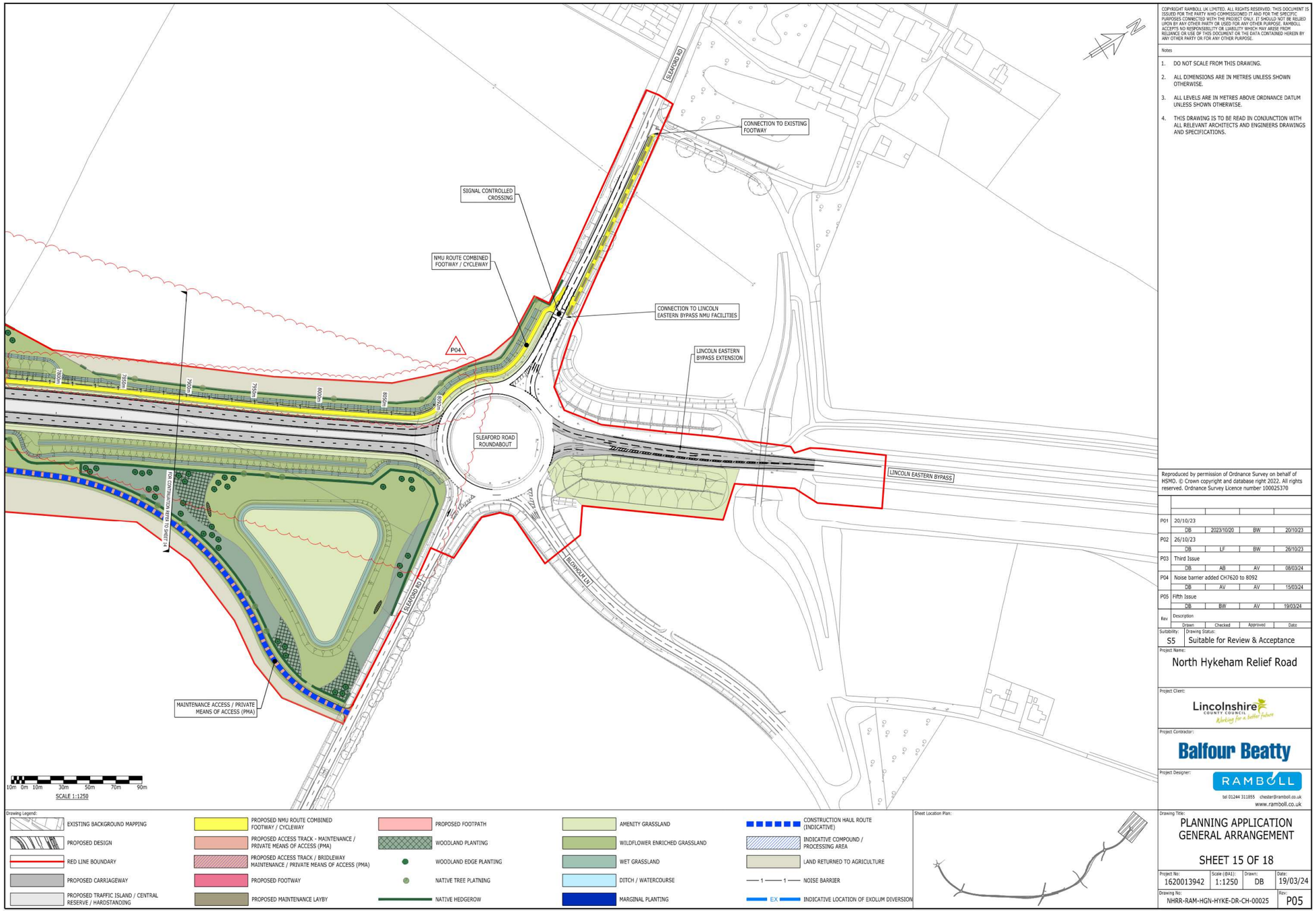
Drawing Title: PLANNING APPLICATION GENERAL ARRANGEMENT

SHEET 14 OF 18

Project No:	Scale (@A1):	Drawn:	Date:
1620013942	1:1250	DB	19/03/24

Drawing No: NHRR-RAM-HGN-HYKE-DR-CH-00024 — Rev: P05

Figure 3: Subsequent Additional Acoustic Barriers: Grantham Road junction and the Sleaford Road junction, Part 2 (Planning Application General Arrangements: Sheet 14 of 18)



Notes

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Rev	Description	Drawn	Checked	Approved	Date
P01	20/10/23	DB	2023/10/20	BW	20/10/23
P02	26/10/23	DB	LF	BW	26/10/23
P03	Third Issue	DB	AB	AV	08/03/24
P04	Noise barrier added CH7620 to 8092	DB	AV	AV	15/03/24
P05	Fifth Issue	DB	BW	AV	19/03/24

Suitability: S5 — Drawing Status: Suitable for Review & Acceptance

Project Name: North Hykeham Relief Road

Project Client: Lincolnshire County Council — Working for a better future

Project Contractor: Balfour Beatty

Project Designer: RAMBOLL

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Drawing Title: PLANNING APPLICATION GENERAL ARRANGEMENT

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Project No:	Scale (@A1):	Drawn:	Date:
1620013942	1:1250	DB	19/03/24

Drawing No: NHRR-RAM-HGN-HYKE-DR-CH-00025 — Rev: P05

Figure 4: Subsequent Additional Acoustic Barriers: Grantham Road junction and the Sleaford Road junction, Part 3 (Planning Application General Arrangements: Sheet 15 of 18)