Document 5.14

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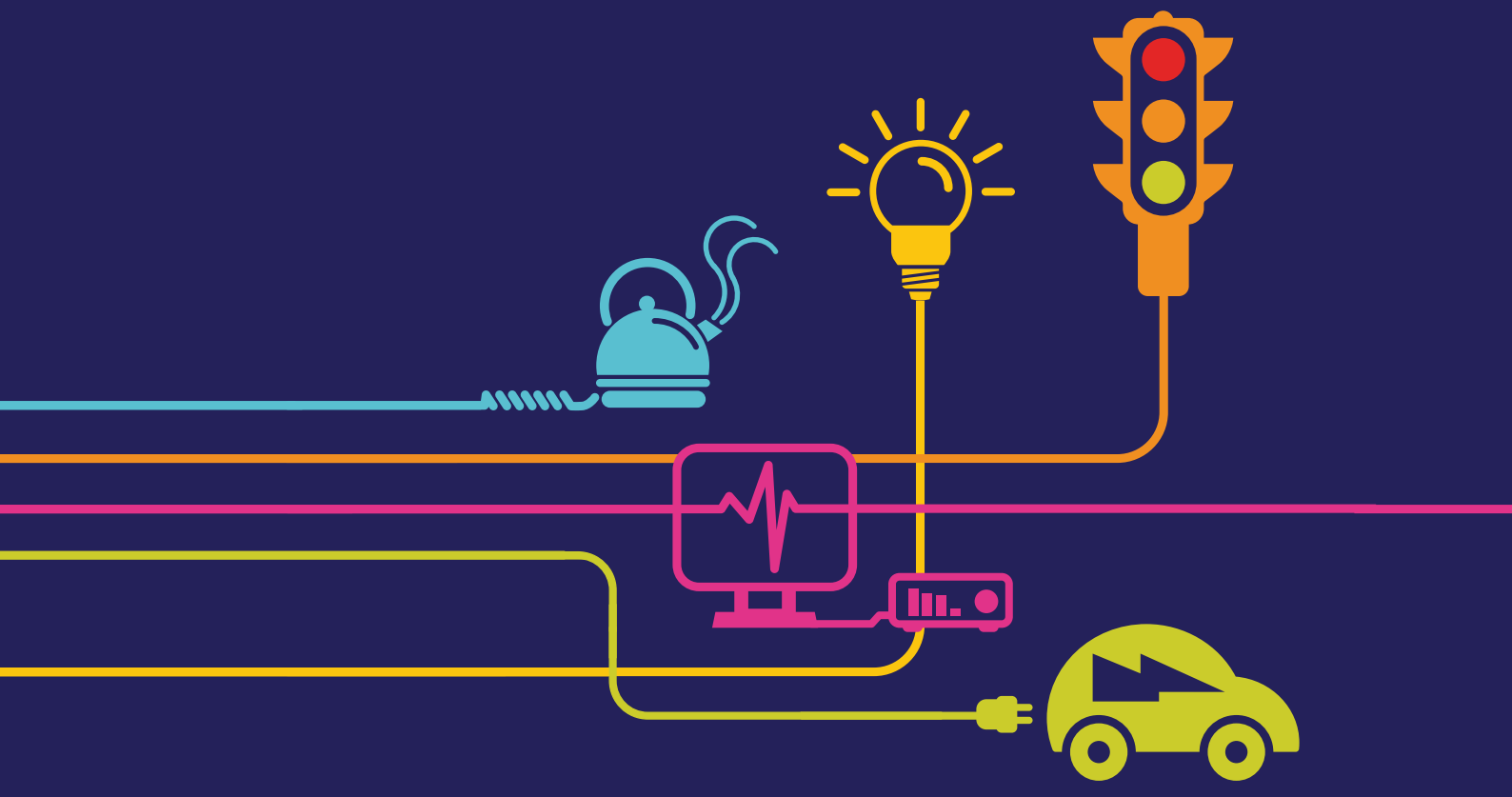
# Environmental Statement Noise and Vibration

## Hinkley Point C Connection Project

*Regulation 5(2)(a) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009*



Application Reference EN020001

May 2014

nationalgrid

**Hinkley Point C Connection Project**

# ENVIRONMENTAL STATEMENT – MAY 2014

## VOLUME 5.14.1, CHAPTER 14 – NOISE AND VIBRATION

| Document Control | | | |
|---|---|---|---|
| **Document Properties** | | | |
| **Organisation** | | **National Grid** | |
| **Author** | | **David Gray, Bureau Veritas** | |
| **Approved By** | | **Bobby Clayton, TEP** | |
| **Title** | | **Environmental Statement Chapter 14 – Noise and Vibration** | |
| **Document Reference** | | **Volume 5.14.1** | |
| | | | |
| **Date** | **Version** | **Status** | **Description/Changes** |
| 09/05/14 | A | Live | Final version for DCO submission |

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**INSETS (VOLUME 5.14.1)**



**APPENDICES (VOLUME 5.14.2)**

# 14 NOISE AND VIBRATION

## 14.1 Introduction

14.1.1 This chapter of the Environmental Statement (ES) describes the assessment of potential noise and vibration effects of the construction (including removal of existing overhead lines), operation and decommissioning of the various components of the Propose d Development. Potential effects and mitigation measures that would be implemented to reduce or avoid effects, if needed, are then summarised.

14.1.2 A description of the Proposed Development is provided in **Volume 5.3.1** and illustrated in **Volume 5.3.3, Figures 3.1 - 3.6**. This chapter, **Volume 5.14**, is supported by a number of appendices provided after the main chapter and insets provided within the chapter. This chapter should be read with the corresponding insets and appendices available for reference as they assist the understanding of the descriptions and assessments presented in the text.

### Chapter Layout

14.1.3 Following this introduction section, which includes records of and responses to relevant consultee representations, this chapter has been separated into three parts. Part 1 deals with construction and decommissioning effects. Part 2 deals with operational effects. Part 3 summarises the findings of this chapter for construction, decommissioning and operational effects. This separation should aid the reader and minimise confusion between the various methodologies, standards and assessments described in this chapter. There may be repetition between Part 1, Part 2 and Part 3, where appropriate; this is included to aid the reader.

### Project Engagement

#### *EIA Scoping*

14.1.4 As part of the scoping phase of the Environmental Impact Assessment (EIA), National Grid Electricity Transmission plc (National Grid) prepared the EIA Scoping Report 2013 setting out the proposed approach to EIA in respect of the Proposed Development, including the identification of assessment methods for each of the EIA topics to be assessed.

14.1.5 In response to that Scoping Report, the Planning Inspectorate produced a Scoping Opinion. The Scoping Opinion is provided at **Volume 5.5.2, Appendix 5A**. A summary of all Scoping Opinion representations received (relevant to EIA) and National Grid's responses are set out at **Volume 5.5.2, Appendix 5B**. A summary of the main Scoping Opinion representations received in relation to noise and vibration are presented in the table below.

Table 14.1 Summary of the Main Noise and Vibration Scoping Representations Received

| Representation | Response |
|---|---|
| The SoS recommends that the methodology and choice of noise receptors should also be discussed and agreed with the relevant Environmental Health Department of the Councils and the relevant parish councils where the new substations would be sited. In particular, consideration should be given to any potential noise disturbance likely to occur at night and other unsocial hours such as weekends and public holidays. | **Volume 5.14.1**, describes consultation with EHOs and other relevant stakeholders. Representations have been taken into account in the determination of baseline conditions, assessment and proposals for mitigation. Assessment of operational noise has been undertaken against night time background conditions. A meeting took place with the EHO representing the LPA where the background monitoring methodology was discussed. |
| Information should be provided on the types of vehicles and plant to be used during the construction phase and an assessment of noise and vibration undertaken. The noise and vibration assessments should take account of construction traffic movements along access routes. | A quantitative traffic noise assessment and a qualitative traffic vibration assessment for sensitive receptors have been undertaken and is provided in **Volume 5.14.1.** Types of vehicles and plant to be used during the construction phase are described in **Volumes 5.3.1, 5.12.1 and 5.14.1**. **Volume 5.14.1** includes an assessment of noise and vibration during the construction phase and refers to the Transport Assessment (**Volume 5.22**) and the Draft Construction Traffic Management Plan (CTMP) (**Volume 5.26.5**) for traffic movements during construction. |
| The SoS notes the intention to mitigate impacts during construction through working time restrictions and the provision of an appropriate Construction Management Plan. The ES should identify the measures that the plan will contain and assess their effectiveness. | Works would be undertaken in accordance with the Draft Construction Environmental Management Plan (CEMP) **(Volume 5.26)**; |
| In relation to cumulative effects from other potential developments, the final assessment should include the combined, indirect effects of road transport. The assessment should also identify where construction or operational traffic from different developments will simultaneously affect certain road links. | Cumulative effects from traffic serving simultaneous development are addressed within the TA (**Volume 5.22**) and **Volume 5.17.** |

| Representation | Response |
|---|---|
| Insufficient evidence has been presented in the Scoping Report to allow the scoping out of operational vibration. Evidence should be provided in the ES to justify the decision to scope out these effects. | Transformers and other wound power equipment vibrate at twice power frequency i.e. 100Hz and associated harmonic frequencies e.g. 200Hz, 300Hz. However the effects are negligible and are countered by the use of industry standard mitigation techniques such as the use of vibration isolation pads to prevent transmission of ground borne vibration. Ground bourne vibration has never been raised as a significant issue or resulted in any complaints at any of our other operational sites. |
| Insufficient evidence has been presented in the Scoping Report to allow the scoping out of operational noise from Aust and Seabank substations. Evidence should be provided in the ES to justify the decision to scope out these effects during operation. If this cannot be done then the effects should not be scoped out at this stage. | Further information regarding the scoping out of noise sources is provided in **Volume 5.14.2, Appendix 14C.** |

### *Statutory Stage 4 Consultation*

14.1.6 Statutory Stage 4 Consultation took place over a period of eight weeks between 3 September and 29 October 2013 in accordance with the Planning Act 2008. Statutory and non-statutory consultees and members of the public were included in the consultation. Various methods of consultation and engagement were used in accordance with the Statement of Community Consultation (SoCC) including letters, website, public exhibitions, publicity and advertising, inspection of documentation at selected locations and parish and town council briefings.

14.1.7 National Grid prepared a Preliminary Environmental Information Report (PEIR) which was publicised at this consultation stage. National Grid sought feedback on the environmental information presented in that report. Feedback received during Statutory Stage 4 Consultation was considered by National Grid and incorporated where relevant in the design of the Proposed Development and its assessment and presentation in this ES.

14.1.8 A summary of the Statutory Stage 4 Consultation representations received (relevant to EIA) and National Grid's responses are summarised at **Volume 6.1** (Consultation Report). A summary of the main Statutory Stage 4 Consultation representations received in relation to noise and vibration is presented in the table below.

Table 14.2 Summary of the Main Noise and Vibration Statutory Stage 4 Consultation Representations Received

| Representation | Response |
|---|---|
| Further clarification is required regarding noise generated by the T pylon during wet weather, which is touched upon in the Pylon Options Report. | The impact of noise from the overhead lines is discussed in **Volume 5.14.1** and takes account of the noise generation from each specific pylon design |
| The assessment criteria described for construction noise in the methodology does not seem to align with the approach that is then described in the assessment text. | **Volume 5.14.1** provides an assessment of the geographic range of construction noise effects. This has been defined more clearly in the assessment text. |
| The impact assessment is systematic in applying the selected assessment criteria to evaluate construction and operational effects. There is a minor anomaly concerning the assessment of construction traffic vibration. Although this should be clarified for later assessment stages, it does not affect the result of the PEIR. The locations of noise effects are identified and the magnitudes quantified. | Vibration due to construction traffic cannot be directly assessed. Further, as noted in the PEIR, traffic vibration is typically caused by uneven road surfaces which can be easily rectified. |

### *Draft ES and Supporting Documents*

14.1.9 The Draft ES and a large number of the ES supporting documents were provided to a number of statutory and non-statutory bodies over a period of two weeks between 3 and 17 February 2014. This process of engagement (over and above that required by the statutory consultation process) was undertaken to provide an opportunity for these bodies to influence the assessment documents prior to their finalisation to accompany the Development Consent Order (DCO) application.

14.1.10 A summary of the Draft ES representations received (relevant to EIA) and National Grid's responses are summarised at **Volume 5.5.2, Appendix 5C.** A summary of the main Draft ES representations received in relation to noise and vibration are presented in the table below.

Table 14.3 Summary of the Main Noise and Vibration Draft ES Representations Received

| Representation | Response |
|---|---|
| Difficult to distinguish between construction and operational sections of the chapter. | The chapter has been split into parts dealing with construction and operational effects separately. This should significantly aid the reader. |

| Representation | Response |
|---|---|
| 14.2.24 Describes the 5dB Change method from BS5228. The BS considers significance where the "***total noise*** *(pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5 dB or more*" and not the construction noise only as stated in the text. If this difference is intentional, further explanation is required in justification. | It is expected that noise levels at the vast majority of locations would be significantly below 65dBA. As such, the sum of pre-construction ambient plus construction noise is not expected to be significantly affected by the pre-construction noise. Where the pre-construction ambient noise approaches or exceeds 65dBA, a higher noise limit may be applicable. The 65dB criterion is therefore considered to provide a worst case assessment.<br><br>This has been made clearer in the text. |
| Section 4.3 also states that the core working hours will be from 07.00 to 19.00 Mondays to Saturdays and 07.00 and 17.00 on Sundays, but there should be localised additional restrictions near to residential properties. Bristol CC normal restrictions should be used to mitigate construction noise in this location and limit working hours to 08 00 Hours and 18 00 Hours on Mondays to Fridays, 08 00 and 13 00 Hours on Saturdays and at no time on Sundays and Bank Holidays. Joint Councils agreement will be required in respect of working hours, activities within start up and shut down and any departures from these defined activities. | The local authorities and surrounding communities will be informed of known activities that will be undertaken outside of the core working hours. Where advised, consent will be sought under Section 61 of the Control of Pollution Act 1974. A Section 61 is a formal agreement between the contractor and the Local Authority. This agreement is applied for before work commences and allows the contractor and Local Authority to agree, for example noise levels and hours of work. |
| In area G the route passes near to residential properties at Portview Road, Clayton Street, Queen Street and King Street (LD109-LD113 page 18 of 5.3 draft figure 3.1) but there appears to be no reference in the other documentation as to predicted noise levels from the overhead power cables or noise from the construction phase of the development at the nearby residential the properties. | Table 14.14 (now in **Volume 5.14.2, Appendix 14A, Table 3**) contains details of the effects of construction in this area. Generic data curves were produced (**Volume 5.14.2, Appendix 14F**) and were used to identify spans of the overhead line where more detailed modelling of effect was required, due to either proximity of residential properties or low background noise levels. At this stage, some spans with residential receptors within 200m of the overhead line were scoped out of further assessment. These spans are listed in **Volume 5.14.2, Appendix 14G**. |
| No provision has been included for noise insulation and temporary rehousing. This should be included as a provision in the CEMP and adopt threshold criteria as outlined within the draft ES text in 14.2.25. | Noise levels and durations required for noise insulation and temporary rehousing are not expected to reached. |

***Other Engagement***

14.1.11 The engagement with the local planning authorities to discuss noise and vibration has been concise and effective. A meeting was held between the Joint Councils' and National Grid's respective noise and vibration and planning representatives on 13 November 2013. No significant concerns were raised regarding construction and operational noise by the Joint Councils' representatives. A revised assessment methodology for operational noise was discussed and agreed as acceptable. The background noise surveys completed to date were agreed as acceptable and it was agreed that no further surveys were required.

# Part 1 – Construction and Decommissioning Noise and Vibration

## 14.2 Method

### Approach

14.2.1 A desk-based assessment has been applied to identify and evaluate the potential noise and vibration effects on receptors arising from the construction of the Proposed Development.

14.2.2 The following information has been used in the assessment:

- Ordnance Survey mapping;
- topographical data;
- previous experience of similar developments elsewhere; and
- on-site noise monitoring data.

14.2.3 In order to produce a robust and conservative assessment, noise levels used for the construction assessment are based on quieter, night time data. These data indicate that daytime noise levels would be low along the majority of the route.

14.2.4 The construction noise assessment uses the construction method statements and noise levels from manufacturers' data or British Standards to determine the noise levels that can be expected at the nearest receptors. The effects of these noise levels have been assessed against the guidelines identified in this chapter and appropriate mitigation measures recommended.

### Assessment Guidance

14.2.5 The following documents have been used to assess the noise effects from the construction of the Proposed Development.

#### *National Policy Statements*

14.2.6 National Policy Statements (NPS) provide the primary basis on which the Secretary of State is required to make a decision on Nationally Significant Infrastructure projects (NSIPs). The specific assessment requirements for construction noise, as detailed in Overarching NPS for Energy (EN-1), are set out below.

Table 14.4 Summary of NPS EN-1 Requirements Relevant to Construction and Decommissioning Noise and Vibration

| Para | Requirement | Section of ES | Compliance Assessment |
|---|---|---|---|
| 5.11.4 | The applicant should include a description of the noise generating aspects of the development proposal leading to noise impacts, including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise | Section 14.4 of this Volume | Descriptions of the noise generating aspects of the Proposed Development leading to noise impacts, including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise are provided in the chapter for both construction and operation noise sources. |
| 5.11.4 | The applicant should include identification of noise sensitive premises and noise sensitive areas that may be affected; | **S**ection 14.4 of this Volume | Noise sensitive premises and noise sensitive areas that may be affected have been identified for both construction and operation noise effects. |
| 5.11.4 | The applicant should include the characteristics of the existing noise environment | **S**ection 14.3 of this Volume | The chapter and Appendices include a description of the existing noise environment. |
| 5.11.4 | The applicant should include a prediction of how the noise environment will change with the proposed development: | See below. | |
| | > in the shorter term such as during the construction period | Section 14.4 of this Volume, **Volume 5.14.2, Appendix 14A, Appendix 14D, Appendix 14G** | The chapter and Appendices include a prediction of how the noise environment will change due to construction effects. |
| | > at particular times of the day, evening and night as appropriate | | Construction and operational noise effects have been assessed for the periods over which they are expected to have the most significant effect. |
| 5.11.4 | The applicant should include an assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive areas | Section 14.4 of this Volume | The chapter includes an assessment of how the noise environment will change due to both construction and operational effects. |
| 5.11.4 | The applicant should include measures to be employed in mitigating noise | Section 14.6 of this Volume | The chapter includes measures to be employed in mitigating noise. |

| Para | Requirement | Section of ES | Compliance Assessment |
|---|---|---|---|
| 5.11.4 | The nature and extent of the noise assessment should be proportionate to the likely noise impact. | **Volume 5.14** | The noise assessment presented at Volume 5.14 is considered to be proportionate to the likely noise impact. |
| 5.11.5 | The noise impact of ancillary activities associated with the development, such as increased road and rail traffic movements, or other forms of transportation, should also be considered | Section 14.4 and 14.5 of this Volume | The chapter considers the noise impact of ancillary activities associated with the Proposed Development, such as increased road and rail traffic movements, or other forms of transportation. |
| 5.11.6 | For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies. | Section 14.2 of this Volume | Construction noise is predicted and assessed and mitigation is detailed with reference to BS5228:2009. |
| 5.11.7 | The applicant should consult EA and Natural England (NE), or the Countryside Council for Wales (CCW), as necessary and in particular with regard to assessment of noise on protected species or other wildlife. | **Volume 5.8.1,** section 8.5 | All effects on ecological receptors are addressed in **Volume 5.8.1,** section 8.5, with technical input from the acoustics and vibration consultants. |
| 5.11.7 | The results of any noise surveys and predictions may inform the ecological assessment. The seasonality of potentially affected species in nearby sites may also need to be taken into account. | **Volume 5.8.1,** section 8.5 | All effects on ecological receptors are addressed in **Volume 5.8.1,** section 8.5, with technical input from the acoustics and vibration consultants. |

| Para | Requirement | Section of ES | Compliance Assessment |
|---|---|---|---|
| 5.11.9 | The IPC should not grant development consent unless it is satisfied that the proposals will:<br><br>- avoid significant adverse impacts on health and quality of life from noise; mitigate and minimise other adverse impacts on health and quality of life from noise; and where possible, contribute to improvements to health and quality of life through the effective management and control of noise. | Section 14.4 of this Volume | The chapter demonstrates that significant adverse impacts on health and quality of life from noise will be avoided, mitigated and minimised through the effective management and control of noise. |
| 5.11.12 | Mitigation measures may include one or more of the following: engineering: reduction of noise at point of generation and containment of noise generated; lay-out: adequate distance between source and noise-sensitive receptors; incorporating good design to minimise noise transmission through screening by natural barriers, or other buildings; and administrative: restricting activities allowed on the site; specifying acceptable noise limits; and taking into account seasonality of wildlife in nearby designated sites. | **Volume 5.8.1,** section 8.7; BMS at **Volume 5.26.3;** section 14.6 of this Volume; Draft CTMP at **Volume 5.26.5** | The chapter demonstrates that operational noise is controlled and mitigated as far as practicable at source by design and layout and construction noise is controlled by effective administrative and engineering noise control measures. |

### *National Planning Policy Framework*

14.2.7 The National Planning Policy Framework (NPPF) (published March 2012) (Ref. 14.2) has replaced the relevant Planning Policy Guidance (PPG 24: Planning and Noise) as the means by which noise is considered within the town and country planning regime. The NPPF does not contain assessment criteria; instead it provides a series of policies, giving local authorities the flexibility necessary to meet

the needs of local communities. The NPPF states that planning policies and decision should aim to:

*"avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*

*mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*

*recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*

*identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

14.2.8 The NPPF Planning Practice Guidance for noise (March 2014), was published recently to provide a degree of technical grounding to the policies described in the NPPF. The Planning Practice Guidance mirrors much of the policies and guidance introduced in the Noise Policy Statement for England (NPSE, 2010), with the emphasis on avoiding significant adverse effects, and promoting sustainable growth with overall improvement in health and quality of life for the country. These principles form the basis upon which the relevant National Policy Statements (see **Table 14.4**) were written and on which this assessment is founded.

***Local Policy***

14.2.9 Local planning policies state that developments should seek to avoid or else appropriately mitigate unavoidable harm to environmental amenity. Local planning policy does not set policy for testing the acceptability of nationally significant infrastructure projects and does not add materially to the protection afforded at a national level in respect of noise and vibration.

14.2.10 The majority of local planning policies seek to control the impact of noise. The remaining policies (policy D10 from the Sedgemoor District Council Core Strategy and South Gloucestershire Local Plan saved policy T12), relate to transport, and more particularly ensuring adequate provision for transport is made in development, whilst minimising adverse impacts.

14.2.11 Local planning policies are summarised at **Volume 5.4.2, Appendix 4A**.

***British Standards and Guidance Documents***

14.2.12 Various British Standard methods for noise assessments have been used in this assessment as follows:

BS5228-1:2009 - Calculation for Noise from Open and Construction Sites - Part 1: Noise

14.2.13 Construction site noise is assessed differently from noise from permanent installations, as it is recognised that the former is an inevitable by-product of required works and its effects are limited in duration.

14.2.14 Advice is contained within BS5228-1 (Ref. 14.3). This document contains a database of the noise emission levels from individual items of equipment and certain activities to allow the prediction of noise from construction (and demolition) works to the nearest noise-sensitive receptors. The prediction method provides guidance on the effects of different types of ground and barrier attenuation and on how to assess the impact of fixed and mobile plant. Whilst not mandatory, Annex E of BS5228 provides informative advice to aid the development of noise assessment criteria based on previous published guidance and methodologies adopted successfully for other planning applications.

14.2.15 In assessing the requirement for noise limits, or operating period controls relating to construction works, Government Agencies and Local Authorities generally give consideration to the following aspects of the planned works, all of which have a bearing on the 'significance' of the effect:

- duration of planned activities (weeks, months, years);
- whether activities are planned for the night time period;
- proximity of development to residential areas; and
- predicted source-term noise levels and noise effects at residential areas.

14.2.16 The assessment predicts noise emissions from various construction activities, which are then compared against baseline ambient noise levels at the location of nearby residential receptors. Noise levels generated by construction activities are significant if the construction noise level exceeds the pre-construction ambient noise by 5dB or more, subject to lower cut-off values as highlighted in **Table 14.5** below, for a duration of one month or more, unless works of a shorter duration are likely to result in significant impact.

Table 14.5 Time Periods, Averaging Times and Noise Levels Applicable Lower Threshold Values of Construction Noise

| Day | Relevant Time Period | Averaging Time, T | Lower Cut-Off Value, dB ($L_{Aeq,T}$[1]) |
|---|---|---|---|
| Monday to Friday | 07:00 – 19:00 | 12h | 65 |
| | 19:00 – 23:00 | 4h | 55 |
| | 23:00 – 07:00 | 8h | 45 |
| Saturday | 07:00 – 13:00 | 5h | 65 |
| | 13:00 – 23:00 | 10h | 55 |
| | 23:00 – 07:00 | 8h | 45 |
| Sunday | 07:00 – 23:00 | 16h | 55 |

| Day | Relevant Time Period | Averaging Time, T | Lower Cut-Off Value, dB ($L_{Aeq, T}$ [1]) |
|---|---|---|---|
| | 23:00 – 07:00 | 8h | 45 |

Note 1) Equivalent continuous A-weighted noise level predicted or measured at a point 1m in front of the most exposed windows or doors leading directly to a habitable room (living room or bedroom) in an eligible dwelling.

14.2.17 Annex E of the standard also provides criteria for the assessment of significance. Exceeding a threshold level triggers a responsibility on the developer to provide noise insulation or a scheme to facilitate temporary rehousing. The standard suggests that noise insulation should be provided if the trigger levels shown in **Table 14.6** are predicted to be exceeded for a period of ten or more days of working in any fifteen consecutive days, or for a total of days exceeding 40 in any six month period.

Table 14.6 Time Periods, Averaging Times and Noise Levels Applicable to Assessing Eligibility for Noise Insulation (Construction Noise)

| Day | Relevant Time Period | Averaging Time, T | Noise Trigger Level, dB ($L_{Aeq, T}$ [1]) |
|---|---|---|---|
| Monday to Friday | 07:00 – 08:00 | 1h | 70 |
| | 08:00 – 18:00 | 10h | 75 |
| | 18:00 – 19:00 | 1h | 70 |
| | 19:00 – 22:00 | 3h | 65 |
| | 22:00 – 07:00 | 1h | 55 |
| Saturday | 07:00 – 08:00 | 1h | 70 |
| | 08:00 – 13:00 | 5h | 75 |
| | 13:00 – 14:00 | 1h | 70 |
| | 14:00 – 22:00 | 3h | 65 |
| | 22:00 – 07:00 | 1h | 55 |
| Sunday & Public Holidays | 07:00 – 21:00 | 1h | 65 |
| | 21:00 – 07:00 | 1h | 55 |

Note 1) Equivalent continuous A-weighted noise level predicted or measured at a point 1m in front of the most exposed windows or doors leading directly to a habitable room (living room or bedroom) in an eligible dwelling.

<u>BS5228-2:2009 - Noise and Vibration Control on Construction and Open Sites - Part 2: Vibration</u>

14.2.18 BS5228-2 (Ref. 14.4) describes methods of mitigation that can be employed for ground-borne vibration from construction activities and provides historical library data of vibration levels measured during various activities on various ground types.

14.2.19 **Table 14.7** (Table B.1 from BS5228-2) describes the likely response to various peak particle velocity (PPV) vibration levels.

Table 14.7 Typical Human Responses to Different PPV Levels

| Vibration Level | Effect |
|---|---|
| 0.14mms$^{-1}$ | Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration. |
| 0.3mms$^{-1}$ | Vibration might just be perceptible in residential environments. |
| 1.0mms$^{-1}$ | It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents |
| 10mms$^{-1}$ | Vibration is likely to be intolerable for any more than a very brief exposure to this level. |

14.2.20 BS5228-2 states transient vibration guide values in the 4Hz – 15Hz and 15Hz and above frequency bands that lead to cosmetic damage. BS5228-2 also discusses the assessment of the vulnerability of ground-related structures and services concluding that a maximum PPV for intermittent or transient vibration of 30mms$^{-1}$ and a maximum PPV for continuous vibration of 15mms$^{-1}$. BS5228 also discusses the vulnerability of building contents and activities within buildings to vibration, concluding that they too should be assessed on an individual basis.

Calculation of Road Traffic Noise & Design Manual for Roads and Bridges

14.2.21 The 'Calculation of Road Traffic Noise' (CRTN) (Ref. 14.5) produced by the Department of Transport and Welsh Office provides a method for the prediction of noise from road traffic. The Highways Agency Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7 HD 213/11 Noise and Vibration (DMRB) (Ref. 14.6), provides guidance on the assessment of noise and vibration effects from road traffic. The criteria from DMRB for short-term effects (i.e. during construction), shown in **Table 14.8**, can be used in the assessment of changes to traffic noise as a result of proposed construction traffic, including heavy vehicles. No significant long term traffic effects (i.e. post development) are expected and are therefore scoped out of further assessment.

Table 14.8 Classification of Magnitude of Noise Effects from Changes to Traffic Noise in the Short-term

| **Noise Change, $L_{A10, 18\ hour}$ (dB)** | **Magnitude of Effect** |
|---|---|
| 0.0 | No change |
| 0.1 - 0.9 | Negligible |
| 1.0 - 2.9 | Minor |
| 3.0 - 4.9 | Moderate |
| 5.0 or more | Major |

14.2.22 An initial review of the data should be undertaken as per the noise assessment to assess whether the traffic effect would be considered negligible (i.e. a change of less than 1dB).

14.2.23 The magnitude of effects described above is used to assess the effect of construction traffic on existing routes. Construction traffic on temporary haul and access routes are assessed as construction noise, as described in **Tables 14.6 and 14.7**.

14.2.24 Within DMRB, change to airborne vibration from traffic is assessed by examining the increases in dB (as air overpressure) and correlating this to a graph relating this change empirically to 'percentage of people bothered' by vibration.

14.2.25 DMRB states that significant ground-borne vibration is unlikely unless sensitive receptors are close to the construction traffic route. The threshold value for scoping ground-borne vibration into more detailed investigation is a Peak Particle Velocity (PPV) of $0.3mms^{-1}$ or increases to the PPV if existing vibration levels exceed this level. DMRB does not have a description of how to assess ground-borne vibration.

**Background to Construction Noise**

14.2.26 Construction noise is assessed differently to noise from permanent installations as it is recognised that construction noise is an inevitable by-product of required works and that construction activities are of temporary operation. Construction noise is considered for activities involved in the Proposed Development, including:

- the decommissioning of the existing 132kV overhead lines;
- the construction of the 400kV overhead line and underground cables;
- construction traffic;
- construction of temporary construction compounds;
- construction of cable sealing end (CSE) compounds;
- construction of substations; and
- the end of life decommissioning of the Proposed Development.

**Construction Noise and Vibration Study Areas**

14.2.27 The study area for construction noise effects considers all sensitive receptors within 200m of the proposed overhead lines, overhead line decommissioning,

underground cable routes (except cable transition jointing) and substations. The effect of construction noise is expected to be below the lowest threshold criteria for all time periods at this distance. Cable transition jointing would likely require night time working and as such the study area for this activity is 350m, beyond which construction noise is expected to be below the lowest night time threshold where mitigation is applied. Underground cable construction is assessed from the boundary of the Order Limits

14.2.28 Due to the complex relationship between the source of vibration, forcing frequency, the distance and geological characteristics between source and receiver and the construction of the receiving structure, it is difficult to predict the degree of vibration which may occur and it is therefore not appropriate to define a study area. However, based on experience, corroborated by data such as that contained in BS5228-2, vibration is not expected to be perceptible beyond 100m. Significant effects would only expected at much shorter distances (<10m) and is only likely to occur where pylon and substation foundations are being piled. There are no residential dwellings within 10m of proposed pylon and substation construction works.

14.2.29 No specific study area is defined for construction traffic noise but is assessed on a road by road basis as determined by the traffic assessment discussed in **Volume 5.12.1** (Traffic and Transport).

**Construction Noise Assessment Methodology**

14.2.30 The assessment of construction noise has been undertaken in accordance with the method presented in BS5228, and is based on the Proposed Development (see **Volume 5.3.1**). **Volume 5.14.2, Appendix 14A, Table 1** is populated by the various construction sites, activities within those sites and the expected (typical) plant to be employed, together with noise emission values taken from BS5228-1.

**Decommissioning Noise and Vibration Assessment Methodology**

14.2.31 As part of the Proposed Development, existing sections of some 132kV overhead lines would be removed. The noise from the decommissioning of these lines is considered within the construction noise and vibration assessment (section 14.4).

14.2.32 Decommissioning of the Proposed Development would be undertaken once its useful life is complete. It is expected that the effect of noise and vibration for the decommissioning process would be similar to the construction phase, assuming the decommissioning of the entire connection route, CSE compounds and substations. No separate assessment has therefore been carried out.

## Methodology for Assessing the Significance of Construction Noise Effects

### *Sensitivity*

14.2.33 The sensitivities of receptors to construction noise and vibration are shown in **Table 14.9**.

Table 14.9 Sensitivity of Receptor - Construction

| Sensitivity of Receptor | Construction Noise | Construction Vibration |
|---|---|---|
| High | Education, healthcare facility | Listed buildings & non-earthwork Scheduled Ancient Monuments |
| Medium | Residential area | Unreinforced or light framed structures |
| Low | Area used primarily for leisure activities, including Public Rights of Way (PRoW), sports facilities and sites of historic or cultural importance. | Residential or light commercial buildings |
| Negligible | All other areas such as those used primarily for industrial or agricultural purposes | Reinforced or framed structures<br>Industrial, heavy commercial buildings and earthworks (Scheduled Ancient Monuments) |

14.2.34 The sensitivities specified above are the same as those used for the recently consented Hinkley Point C Nuclear Power Station proposal. Further definition of the receptor sensitivities, based on guidance provided by the World Health Organisation (WHO) Guidelines for Community Noise (Ref. 14.7), is provided below:

High Sensitivity

*Noise*

14.2.35 Receptors have been categorised as high sensitivity where noise may be detrimental to vulnerable subgroups. Such subgroups include pupils in educational facilities and patients in healthcare facilities.

*Vibration*

14.2.36 Receptors have been categorised as high sensitivity where the receptors are listed buildings or Scheduled Ancient Monuments.

Medium Sensitivity

*Noise*

14.2.37 Receptors have been categorised as medium sensitivity where noise may cause disturbance and a level of protection is required but a level of tolerance is expected.

*Vibration*

14.2.38 Receptors have been categorised as medium sensitivity where the structural integrity of the structure is limited but the receptor is not a listed building or Scheduled Ancient Monument.

Low Sensitivity

*Noise*

14.2.39 Receptors have been categorised as low sensitivity where noise may cause short duration effects in a recreational setting although particular high noise levels may cause a moderate effect.

*Vibration*

14.2.40 Receptors have been categorised as low sensitivity where the structural integrity of the structure is expected to be high. The level of vibration required to cause damage is very high and such levels are not expected to be reached during the Proposed Development.

Negligible Sensitivity

*Noise*

14.2.41 Receptors have been categorised as negligible sensitivity where noise is not expected to be detrimental.

*Vibration*

14.2.42 Receptors have been categorised as negligible sensitivity where vibration is not expected to be detrimental.

***Magnitude***

14.2.43 The significance of noise and vibration effects from construction was assessed using the criteria defined in **Table 14.10**.

Table 14.10 Magnitude of Construction Effects

| Magnitude of Effect | Construction Noise | Construction Vibration |
|---|---|---|
| High | Construction noise levels predicted to exceed BS5228 trigger levels to a degree and for a duration triggering noise insulation requirements or temporary re-housing. A 5dB or more change in $L_{A10,\ 18\ hour}$ traffic noise. | Vibration exceeding threshold values at frequencies likely to be encountered. |
| Medium | Construction noise levels predicted to exceed BS5228-1 threshold values for a period of one month or more, but not for a level and duration to trigger noise insulation or temporary re-housing requirements. A 3dB - 4.9dB change in $L_{A10,\ 18\ hour}$ traffic noise. | Vibration effects measurable but below threshold for likely frequencies encountered. |

| Magnitude of Effect | Construction Noise | Construction Vibration |
|---|---|---|
| Low | Noise levels may cause some minor temporary disturbance, but noise levels do not exceed BS5228-1 threshold values for a period of one month or more or for a level and duration to trigger noise insulation or temporary re-housing requirements. A 1dB - 2.9dB change in $L_{A10, 18\ hour}$ traffic noise. | Vibration effects measurable but below threshold of minimum cosmetic damage at all frequencies. |
| Negligible | Construction noise levels below BS5228-1 threshold levels at a receptor façade. A 0.1dB - 0.9dB change in $L_{A10, 18\ hour}$ traffic noise. | Vibration effects minimal and below threshold of effect. |

### *Significance*

14.2.44 A combination of receptor sensitivity and magnitude of effect before and after mitigation was used to determine the overall significance of the effect, as shown in **Table 14.11**.

Table 14.11 Significance of Effects Matrix

| Significance of Effect | Sensitivity of Receptor | | | |
|---|---|---|---|---|
| **Magnitude** | **High** | **Medium** | **Low** | **Negligible** |
| High | Major | Major | Moderate | Minor |
| Medium | Major | Moderate | Minor | Negligible |
| Low | Moderate | Minor | Negligible | Negligible |
| Negligible | Minor | Negligible | Negligible | Negligible |

## 14.3 Baseline Environment

### Baseline Characteristics

14.3.1 The Proposed Development would be located within a mixture of rural, urban and industrial areas, which has a correspondingly varied noise environment.

14.3.2 The ambient noise levels in the vicinity of the Proposed Development were predominantly governed by their distance from the M5 Motorway and other main highways.

14.3.3 In order to produce a robust and conservative assessment, noise levels are based on quieter, night time data. These data indicate that daytime noise levels would be

low along the majority of the route. This is concordant with subjective impressions of the noise climate. This assumption leads to a robust, worst case assessment.

14.3.4 The baseline environment would not be expected to change prior to the commencement of the Proposed Development.

## 14.4 Prediction and Assessment of Significance of the Potential Construction Noise Effects

### 400kV and 132kV Overhead Line and Underground Cable Route Construction Effects

14.4.1 The distances shown in **Volume 5.14.2, Appendix 14A, Table 2** are the separation distances from the construction activity at which BS5228 would be applicable (i.e. the distance within which threshold levels would be exceeded during the daytime). Transition jointing may involve night time working and has been assessed separately.

14.4.2 Along the proposed route of the 400kV and 132kV overhead lines, threshold values would be exceeded at receptors within 131m of proposed lattice pylons and 108m of proposed T-pylons (where piling is required for foundations). For underground cable works, threshold values would be exceeded at receptors within 82m. For horizontal directional drilling (HDD) works threshold values would be exceeded at receptors within 75m. For the construction of temporary access roads threshold values would be exceeded at receptors within 66m. Threshold values would be exceeded within 112m of pylon decommissioning works. **Volume 5.14.2, Appendix 14A, Table 3** provides a summary of the receptors which fall within these threshold distances for the main construction activities.

14.4.3 Threshold values are unlikely to be exceeded for significant periods (the duration of the works would be less than one month) at each receptor and as such the magnitude of effects is expected to be low. As such, no specific receptors with a major or moderate significance of effect were identified. The exceedance of threshold values would not necessarily lead to a moderate or high magnitude effect unless they occur for significant periods of time as noise is an expected and unavoidable aspect of construction activities. Mitigation measures will be implemented (see section 14.6) to reduce the absolute noise levels likely to be experienced during construction and number of properties where threshold values would be exceeded.

### Substation Construction Effects

14.4.4 Construction noise from works at the proposed Sandford Substation and works to the existing Seabank, Portishead, Avonmouth and Churchill Substations is considered in **Table 14.12**.

Table 14.12 Construction Noise Assessment at Substations

| Substation | Location | Distance from Substation (m) | Façade Construction Noise Level (dB $L_{Aeq,T}$) | Magnitude of Effect |
|---|---|---|---|---|
| Sandford Substation | Droveway Farm | 200 | 62dB | Negligible |
| | The Oaks | 230 | 61dB | Negligible |
| | Mead Farm | 550 | 53dB | Negligible |
| Seabank Substation | West House Farm | 1200 | 46dB | Negligible |
| Portishead Substation | Wren Gardens | 40 | 75dB | Low |
| Avonmouth Substation | Laurence Weston | 800 | 49dB | Negligible |
| | Avonmouth Road and surrounding dwellings | 600 | 52dB | Negligible |
| Churchill Substation | Dwelling on Stock Lane to South East of Site | 75 | 70dB | Low |
| | Dwelling on Stock Lane to West of Site | 400 | 55dB | Negligible |
| | Dwellings on to East of Site | 240 | 60dB | Negligible |

14.4.5 The time period 'T' corresponds to the averaging time periods specified in Tables 14.5 and 14.6, assuming the activity is occurring for the full period duration for the percentage of time specified in **Volume 5.14.2, Appendix 14A, Table 1**.

14.4.6 Noise from construction activity at Sandford, Seabank and Avonmouth Substations would not exceed BS5228-1 threshold values at nearby receptors and would lead to a negligible magnitude effect. All receptors are of medium sensitivity and the significance of effect is therefore **negligible**.

14.4.7 Construction activity at Portishead and Churchill Substations would occasionally exceed threshold values leading to low magnitude effects. All receptors are of medium sensitivity and the significance of effect is therefore **minor adverse**.

14.4.8 Mitigation and best practice measures will be used to reduce the magnitude of effect (see section 14.6 of this chapter).

**Construction Compounds Construction Effects**

14.4.9 Threshold values would be exceeded within 79m of construction compound construction works. **Volume 5.14.2, Appendix 14A, Table 4** provides a summary

of the receptors which fall within these threshold distances for the main construction activities.

14.4.10 Noise from the proposed construction activity at construction compounds would exceed threshold values at dwellings close to the Bridgwater Tee (Bath Road), Barton Road, Towerhead Road, Churchill, Nailsea, Church Lane, Cleveson Road and Whitehouse Lane construction compounds, leading to a low magnitude of effect. All receptors are of medium sensitivity and the significance of effect is therefore **minor adverse**.

14.4.11 There are no receptors within the threshold distances at the A38 Bristol Road (UGC), A38 Bristol Road (OHL), South Mendips (Hams Lane), Sandford Substation, AT Route OHL, Engine Lane, Caswell Hill, Sheepway, BW UGC Route West, BW UGC Route East, St Andrews Road, Kings Weston Lane, G Route UGC (East of M49) and Seabank (Severn Road) compounds and therefore the magnitude of effect would be negligible. All receptors are of medium sensitivity and the significance of effect is therefore **negligible**.

14.4.12 Mitigation and best practice measures will be used to reduce the magnitude effect (see section 14.6 of this chapter).

**CSE Compounds Construction Effects**

14.4.13 Construction noise from works at CSE compounds is considered in Table **14.13**.

Table 14.13 Assessment of Noise due to the Construction of CSE Compounds

| CSE Compound | Receptor Location | Distance from CSE Compound (m) | Façade Construction Noise Level (dB $L_{Aeq,T}$) | Magnitude of Effect |
|---|---|---|---|---|
| Bridgwater Tee | Manor Farm | 400 | 55 | Negligible |
| South of Mendip Hills | Riverside Farm | 600 | 52 | Negligible |

14.4.14 Noise from construction activity at CSE compounds would not exceed threshold values and would therefore be of negligible magnitude for all receptors. All receptors are of medium sensitivity and the significance of effect is therefore **negligible**.

**Transition Jointing Pits Construction Effects**

14.4.15 Transition Jointing may include works during night time periods. This would occur if works overrun during daytime periods. Works would be required to be continuous to prevent contamination of the site. The noisiest source associated with transition jointing is the angle grinder although this would not typically be used outside of daytime periods. The angle grinding and welding during transition jointing would take place in an enclosed container to prevent contamination. The container is

expected to achieve an insertion loss of approximately 20dB(A). The major source of noise egress is therefore generator noise. The precise location of works within the Order Limits is unknown and would be determined upon appointment of a contractor. Construction noise from Transition Jointing works is considered in **Table 14.14**.

Table 14.14 Construction Noise Assessment at Transition Jointing Pits

| Activity | Sound Power Level , dB(A) | Distance (m) At Which Predicted Facade Noise Level Is Below BS5228-1 Threshold Level (Including 20dBA insertion loss): | | | | |
|---|---|---|---|---|---|---|
| | | 45dB $L_{Aeq,T}$ | 55dB $L_{Aeq,T}$ | 65dB $L_{Aeq,T}$ | 70dB $L_{Aeq,T}$ | 75dB $L_{Aeq,T}$ |
| Transition jointing | 113 | 860 | 275 | 86 | 49 | 28 |

14.4.16 Unmitigated noise from the transition jointing activity would exceed threshold values at distances of up to 860m during night time periods, up to 275m during evening periods and up to 86m during daytime periods. Works in any single location would not be expected to be of a significant duration (less than one month) and as such the magnitude of effect would be low. No specific locations for transition jointing are defined prior to submission of the DCO application but worst case receptors are expected to be of medium sensitivity and the significance of effect is therefore **minor adverse** during daytime periods. However, due to the potential for night time operations, professional judgement dictates that there is the potential for the significance of effect to be **moderate adverse** during night time periods. This is a worst case assessment assuming that the noisiest activities, such as angle grinding, are undertaken at night, which is not expected.

14.4.17 Mitigation and best practice measures will be used to reduce effects (see section 14.6 of this chapter).

## Construction Traffic Noise and Vibration Effects

### *Construction Traffic on Existing Roads*

14.4.18 The construction traffic assessment presented in **Volume 5.14.2, Appendix 14B, Table 1** provides an assessment of the increase in traffic noise on existing roads based on the CRTN calculation method. Due to the scale of the Proposed Development, construction traffic would be present in different areas during different periods throughout the construction programme. As such, the assessment is based on the total traffic levels with construction traffic data against baseline traffic data for the applicable peak year for each section of road. Baseline data, and therefore the assessment, took account of any predicted increase in traffic due to other local developments.

14.4.19 The predicted increase in traffic noise due to construction traffic is 0dB to 1dB on most affected routes leading to negligible magnitude effects. The A403 St Andrews Road and the Wick to Stalford Road have predicted increases of +2.9dB and +1.8dB respectively, leading to effects of low magnitude.

14.4.20 The increase in traffic noise due to construction traffic would lead to negligible or low magnitude of effects along all existing roads. Receptors are of negligible, low

and medium sensitivity and the significance of effect is therefore **minor adverse** or **negligible**.

***Construction Traffic on Temporary Construction Haul and Access Roads***

14.4.21 Construction traffic flows on temporary construction haul and access roads are expected to be relatively low. Noise levels for construction traffic on these routes are expected to be lower than the levels for the construction of these routes, which is assessed above and tends towards low and negligible magnitude effects and a significance of effect which is minor adverse or negligible. Construction traffic on temporary haul and access routes is expected to tend towards low and negligible magnitude effects. Receptors are of negligible, low and medium sensitivity and the significance of effect is therefore **minor adverse** or **negligible**.

***Construction Traffic Vibration Effects***

14.4.22 Vibration from construction traffic would be most likely to be caused by poor road surface on the haul roads which, if determined to have been caused by construction traffic associated with the Proposed Development, could be easily rectified by *ad hoc* road surface repair. On the public highway, vibration is proportional to noise generated and effects would be similar to those generated in **Volume 5.14.2, Appendix 14B, Table 1**. This would tend towards effects of negligible magnitude. Receptors are of negligible, low and medium sensitivity and the significance of effect is therefore **negligible**.

**Construction Activity Vibration Effects**

14.4.23 Ground-borne and airborne vibration effects have been considered in relation to construction activities. Due to the complex relationship between the source of vibration, forcing frequency, the distance and geological characteristics between source and receiver and the construction of the receiving structure, it is difficult to predict the degree of vibration that may occur.

14.4.24 The level of vibration required to cause structural damage is very high and therefore highly unlikely to be reached during the construction of this Proposed Development.

14.4.25 Airborne vibration would typically be effectively controlled via the mitigation measures to reduce the effect of airborne noise.

14.4.26 Most construction activities are not significant sources of ground-borne vibration. Activities such as earth-working, crane activities and concreting would produce relatively low levels of ground borne vibration. Piling activities could produce perceptible levels of vibration. As such, the magnitude of effect of ground-borne vibration would be negligible to low. Receptors are of negligible, low and medium sensitivity and the significance of effect is therefore **minor adverse** or **negligible**.

## Summary of Significance of Construction Noise Effects (No Mitigation)

14.4.27 **Table 14.15** summarises the significance of effects of construction noise before mitigation.

Table 14.15 Significance of Effects of Construction Noise (No Mitigation)

| Construction Activity | Receptors | Sensitivity of Receptor | Magnitude of Effect | Significance of Effect |
|---|---|---|---|---|
| 400kV overhead line T-pylon construction | All receptors beyond 108m | All | Negligible | **Negligible** |
| | Residential receptors within 108m | Medium | Low | **Minor adverse** |
| 400kV and 132kV overhead line Lattice pylon construction | All receptors beyond 131m | All | Negligible | **Negligible** |
| | Residential receptors within 131m | Medium | Low | **Minor adverse** |
| Underground cable construction (excluding transition jointing) | All receptors beyond 82m | All | Negligible | **Negligible** |
| | Residential receptors within 82m | Medium | Low | **Minor adverse** |
| HDD | All receptors beyond 75m | All | Negligible | **Negligible** |
| | Residential receptors within 75m | Medium | Low | **Minor adverse** |
| 132kV overhead line decommissioning | All receptors beyond 112m | All | Negligible | **Negligible** |
| | Residential receptors within 112m | Medium | Low | **Minor adverse** |
| Sandford Substation | Residential to south | Medium | Negligible | **Negligible** |
| Seabank Substation | Residential to east | Medium | Negligible | **Negligible** |
| Portishead Substation | Residential to west (Wren Gardens) | Medium | Low | **Minor adverse** |
| Churchill Substation | Dwelling on Stock Lane to south east | Medium | Low | **Minor adverse** |
| | Other nearby residential | Medium | Negligible | **Negligible** |

| Construction Activity | Receptors | Sensitivity of Receptor | Magnitude of Effect | Significance of Effect |
|---|---|---|---|---|
| Construction Compounds:<br>Bridgwater Tee (Bath Road)<br>Barton Road<br>Towerhead Road<br>Churchill<br>Nailsea<br>Church Lane<br>Cleveson Road<br>Whitehouse Lane | Residential receptors within 79m | Medium | Low | **Minor adverse** |
| Construction compounds:<br>A38 Bristol Road (UGC)<br>A38 Bristol Road (OHL)<br>South Mendips (Hams Lane)<br>Sandford Substation<br>AT Route OHL<br>Engine Lane<br>Caswell Hill<br>Sheepway<br>BW UGC Route West<br>BW UGC Route East<br>St Andrews Road<br>Kings Weston Lane<br>G Route UGC (East of M49)<br>Seabank (Severn Road) | Residential receptors beyond 79m | Medium | Negligible | **Negligible** |
| CSE compounds | Other nearby residential | Medium | Negligible | **Negligible** |
| Transition jointing (daytime) | Residential receptors within 86m | Medium | Low | **Minor adverse** |

| Construction Activity | Receptors | Sensitivity of Receptor | Magnitude of Effect | Significance of Effect |
|---|---|---|---|---|
| Transition jointing<br>(worst case night time) | Residential receptors within 860m | Medium | Low to Medium | **Minor adverse** to **moderate adverse** |
| Construction traffic noise on existing roads | Industrial and residential | Low to Medium | Negligible to Low | **Negligible** to **minor adverse** |
| Construction traffic noise on temporary routes | Industrial and residential | Low to Medium | Negligible to Low | **Negligible** to **minor adverse** |
| Construction traffic vibration | Industrial and residential | Low to Medium | Negligible to Low | **Negligible** to **minor adverse** |
| Construction vibration | Industrial and residential | Low to Medium | Negligible to Low | **Negligible** to **minor adverse** |

***Route Options***

14.4.28 The magnitude of effect of construction noise and vibration is negligible to low and therefore the significance of effect is **negligible** to **minor adverse** for either preferred route Option A or alternative route Option B.

**Decommissioning Effects**

14.4.29 The magnitude of noise from decommissioning activities is similar to those for construction with the exception of transition jointing which would not be required. Therefore the levels determined for the preparation of the sites can be used in determining the magnitude of decommissioning effects, leading to negligible to low magnitude effects. The highest sensitivity receptors are medium sensitivity and the significance of effect is therefore **minor adverse** or **negligible**.

**Limits of Deviation and Order Limits**

14.4.30 The Limits of Deviation (LoD) would provide a necessary and proportionate degree of flexibility as to the final alignment of the works. The LoD identify a maximum distance or measurement of variation within which these works must be constructed. The overhead line LoD are shown at **Volume 5.3.3, Figures 3.1 and 3.2**; the underground cable LoD are shown at **Volume 5.3.3, Figure 3.3**.

14.4.31 The Order Limits, identified in the Proposed Development Plans (see **Volume 5.3.3, Figure 3.1 and 3.2**) as a red outline, are fixed and detail the anticipated maximum extent of land in which the Proposed Development may take place (if approved and subject to DCO Requirements and any other associated commitments).

14.4.32 Further detail as to the level of flexibility that would be afforded by the LoD and the Order Limits and the assessment approach is provided in **Volume 5.5.1, section 5.6.** The implication of the LoD and Order Limits is that some components of the Proposed Development (both temporary and permanent) may be closer or further away from existing receptors than assessed above.

***Potential Variation of Significance of Construction Effects***

14.4.33 Variation within the LoD, both lateral and longitudinal, was taken into account by the assessment. No change in significance of construction effects is expected due to variation within the LoD or variation within the Order Limits. Due to the relatively short duration (less than one month) of particular noise-generating construction activities affecting individual receptors, the significance of overhead line construction and decommissioning effects would remain **minor adverse** or **negligible**. Underground cable construction is assessed from the boundary of the Order Limits; variation within the Order Limits would not lead to a change in significance for underground cable construction noise and would remain **minor adverse** or **negligible** during daytime periods and remain up to **moderate adverse** for potential worst case night time activities.

14.4.34 Proposed substations (new and modifications/extensions to existing), CSE compounds and construction compounds have been assessed in their positions as shown on the Proposed Development Plans (see **Volume 5.3.3, Figure 3.1 and 3.2**) and as described in **Volume 5.5.1, section 5.6**. As such, these components are afforded no flexibility with regards the Order Limits and the LoD and the significance of effects remains as previously assessed.

**Construction Programme Sensitivity Analysis**

14.4.35 There may be changes to the construction programme that require a later commencement and/or completion of the Proposed Development (see **Volume 5.5.1, section 5.6**). Variation in the construction program is not likely to affect the duration or level of construction noise exposure at any particular receptor. In some instances variation in the construction programme may result in periods of respite; for example, if underground cable construction works are conducted outside of the winter period. The significance of effects would not differ to that previously assessed.

**Climate Change Effects**

14.4.36 The effects of construction noise and vibration would not be affected by climate change.

## 14.5 Inter-relationship of Potential Effects

14.5.1 Noise and vibration is considered in **Volume 5.8.1** (Biodiversity and Nature Conservation) in relation to the effect on fauna. Modelled data for the construction phase includes the predicted sound pressure levels at each badger sett (measurements taken from the entrance closest to the development footprint) and sound pressure levels at various receptors generated by HDD. No data is available to quantify vibration effects on fauna during construction. Whilst in general terms this is not expected to be significant for human receptors; no specific judgement can accurately be made for ecological receptors. Construction noise is unlikely to have a significant effect on species.

14.5.2 Noise and vibration is considered in **Volume 5.15.1** (Socio-economics and Land Use). An amenity effects assessment (see **Volume 5.15.2, Appendix 15J**) has

been undertaken which considers effects arising as a result of the inter-relationship of other environmental effects which together could affect the amenity value of receptors during construction, operation and decommissioning. The assessment has considered likely effects on the amenity various receptors including:

- visitor attractions, PRoW, recreational routes, tourism accommodation and recreational areas; and
- local communities and community facilities (including health, education and community gathering).

14.5.3 Construction and decommissioning noise and vibration are not expected to lead to significant effect on socio-economics and land use.

## 14.6 Mitigation

**General Guidance and Best Practice for Construction Noise Mitigation**

14.6.1 The mitigation of construction noise is not always possible. Works will be undertaken in accordance with the Noise and Statutory Nuisance Act 1992 and in accordance with BS5228-1. The following measures will be implemented to reduce effects from noise and vibration from the construction activities of the Proposed Development:

- construction traffic routes would be used in accordance with the Draft CTMP (**Volume 5.26.5**) would be implemented;
- reverse alarms will incorporate at least one of the following features: directional sounders, broadband signals, self-adjusting sounders, and/or flashing warning lights;
- internal haul roads will be well maintained;
- construction work will be undertaken in accordance with Schedule 3, Requirement 7 of the DCO;
- where advised, consent will be sought under Section 61 of the Control of Pollution Act 1974;
- loading and unloading activities will be located as far as reasonably possible from residential properties or screened;
- mains electricity will be used rather than diesel generators where connection to mains electricity is possible;
- exhaust silencing and plant muffling equipment will be fitted and maintained in good working order;
- low-noise generators and quieter plant and equipment will be used and will conform to European standards;
- the bunding (soil stockpiles) and fencing proposed at the construction compounds will also help to attenuate noise;
- vehicles will not wait or queue on the public highway with engines idling;
- engines would be turned off when vehicles are stationary to avoid idling;
- plant and equipment will be shut down when not in use;
- plant and equipment will be started-up sequentially rather than simultaneously;
- the jointing of cables will be undertaken in a covered working area; and
- drop heights of materials will be minimised.

**Monitoring**

14.6.2 Monitoring will be undertaken in accordance with the Draft CEMP **(Volume 5.26.1)**.

14.6.3 Records will be kept of noise and vibration incidents and complaints in accordance with the Draft CEMP **(Volume 5.26.1)**. Where non-conformance with the CEMP is found, the incident will be reported and investigated using the Pollution Incident Control Plan as described in the Draft CEMP (**Volume 5.26.1**). Appropriate remedial measures will be implemented.

## 14.7 Residual Effects

14.7.1 **Table 14.16** summarises the residual significance of effects of construction and decommissioning noise. As described in section 14.6, mitigation of construction noise is not always possible. As such, the residual effects described below assume no additional mitigation is applied.

Table 14.16 Significance of Residual Effects of Construction and Decommissioning Noise

| Construction Activity | Receptors | Sensitivity of Receptor | Magnitude of Effect | Significance of Effect |
|---|---|---|---|---|
| 400kV overhead line T-pylon construction | All receptors beyond 108m | All | Negligible | **Negligible** |
| | Residential receptors within 108m | Medium | Low | **Minor adverse** |
| 400kV and 132kV overhead line lattice pylon construction | All receptors beyond 131m | All | Negligible | **Negligible** |
| | Residential receptors within 131m | Medium | Low | **Minor adverse** |
| Underground cable construction (excluding transition jointing) | All receptors beyond 82m | All | Negligible | **Negligible** |
| | Residential receptors within 82m | Medium | Low | **Minor adverse** |
| HDD | All receptors beyond 75m | All | Negligible | **Negligible** |
| | Residential receptors within 75m | Medium | Low | **Minor adverse** |
| 132kV overhead line | All receptors beyond 112m | All | Negligible | **Negligible** |

| Construction Activity | Receptors | Sensitivity of Receptor | Magnitude of Effect | Significance of Effect |
|---|---|---|---|---|
| decommissioning | Residential receptors within 112m | Medium | Low | **Minor adverse** |
| Sandford Substation | Residential to south | Medium | Negligible | **Negligible** |
| Seabank Substation | Residential to east | Medium | Negligible | **Negligible** |
| Portishead Substation | Residential to west (Wren Gardens) | Medium | Low | **Minor adverse** |
| Churchill Substation | Dwelling on Stock Lane to south east | Medium | Low | **Minor adverse** |
| | Other nearby residential | Medium | Negligible | **Negligible** |
| Construction compounds:<br>Bridgwater Tee (Bath Road)<br>Barton Road<br>Towerhead Road<br>Churchill<br>Nailsea<br>Church Lane<br>Cleveson Road<br>Whitehouse Lane | Residential receptors within 79m | Medium | Low | **Minor adverse** |

| Construction Activity | Receptors | Sensitivity of Receptor | Magnitude of Effect | Significance of Effect |
|---|---|---|---|---|
| Construction compounds:<br>A38 Bristol Road (UGC)<br>A38 Bristol Road (OHL)<br>South Mendips (Hams Lane)<br>Sandford Substation<br>AT Route OHL<br>Engine Lane<br>Caswell Hill<br>Sheepway<br>BW UGC Route West<br>BW UGC Route East<br>St Andrews Road<br>Kings Weston Lane<br>G Route UGC (East of M49)<br>Seabank (Severn Road) | Residential receptors beyond 79m | Medium | Negligible | **Negligible** |
| CSE compounds | Other nearby residential | Medium | Negligible | **Negligible** |
| Transition jointing (daytime) | Residential receptors within 86m | Medium | Low | **Minor adverse** |
| Transition jointing (worst case night time) | Residential receptors within 860m | Medium | Low to Medium | **Minor adverse** to **moderate adverse** |
| Construction traffic noise on existing roads | Industrial and residential | Low to Medium | Negligible to Low | **Negligible** to **minor adverse** |
| Construction traffic noise on temporary routes | Industrial and residential | Low to Medium | Negligible to Low | **Negligible** to **minor adverse** |

| Construction Activity | Receptors | Sensitivity of Receptor | Magnitude of Effect | Significance of Effect |
|---|---|---|---|---|
| Construction traffic vibration | Industrial and residential | Low to Medium | Negligible to Low | **Negligible** to **minor adverse** |
| Construction vibration | Industrial and residential | Low to Medium | Negligible to Low | **Negligible** to **minor adverse** |

## 14.8 Cumulative Effects

14.8.1 The cumulative assessment is provided at **Volume 5.17** and includes potential cumulative effects of the Proposed Development together with other major development proposals.

14.8.2 Cumulative construction effects have been considered for all other major developments with regards to noise and vibration. No significant cumulative effects are expected.

14.8.3 No further mitigation measures would be required above those identified in this chapter (section 14.6). The residual cumulative effects would be the same as those identified at section 14.7 above.

## 14.9 Conclusions

### Construction Effects

14.9.1 The assessment of the significance of effects due to construction noise and vibration has concluded that:

- the significance of noise from construction activities (excluding transition jointing) is assessed as being **negligible** to **minor adverse**;
- due to night time working, the significance of noise from transition jointing may be **moderate adverse**;
- the significance of construction traffic noise and vibration is assessed as being **minor adverse** to **negligible**; and
- construction vibration is assessed as being **minor adverse** to **negligible**.

### Decommissioning Effects

14.9.2 The significance of decommissioning noise is assessed as being **minor adverse** to **negligible**.

# Part 2 – Operational Noise and Vibration

## 14.10 Method

### Approach

14.10.1 A combination of desk-based and site-based techniques have been employed in the assessment; the objective being to identify and evaluate the potential noise and vibration effects on receptors arising from effects of the operation of the Proposed Development.

14.10.2 The following information has been used in the assessment:

- Ordnance Survey mapping;
- topographical data;
- previous experience of similar developments elsewhere; and
- on-site noise monitoring data.

### Assessment Guidance

14.10.3 The following documents have been used to assess the noise effects from the operation of Sandford Substation and 400kV overhead lines.

#### *National Policy Statements*

14.10.4 NPSs provide the primary basis on which the Secretary of State is required to make a decision on NSIPs. The specific assessment requirements for noise, as detailed in NPS EN-1 and NPS for Electricity Networks Infrastructure (EN-5) are set out below.

Table 14.17 Summary of NPS EN-1 and EN-5 Requirements Relevant to Operational Noise and Vibration

| Para | Requirement | Section of ES | Compliance Assessment |
|---|---|---|---|
| **EN-1** | | | |
| 5.11.4 | The applicant should include a description of the noise generating aspects of the development proposal leading to noise impacts, including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise | Section 14.4 of this Volume | Descriptions of the noise generating aspects of the Proposed Development leading to noise impacts, including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise are provided in the chapter for both construction and operation noise sources. |
| 5.11.4 | The applicant should include identification of noise sensitive premises and noise sensitive areas that may be affected; | Section 14.4 of this Volume | Noise sensitive premises and noise sensitive areas that may be affected have been identified for both construction and operation noise effects. |

| Para | Requirement | Section of ES | Compliance Assessment |
|---|---|---|---|
| 5.11.4 | The applicant should include the characteristics of the existing noise environment | Section 14.3 of this Volume | The chapter and Appendices include a description of the existing noise environment. |
| 5.11.4 | The applicant should include a prediction of how the noise environment will change with the proposed development: | Section 14.4 of this Volume, **Volume 5.14.2, Appendix 14A, Appendix 14D, Appendix 14G** | The chapter and Appendices include a prediction of how the noise environment will change due to both construction and operational effects |
| 5.11.4 | > in the longer term during the operating life of the infrastructure | | The chapter and Appendices include a prediction of how the noise environment will change due to operational effects. |
| 5.11.4 | > at particular times of the day, evening and night as appropriate | | Construction and operational noise effects have been assessed for the periods over which they are expected to have the most significant effect. |
| 5.11.4 | The applicant should include an assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive areas | Section 14.4 of this Volume | The chapter includes an assessment of how the noise environment will change due to both construction and operational effects. |
| 5.11.4 | The applicant should include measures to be employed in mitigating noise | Section 14.6 of this Volume | The chapter includes measures to be employed to mitigate noise. |
| 5.11.4 | The nature and extent of the noise assessment should be proportionate to the likely noise impact. | **Volume 5.14.1** | The noise assessment presented at **Volume 5.14.1** is considered to be proportionate to the likely noise impact. |
| 5.11.5 | The noise impact of ancillary activities associated with the development, such as increased road and rail traffic movements, or other forms of transportation, should also be considered | Section 14.4 and 14.5 of this Volume | The chapter considers the noise impact of ancillary activities associated with the Proposed Development, such as increased road and rail traffic movements, or other forms of transportation. |

| Para | Requirement | Section of ES | Compliance Assessment |
|---|---|---|---|
| 5.11.6 | Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance. | Section 14.2 of this Volume | Operational noise is assessed with reference to Bs4142:1997, BS833:1999 and TR (T)94. |
| 5.11.7 | The applicant should consult EA and Natural England (NE), or the Countryside Council for Wales (CCW), as necessary and in particular with regard to assessment of noise on protected species or other wildlife. | **Volume 5.8.1,** section 8.6 | All effects on ecological receptors are addressed in **Volume 5.8.1,** section 8.5, with technical input from the acoustics and vibration consultants. |
| 5.11.7 | The results of any noise surveys and predictions may inform the ecological assessment. The seasonality of potentially affected species in nearby sites may also need to be taken into account. | **Volume 5.8.1,** section 8.6 | All effects on ecological receptors are addressed in **Volume 5.8.1,** section 8.5, with technical input from the acoustics and vibration consultants. |
| 5.11.9 | The IPC should not grant development consent unless it is satisfied that the proposals will meet the following aims: | Section 14.4 of this Volume | The chapter demonstrates that significant adverse impacts on health and quality of life from noise will be avoided, mitigated and minimised through the effective management and control of noise. |
| 5.11.9 | - avoid significant adverse impacts on health and quality of life from noise; mitigate and minimise other adverse impacts on health and quality of life from noise; and where possible, contribute to improvements to health and quality of life through the effective management and control of noise. | | |

| Para | Requirement | Section of ES | Compliance Assessment |
|---|---|---|---|
| 5.11.12 | Mitigation measures may include one or more of the following: engineering: reduction of noise at point of generation and containment of noise generated; lay-out: adequate distance between source and noise-sensitive receptors; incorporating good design to minimise noise transmission through screening by natural barriers, or other buildings; and administrative: restricting activities allowed on the site; specifying acceptable noise limits; and taking into account seasonality of wildlife in nearby designated sites. | **Volume 5.8.1,** section 8.7; BMS at **Volume 5.26.3;** section 14.6 of this Volume; Draft CTMP at **Volume 5.26.5.** | The chapter demonstrates that operational noise is controlled and mitigated as far as practicable at source by design and layout and construction noise is controlled by effective administrative and engineering noise control measures. |
| **EN-5** | | | |
| 2.9.8 & 2.9.9 | While standard methods of assessment and interpretation using the principles of the relevant British Standards18 are satisfactory for dry weather conditions, they are not appropriate for assessing noise during rain, which is when overhead line noise mostly occurs, and when the background noise itself will vary according to the intensity of the rain. Therefore an alternative noise assessment method to deal with rain-induced noise is needed, such as the one developed by National Grid as described in report TR(T)94,1993 | Section 14.2 of this Volume | An assessment methodology based on the principles of BS41442:1997 and TR(T)93 has been used to assess noise from 400kV overhead lines during wet conditions. |
| 2.9.12 | Applicants should have considered the following measures: | See below | |

| Para | Requirement | Section of ES | Compliance Assessment |
|---|---|---|---|
| | > The positioning of lines (see Section 2.8 (landscape/visual impact)) to help mitigate noise; | **Volume 5.2.1** | The alignment has been selected to minimise the effects of noise as far as practicable. |
| | > Ensuring that the appropriately sized conductor arrangement is used to minimise potential noise; | Embedded mitigation and further mitigation measures are provided at section 14.6 of this Volume | Twin Redwood, the proposed conductor for the majority of the Proposed Development is the quietest twin conductor system that National Grid currently operates. |
| | > Quality assurance through manufacturing and transportation to avoid damage to overhead line conductors which can increase potential noise effects; and | | Quality assurance through manufacturing and transportation will be undertaken to avoid damage to overhead line conductors which can increase potential noise effects. |
| | > Ensuring that conductors are kept clean and free of surface contaminants during stringing/installation. | | Care will be taken during installation to ensure that conductors will be kept clean and free of surface contaminants during stringing. This will minimise the risk of excessive dry noise on energisation of the proposed 400kV overhead line. |
| 2.9.13 | The ES should include information on planned maintenance arrangements. | **Volume 5.3.1,** section 3.7 | The ES includes information on planned maintenance arrangements. |

EN-5

14.10.5 In respect of potential noise effects, the NPS for Electricity Networks Infrastructure, EN-5 (EN-5), (Ref. 14.8) recognises that:

*"All high voltage transmission lines have the potential to generate noise under certain conditions."*

*EN-5. Paragraph 2.9.2*

In addition,

*"Audible noise effects can also arise from substation equipment such as transformers, quadrature boosters and mechanically switched capacitors…Noise may also arise from discharges on overhead line fittings such as spacers, insulators and clamps".*

*EN-5. Paragraph 2.9.7*

### *National Planning Policy Framework*

14.10.6 The National Planning Policy Framework (NPPF) (published March 2012) (Ref. 14.2) has replaced the relevant Planning Policy Guidance (PPG 24: Planning and Noise) as the means by which noise is considered within the town and country planning regime. The NPPF does not contain assessment criteria; instead it provides a series of policies, giving local authorities the flexibility necessary to meet the needs of local communities. The NPPF states that planning policies and decision should aim to:

*"avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*

*mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*

*recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*

*identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

14.10.7 The NPPF Planning Practice Guidance for noise (March 2014), was published recently to provide a degree of technical grounding to the policies described in the NPPF. The Planning Practice Guidance mirrors much of the policies and guidance introduced in the NPSE, with the emphasis on avoiding significant adverse effects, and promoting sustainable growth with overall improvement in health and quality of life for the country. These principles form the basis upon which the relevant National Policy Statements (see **Table 14.17**) were written and on which this assessment is founded.

### *Local Policy*

14.10.8 Local planning policies state that developments should seek to avoid or else appropriately mitigate unavoidable harm to environmental amenity. Local planning policy does not set policy for testing the acceptability of nationally significant infrastructure projects and does not add materially to the protection afforded at a national level in respect of noise and vibration.

14.10.9 The majority of local planning policies seek to control the impact of noise. The remaining policies (policy D10 from the Sedgemoor District Council Core Strategy and South Gloucestershire Local Plan saved policy T12), relate to transport, and more particularly ensuring adequate provision for transport is made in development, whilst minimising adverse impacts.

14.10.10 Local planning policies are summarised at **Volume 5.4.2, Appendix 4A**.

***British Standards and Guidance Documents***

14.10.11 Various British Standard methods for noise assessments have been used in this assessment as follows:

BS7445: 2003 - Description and Measurement of Environmental Noise - Guide to Quantities and Procedures

14.10.12 BS7445 (Ref. 14.9) provides the framework within which environmental noise should be quantified. Part 1 provides a guide to quantities and procedures and Part 2, a guide to the acquisition of data pertinent to land use. Part 3 provides a guide to the application of noise limits. The standard also refers to BS EN 61672, which prescribes the equipment necessary for such measurements.

BS4142: 1997 - Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas

14.10.13 BS4142 (Ref. 14.10) provides a method for assessing industrial noise against ambient background noise levels. A 'rating penalty' of 5dB is added to the industrial noise if it contains characteristics that are likely to increase the potential for it to cause annoyance. Such characteristics could include impulses e.g. bangs/crashes or tonal components e.g. hums and whistles.

14.10.14 Comparison of the difference between the industrial noise level including any rating penalty (the rating level) and the background noise level indicates the likelihood of complaint. The greater the difference, the greater the likelihood of complaints arising.

- a difference of around +10dB or more indicates that complaints are likely;
- a difference of around +5dB is of marginal significance; and
- if the rating level is more than 10dB below the measured background then this is a positive indication that complaints are unlikely.

14.10.15 BS4142 is general in character and does not cover all situations. Section 1 (Scope) of BS4142 states: *"The method is not suitable for assessing the noise measured inside buildings or when the background and rating levels are both very low"*. A note to Section 1 states: *"For the purposes of this standard, background noise levels below about 30dB and rating levels below about 35dB are considered to be very low"*.

TR(T)94, 1993

14.10.16 TR(T)94, 1993 (Ref. 14.11) is an internal National Grid report, referenced in EN-5, describing a method to assess the potential effects of dry and rain-induced noise from new overhead lines. TR(T)94 does not set specific noise assessment criteria; instead it refers to BS4142 and the subjective response of communities and individuals to changes in noise levels.

**Background to Operational Substation Noise**

14.10.17 There are three basic sources of audible noise from substations. Each of these has its own characteristic frequency spectrum and pattern of occurrence due to the nature of the noise-generating mechanisms involved:

14.10.18 Transformer and shunt reactor noise is practically constant, with a low frequency hum occurring at exact harmonics of the supply frequency; 100Hz and 200Hz components are usually dominant. Transformers generally run continuously except for occasional maintenance and fault outages. The shunt reactors proposed for the Proposed Development would also be in service for the majority of the time. Transformer and shunt reactor coolers typically emit a broadband noise; however, their operation depends on temperature and loading.

14.10.19 Switchgear noise is generated, in the main, by the operation of circuit breakers, for which the noise emissions are 'impulsive' in character (i.e. of short duration). Switchgear operations would be very infrequent. Modern switchgear of the Sulphur Hexafluoride ($SF_6$) type operates with a dull 'thud'.

14.10.20 Substation auxiliary plant comprises standby diesel generators and air compressors to provide emergency back-up power to cooling plant. When present and operating, these may contribute to the broadband noise climate. They do not run continuously, and in any case, are housed in a building or outdoor acoustic enclosure. Noise from such assets, if installed at the substation, is seldom discernible beyond the substation perimeter fence.

**Background to 400kV Overhead Line Noise**

14.10.21 The proposed 400kV sections of overhead line would be of a twin bundle conductor system, which would be in continuous operation except for maintenance and fault outages. 400kV transmission lines of twin conductor bundle construction can produce audible noise under certain conditions. Conductor system noise occurs when the conductor surface electrical stress exceeds the inception level for corona discharge activity, a level of around 17-20kV/cm. Most transmission line conductors are designed to operate below this threshold, and so usually operate quietly in dry weather conditions. The typical electrical stress on twin Redwood conductor systems (on standard pylons or the T-pylon), as proposed for the major part of the Proposed Development, is well below 15kV/cm in ideal operating conditions and twin Redwood is the quietest twin conductor system that National Grid currently operates. However, small areas of surface contamination on conductors, spoiling the otherwise smooth conductor surface, would cause a local enhancement of electrical stress which may be sufficiently high to initiate localised discharge activity. At each discharge site a limited electrical breakdown of the air occurs. A portion of the energy associated with the corona process is released as acoustic energy which radiates into the air as sound pressure waves.

14.10.22 The highest noise levels generated by a 400kV line generally occur during and soon after periods of rainfall. Water droplets may accumulate on the surface of the conductor and initiate multiple corona discharges. The number of droplets, and the resultant noise level, would depend primarily on the rate of rainfall. Fog may also give rise to increased noise levels, although these levels will be less than those during rain. Noise generated under these circumstances is referred to as 'wet noise'. However, some of the effect of this increased noise is masked by increased ambient noise due to rainfall (either directly due to raindrops falling on hard surfaces or nearby foliage, or indirectly due to increased vehicle tyre/road interaction noise on local wet roads).

14.10.23 Similarly, after a prolonged spell of dry weather, without heavy rain to wash the conductors, contamination may accumulate sufficiently to result in increased noise. Under these circumstances, the noise is referred to as 'dry noise'. During the next occurrence of heavy rain, these discharge sources are washed away and the line would resume its normal quieter operation.

14.10.24 The level of operational noise from overhead lines falls quickly with distance from the overhead line.

14.10.25 Anecdotal evidence received by National Grid over the years suggests that levels of audible noise from overhead lines can be higher in the first few months of operation as the conductors undergo a "weathering in" process. This chapter assesses the noise impacts after this weathering in process has taken place.

## Study Areas

14.10.26 The study area for substation operational noise at Sandford considers all sensitive receptors within 800m of the proposed substation site so that all of the nearest sensitive receptors were assessed.

14.10.27 The substations at Seabank, Churchill, Portishead and Avonmouth are scoped out the assessment as they contain no new material sources of noise. Further information is given in **Volume 5.14.2, Appendix 14C.**

14.10.28 The study area for overhead line operational noise extends to 200m from the proposed centre line. Based on at least 50 years of experience operating the UK transmission network at 400kV, there is no significant audible noise effect beyond this distance, even in the most sensitive of locations, for the type of conductor system that would be used in the Proposed Development.

## Operational Phase Assessment Methodologies

### *Operational Substation Noise*

Seabank Substation

14.10.29 The Proposed Development at the existing Seabank Substation includes the addition of switchgear and auxiliary plant, and the removal of an existing transformer. Since substation noise is dominated by transformer noise at this location, the Proposed Development would have an overall noise benefit and therefore operational noise associated with Seabank Substation is scoped out of further assessment. Further information is given in **Volume 5.14.2, Appendix 14C**.

Churchill, Portishead and Avonmouth Substations

14.10.30 The Proposed Developments at the existing Churchill, Portishead and Avonmouth Substations would contain no new material sources of noise and as such operational noise is scoped out of further assessment. Further information is given in **Volume 5.14.2, Appendix 14C**.

Sandford Substation

14.10.31 The proposed new development at Sandford Substation would comprise transformers, shunt reactors, switchgear and auxiliary plant. The predominant

noise source at this site would be the transformers and shunt reactors and their associated coolers, and these are all included in the assessment of the site.

Substation Maintenance

14.10.32 The substations will be unmanned under normal operating conditions. Routine maintenance would require occasional site visits by staff, and would not lead to a noticeable increase in traffic movements. Routine maintenance activities do not create sources of noise that would be audible beyond the substation fence. On this basis, audible noise from substation maintenance has been scoped out of further assessment.

Operational Substation Noise Assessment Methodology

14.10.33 A desk-based assessment of sensitive receptors close to the proposed Sandford Substation site has been undertaken, by the use of aerial photography available from Google Maps and Intergraph Geomedia mapping software.

14.10.34 Modelling of operational noise at Sandford Substation has been undertaken using CadnaA noise modelling software, which incorporates prediction methodology within ISO 9613: 1993 'Acoustics - Attenuation of sound during propagation outdoors, Part 2: 'General method of calculation'. The ISO 9613-2 method predicts a long-term equivalent continuous A-weighted sound pressure level ($L_{Aeq}$) under meteorological conditions favourable to propagation at distances from a variety of sources of known emission. Details, including input parameters, of the noise prediction modelling study for the proposed Sandford Substation are provided in **Volume 5.14.2, Appendix 14D**.

14.10.35 The model assumes downwind propagation, irrespective of prevailing wind direction, within +/- 45 degrees of direction connecting dominant source and receiver, wind speeds between 1m/s and 5m/s at heights between 3m and 11m above the ground.

14.10.36 The CadnaA model includes transformers and shunt reactors, and where appropriate, their coolers. The modelled sound emission levels (at receivers) include a +5dB penalty to account for the tonal element of this type of equipment, in accordance with the recommendations of BS4142. Due to the infrequent nature of operation the CadnaA model does not include switchgear or auxiliary plant noise.

14.10.37 The model has been used to assess the free field (excluding façade reflections) $L_{Aeq}$ levels at positions representative of the external facades of residential receptors. No façade correction was applied in these calculations as the background noise measurements were free field.

14.10.38 Background noise survey results have been used to determine residential receptors likely to be most affected by noise from the Sandford Substation (whether as a result of proximity or existing background noise level). Attended five minute noise surveys were undertaken during the night-time, to represent the quietest exposure period to provide a conservative assessment (see **Volume 5.14.2, Appendix 14E**).

14.10.39 Measurements were taken in accordance with relevant measurement standards and equipment was calibrated in accordance with the manufacturers' instructions.

14.10.40 Where 'very low' (below 30dB $L_{A90}$) background noise levels were measured, a Proposed Development specific assessment (based on the methodology of BS4142) which compares a rating level (including a +5dB penalty where applicable) to a minimum background level of 30dB $L_{A90}$ was followed. Background noise levels were measured during worst case, quiet night time periods. This ensured a conservative assessment outcome at these locations. Where relevant, alternative criteria, such as those based on WHO guidelines (Ref. 14.7), and British Standard BS8233:1999 Sound insulation and noise reduction for buildings - Code of practice (BS8233) (Ref. 14.12), were considered.

***400kV Overhead Line Operational Noise***

400kV Overhead Line Noise Assessment Methodology

14.10.41 A desk-based assessment of sensitive receptors within at least 200m of the proposed overhead line route has been undertaken, taking into account the LoD, by the use of aerial photography available from Google Maps and Intergraph Geomedia mapping software.

14.10.42 Background noise surveys, comprising attended five and 15 minute measurements at locations representing residential receptors located along the proposed route have been undertaken during the night, to represent the quietest exposure period (see **Volume 5.14.2, Appendix 14E**). These results were used to inform the analysis of likely effects from the overhead line.

14.10.43 Calculations of dry corona noise for the proposed overhead line conductors were based on data from existing overhead lines, with appropriate correction factors for pylon design and conductor wire configurations, as per the method in TR(T)94.

14.10.44 A Proposed Development specific methodology based on the principles of BS4142 was used to assess overhead line noise occurring in dry weather conditions. A difference in the sound pressure at a receptor compared to background noise levels of +10dB or more means complaints would be likely, whereas a difference of around +5dB means the likelihood would be marginal. For assessment levels below +5dB, the lower the value, the lower the likelihood of complaints, and a -10dB assessment level is a positive indication that complaints would be unlikely.

14.10.45 The methodology for assessing noise generated by overhead line conductors in wet weather conditions differs (due to the increase in background noise due to rainfall). The detailed methodology of TR(T)94 produces a weighted average increase in total sound pressure levels over a range of likely background noise levels due to rainfall, with the typical rainfall rates given the highest weighting. The greatest difference between noise levels with and without overhead line noise occur at rainfall rates of 1mm/hr, since at this level the methodology adds an additional tonal penalty of 5dB is added to line noise to account for hum inception. Using the predicted sound emission rate in wet conditions (based on the TR(T)94 method assessing conductor type and configuration, and assuming a 1mm/hr intensity rainfall), and a typical background noise level during rain, adoption of the BS4142 methodology can be considered appropriate, and is likely to produce a conservative assessment.

14.10.46 Generic data curves were produced (**Volume 5.14.2, Appendix 14F**) and were used to identify spans of the overhead line where more detailed modelling of effect was required, due to either proximity of residential properties or low background

noise levels. At this stage, some spans with residential receptors within 200m of the overhead line, taking into account the LoD, were scoped out of further assessment. These spans are listed in **Volume 5.14.2, Appendix 14G**.

14.10.47 The predicted conductor sound power levels (wet and dry) from TR(T)94 calculations for each overhead line design was then manually adjusted using measured octave curves for the observed 'crackle' (dry) or 'hum' (wet). These octave sound power data were then used as input data to detailed noise propagation models, using CadnaA noise modelling software. The prediction methodology within ISO 9613-2: 1993 was used to predict long-term equivalent continuous A-weighted sound pressure levels ($L_{Aeq}$) at the identified dwellings to each 'scoped-in' overhead line span (spans with residential receptors within 200m where more detailed modelling was considered appropriate). Details, including input parameters, of the noise prediction modelling study for the assessed (scoped-in) spans are provided in **Volume 5.14.2, Appendix 14G**.

14.10.48 The models assume downwind propagation, within +/- 45 degrees of direction connecting dominant source and receiver, and wind speeds between 1m/s and 5m/s at heights between 3m and 11m above the ground.

14.10.49 In order to assess the potential effects of noise during wet conditions, the measured background levels were corrected using the 'Miller Curves' (Ref. 14.13) presented in TR(T) 94 which take account of the terrain/ground around the receptor being assessed, to produce a likely background noise level due to the effect of rainfall. These calculations assumed a typical Miller Curve "Type 2", which estimated the sound levels due to rainfall as 41dB at a rainfall rate of 1mm/hr, and was considered to be a conservative estimate of the likely background noise due to rainfall over the whole Proposed Development area.

14.10.50 The model has been used to assess the free field $L_{Aeq}$ sound levels at positions representative of the external facades of residential receptors. No façade correction was applied in these calculations.

***132kV Overhead Line Operational Noise***

14.10.51 Electrical stresses on 132kV overhead line conductors are generally much lower than those on 400kV overhead lines in normal operation, and as such, are below the thresholds for audible noise inception. These types of overhead lines are practically quiet in operation. Therefore, operational audible noise from any of the proposed 132kV sections of overhead line is scoped out of any further assessment.

***Operational Noise from Underground Cables and CSE Compounds***

14.10.52 Underground cables and CSE compounds are practically quiet in operation. Operation noise from this equipment is therefore scoped out of further detailed analysis.

***Overhead Line Maintenance***

14.10.53 Routine maintenance for overhead lines includes visual and infrared inspection by helicopter one or two times per year. If further work is required, components of overhead line pylons and conductors will be accessed by Mobile Elevated Working

Platforms. Maintenance activities are considered to have less effect (typically of lower magnitude and shorter duration) than construction activities and are therefore scoped out of further assessment.

***Operational Vibration, Substations and Overhead Lines***

14.10.54 The operation of substations and overhead lines will not generate significant levels of vibration and therefore operational vibration effects have been scoped out from further assessment.

**Methodology for Assessing the Significance of Operational Noise Effects**

***Sensitivity***

14.10.55 Residential properties are assessed as being noise sensitive, although developments such as hospitals and schools also contain receptors that are potentially noise sensitive. It is therefore appropriate to determine sensitivity on a case by case basis at a local level. The WHO guidelines do offer some comment on degrees of sensitivity, identifying 'vulnerable subgroups' such as those suffering from particular medical conditions. Taking this into account, the sensitivity scale shown in **Table 14.18** has been developed.

Table 14.18 Sensitivity of Receptor – Operational Noise

| Sensitivity of Receptor | Receptor Description |
|---|---|
| **High** | Patients in hospitals/hospices etc. – defined as a "vulnerable subgroup" with very high or continuous rates of occupancy |
| **Medium** | Residential receptors |
| **Low** | Area used primarily for leisure activities, including PRoW, sports facilities and sites of historic or cultural importance |
| **Negligible** | All other areas such as those used primarily for industrial or agricultural purposes |

14.10.56 The sensitivities specified above are identical to those used for the recent Hinkley Point C Nuclear Power Station proposal. Further definition of the receptor sensitivities, based on guidance provided by the WHO Guidelines for Community Noise (Ref. 14.7), is provided below for operational noise:

High Sensitivity

14.10.57 Receptors have been categorised as high sensitivity where noise may be detrimental to vulnerable subgroups. Such subgroups include pupils in educational facilities and patients in healthcare facilities.

Medium Sensitivity

14.10.58 Receptors have been categorised as medium sensitivity where noise may cause disturbance and a level of protection is required but a level of tolerance is expected.

Low Sensitivity

14.10.59 Receptors have been categorised as low sensitivity where noise may cause short duration effects in a recreational setting although particular high noise levels may cause a moderate effect.

Negligible Sensitivity

14.10.60 Receptors have been categorised as negligible sensitivity where noise is not expected to be detrimental.

14.10.61 No receptors within the 'vulnerable subgroups' categories in the Sandford Substation or the 400kV overhead line study areas have been identified, taking into account the LoD. Analysis in this report is therefore based upon receptors classified as having medium or low sensitivity.

***Magnitude***

14.10.62 The magnitude of effect is based upon noise predictions that were undertaken. However, since the noise predictions are based on reasonable worst case assumptions, it would be inappropriate to conclude a high magnitude of effect simply because a certain threshold (e.g. the assessment level) is exceeded. The amount by which a threshold is exceeded, along with the duration of effect should also be taken into account. The apportionment of a magnitude rating has therefore taken this situation into account by applying professional judgement.

14.10.63 A Proposed Development noise assessment of the rating level compared to background noise level was adopted for overhead line dry and wet noise, as well as noise generated by the proposed Sandford Substation. This is consistent with the principles of BS4142, and is conservative when used in situations where the background noise levels are 'very low' (as defined by BS4142). For background noise levels below 30dB, and therefore out of scope of BS4142, a minimum background level of 30dB was assumed. The implication of this is that rating levels lower than 30dB are therefore categorised as having no greater than a low magnitude of effect. In absolute terms, a noise level of 30dB is significantly below the recommended values for external and subsequent internal amenity (taking into account attenuation through an open window) stated by British Standard BS8233:1999 and the WHO Guidelines for Community Noise during both daytime and night time periods. Furthermore, background noise surveys were conducted during quiet night time periods and as such represented a worst case assessment. The magnitude of effect during daytime periods is therefore expected to be lower.

14.10.64 The assessment criteria for the magnitude of effect of operational noise are shown in **Table 14.19**.

Table 14.19 Magnitude of Operational Effects

| **Magnitude of Effect** | **Operational Noise - Substation or Overhead Line - Dry and Wet Noise** |
|---|---|
| High | Predicted rating levels are 5dB or more above the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |

| Magnitude of Effect | Operational Noise - Substation or Overhead Line - Dry and Wet Noise |
|---|---|
| Medium | Predicted rating levels are between 5dB and 0dB above the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |
| Low | Predicted rating levels are between 0dB and 5dB below the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |
| Negligible | Predicted rating noise levels are between 5dB and 10dB below the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |
| No effect | Predicted rating noise levels are 10dB or more below the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |

14.10.65 The above criteria are based on the assessed levels during the quietest night-time hours, when people are likely to be sleeping. In addition, the levels assessed are free-field calculations (assuming no sound reflections other than from the ground) of external levels, and take no account of building attenuation effects to predict levels inside residential dwellings. As such, the above criteria are considered to be conservative.

***Significance***

14.10.66 A combination of receptor sensitivity and magnitude of effect before and after mitigation was used to determine the overall significance of the effect, as shown in **Table 14.20**.

Table 14.20 Significance of Effects

| Significance of Effect | Sensitivity of Receptor | | | |
|---|---|---|---|---|
| **Magnitude** | **High** | **Medium** | **Low** | **Negligible** |
| High | Major | Major | Moderate | Minor |
| Medium | Major | Moderate | Minor | Negligible |
| Low | Moderate | Minor | Negligible | Negligible |
| Negligible | Minor | Negligible | Negligible | Negligible |
| No effect | Negligible | Negligible | Negligible | Negligible |

14.10.67 The above significance criteria are based on the assessment at locations representing the external façade of properties, and as such there will be a correspondingly lower assessment when attenuation of buildings is taken into account.

## 14.11 Baseline Environment

### Noise Survey Results

14.11.1 Attended five-minute spot measurements were taken in the vicinity of Sandford Substation during the early hours of 16 February 2013, and along the proposed overhead line route in the early hours of 27 May, 19 June and 21 August 2013. Further attended 15-minute spot measurements were taken along the proposed overhead line route in the early hours of 16 October 2013.

14.11.2 Night-time background levels, $L_{A90,5min}$ were between 27.9 and 31.4dB in the vicinity of Sandford Substation, and varied along the overhead line route between 28.1dB and 46.8dB. The measurements along the overhead line route in particular were affected by their proximity to the M5 Motorway and industrial areas around Avonmouth.

14.11.3 The measurements were all taken in the early hours of the morning, when weather conditions were fine, with little wind, and are considered representative of the likely quietest background conditions. Details of all measurements including locations and dates/times are provided in **Volume 5.14.2, Appendix 14E**.

### Baseline Characteristics

14.11.4 The Proposed Development would be located within a mixture of rural, urban and industrial areas, which would have a correspondingly varied noise environment. While much of the development is in a rural environment, measured noise levels close to sensitive receptors were considered typical of those likely to be influenced by nearby existing noise sources such as motorways and existing industrial facilities.

14.11.5 The ambient noise levels in the vicinity of the Proposed Development were predominantly governed by their distance from the M5 Motorway and other main highways.

14.11.6 The baseline environment would not be expected to change prior to the commencement of the Proposed Development.

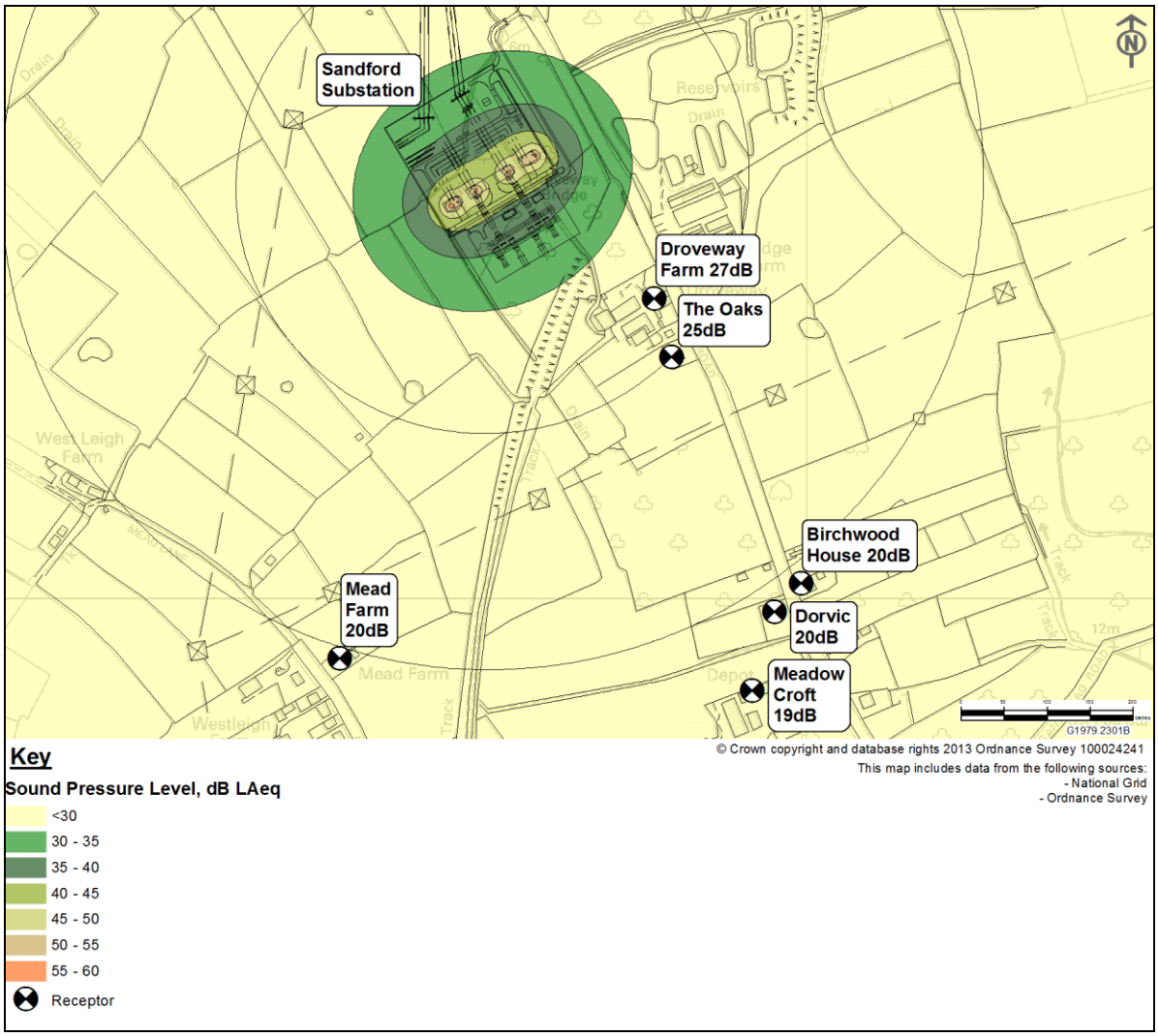
## 14.12 Prediction and Assessment of Significance of the Potential Operational Noise Effects

### Sources of Operational Noise

#### *Sandford Substation Operational Effects*

14.12.1 Modelling of the operational noise effects from the proposed Sandford Substation was undertaken using CadnaA software (see **Volume 5.14.2, Appendix 14D**). **Inset 14.1** below shows the, night time CadnaA noise model.

Inset 14.1: Proposed Sandford Substation Night Time Noise Propagation Model




14.12.2 Transformers and shunt reactors would be in service 24 hours a day, except during maintenance periods. The overnight period has been modelled as substation noise would be likely to have the most effect when background noise levels in the surrounding area are at their lowest, and also when people are sleeping. Overnight, transformer loading would be reduced, so it is unlikely that transformer coolers would be operating at this time. Shunt reactors however would be at full load at all times, so continuous operation of their coolers has been assumed. A +5dB penalty was applied for the tonality of the noise sources. The transformers and shunt reactors will be specified (likely to be with acoustic enclosures) as part of

their inherent design to meet a specified rating level at the nearest residential receptors to the substation.

14.12.3 The analysis of substation noise is provided in **Table 14.21**.

Table 14.21 Sandford Substation Operational Noise

| **Receptor Name** | **Background Noise Level, dB $L_{A90}$** | **Rating Level, dB** | **Assessment Level, dB** | **Magnitude of Effect** |
|---|---|---|---|---|
| Droveway Farm | 30 | 27 | -3 | Low |
| The Oaks | 30 | 25 | -5 | Negligible |
| Mead Farm | 30 | 20 | -10 | No effect |
| Birchwood House | 30 | 20 | -10 | No effect |
| Dorvic | 30 | 20 | -10 | No effect |
| Meadow Croft | 30 | 19 | -11 | No effect |

14.12.4 The above assessment levels represent the free field $L_{Aeq}$ levels at positions representative of the external facades of properties. Internal levels at properties would be lower.

14.12.5 Results indicate that the magnitude of operational noise is of low, negligible or no effect at all receptors. The highest sensitivity receptors are medium sensitivity and the significance of effect is therefore **minor adverse** or **negligible**.

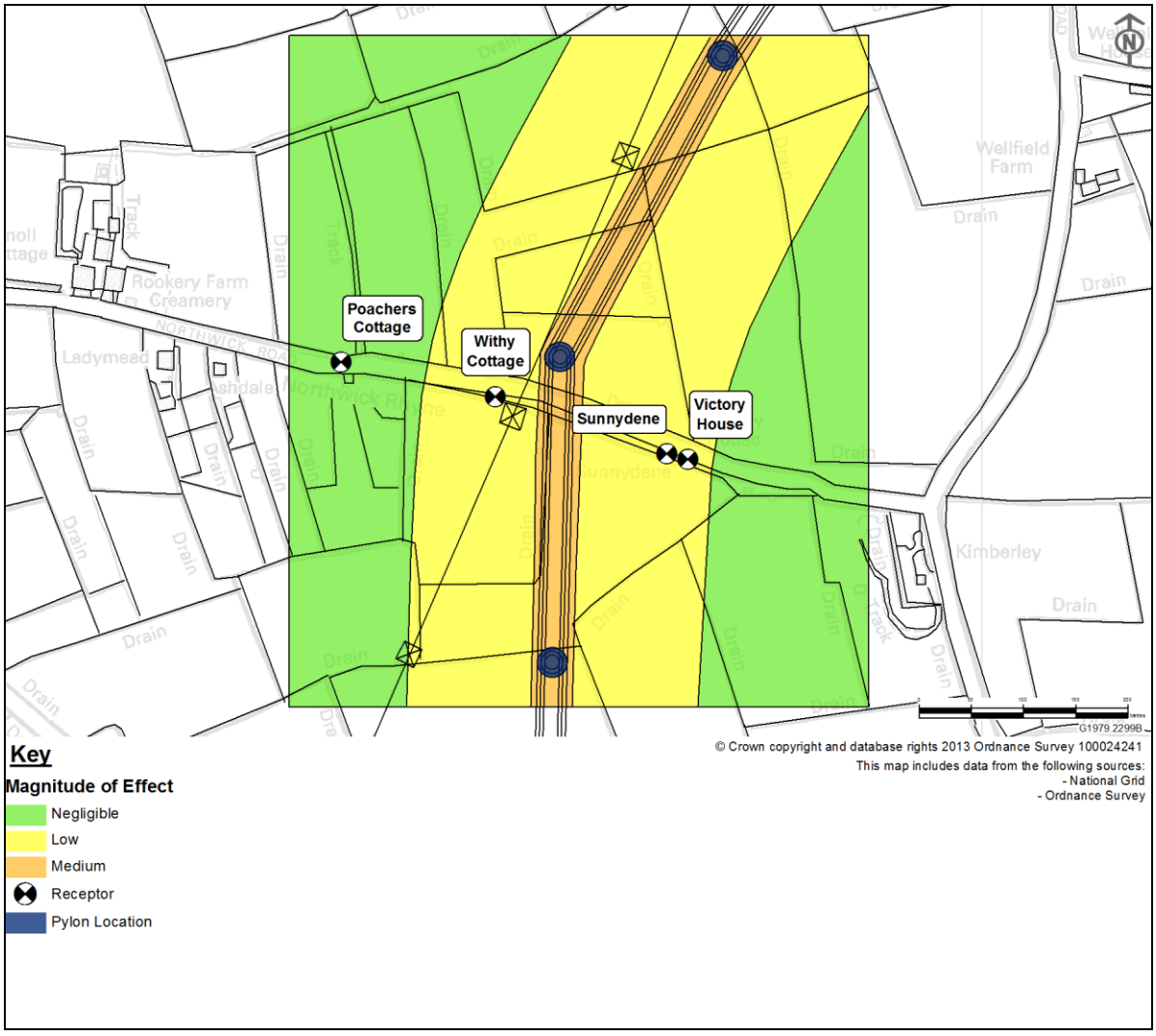
***400kV Overhead Line Operational Effects***

Medium and High Sensitivity Receptors

14.12.6 There are no high sensitivity receptors, such as schools or healthcare facilities, within the study area of operational 400kV overhead line noise. The assessment therefore considers medium sensitivity residential receptors.

14.12.7 The results of the analysis are shown in **Tables 14E.4 in Volume 5.14.2, Appendix 14G**. **Inset 14.2** below shows an example of the CadnaA noise model of overhead line noise.

Inset 14.2: Example CadnaA 400kV Overhead Line Noise Assessment Model




14.12.8 The receptors where there is there may be a major or moderate significance of effect (i.e. operational noise with a magnitude effect of medium or high for receptors of medium sensitivity) were identified and are set out in **Table 14.22**.

Table 14.22 Assessment of Predicted Dry and Wet Noise from Overhead Lines Based on CadnaA Noise Propagation Model

| Receptor Ref. | Receptor Name | Section | Predicted Assessment Level, dB (Including 5dB Acoustic Character Correction) | | Magnitude of Effect | |
|---|---|---|---|---|---|---|
| | | | Dry | Wet | Dry | Wet |
| 33 | Flat above Garage (Tarnock) | B | -6.8 | +2.5 | Negligible | Medium |
| 34 | Tarnock Cottage | B | -8.8 | +0.4 | Negligible | Medium |
| 39 | Moorland Park | D | -9.1 | +1.2 | Negligible | Medium |
| 69 | Star Inn | D | +0.6 | +4.9 | Medium | Medium |

14.12.9 The above numbers are assessed at locations representative of the external facades of properties.

14.12.10 Results indicate that the magnitude of 400kV overhead line operational noise is low or negligible or would have no effect at the majority of receptors. All receptors are of medium sensitivity and the significance of effect is therefore **minor adverse**, or **negligible** for both dry and wet conditions.

14.12.11 During dry conditions the magnitude of 400kV overhead line operational noise is medium at the Star Inn which is classed as a medium sensitivity receptor; the significance of effect is therefore **moderate adverse**.

14.12.12 During wet conditions the magnitude of 400kV overhead line operational noise is medium at the flat above garage (Tarnock), Tarnock Cottage, Moorland Park and the Star Inn. All receptors are of medium sensitivity and the significance of effect is therefore **moderate adverse**.

14.12.13 The above assessment is based on magnitudes of effect during night time periods when background noise levels are expected to be around their lowest level. The significance is expected to be **minor adverse** to **negligible** during daytime periods.

14.12.14 Rainfall data provided by the Met Office indicates that in this area, wet weather conditions would be likely to occur around 7% of the year (2012 data).

14.12.15 It should be noted that the dry noise level at The Star Inn is calculated as an $L_{Aeq}$ of 30.6dB. WHO Night Noise Guidelines (Ref. 14.14) give average $L_{night,outside}$ of 30dB as the level at which there is no observable effect. Levels of 30-40dB are observed to only give modest effects, $L_{night,\ outside}$ of 40dB is quoted as the Lowest Observable Adverse Effect Level. Against these criteria, professional judgement dictates that the significance of operational 400kV overhead line noise is **minor adverse** to **negligible**.

Low and Negligible Sensitivity Receptors

14.12.16 The route of the proposed 400kV overhead line is in the vicinity or crosses a number of areas used primarily for leisure activities, such as PRoW and nature reserves, as well as industrial and agricultural land. The magnitude of effect may be medium or high during particularly quiet or wet periods in areas close to or under the 400kV overhead lines and the effect will dissipate quickly with increased distance. Furthermore, during daytime periods when the above receptors are likely to be used, background noise levels are expected to be higher. Professional judgement therefore dictates that the effects are expected to be **minor adverse** or **negligible**.

Route Options

14.12.17 The magnitude of effect of operational 400kV overhead lines noise is negligible to low and therefore the significance of effect is **negligible** or **minor adverse** for either preferred route Option A or alternative route Option B.

***Indicative Access for Future Maintenance***

14.12.1 During the operational phase, National Grid would require infrequent access to ensure the Proposed Development could be appropriately maintained. The access would typically be made by foot, 4x4 or tractor and trailer and would not typically require any new temporary accesses; however access to tension pylons may require temporary stone roads or aluminium trackway to be laid. Upon completion of any maintenance works, surfaces would be restored to their condition at the commencement of the works. The indicative accesses for future maintenance are shown at **Volume 5.3.3, Figure 3.5 – 3.6**.

14.12.2 The effects of noise due to the temporary construction and use of future maintenance access routes is expected to be no worse than the effect of construction of temporary access routes as discussed in section 14.4. The highest sensitivity receptors are medium sensitivity and the significance of effect is therefore expected to be **minor adverse** or **negligible**. However, due to the limited frequency of occurrence and the likely duration of noise exposure (typically less than 1 week), primarily associated with trackway construction (if required), the actual effects are unlikely to be significant at any receptors.

**Significance of Effects of Operational Noise**

14.12.3 **Table 14.23** summarises the significance of effects of operational noise.

Table 14.23 Significance of Effects of Operational Noise (No Mitigation)

| Operational Source | Receptors | Sensitivity of Receptor | Magnitude of Effect | Significance of Effect |
|---|---|---|---|---|
| Sandford Substation | Droveway Farm | Medium | Low | **Minor adverse** |
| | The Oaks | Medium | Negligible | **Negligible** |
| | Mead Farm<br>Birchwood House<br>Dorvic<br>Meadow Croft | Medium | No effect | **Negligible** |
| 400kv Overhead Line – Dry Conditions | Star Inn | Medium | Medium | **Moderate adverse** |
| | All other receptors | Medium | Low or Negligible | **Minor adverse** or **negligible** |
| 400kv Overhead Line – Wet Conditions | Flat above Garage (Tarnock)<br>Tarnock Cottage<br>Moorland Park<br>Star Inn | Medium | Medium | **Moderate adverse** |
| | All other receptors | Medium | Low or negligible | **Minor Adverse** or **negligible** |

**Limits of Deviation and Order Limits**

14.12.4 The LoD would provide a necessary and proportionate degree of flexibility as to the final alignment of the works. The LoD identify a maximum distance or measurement of variation within which these works must be constructed. The overhead line LoD are shown at **Volume 5.3.3, Figure 3.1 and 3.2**; the underground cable LoD are shown at **Volume 5.3.3, Figure 3.3**.

14.12.5 The Order Limits, identified in the Proposed Development Plans (see **Volume 5.3.3, Figure 3.1 and 3.2**) as a red outline, are fixed and detail the anticipated maximum extent of land in which the Proposed Development may take place (if approved and subject to DCO Requirements and any other associated commitments).

14.12.6 Further detail as to the level of flexibility that would be afforded by the LoD and the Order Limits and the assessment approach is provided in **Volume 5.5.1, section 5.6.** The implication of the LoD and Order Limits is that some components of the Proposed Development (both temporary and permanent) may be closer or further away from existing receptors than assessed above.

14.12.7 In practice, the implication of the LoD is that pylon structures and hence the centre line of the overhead line can move a maximum of 10m laterally, i.e. the noise sources can move a maximum of 10m closer to receptors, although there are 'pinch points' (see **Volume 5.5.1, section 5.6 and Volume 5.5.3, Figure 5.2**) along the route where this distance is less.

***Potential Variation of Significance of Operational Effects***

14.12.8 **Table 14.24** shows the receptors where a change in lateral overhead line route within the LoD would result in an increase of significance from overhead line noise.

Table 14.24 Summary of Potential Increase in Significance of Effect within Limits of Deviation

| Ref. | Receptor | Condition (Dry/Wet) | Increase in significance from: | Increase in significance to: | Movement Required to Trigger Change |
|---|---|---|---|---|---|
| 10 | Cripps Farm Caravans | Wet | Minor adverse | **Moderate adverse** | 6m towards receptor |
| 19 | Court Villa | Wet | Negligible | **Minor adverse** | 2m towards receptor |
| 25 | Withy Cottage | Dry | Negligible | **Minor adverse** | 7m towards receptor |
| | | Wet | Minor adverse | **Moderate adverse** | 4m towards receptor |
| 31 | The Willows | Wet | Negligible | **Minor adverse** | 7m towards receptor |
| 35 | South View | Wet | Negligible | **Minor adverse** | 4m towards receptor |
| 46 | Homeground | Wet | Negligible | **Minor adverse** | 7m towards receptor |
| 58 | 1 Clevedon Road | Dry | Negligible | **Minor adverse** | 7m towards receptor |
| 61 | Honeysuckle Cottage | Wet | Minor adverse | **Moderate adverse** | 1m towards receptor |

**Climate Change Effects**

14.12.9 Data from the Met Office (Ref. 14.15) shows a stable/slightly decreasing trend in rainfall rates over the last 100 years. Based on this trend in rainfall, wet noise generation by the overhead lines is not expected to be worse than assessed over the lifespan of the Proposed Development.

## 14.13 Inter-relationship of Potential Effects

14.13.1 Noise and vibration is considered in **Volume 5.8.1** (Biodiversity and Nature Conservation) in relation to the effect on fauna. Operational noise is unlikely to have a significant effect on sensitive species.

14.13.2 Noise and vibration is considered in **Volume 5.15.1** (Socio-economics and Land Use). An amenity effects assessment (see **Volume 5.15.2, Appendix 15J**) has been undertaken which considers effects arising as a result of the inter-relationship of other environmental effects which together could affect the amenity value of receptors during construction, operation and decommissioning. The assessment has considered likely effects on the amenity various receptors including:

- visitor attractions, PRoW, recreational routes, tourism accommodation and recreational areas; and
- local communities and community facilities (including health, education and community gathering).

14.13.3 Operational noise and vibration are not expected to lead to a significant effect on socio-economics and land use.

## 14.14 Mitigation

**Sandford Substation Operational Noise Mitigation**

14.14.1 The substation design will include specifications for the sound power of the transformers and shunt reactors and their associated coolers such that the calculated rating level at nearby residential receptors does not exceed defined limits.

14.14.2 Operational noise from Sandford substation will be secured via a Requirement to ensure noise does not exceed a specified and agreed level.

**400kV Overhead Line Operational Noise Mitigation**

14.14.3 Noise from overhead lines cannot be practically mitigated. Quality assurance through manufacturing and transportation will be undertaken to avoid damage to overhead line conductors which can increase potential noise effects. Care will be taken during installation to ensure that conductors will be kept clean and free of surface contaminants during stringing. This will minimise the risk of excessive dry noise on energisation of the proposed 400kV overhead line.

## 14.15 Residual Effects

**Residual Effects of Operational Noise**

14.15.1 Residual effects for operational noise are not assessed, since all practical mitigation has already been applied during the design and specification of the overhead line and substation.

**Significance of Residual Effects of Operational Noise**

14.15.2 **Table 14.25** summarises the significance of effects of operational noise. No mitigation is applied to 400kV overhead line noise, as described above, and no additional mitigation is applied to Sandford Substation.

Table 14.25 Significance of Effects of Residual Operational Noise

| Operational Source | Receptors | Sensitivity of Receptor | Magnitude of Effect | Significance of Effect |
|---|---|---|---|---|
| Sandford Substation | Droveway Farm | Medium | Low | **Minor adverse** |
| | The Oaks | Medium | Negligible | **Negligible** |
| | Mead Farm<br>Birchwood House<br>Dorvic<br>Meadow Croft | Medium | No effect | **Negligible** |
| 400kv Overhead Line – Dry Conditions | Star Inn | Medium | Medium | **Moderate adverse** |
| | All other receptors | Medium | Low or negligible | **Minor adverse or negligible** |

| Operational Source | Receptors | Sensitivity of Receptor | Magnitude of Effect | Significance of Effect |
|---|---|---|---|---|
| 400kv Overhead Line – Wet Conditions | Flat above Garage (Tarnock)<br>Tarnock Cottage<br>Moorland Park<br>Star Inn | Medium | Medium | **Moderate adverse** |
| | All other receptors | Medium | Low or negligible | **Minor adverse or negligible** |

## 14.16 Cumulative Effects

14.16.1 The cumulative assessment is provided at **Volume 5.17** and includes potential cumulative effects of the Proposed Development together with other major development proposals.

14.16.2 Cumulative construction and operational effects have been considered for all other major developments with regards to noise and vibration. No significant cumulative effects are expected.

14.16.3 No further mitigation measures would be required above those identified in this chapter (section 14.14). The residual cumulative effects would be the same as those identified at section 14.15 above.

## 14.17 Conclusions

**Operational Effects**

14.17.1 The assessment of the significance of effects due to operation noise has concluded that:

- the significance of operational noise from Sandford Substation is assessed as being **minor adverse** or **negligible**;
- the significance of operational dry noise from 400kV overhead lines is assessed as being **minor adverse** or **negligible** at all receptors except The Star Inn, where the significance of dry overhead line noise is assessed as being **moderate adverse**;
- the significance of operational wet noise from 400kV overhead line noise is assessed as being **minor adverse** or **negligible** at all receptors except at The Star Inn, Flat above garage (Tarnock), Tarnock cottage and Moorland Park where the significance of wet 400kV overhead line noise is assessed as being **moderate adverse**.

## Part 3 – Summary of Noise and Vibration Effects

### 14.18 Conclusions

14.18.1 The likely residual noise and vibration effects of the Proposed Development are summarised below:

**Construction Effects**

14.18.2 The assessment of the significance of effects due to construction noise and vibration has concluded that:

- the significance of noise from construction activities (excluding transition jointing) is assessed as being **negligible** to **minor adverse**;
- due to night time working, the significance of noise from transition jointing may be **moderate adverse**;
- the significance of construction traffic noise and vibration is assessed as being **minor adverse** to **negligible**; and
- construction vibration is assessed as being **minor adverse** to **negligible**.

**Operational Effects**

14.18.3 The assessment of the significance of effects due to operation noise has concluded that:

- the significance of operational noise from Sandford Substation is assessed as being **minor adverse** or **negligible**;
- the significance of operational dry noise from 400kV overhead lines is assessed as being **minor adverse** or **negligible** at all receptors except The Star Inn, where the significance of dry overhead line noise is assessed as being **moderate adverse**;
- the significance of operational wet noise from 400kV overhead line noise is assessed as being **minor adverse** or **negligible** at all receptors except at The Star Inn, Flat above garage (Tarnock), Tarnock cottage and Moorland Park where the significance of wet 400kV overhead line noise is assessed as being **moderate adverse**.

**Decommissioning Effects**

14.18.4 The significance of decommissioning noise is assessed as being **minor adverse** to **negligible**.

14.1 Department of Energy & Climate Change. Overarching National Policy Statement for Energy (EN-1). London: The Stationery Office, 2011.

14.2 Department for Communities and Local Government. National Planning Policy Framework. London, 2012.

14.3 British Standards Institution. BS5228-1:2009. Code of practice for noise and vibration control on construction and open sites - Noise, London, 2008.

14.4 British Standards Institution. BS5228-2:2009. Code of practice for noise and vibration control on construction and open sites - Vibration, London, 2008.

14.5 Department of Transport. Calculation of Road Traffic Noise. London, 1988

14.6 Department of Transport. Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7, Noise and Vibration. London, 1988.

14.7 World Health Organisation. Guidelines for Community Noise. Geneva, 1995.

14.8 Department of Energy & Climate Change. National Policy Statement for Electrical Networks (EN-5). London: The Stationery Office, 2011.

14.9 British Standards Institution. BS7445-1:2003. Description and measurement of environmental noise – Guide to quantities and procedures, London, 2003.

14.10 British Standards Institution. BS4142:1997. Method for rating industrial noise affecting mixed residential and industrial areas, London, 1997.

14.11 National Grid. Technical Report TR(T)94 – A Method for Assessing the Community Response to Overhead Line Noise

14.12 British Standards Institution. BS8233:1999. Sound insulation and noise reduction for buildings. Code of practice, London, 1999.

14.13 Miller L N. 1978, 'Sound Levels of Rain and Wind in the Trees', Noise Control Engineering Vol 11, No 3

14.14 World Health Organisation. Night Noise Guidelines for Europe. Copenhagen, 2009.

14.15 Jenkins, G.J., Perry, M.C., and Prior, M.J. 2008. The Climate of the United Kingdom and Recent Trends. Met Office Hadley Centre, Exeter, UK

# Appendix 14A – Construction Noise Assessment Tables

| Activity | Plant | No. | BS5228 ref. or Alternative Source | On Time | A-weighted Sound Pressure Level (dB(A)) at 10m or Alternative |
|---|---|---|---|---|---|
| **General Works** | | | | | |
| Site Preparation | Tracked Excavator | 2 | C2.3 | 90% | 78 |
| | Dozer | 3 | C2.1 | 90% | 75 |
| Topsoil Strip | Tracked Excavator | 2 | C2.3 | 90% | 78 |
| | Dozer | 3 | C2.1 | 90% | 75 |
| Access Road | Wheeled backhoe loader | 1 | C2.8 | 90% | 68 |
| | Dumper | 2 | C4.7 | 90% | 78 |
| | Vibratory roller | 1 | C2.40 | 90% | 73 |
| **Underground Cable Construction (400 and 132kV)** | | | | | |
| Trenching | Tracked excavator | 1 | C2.5 | 90% | 76 |
| | Tracked mobile crane | 1 | C3.29 | 90% | 70 |
| | Piling | 1 | C3.9 | 90% | 63 |
| | Power pack | 1 | C3.10 | 90% | 68 |
| Lower and Lay | Side boom | 3 | C3.28 | 90% | 67 |
| | Water pump | 1 | C4.88 | 90% | 68 |
| | Wheeled backhoe loader | 1 | C2.8 | 90% | 68 |
| Backfill Trench | Wheeled backhoe loader | 1 | C2.8 | 90% | 68 |
| | Tracked excavator | 1 | C2.5 | 90% | 76 |
| | Dumper | 2 | C4.7 | 90% | 78 |
| | Vibratory roller | 2 | C2.40 | 90% | 73 |
| Reinstatement | Wheeled backhoe loader | 1 | C2.8 | 90% | 68 |
| | Dumper | 1 | C4.7 | 90% | 78 |
| Transition Joint | Generator | 3 | C3.32 | 90% | 73 |

| Activity | Plant | No. | BS5228 ref. or Alternative Source | On Time | A-weighted Sound Pressure Level (dB(A)) at 10m or Alternative |
|---|---|---|---|---|---|
| Pit | Welder | 3 | C3.31 | 90% | 73 |
| | Grinder | 2 | C4.93 | 90% | 80 |
| | Generator | 2 | C4.94 | 90% | 75 |
| | Sideboom | 1 | C3.28 | 90% | 67 |
| Cable Pulling | Conveyor Drive Unit | 1 | C10.20 | 90% | 77 |
| | Field Conveyor | 2 | C10.23 | 90% | 53 |
| Horizontal Directional Drilling | Power Auger (Crawler Mounted Rig) | 1 | C3.21 | 100% | 79 |
| | Power Pack | 1 | C3.10 | 100% | 68 |
| | Generator | 2 | C4.84 | 100% | 74 |
| | Tracked excavator (22t) | 1 | C2.3 | 50% | 78 |
| | Water pump | 2 | C4.88 | 100% | 68 |
| **Overhead Line Construction (400 and 132kV)** | | | | | |
| Lattice Pylon Construction (Piling Single) | Excavator (For Ground prep) | 1 | C2.14 | 10% | 79 |
| | Steel Tube Piling Rig | 1 | C3.8 | 70% | 88 |
| | Concrete Pump | 1 | C3.25 | 20% | 78 |
| Lattice Pylon Construction (Piled with cap) | Excavator (Ground Prep and cap prep) | 1 | C2.14 | 70% | 79 |
| | Steel Tube Piling Rig | 1 | C3.8 | 70% | 88 |
| | Concrete Pump (pile and cap) | 1 | C3.25 | 70% | 78 |
| Lattice Pylon Construction (No piling) | Excavator (on time dependant on size) | 1 | C2.14 | 70% | 79 |
| | Telehandler | 1 | C4.55 | 70% | 70 |
| | Concrete Pump | 1 | C3.25 | 70% | 78 |
| Lattice Pylon | Tele Handler | 1 | C4.55 | 50% | 70 |

| Activity | Plant | No. | BS5228 ref. or Alternative Source | On Time | A-weighted Sound Pressure Level (dB(A)) at 10m or Alternative |
|---|---|---|---|---|---|
| Assembly | | | | | |
| Lattice Pylon Installation | Crane Lifting Pylon | 1 | C4.38 | 10% | 78 |
| T-pylon Installation | Tracked Excavator | 1 | C2.14 | 10% | 79 |
| | Piling Rig (MonoPile) | 1 | C3.2 | 70% | 87 |
| | MEWP | 1 | C4.57 | 40% | 67 |
| | Concrete Pump | 1 | C3.25 | 10% | 78 |
| Lattice and T-pylon Tensioning | Winder | 1 | Suppliers data | 60% | 77 |
| | Rear Winder | 1 | Suppliers data | 60% | 77 |
| **Overhead Line Decommissioning** | | | | | |
| Site Preparation | Tracked Excavator | 1 | C2.14 | 90 | 79 |
| Breaking up Concrete | Excavator Mounted Pulverizer | 2 | C1.3 | 90 | 80 |
| Dumping Brick Rubble | Tracked Excavator | 1 | C1.10 | 20 | 85 |
| Breaking Up/Cutting Steel | Tracked Excavator | 1 | C1.16 | 50 | 82 |
| **Sandford Substation** | | | | | |
| Site preparation | Tracked Excavator | 2 | C2.3 | 90% | 78 |
| | Dozer | 3 | C2.1 | 90% | 75 |
| Substation Assembly | Tele Handler | 2 | C4.55 | 50% | 70 |
| | Generator | 2 | C4.84 | 100% | 74 |
| | Vibrating Piling Rig | 1 | C3.8 | 10% | 88 |
| **Seabank, Portishead, Avonmouth and Churchill Substations and Cable Sealing End (CSE) Compounds** | | | | | |
| Site preparation | Tracked Excavator | 2 | C2.3 | 90% | 78 |
| | Dozer | 3 | C2.1 | 90% | 75 |
| Substation/CSE | Tele Handler | 2 | C4.55 | 50% | 70 |

| Activity | Plant | No. | BS5228 ref. or Alternative Source | On Time | A-weighted Sound Pressure Level (dB(A)) at 10m or Alternative |
|---|---|---|---|---|---|
| Assembly | Generator | 2 | C4.84 | 100% | 74 |
| **Construction Compounds** | | | | | |
| Site Preparation | Tracked Excavator | 2 | C2.3 | 90% | 78 |
| | Dozer | 3 | C2.1 | 90% | 75 |
| Road Construction | Dumper | 3 | C4.3 | 90% | 76 |
| | Road Roller | 1 | C5.19 | 90% | 80 |
| Compound Buildings | Tele Handler | 2 | C4.55 | 50% | 70 |
| | Generator | 2 | C4.84 | 100% | 74 |

Table 2 Distances from Works at Which BS5228 Annex E Trigger Levels Would Be Exceeded

| Activity | Sound Power Level, dB(A) | Distance (m) At Which Predicted Noise Level Is Below Threshold Or Trigger Level: | | |
|---|---|---|---|---|
| | | 65dB(A) | 70dB(A) | 75dB(A) |
| **General Works** | | | | |
| Site clearance | 111 | 79 | 45 | 25 |
| Topsoil strip | 111 | 79 | 45 | 25 |
| Construction of temporary site access road | 109 | 66 | 37 | 21 |
| **Underground Cable Construction (132 and 400kV)** | | | | |
| Trenching | 105 | 41 | 23 | 13 |
| Lower and lay | 102 | 28 | 16 | 9 |
| Backfill trench | 111 | 82 | 46 | 26 |

| **Activity** | **Sound Power Level, dB(A)** | **Distance (m) At Which Predicted Noise Level Is Below Threshold Or Trigger Level:** | | |
|---|---|---|---|---|
| | | **65dB(A)** | **70dB(A)** | **75dB(A)** |
| Reinstatement | 106 | 44 | 25 | 14 |
| Cable pulling | 105 | 38 | 21 | 12 |
| Horizontal directional drilling | 111 | 75 | 42 | 24 |
| **Lattice Pylon Construction** | | | | |
| Piling required | 115 | 131 | 74 | 41 |
| Piling not required | 108 | 58 | 33 | 18 |
| Pylon assembly | 95 | 13 | 7 | 4 |
| Pylon installation | 96 | 14 | 8 | 4 |
| **T-pylon Construction** | | | | |
| Monopiling, and assembly | 114 | 108 | 63 | 35 |
| **Overhead Line Tensioning** | | | | |
| Tensioning | 106 | 44 | 25 | 14 |
| **Decommissioning 132kV and 400kV Overhead Lines** | | | | |
| Decommissioning overhead lines | 114 | 112 | 63 | 35 |

Table 3 Summary of Receptors Falling Within Maximum Threshold Distances for Main Construction Activities

| **Activity** | **Minimum Threshold Distance, m** | **Receptors Falling Within Maximum Threshold Distances** |
|---|---|---|
| Existing 132kV Overhead Line Decommissioning | 112 | The Lodge, Dunware<br>Slape Cross (approx. 5 properties)<br>Manor Farm, Bradney<br>The Yards |

| Activity | Minimum Threshold Distance, m | Receptors Falling Within Maximum Threshold Distances |
|---|---|---|
| | | Homestead Farm<br>Court Farm<br>Moor Row<br>Southwick House<br>Elm Tree Farm<br>Mark Causeway (approx. properties)<br>Dwelling on Northwick Road<br>Vole House<br>Pear Tree House<br>Knoll View Farm<br>Pilrow Farm<br>Tarnock (approx. 4 properties)<br>Westliegh Farm<br>Nye Farm<br>Moorland Park<br>Heathgate<br>Middle Elm<br>Primrose Cottage<br>Orchard Side<br>Homeground<br>Rushlands<br>Nailsea Western Fringe (>50 properties)<br>Stone Edge (approx. 5 properties)<br>Spindlewood<br>Cockoos Mead<br>Hunters Croft<br>Clapton-in-Gordano (approx. 5 properties)<br>Portbury Eastern Fringe (>20 properties) |

| **Activity** | **Minimum Threshold Distance, m** | **Receptors Falling Within Maximum Threshold Distances** |
|---|---|---|
| | | Avonmouth (>20 properties) |
| 400kV and 132kV Overhead Line Construction and End of Life Decommissioning | 131 | Dwelling on Northwick Road<br>Tarnock (approx. 4 properties)<br>Moorland Park<br>Star Inn<br>Honeysuckle Cottage<br>Spindle Wood<br>The Meadow<br>18 Elm Tree Park + Others<br>Portview Road, Avonmouth (approx10 properties)<br>Rockery Farm<br>Hinkley (approx. 3 properties) |
| Underground Cable Construction | 82 | Webbington Farm<br>Towerhead (approx. 4 properties)<br>Mead Lane<br>Nailsea Western Fridges (>50 properties)<br>Sandford Batch (approx. 10 properties)<br>Middle Farm<br>Waterfront Farm<br>Crab Hole Farm<br>Chestnut Farm |

Table 4 Summary of Receptors Falling Within Maximum Threshold Distances for Construction of Construction Compounds

| **Compound** | **Minimum Threshold Distance, m** | **Receptors Falling Within Maximum Threshold Distances** |
|---|---|---|
| Bridgwater Tee (Bath Road) | 79 | Dwellings on Bath Road to east |
| A38 Bristol Road (UGC) | 79 | None |
| A38 Bristol Road (OHL) | 79 | None |
| South Mendips (Hams Lane) | 79 | None |
| Barton Road | 79 | Dwellings on Barton Road to the east |
| Castle Hill | 79 | None |
| Towerhead Road | 79 | Dwellings on Towerhead Road to the south and west |
| Sandford Sub Compound | 79 | None |
| AT Route OHL Compound | 79 | None |
| Churchill | 79 | Dwellings on Stock Lane to the south |
| Engine Lane | 79 | None |
| Nailsea | 79 | Dwellings on Causeway View to the east |
| Church Lane | 79 | Dwellings on Washing Pound Lane and Church Lane to the south |
| Clevedon Road | 79 | Dwellings on Clevedon Road to the south, east and west |
| Whitehouse Lane | 79 | Dwellings on Cuckoo Lane to the south and Whitehouse Lane to the east |
| Caswell Hill | 79 | None |

| **Compound** | **Minimum Threshold Distance, m** | **Receptors Falling Within Maximum Threshold Distances** |
|---|---|---|
| Sheepway | 79 | None |
| BW UGC Route West | 79 | None |
| BW UGC Route East | 79 | None |
| St Andrews Road | 79 | None |
| Kings Weston Lane | 79 | None |
| G Route UGC (East of M49) | 79 | None |
| Seabank (Severn Road) | 79 | None |

# Appendix 14B – Construction Traffic Noise Assessment

Table 1 Construction Traffic Assessment

| ATC Number | Road Name | Peak Year | Increase in Road Traffic Noise during peak year, dB | Magnitude of Effect |
|---|---|---|---|---|
| 1 | A39 Puritan Road | 2018 | 0.1 | Negligible |
| 2 | A39 Bath Road | 2018 | 0.1 | Negligible |
| 3 | B3141 Woolavington Hill | 2018 | 0.2 | Negligible |
| 4 | B3141 Causeway | 2018 | 0.3 | Negligible |
| 5 | B3139 (West of Watchfield) | 2018 | 0.2 | Negligible |
| 6 | A38 Bristol Road (North of Highbridge) | 2018 | 0.0 | No Change |
| 7 | Harp Road | 2018 | 0.0 | No change |
| 8 | Southwick Road | 2018 | 0.0 | No change |
| 9 | A38 Bristol Road, Tarnock | 2018 | 0.2 | Negligible |
| 10 | A38 Bristol Road (North of Sidcott) | 2018 | 0.3 | Negligible |
| 11 | A368 Dinghurst Road, Churchill | 2018 | 0.4 | Negligible |
| 12 | A38 Bristol Road, Langford | 2018 | 0.2 | Negligible |
| 13 | A3133 Stock Lane | 2018 | 0.0 | No change |
| 14 | A370, Hewish | 2018 | 0.1 | Negligible |
| 14(2) | A370, Hewish | 2018 | 0.2 | Negligible |
| 15 | A370 Station Road, Congresbury | 2018 | 0.1 | Negligible |
| 16 | Lampley Road | 2019 | 0.2 | Negligible |
| 17 | Kenmoor road | 2019 | 0.5 | Negligible |
| 18 | B3133 Kenn Road | 2019 | 0.1 | Negligible |
| 19 | Kenn Street, Kenn | 2019 | 1.6 | Low |
| 20 | Nailsea Wall | 2019 | 0.0 | No change |
| 21 | B3133 (South of Clevedon) | 2019 | 0.1 | Negligible |
| 22 | Court Lane | 2019 | 0.0 | No change |

| ATC Number | Road Name | Peak Year | Increase in Road Traffic Noise during peak year, dB | Magnitude of Effect |
|---|---|---|---|---|
| 23 | Clevedon Road (East of Celvedon) | 2019 | 0.1 | Negligible |
| 24 | Clevedon Road (North of Tickenham) | 2019 | 0.1 | Negligible |
| 25 | B3128 Clevedon Road (North of Nailsea) | 2019 | 0.1 | Negligible |
| 26 | Whitehouse Lane | 2019 | 0.1 | Negligible |
| 27 | Caswell Hill | 2019 | 0.9 | Negligible |
| 28 | Sheepway | 2019 | 0.5 | Negligible |
| 29 | A369 The Portbury Hundred | 2019 | 0.0 | No Change |
| 30 | Victoria Road | 2017 | 0.1 | Negligible |
| 31 | Avonmouth Way | 2017 | 0.3 | Negligible |
| 32 | A403 St Andrews Road * | 2017 | 2.9 | Low |
| 33 | Kings Weston Lane | 2017 | 0.1 | Negligible |
| 34 | A403 Smoke Lane | 2017 | 0.1 | Negligible |
| 35 | Poplar Way West | 2017 | 0.1 | Negligible |
| 36 | Poplar Way East | 2017 | 0.4 | Negligible |
| 37 | A403 Severn Road | 2017 | 0.1 | Negligible |
| 38 | Severn Road (East of Chittening Road | 2017 | 0.3 | Negligible |
| 39 | Wick Moor Road | 2016 | 0.6 | Negligible |
| 40 | Wick to Stalford Road | 2016 | 1.8 | Low |
| 41 | Rodway, Cannington | 2016 | 0.5 | Negligible |
| 42 | A39 Quantock Road | 2016 | 0.2 | Negligible |
| 43 | A38 Bristol Road (North of Bridgwater) | 2016 | 0.2 | Negligible |

* Limited data available for this location. Assumed velocity of 45km/h and assumes 0%HGV baseline. As such, actual increase in noise level is expected to be lower.

# Appendix 14C – Noise and Vibration Scoping Out Note

# Scoping Out Information Note

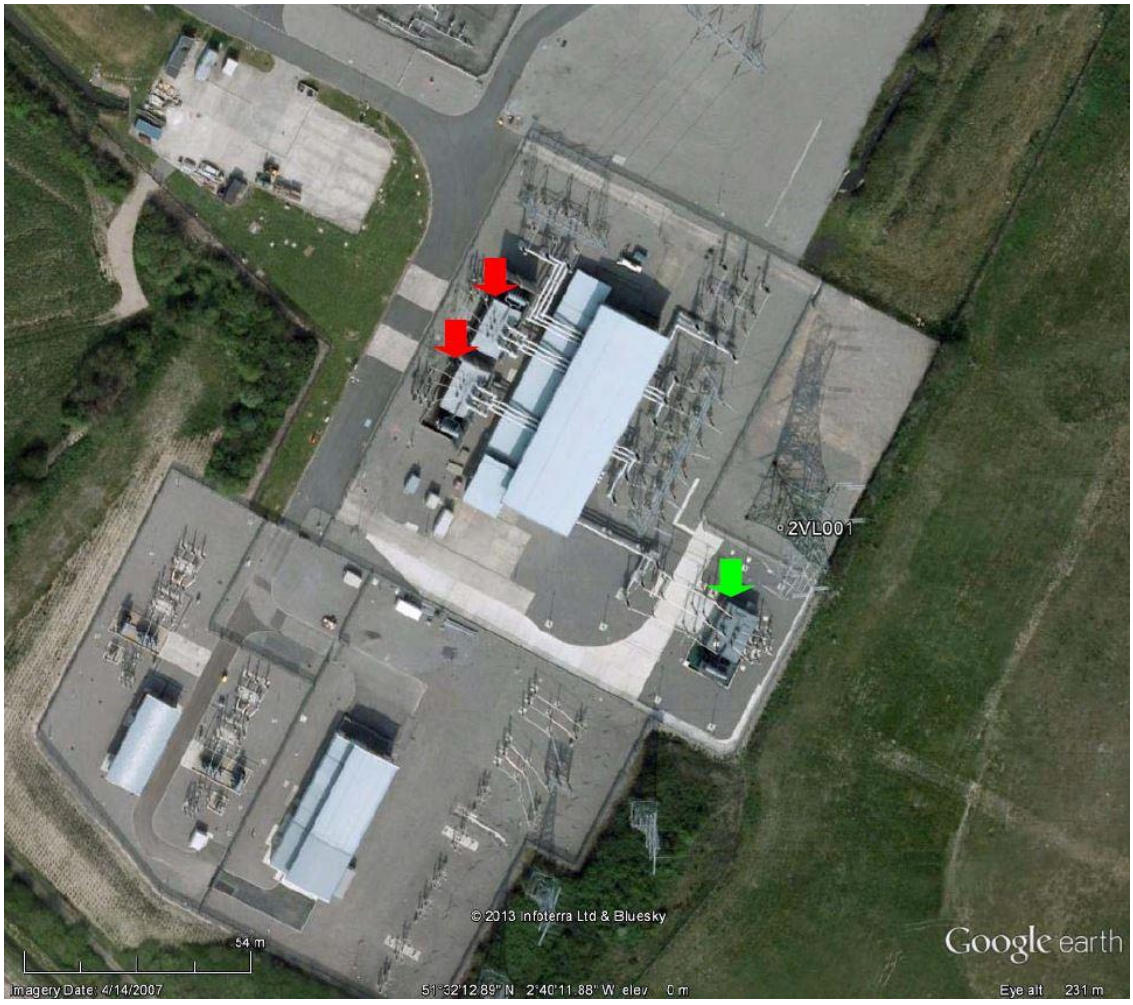
## 1 Introduction

1.1 This appendix provides information to support the scoping out of operational noise from Seabank Substation, Churchill, Avonmouth and Portishead 132kV Substations and 132kV overhead lines as part of this application.

## 2 Seabank Substation

2.1 This appendix provides information to support the scoping out of operational noise from Seabank Substation as part of this application. A site plan of Seabank Substation is shown in Figure 1

**Figure 1 Aerial photograph showing the existing layout of Seabank Substation**




2.2 The main source of operational noise at the substation is the three supergrid transformers (SGTs); this is the equipment that produces the distinctive 100Hz “hum”. The arrows in the above aerial photograph show the location of the three SGTs.

2.3 The proposed work at Seabank includes the decommissioning and removal of SGT4, highlighted with the green arrow. SGT1 & SGT2, highlighted with the red arrows will remain. These transformers will not change their mode of operation, and hence their noise characteristics will not change. The nearest residential receptor to the proposed site is some 750m to the South East.

2.4 Background noise measurements were undertaken in the vicinity in the early hours of 19 June 2013. The $L_{A90,5min}$ was measured as 46.8dB

2.5 The overall effect of the project at Seabank is therefore a small beneficial noise effect at all receptors due to the permanent removal of SGT4.

# 3 Churchill, Avonmouth and Portishead Substations

3.1 The proposed developments at Churchill 132kV Substation, Avonmouth 132kV Substation and Portishead 132kV Substation involve the installation of switchgear at each of these sites. Switchgear noise is generated, in the main, by the operation of circuit breakers, for which the noise emissions are 'impulsive' in character (i.e. of short duration). Switchgear operations will be very infrequent. Modern switchgear of the Sulphur Hexafluoride ($SF_6$) type operates with a dull 'thud'. There will be no other new significant noise sources installed at these sites, and as such operational noise at these sites is scoped out of the ES.

# 4 132kV Overhead Lines

4.1 Conductor system noise occurs when the conductor surface electric stress exceeds the inception level for corona discharge activity, a level of around 17-20kV/cm. Electrical stresses on 132kV overhead lines are generally much lower than those on 400kV overhead lines in normal operation, and as such, are below the thresholds for audible noise inception. These types of overhead lines are practically quiet in operation.

# 5 Cable Sealing End Compounds

5.1 Cable sealing end (CSE) compounds produce noise in the same manner as overhead lines. Where appropriate, noise from CSE compounds would therefore be assessed similarly.

# Appendix 14D – Sandford Substaton CadnaA Noise Modelling

# 1 Objective

1.1 The objective of the noise prediction modelling exercise was to predict substation noise levels at the nearest noise sensitive receptor locations. The following scenario was assessed:

- (Night) – 2 no. Supergrid transformers and 2 no. shunt reactors within acoustic enclosures and 2 no. shunt reactor coolers;

# 2 Noise prediction modelling software and calculation methodology

2.1 Noise propagation calculations were undertaken in accordance with Internal Standard ISO 9613 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation", which is embedded as a software module.

2.2 Predictions of substation noise levels at the receptor locations take account of features that may affect propagation, such as ground absorption; and, screening by the natural and/or formed topography.

## Modelling parameters

### Modelling the topography

2.3 The topography around the site is generally flat farmland. As such, the model assumes flat ground as variations in topography are unlikely to significantly affect the propagation, especially with the hard ground assumption described in below.

### Modelling buildings and other obstacles

2.4 In order to provide a worst case assessment no buildings are included in the model and as such screening from buildings is ignored.

### Modelling noise sources (emission points)

2.5 Point noise sources were used in the model to represent substation equipment. Sound power levels of these sources have been supplied by National Grid. The type and number of plant assumed for each scenario is presented in Table 1 together with sound power levels.

Table 1 Sandford Substation Noise Sources

| Substation Item | Number of Operating Noise Source | Sound Power Level, dBA |
|---|---|---|
| Supergrid transformer | 2 | 90 |
| Shunt reactors | 2 | 87 |
| Supergrid transformer cooler | 0 | 84 |
| Shunt reactor cooler | 2 | 70 |

2.6 In accordance with BS4142:1997, a 5dB correction is to be applied if one or more of the follow features occur, or are expected to be present for new or modified noise sources:

- The noise contains a distinguishable, discrete continuous note (whine, hiss, screech hum, etc.);
- The noise contains distinct impulses (bangs, clicks, clatters, or thumps);
- The noise is irregular enough to attract attention.

2.7 It is noted that the Supergrid transformers and shunt reactors contain a tonal component and as such a 5dB acoustic character correction is to be applied.

2.8 Proposed mitigation is a noise enclosure with a 20dB insertion loss applied to each of the Supergrid Transformers and Shunt Reactor.

### Other modelling parameters

#### *Ground absorption*

2.9 All land was assigned a sound absorption factor of 0 (hard ground) for the purpose of noise propagation calculations as a worst case assumption.

#### *Meteorological conditions*

2.10 The following meteorological conditions were assumed:

- Ambient temperature: 10°C
- Relative humidity: 70%

2.11 These values represent a typical worst case scenario and provide relatively low levels of atmospheric absorption.

2.12 ISO 9613 assumes wind direction within an angle of ±45º of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region, with the wind blowing from the source to receiver, and wind speed between approximately 1m/s and 5 m/s, measured at a height of 3m to 11m above ground level.

#### *Foliage/woodland areas*

2.13 Areas of existing foliage are assumed to have no acoustic effect and are therefore not accounted for within noise propagation calculations.

#### *Reflections*

2.14 The model does not include any buildings and as such reflections are not taken into account (other than hard ground) to provide an assessment of free field conditions.

## Noise sensitive receptor locations (immission points)

2.15 Immission points are positions of noise reception calculation. Modelled prediction calculations determine the broadband noise levels at each immission point resulting during each assessed scenario. In each instance, the height of immission points represents first floor level. Table 2 indicates the location of nearby noise sensitive receptors.

Table 2 Noise Receptor Points

| Ref. | Receptor location | Ordnance Survey co-ordinates | | |
|---|---|---|---|---|
| | | x | y | z (AGL), m |
| 1 | Droveway Farm | 341822 | 160348 | 4.5 |

| Ref. | Receptor location | Ordnance Survey co-ordinates | | |
|---|---|---|---|---|
| | | x | y | z (AGL), m |
| 2 | The Oaks | 341841 | 160279 | 4.5 |
| 3 | Mead Farm | 341456 | 159930 | 4.5 |
| 4 | Birchwood House | 341992 | 160017 | 4.5 |
| 5 | Dorvic | 341961 | 159984 | 4.5 |
| 6 | Measdow Croft | 341936 | 159893 | 4.5 |

# 3 Methodology for Assessing the Significance of Operational Noise Effects

3.1 The assessment criteria for the sensitivity of noise sensitive receptors are shown in Table 3.

Table 3 Sensitivity of Receptor – Operational Noise

| Sensitivity of Receptor | Receptor Description |
|---|---|
| **High** | Patients in hospitals/hospices etc. – defined as a "vulnerable subgroup" with very high or continuous rates of occupancy |
| **Medium** | Residential receptors |
| **Low** | Area used primarily for leisure activities, including Public Rights of Way (PRoW), sports facilities and sites of historic or cultural importance |
| **Negligible** | All other areas such as those used primarily for industrial or agricultural purposes |

**3.2** The assessment criteria for the magnitude of effect of operational noise effects are shown in Table 4.

Table 4 Magnitude of Effects – Operational Noise

| Magnitude of Effect | Operation Noise - Substation or Overhead Line - Dry and Wet Noise |
|---|---|
| High | Predicted rating levels are 5dB or more above the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |
| Medium | Predicted rating levels are between 5 - 0dB(A) above the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |
| Low | Predicted rating levels are between 0dB(A) above and 5dB(A) below the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |

| Magnitude of Effect | Operation Noise - Substation or Overhead Line - Dry and Wet Noise |
|---|---|
| Negligible | Predicted rating levels are between 5dB(A) and 10dB(A) below the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |
| No effect | Predicted rating noise levels are 10dB or more below the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |

3.3 The assessment criteria for the significance of operational noise effects are shown in Table 5.

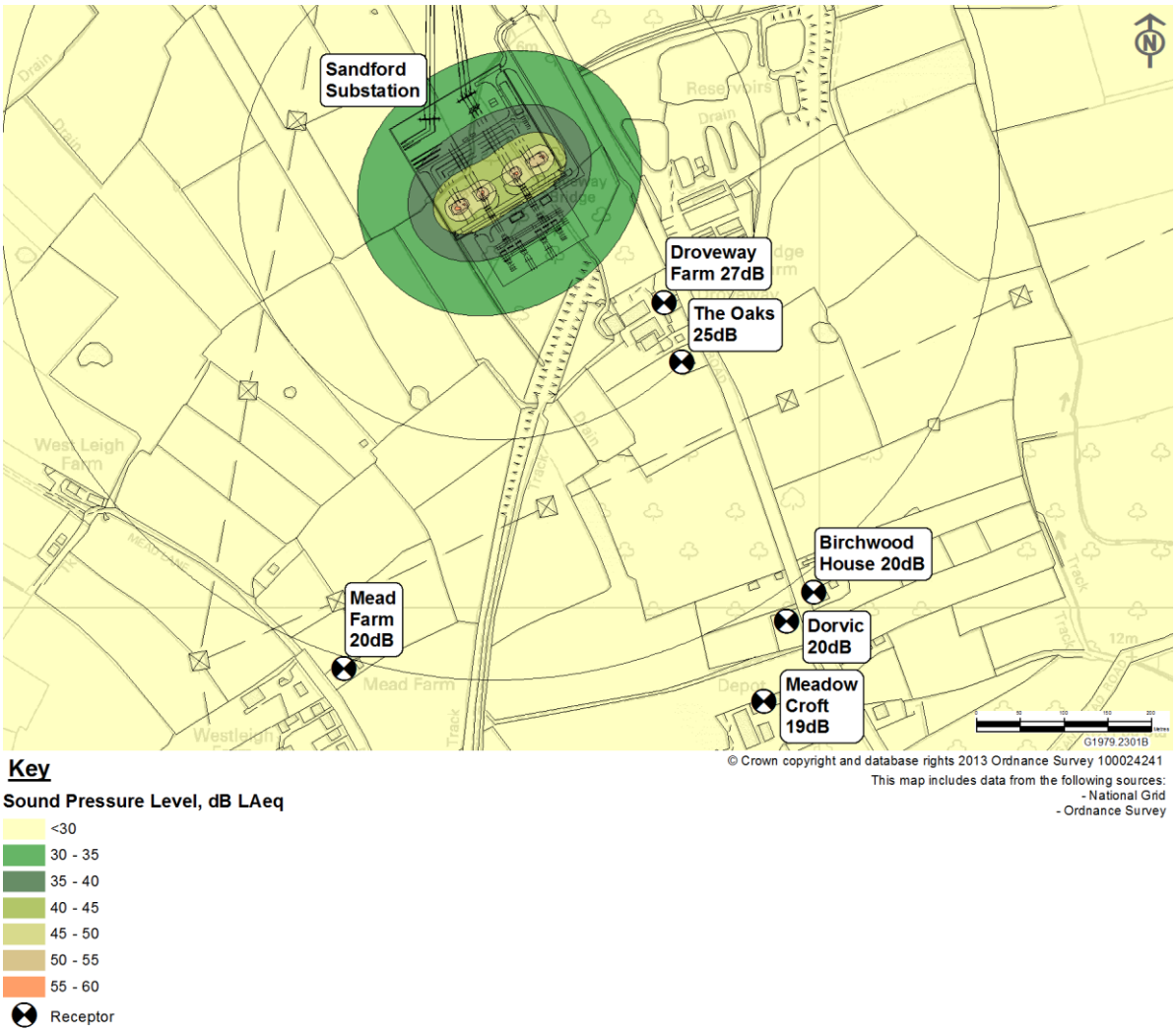
Table 5 Significance of Effect – Operational Noise

| Significance of Effect | Receptor Sensitivity | | | |
|---|---|---|---|---|
| **Magnitude** | High | Medium | Low | Negligible |
| High | Major | Major | Moderate | Minor |
| Medium | Major | Moderate | Minor | Negligible |
| Low | Moderate | Minor | Negligible | Negligible |
| Negligible | Minor | Negligible | Negligible | Negligible |

# 4 Model outputs

4.1 Figure 1 shows a graphical CadnaA representation of noise propagation from Sandford substation during night time periods..

Figure 1 CadnaA Noise Propagation Model of Sandford Substation During Night Time




4.2 Table 6 summarises the substation noise levels, predicted using CadnaA modelling in accordance with BS 9613-2, at each selected receptor location during night time periods.

Table 6 Summary of predicted Sandford Substation noise levels at identified sensitive receptor locations

| **Receptor Name** | **Background Noise Level, dB $L_{A90}$** | **Predicted $L_{Aeq,T}$ Sound Pressure Level, dB (Free Field) (Including 5dB Acoustic Character Correction)** | **Assessment Level, dB** | **Magnitude of Effect** |
|---|---|---|---|---|
| Droveway Farm | 30 | 27 | -3 | Low |
| The Oaks | 30 | 25 | -5 | Negligible |
| Mead Farm | 30 | 20 | -10 | No effect |
| Birchwood House | 30 | 20 | -10 | No effect |
| Dorvic | 30 | 20 | -10 | No effect |

| Receptor Name | Background Noise Level, dB $L_{A90}$ | Predicted $L_{Aeq,T}$ Sound Pressure Level, dB (Free Field) (Including 5dB Acoustic Character Correction) | Assessment Level, dB | Magnitude of Effect |
|---|---|---|---|---|
| Meadow Croft | 30 | 19 | -11 | No effect |

4.3 Table 7 summarises the significance of effect for each receptor.

Table 7 Summary of Significance of Effect

| Receptor Name | Magnitude of Effect | Receptor Sensitivity | Significance of Effect |
|---|---|---|---|
| Droveway Farm | Low | Medium | **Minor adverse** |
| The Oaks | Negligible | Medium | **Negligible adverse** |
| Mead Farm | No effect | Medium | **Negligible** |
| Birchwood House | No effect | Medium | **Negligible** |
| Dorvic | No effect | Medium | **Negligible** |
| Meadow Croft | No effect | Medium | **Negligible** |

# Appendix 14E – Summary of Night-time Background Noise Measurements on Route of Proposed 400kV Overhead Line and Substations

Environmental Engineering Note

EEN/218/NOTE2013
Issue 3

Date: 3rd Mar 2014

National Grid
Electricity Network
Investment

National Grid House
Warwick Technology Park
Gallows Hill
Warwick
CV34 6DA

# Summary of night-time background noise measurements on route of proposed Hinkley Point C connection overhead line

**AUTHOR**
**Sue Fitton**

Addressee: **Aileen Smith**

Signed:
Author

Signed:
Approval for iss

## 1 INTRODUCTION

1.1 This report documents the night-time background noise measurements taken in the vicinity of the proposed route for the Hinkley Point C Connection overhead line and substation.

1.2 To establish the prevailing background noise conditions along the proposed route a series of five minute attended measurements were taken at many of the convenient public access points [road crossings] along the proposed route during the early hours on several different occasions as detailed below;

- The majority of the route to the south of Avonmouth was surveyed in the early hours of Monday 27 May 2013, this being a bank holiday Monday.
- The route around Avonmouth was surveyed in the early hours of 19 June 2013, this being a normal working day.
- The entire route was resurveyed in the early hours of 21 August 2013, this also being a normal working day.
- A number of locations were resurveyed in the early hours of 16 October 2013, for attended 15-minute measurements.
- The area around Sandford substation was surveyed in the early hours of 16 Feb 2013.

1.3 On all of the above occasions the weather was suitable for the purpose of the task. It was fine, calm and dry allowing the real minimum background noise levels to be measured without the influence of wind and precipitation. Throughout the measurement surveys the weather remained fine and there were no peculiar or atypical noise sources to contend with. For the great majority of the measurements, the measurement intervals were not disturbed by passing local traffic or other human activity. When there was passing local traffic, it was considered to be typical for that location, and the number of vehicles passing was noted. Surveyor comments were noted at each location and recorded in National Grid files.

1.4 This report is not a noise assessment; it is simply a record of prevailing background noise measurements which may subsequently be used in an assessment exercise. These measurements have been used to guide the audible noise impact assessment included in the project Environmental Statement.

## 2 EQUIPMENT AND CALIBRATION

2.1 Measurements were taken with a variety of instruments, all of which were calibrated in accordance with the relevant standards:

- Bruel & Kjaer 2270 Investigator, Serial No. 2664167
- Bruel & Kjaer 4189 microphone, Serial No. 2662754

- Bruel & Kjaer 2250 Investigator, Serial No. 2506571
- Bruel & Kjaer 4189 microphone, Serial No. 2529520

- Bruel & Kjaer 2250 Investigator, Serial No. 3000223
- Bruel & Kjaer 4189 microphone, Serial No. 2775412

- Bruel & Kjaer 2260 Investigator, Serial No. 2001634
- Bruel & Kjaer 4189 microphone, Serial No. 2282114

2.2 Sound level equipment was also successfully field calibrated immediately before and after each noise survey in accordance with manufacturer's instructions. Meteorological parameters were recorded for indication only.

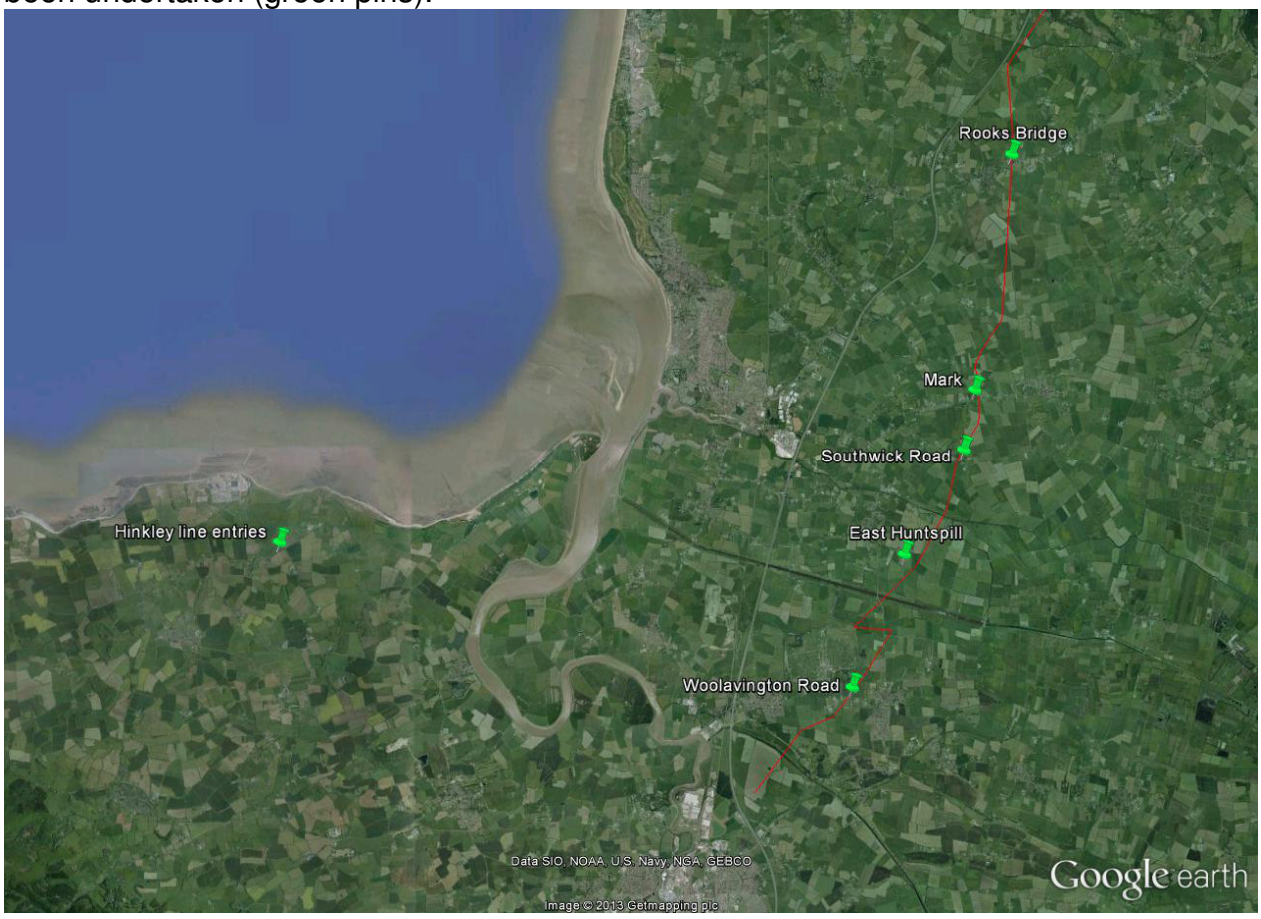
## 3 Version control for this report

| Issue Number | Date | Reason for re-issue | Issued by |
|---|---|---|---|
| 1 | 8 Nov 2013 | First issue | SJ Fitton |
| 2 | 21 Jan 2014 | Updated to include background measurements around substation | SJ Fitton |
| 3 | 26 Feb 2014 | Formatting to Hinkley C project requirements and removing reference to PEIR | SJ Fitton |

# 4 SUMMARY OF SURVEY LOCATIONS

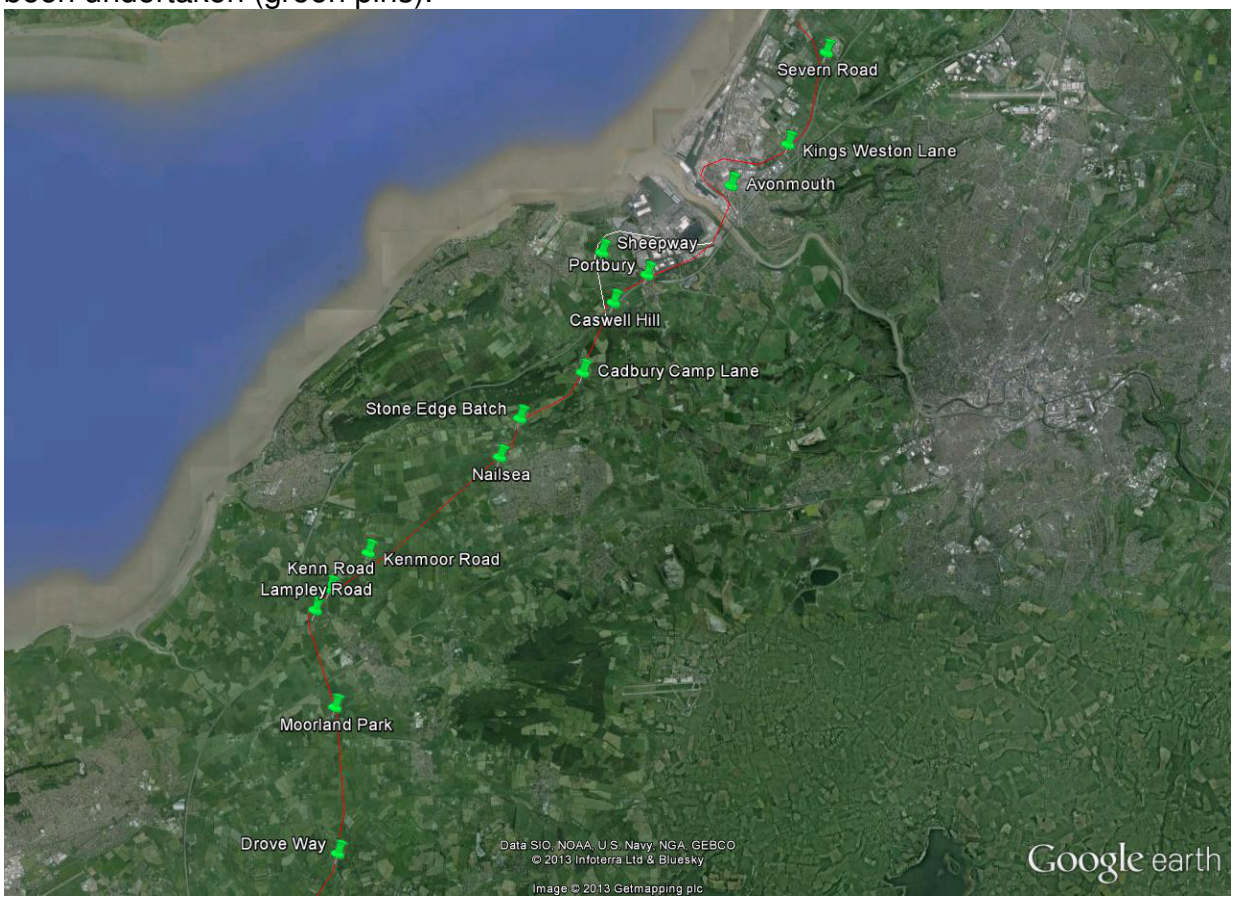
4.1 Background noise surveys were undertaken in the following locations at the Southern end of proposed route:

Figure 1: the proposed alignment of the southern section of the route (in red) and the areas close to residential areas along the route where background surveys have been undertaken (green pins).



4.2 Background noise surveys were undertaken in the following locations at the Northern end of proposed route:

Figure 2: the proposed alignment of the southern section of the route (in red) and the areas close to residential areas along the route where background surveys have been undertaken (green pins).




4.3 Detailed surveys were not undertaken in the middle part of the route which proposed to be constructed using underground cables, since assessment of operational noise has been scoped out in this area.

## 5 DETAIL OF SURVEY LOCATIONS

Figure 3: Survey detail, Hinkley line entries


Table 1: Hinkley line entry measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 16/10/2013 | 00:02 | 15 | 26 | |

Figure 4: Survey detail, Woolavington Road


Table 2: Woolavington Road measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 00:36 | 5 | 32.4 | |
| 21/08/2013 | 00:28 | 5 | 32.7 | |

Figure 5: Survey detail, East Huntspill:


Table 3: East Huntspill measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 00:49 | 5 | 28.6 | Burtle Road |
| 21/08/2013 | 00:56 | 5 | 31.0 | Burtle Road |
| 21/08/2013 | 00:44 | 5 | 29.0 | Long Moor Drove |
| 16/10/2013 | 00:58 | 15 | 22.0 | Long Moor Drove |

Figure 6: Survey detail, Southwick Road:


Table 4: Southwick Road measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 01:04 | 5 | 30.2 | |
| 21/08/2013 | 01:15 | 5 | 32.9 | |

Figure 7: Survey detail, Mark:


Table 5: Mark measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 01:18 | 5 | 31.5 | Mark Crossroads |
| 21/08/2013 | 01:26 | 5 | 33.8 | Butt Lake Road |
| 21/08/2013 | 01:40 | 5 | 36.6 | Harp Road |
| 21/08/2013 | 01:49 | 5 | 36.6 | Mark Causeway |
| 21/08/2013 | 02:01 | 5 | 32.4 | Northwick Road |
| 16/10/2013 | 01:23 | 15 | 28 | Mark Causeway |

Figure 8: Survey detail, Rooks Bridge:


Table 6: Rooks Bridge measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 01:34 | 5 | 35.8 | Bristol Road |
| 21/08/2013 | 02:43 | 5 | 36.2 | Bristol Road |
| 16/10/2013 | 02:02 | 15 | 36 | Bristol Road |
| 21/08/2013 | 02:33 | 5 | 33.5 | Chapel Road |

Figure 9: Survey detail, Drove Way:

,


Table 7: Drove Way measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 21/08/2013 | 03:01 | 5 | 32.3 | |

Figure 10: Survey detail, Moorland Park:


Table 8: Moorland Park measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 02:28 | 5 | 36.8 | |
| 21/08/2013 | 02:44 | 5 | 40.0 | |

Figure 11: Survey detail, Lampley Road:


Table 9: Lampley Road measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 02:53 | 5 | 40.5 | |
| 21/08/2013 | 02:25 | 5 | 40.7 | |

Figure 12: Survey detail, Kenn Road:


Table 10: Kenn Road measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 03:02 | 5 | 38.4 | |
| 21/08/2013 | 02:09 | 5 | 43.6 | |

Figure 13: Survey detail, Kenmoor Road:


Table 11: Kenmoor Road measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 03:12 | 5 | 38.1 | |
| 21/08/2013 | 01:51 | 5 | 36.8 | |

Figure 14: Survey detail, Causeway, Nailsea:


Table 12: Causeway, Nailsea measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 03:35 | 5 | 28.2 | |
| 21/08/2013 | 01:30 | 5 | 30.3 | |

Figure 15: Survey detail, Stone Edge Batch:

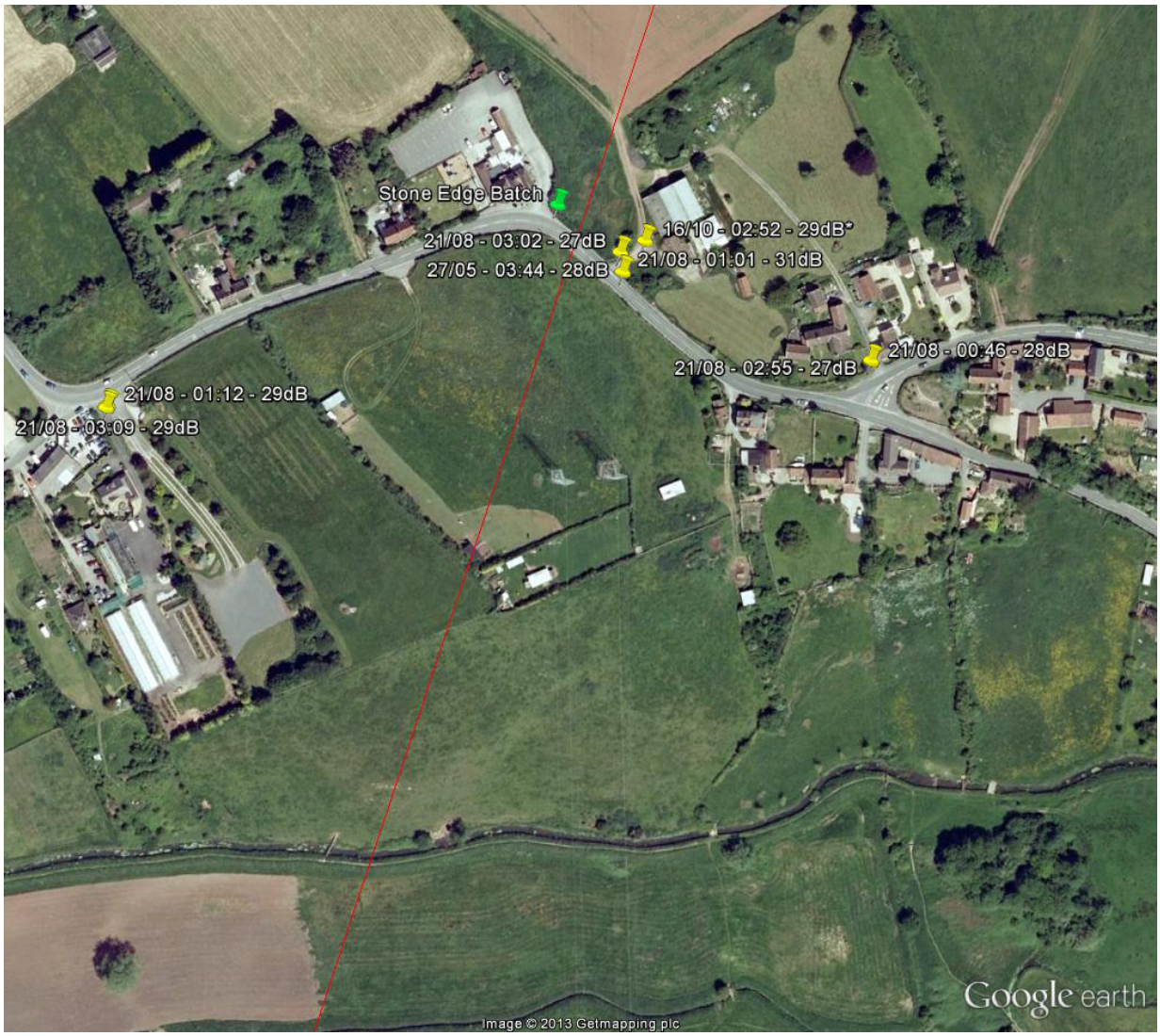



Table 13: Stone Edge Batch measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 21/08/2013 | 01:12 | 5 | 28.8 | Clevedon Road |
| 21/08/2013 | 03:09 | 5 | 29.0 | Clevedon Road |
| 27/05/2013 | 03:44 | 5 | 28.1 | Batch Farm |
| 21/08/2013 | 01:01 | 5 | 31.0 | Batch Farm |
| 21/08/2013 | 03:02 | 5 | 26.5 | Batch Farm |
| 16/10/2013 | 02:52 | 15 | 29 | Batch Farm |
| 21/08/2013 | 00:46 | 5 | 27.5 | Tickenham Hill |
| 21/08/2013 | 02:55 | 5 | 26.5 | Tickenham Hill |

Figure 16: Survey detail, junction of Cadbury Camp Lane and Whitehouse Lane:


Table 14: junction of Cadbury Camp Lane and Whitehouse Lane measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 03:56 | 5 | 33.2 | |
| 21/08/2013 | 02:44 | 5 | 26.6 | |
| 16/10/2013 | 03:16 | 15 | 36 | |

Figure 17: Survey detail, Caswell Hill:


Table 15: Caswell Hill measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 27/05/2013 | 04:05 | 5 | 46.2 | |
| 21/08/2013 | 02:35 | 5 | 47.5 | |

Figure 18: Survey detail, Portbury:


Table 16: Portbury measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 19/06/2013 | 01:31 | 5 | 46.6 | Station Road, north of M5 |
| 21/08/2013 | 02:03 | 5 | 48.8 | Station Road, north of M5 |
| 19/06/2013 | 01:20 | 5 | 31.2 | Station Road, south of M5 |
| 21/08/2013 | 02:26 | 5 | 44.7 | Station Road, south of M5 |
| 16/10/2013 | 03:41 | 15 | 42 | Station Road, south of M5 |

Figure 19: Survey detail, Sheepway:


Table 17: Sheepway measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 19/06/2013 | 01:41 | 5 | 34.7 | |
| 21/08/2013 | 02:13 | 5 | 35.1 | |

Figure 20: Survey detail, Avonmouth:

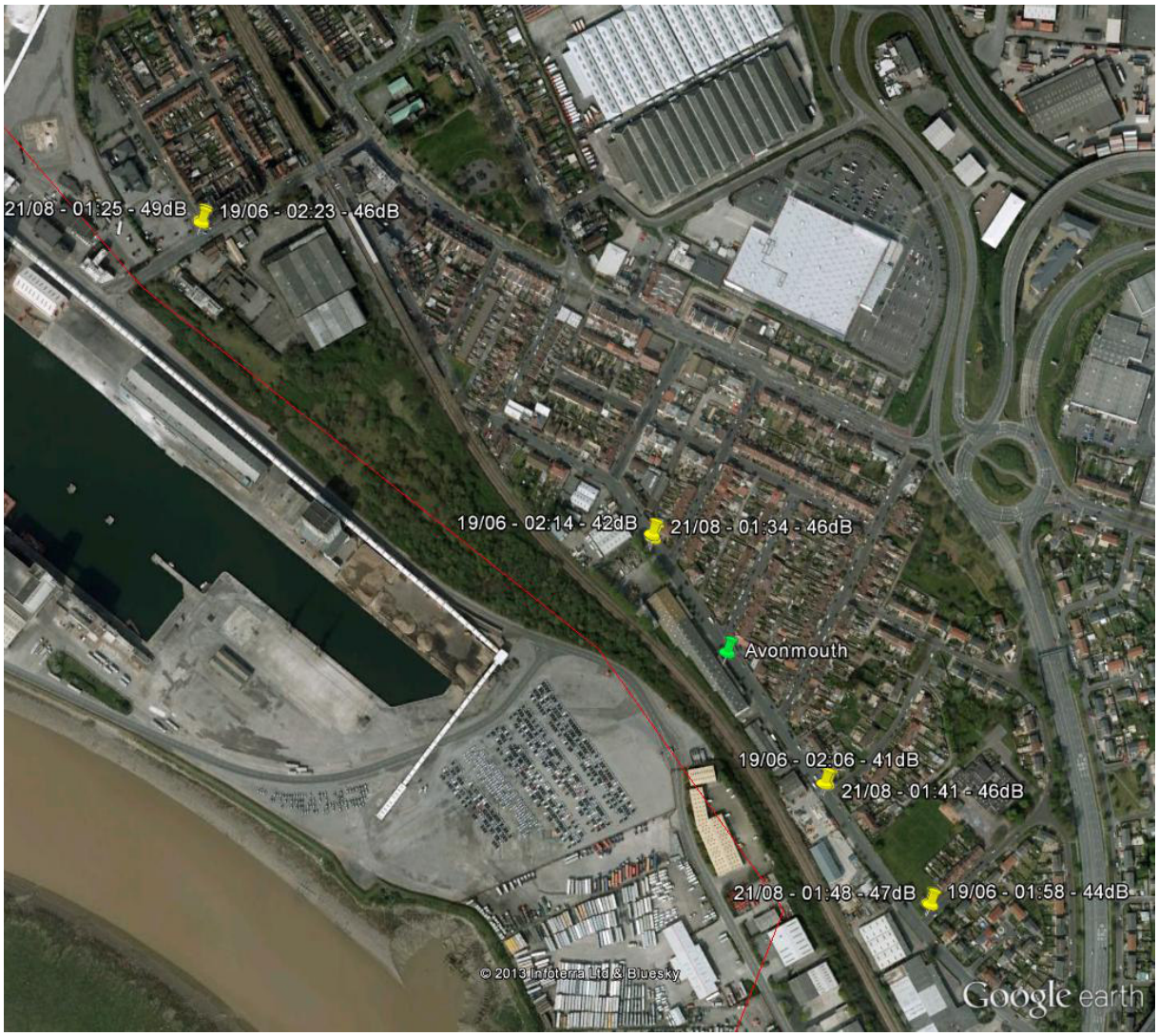



Table 18: Avonmouth measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 19/06/2013 | 02:23 | 5 | 45.6 | Gloucester Road/Clayton Street |
| 21/08/2013 | 01:25 | 5 | 48.9 | Gloucester Road/Clayton Street |
| 19/06/2013 | 02:14 | 5 | 41.8 | Portview Road, nr Collins Street |
| 21/08/2013 | 01:34 | 5 | 45.6 | Portview Road, nr Collins Street |
| 19/06/2013 | 02:06 | 5 | 40.8 | Portview Road/Pages Mead |
| 21/08/2013 | 01:41 | 5 | 46.1 | Portview Road/Pages Mead |
| 19/06/2013 | 01:58 | 5 | 43.8 | Portview Road/Catherine Street |
| 21/08/2013 | 01:48 | 5 | 46.6 | Portview Road/Catherine Street |

Figure 21: Survey detail, Kings Weston Lane:

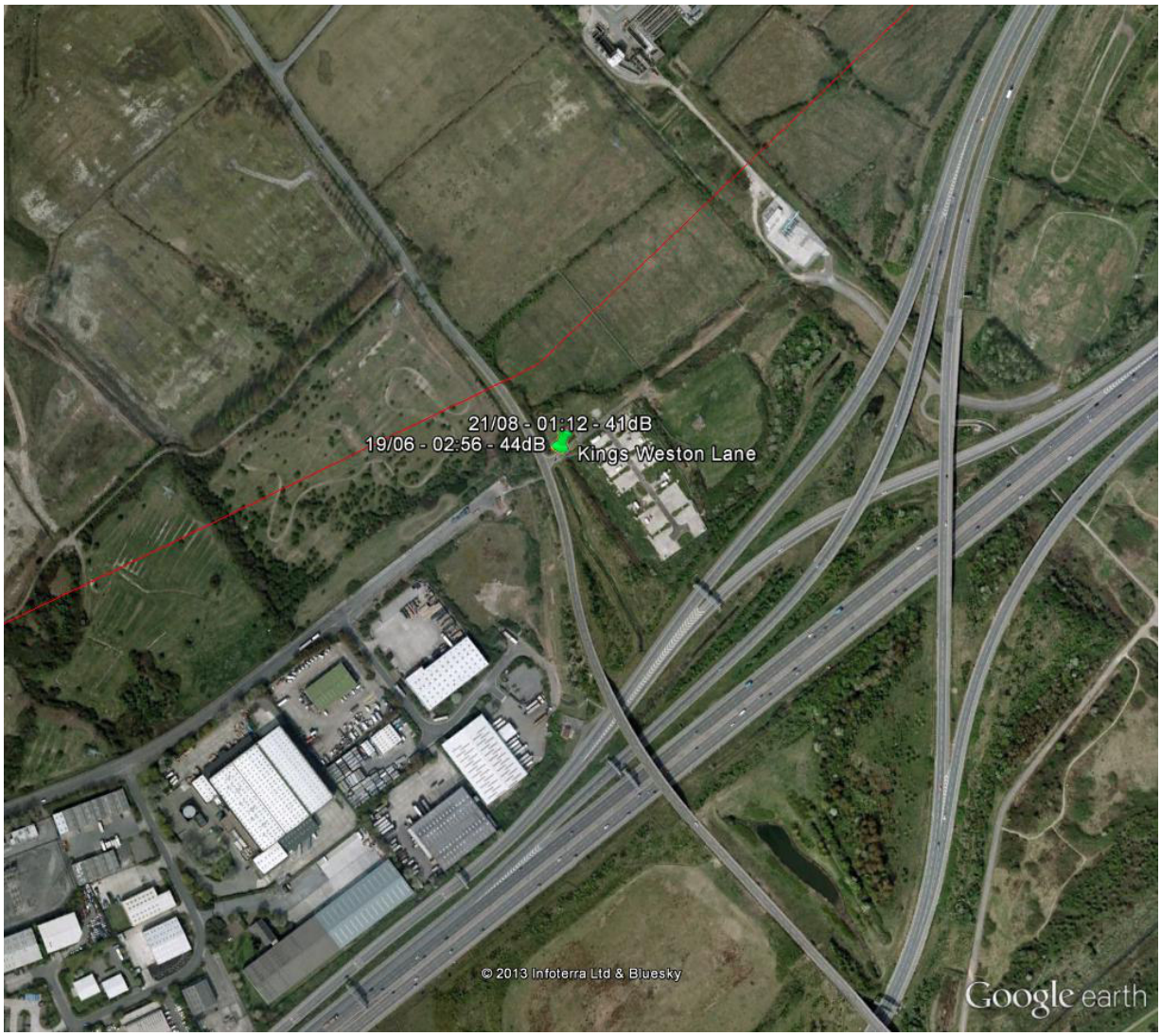



Table 19: Kings Weston Lane measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 19/06/2013 | 02:56 | 5 | 43.5 | |
| 21/08/2013 | 01:12 | 5 | 41.2 | |

Figure 22: Survey detail, Severn Road:


Table 20: Severn Road measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 19/06/2013 | 02:42 | 5 | 46.8 | |
| 21/08/2013 | 00:58 | 5 | 45.0 | |

Figure 23: Survey detail, area around proposed Sandford Substation:


Table 21: area around proposed Sandford Substation, measurement details

| Date | Time | Measurement time, mins | $L_{A90}$, dB | Notes |
|---|---|---|---|---|
| 16/02/2013 | 00:23 | 5 | 31.4 | Sandmead Road |
| 16/02/2013 | 00:41 | 5 | 35.4 | Riverside |
| 16/02/2013 | 00:55 | 5 | 27.9 | Mead Lane |
| 16/02/2013 | 01:06 | 5 | 29.6 | Nye Road |
| 16/02/2013 | 01:15 | 5 | 28.0 | Droveway |
| 16/02/2013 | 01:25 | 5 | 30.5 | Droveway |

Note: blue and green pins show approximate location of main plant items in proposed substation.

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**ENVIRONMENTAL ENGINEERING NOTE; PROGRESS SHEET**

**EEN/218/NOTE2013 v3**

| **TITLE**<br>**Summary of background noise measurements for Hinkley Point C connection project** |
|---|
| AUTHOR(S) **Sue Fitton** |
| Date sent for Technical Editing: 03 March 2014 |
| Technical Editing by: Richard Morris<br>Signature [redacted]<br>Date: 04/03/2014 |
| Approval for Issue: Damien Culley<br>Signa [redacted]<br>Date: |
| Distribution Date: 03 March 2014 |
| Date NGTnet Index updated: 03 March 2014 |
| Date Document Archived to S Drive: 03 March 2014 |

# Appendix 14F – Generic Data Curves to Assess Spans of 400kV Overhead Line Noise

# 14F TECHNICAL APPENDIX: GENERIC OPERATIONAL NOISE ASSESSMENT CURVES

## 14.1 INTRODUCTION

14.1.1 Noise from overhead line conductors can be categorised into two types: noise in dry weather (dry noise) which is usually heard as an intermittent or continuous 'crackle' from specific points on the conductor, and noise in wet weather (wet noise), usually heard as semi-continuous or continuous 'crackle' or 'fizz', and under heavier rainfall conditions a low frequency 'hum'. Noise is produced by "corona discharge" on the surface of the conductors. The effect of the audible noise drops off with distance from the overhead line, and the effect will also depend upon the existing levels of background noise in the area. A summary of overhead line noise and the assessment of its impact and significance are described in **Chapter 14** (Audible Noise and Vibration) in the main part of the ES.

14.1.2 The principal factor affecting conductor noise is conductor surface electrical stress, which itself is a function of operating voltage and physical line configuration. The level of noise can vary depending on weather (principally rainfall) and the surface condition of the conductors (surface contamination). The prediction of noise therefore requires a number of assumptions to be made in order for an assessment of potential noise impact to be made. National Grid uses an in-house method, described in internal report TR(T)94 and referenced in EN-5, which follows the principles of BS 4142 (1997) for dry noise and describes a method for predicting and assessing wet noise. Other methods are available, but these have been developed for systems other than the UK transmission network, and are not thought to give as accurate a result for UK operating conditions.

14.1.3 The National Grid method is based on empirical electrical stress data and measured noise data from selected twin-bundle 400kV overhead lines. The data produced is essentially a time-weighted average noise level for overhead line noise; lines will usually operate quietly under certain (usually dry) conditions and may be noisier under other conditions (usually heavy rainfall).

14.1.4 The model in TR(T)94 was developed with measured data from in service twin Zebra ACSR (28.6 mm diameter) and twin Rubus AAAC (31.5mm diameter) conductor systems on a range of lattice tower types. These conductor systems are inherently noisier (due to much higher surface electrical stresses) than that proposed for Hinkley. It is therefore necessary to assume extrapolation of the assessment method to other conductor systems with lower electrical stresses is valid and because of this, prudent modelling data has been selected to ensure the assessment is conservative. This is particularly the case for the T-pylon, which presents a very different conductor system geometry to that for which the model was developed. As an entirely new design, there are currently no T-pylons in service so that noise behaviour and predictions can be verified.

14.1.5 The method does not predict how a particular individual may perceive noise from an overhead line, instead it produces assessment levels which can then be compared to significance criteria to predict to impact on populations of people living within approximately 200 metres either side. In order to ensure that the predicted impact is conservative, the BS 4142 (1997) dry noise assessment is carried out relative to measured night-time (i.e. lowest) background noise levels, while the wet noise assessment assumes a rate of rainfall sufficient to induce 'hum' on the

overhead line and also a ground terrain that produces minimal masking due to the noise of rainfall on the ground. Both dry and wet noise assessments include a +5dB penalty to account for character in the noise in accordance with the principles of BS 4142 (1997).

## 14.2 HINKLEY PROJECT DETAILS

14.2.1 This appendix provides a record of the generic noise assessment curves for the Hinkley Point C Connection Project overhead line scheme. It is proposed to construct a new 400kV overhead line with a conductor system comprised of twin 41mm diameter 'Redwood' all aluminium alloy conductors (AAAC), spaced 550mm apart. The conductor system geometry in this generic assessment is based on National Grid standard construction, updated with specific data for the Hinkley Project provided by the project design team. The project design ground clearance of 12.4m average span height has been applied to both proposed tower types, namely L12 lattice towers (L12/1) and T-pylon (T1). An average 12.4m ground clearance is considered a typical worst case for normal operating conditions.

14.2.2 For the wet noise assessment it is assumed that an average 850mm of rain falls over 600hrs per year for the whole project area. This is based upon recent rainfall data provided to National Grid by the Met Office for the period 2001-2010 (see section 14.5). From this data it can be assumed that wet weather conditions will be present for approximately 7% of the year.

## 14.3 OVERHEAD LINE NOISE PREDICTION METHOD

14.3.1 The noise prediction methodology is carried out in three steps:

14.3.2 Step 1: Calculation of conductor surface electrical stress:

- Expressed in kV/cm, conductor surface electrical stress is the principal factor which determines the likelihood that the principal source of noise, corona discharge, can occur when contamination or rain drops impinge on the surface of the conductor. The lower the electrical stress, the quieter the overhead line is likely to be. Conductor surface electrical stress is determined by the line voltage (in this case 400kV), the size (diameter) of the conductors, the number of conductors per bundle and the geometry of the tower or pylon.
- The input factors for the electrical stress calculation are: line voltage, tower/pylon geometry (including height and arrangement of cross arms), conductor radius, bundle geometry and electrical phasing arrangement.

14.3.3 Step 2: Calculation of a sound pressure level at 1.5m from the conductor bundle surface:

- The National Grid model calculates an A-weighted sound pressure level [dB(A)] at 1.5 metres from the surface of each conductor bundle, corrected with a +5dB penalty for character of the noise source. This produces twelve values: six corrected sound pressures for dry noise and six for wet noise. These values have been used as inputs to produce the CadnaA noise contour plots shown in **Appendix 14E**.

- The input factors for the calculation of the corrected sound pressure level are: conductor radius, the averaged maximum conductor surface electrical stress (Emax) for each bundle calculated in step 1, and a 'k factor' which describes the skew of the stress profile around the conductors.

14.3.4 Step 3: Calculation of dry noise and wet noise assessment levels at distances from the line.

- The National Grid model includes a basic noise propagation model which accounts for the attenuation of noise over distance and absorption in the air. This propagation model is used to produce the generic noise curves shown in figures 14D.1 and 14D.2. The noise contour plots shown in **Appendix 14E** are produced with the propagation model used in CadnaA, which is complaint with ISO 9612-2. The two propagation models produce consistent results.
- For dry noise, a free-field BS 4142 (1997) type assessment level is calculated at various distances from the line. The assessment level can be positive or negative, depending on the noise level from the line compared to the prevailing background noise level without the line. It is possible to report the result as a rating level (dB LAr,Tr) by adding the assessment level to the background noise level.
- The input values for this are the output values of step 2, a selected background noise level (dB LA90), and the distance in metres to the receiver being assessed.
- For wet noise, additional input information includes the typical annual rainfall rate (mm per year and number of hours of rainfall) and information on the ground terrain near the receiver, which provide an estimate of the increase in background noise due to the noise of rain falling on the ground. (This information can be represented as "Miller curves" (ref 14.13).) The calculated assessment value is the predicted difference in noise level in rain including the presence of the line compared to the noise level in the rain without the line and is always a positive figure.

14.3.5 The electrical stress values and corrected sound pressure values calculated in steps 1 and 2 for the two proposed overhead line configurations for the Hinkley project are summarised in Table 14D.1 below.

TABLE 14D.1: Conductor surface electrical stress and predicted source sound pressure levels

| Tower type | Maximum Conductor Surface Electrical Stress [twin Redwood - 2 x 41mm diameter] (Emax) kV/cm | Dry noise rating level at 1.5m from each bundle (dBA) | Wet noise rating level at 1.5m from each bundle (dBA) |
|---|---|---|---|
| Lattice L12/1 | 13.8 | Top: 26.3, 26.3<br>Middle: 28.5, 28.5<br>Bottom: 28.4, 28.4 | Top: 41.9, 41.9<br>Middle: 44.1, 44.1<br>Bottom: 44.0, 44.0 |
| T-pylon T1 | 14.6 | Outer: 33.0, 33.0<br>Inner: 30.3, 30.3<br>Bottom: 34.8, 34.8 | Outer: 48.6, 48.6<br>Inner: 45.9, 45.9<br>Bottom: 50.4, 50.4 |

14.3.6 The sound level values calculated above can then be used in a sound propagation model to calculate the relevant assessment levels at various distances from the line. By inputting a range of background noise levels (30, 35, 40 and 45 dB LA90) and a range of distances (0, 40, 70, 100, 150, and 200 metres), a matrix of results is produced which can be represented as a series of curves for each proposed overhead line construction type.

14.3.7 The dry noise and wet noise curves generated using the National Grid TR(T)94 method are shown in Figures 14D.1 and 14D.2.

14.3.8 The dry noise curves represent assessment levels consistent with BS 4142 (1997) and hence these values can be compared to the assessment method values presented in section 9 of BS 4142 (1997). BS 4142 (1997) describes a method to assess the likelihood of complaints from a population of people when a new industrial noise source is introduced. BS 4142 (1997) states that a difference of around +10dB or indicates that complaints are likely, a difference of around +5dB is of marginal significance and a difference of more than 10dB below background is a positive indication that complaints are unlikely.

14.3.9 The wet noise curves represent the predicted time weighted change (increase) in noise levels near the overhead line in wet weather. (Wet weather noise will vry with rainfall rate and hence is not a single number.) The noise change can be used to calculate an equivalent rating level for wet noise.

14.3.10 It is important to understand that overhead line noise and background noise levels can vary hence the assessment describes typical conditions, time-weighted average noise levels and typical rainfall rates.

## 14.4 GENERIC NOISE CURVES FOR HINKLEY PROJECT

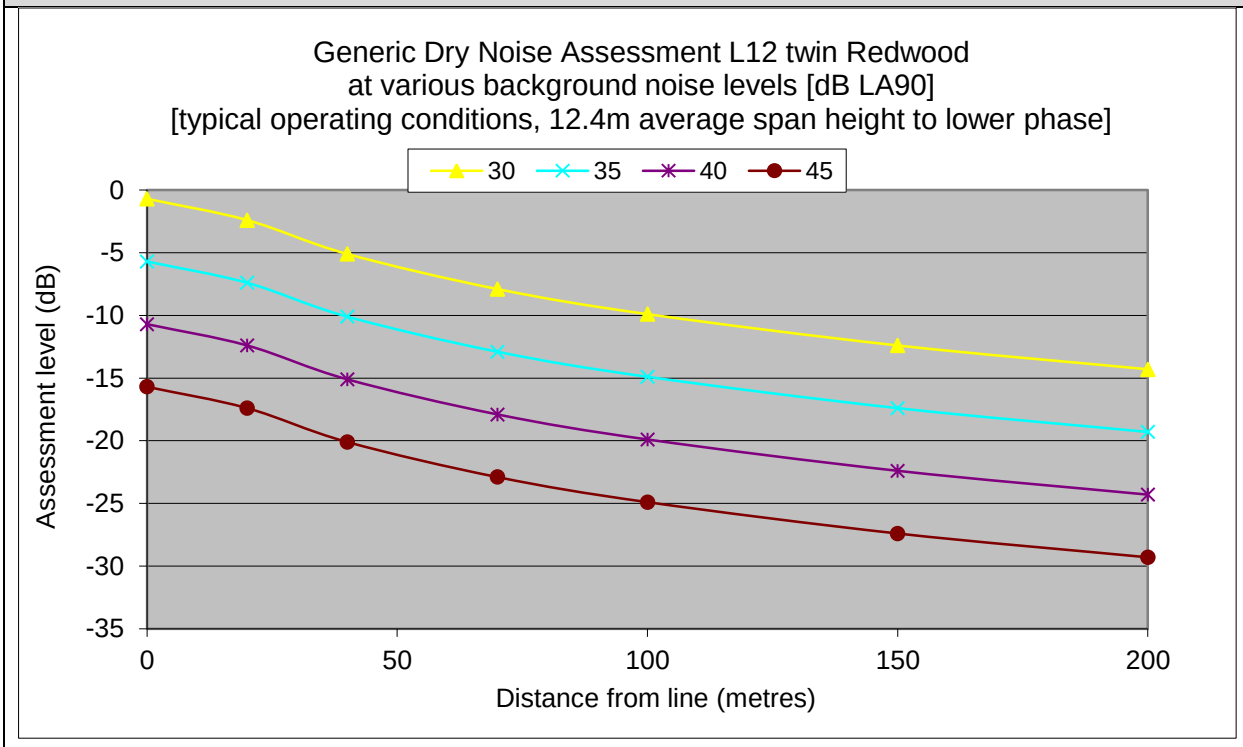
14.4.1 The charts below are explained using the following worked example for a person standing directly under an L12 line with twin Redwood conductors in an area where the night-time background noise level without the line is 30dB LA90 (yellow curve with triangles in Figure 14D.1).

- The dry noise curve indicates a 0dB BS 4142 (1997) assessment level. This means the new noise introduced by the line is roughly equal to the pre-existing background noise level. In dry weather the person would typically experience a noise level from the line of just below the night-time background noise level.

- In wet weather the person would typically experience a noise level 4dB higher in the presence of the line compared to being in the same location without the line present. A 4dB change is regarded as being ‘just perceptible’.

- Both these values include a +5dB penalty for character in the noise and hence they include a correction to account for that fact the overhead line noise can subjectively regarded as intrusive or annoying in certain circumstances.

Figure 14D.1: Generic noise curves for twin Redwood conductors on L12 lattice towers



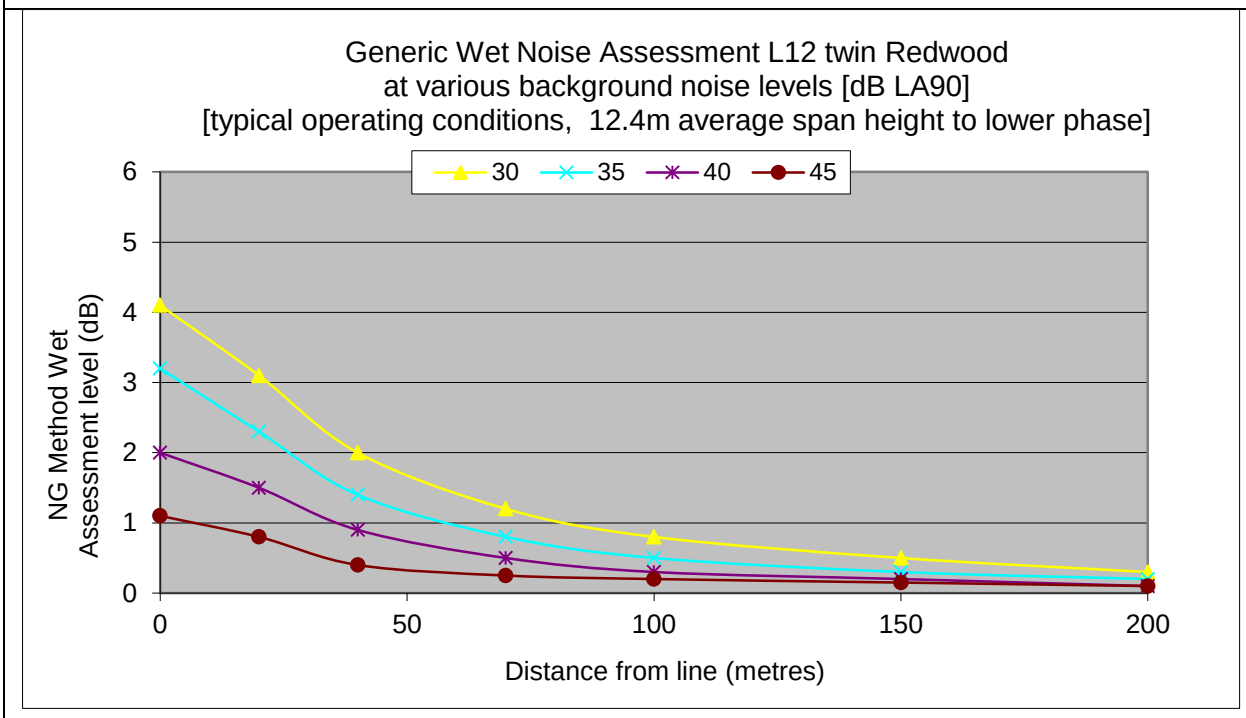
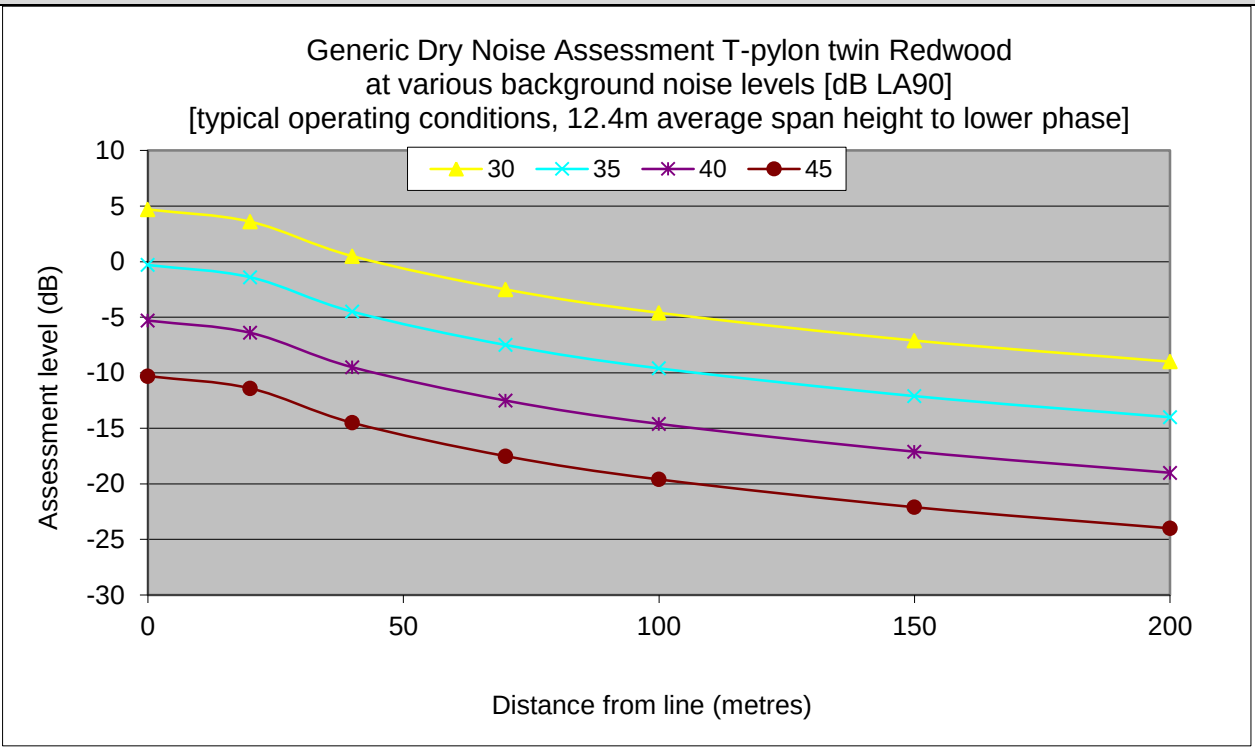
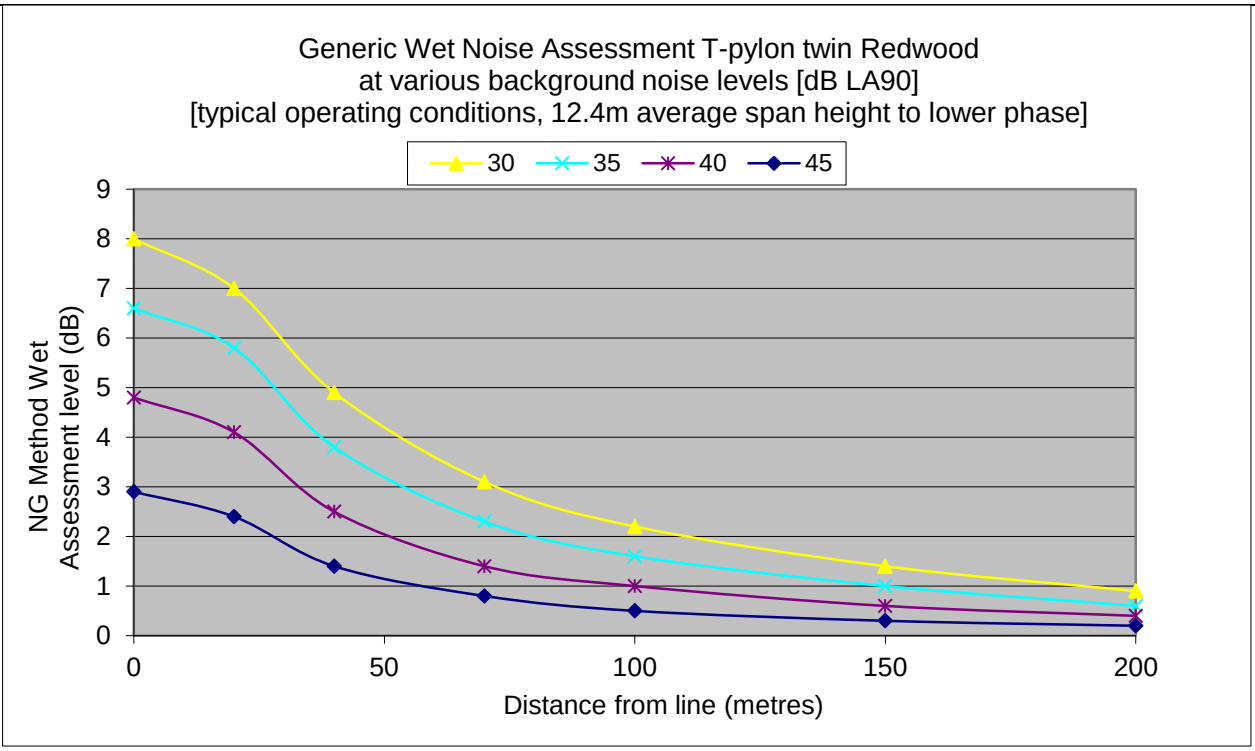



Figure 14D.2: Generic noise curves for twin Redwood conductors on T-pylon




Note: The T-pylon has a very different geometrical configuration to the to a lattice tower. The above results are considered to be a conservative estimate of the likely effects. Comparison with calculations from other overhead line noise application modelling packages (which were developed in non-UK transmission systems) suggests that the above charts are conservative and hence predict a conductor noise higher than will actually be produced.

## 14.5 WET WEATHER DATA

14.5.1 The Met Office has recently reviewed its rainfall intensity and rainfall duration data for the period 2001 to 2010 on behalf of National Grid and has produced the charts shown in figures 14D.3 and 14D.4. From these figures it can be seem the typical rainfall rate in the project area falls in the range 700 to 1000 mm over 450 to 600 hours. The selected rainfall rate for the wet noise modelling for the Hinkley Project is 850 mm rain falling over 600 hours.

Figure 14D.3: Total annual average rainfall, 2001-2010:

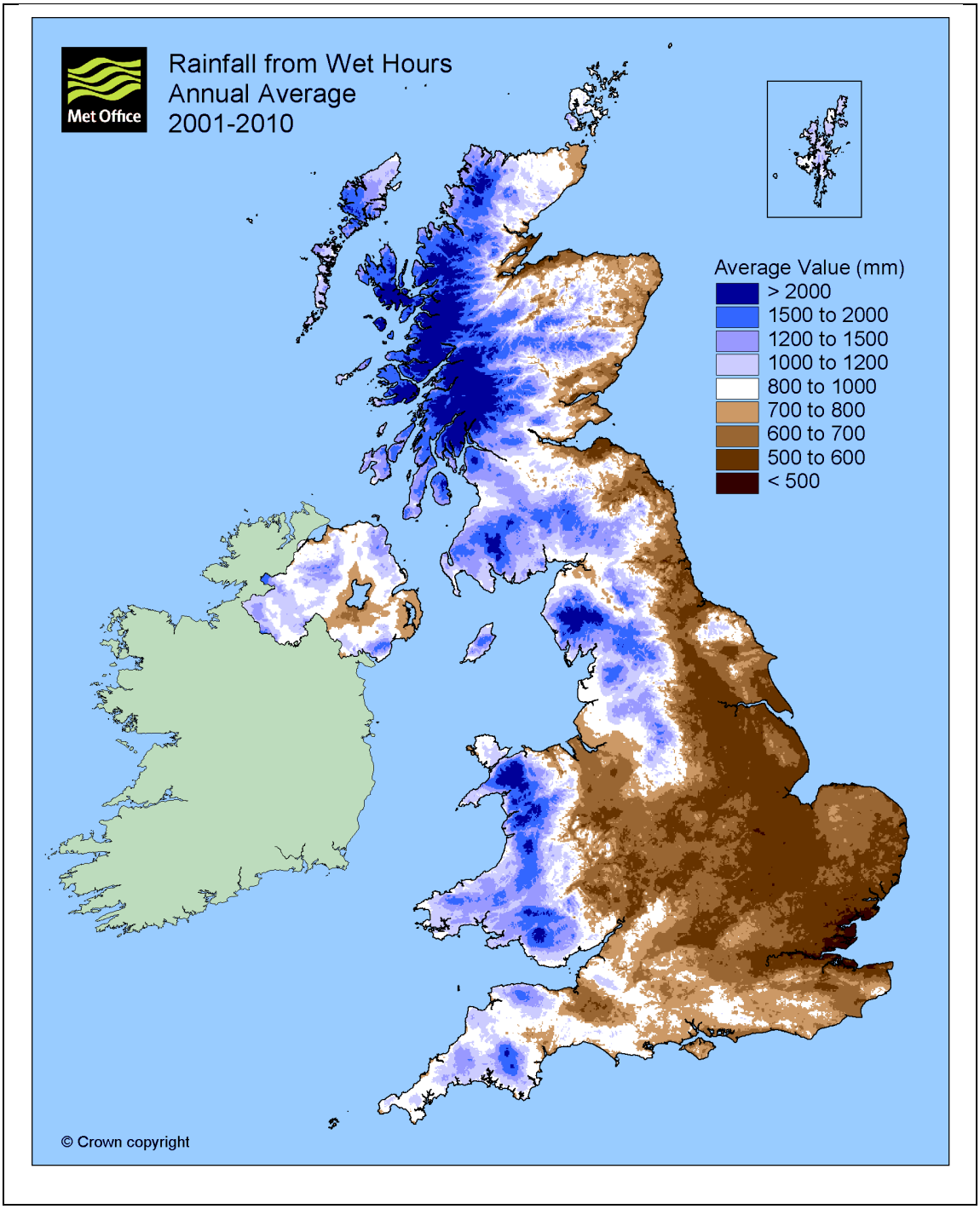
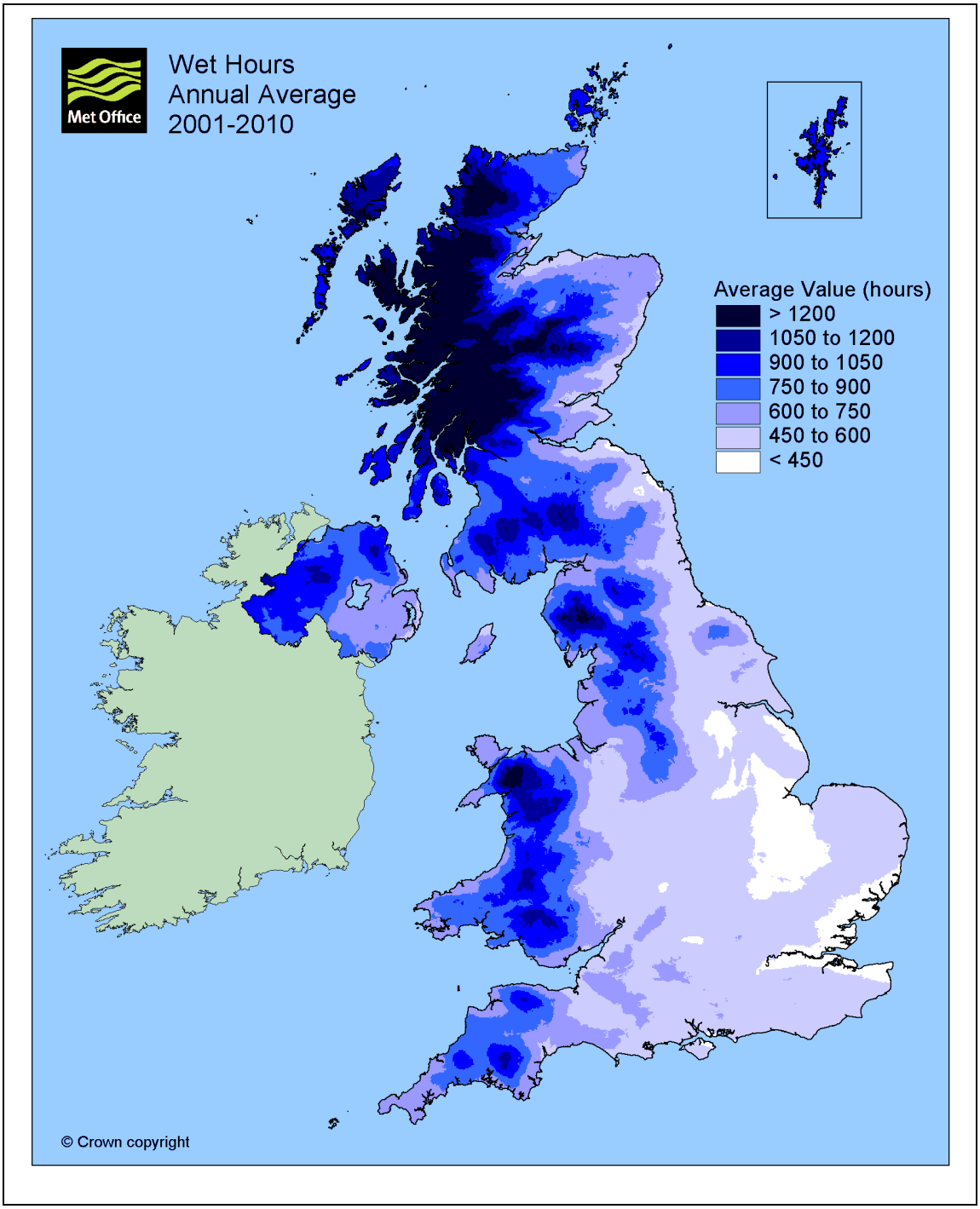


Figure 14D.4: Annual Average Wet Hours (above 0.2mm/hr), 2001-2010:




## 14.6 References

14.13 Miller L N. 1978, 'Sound Levels of Rain and Wind in the Trees', Noise Control Engineering Vol 11, No 3

# Appendix 14G – 400kV Overhead Line Noise Modelling

# 1 Objective

1.1 The objective of the noise prediction modelling exercise was to predict overhead conductor noise levels at the nearest noise sensitive receptor locations. The following scenarios were assessed:

- Dry conductor noise (crackle);and
- Wet conductor Noise (hum).

# 2 Noise prediction modelling software and calculation methodology

2.1 Noise propagation calculations were undertaken in accordance with Internal Standard ISO 9613 “Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation”, which is embedded as a software module.

## Modelling parameters

### Modelling the topography

2.2 Topography is assumed to be flat along the proposed route as worst case (lowest) source heights are assumed. The height of the source compared to the receptor height is not likely to lead to significant screening, especially at worst case receptors closest to the conductor route.

### Modelling buildings and other obstacles

2.3 In order to provide a worst case assessment no buildings are included in the model and as such screening from buildings is ignored.

### Modelling noise sources (emission points)

2.4 Line noise sources were used in the model to represent conductors. Sound power levels of these sources have been supplied by National Grid. Conductor noise levels vary for different conductor types and electrical stresses. The configuration and sound power level for the conductors is presented in Table 1.

Table 1 Conductor Noise Sources

| Pylon Type | Wet/Dry | Conductor Position | Conductor Height AGL, m | Conductor Distance from Centre Line, m | Conductor Sound Power Level, dBA |
|---|---|---|---|---|---|
| T Pylon | Dry | Lower | 12.40 | 10.55 | 42.7 |
| | | Inner | 18.81 | 6.90 | 40.9 |
| | | Outer | 18.81 | 14.20 | 40.9 |
| | Wet | Lower | 12.40 | 10.55 | 58.3 |
| | | Inner | 18.81 | 6.90 | 56.5 |
| | | Outer | 18.81 | 14.20 | 56.5 |

2.5 In accordance with BS4142:1997, a 5dB correction is to be applied if one or more of the follow features occur, or are expected to be present for new or modified noise sources:

- The noise contains a distinguishable, discrete continuous note (whine, hiss, screech hum, etc.);
- The noise contains distinct impulses (bangs, clicks, clatters, or thumps);
- The noise is irregular enough to attract attention.

2.6 A 5dB acoustic character correction is to be applied to the above data to take account of 'hum' and 'crackle' noise.

## Other modelling parameters

### *Ground absorption*

2.7 All land was assigned a sound absorption factor of 0 (hard ground) for the purpose of noise propagation calculations, resulting in noise levels 3dB higher than those expected for soft ground and represents a worst case scenario.

### *Meteorological conditions*

2.8 The following meteorological conditions were assumed:

- Ambient temperature: 10°C
- Relative humidity: 70%

2.9 These values represent a typical worst case scenario and provide relatively low levels of atmospheric absorption.

2.10 ISO 9613 assumes favourable (worst case) conditions for downwind propagation.

### *Foliage/woodland areas*

2.11 Areas of existing foliage are assumed to have no acoustic effect and are therefore not accounted for within noise propagation calculations.

### *Reflections*

2.12 The model does not include any buildings and as such reflections are not taken into account (other than hard ground) to provide an assessment of free-field conditions.

### Noise sensitive receptor locations

2.13 Immission points are positions of the noise reception calculation and are representative of the position of building façades. Modelled prediction calculations determine the broadband noise levels at each immission point resulting during each assessed scenario. In each instance, the height of immission points represents first floor level. Table 2 shows indicates the location of nearby noise sensitive receptors.

Table 2 Receptor Locations

| Receptor Ref. | Receptor Name | Ordnance Survey co-ordinates | | |
|---|---|---|---|---|
| | | x | y | z (AGL), m |
| 1 | Hillside Farm | 333477 | 141366 | 4.5 |
| 2 | The Yards | 333943 | 141442 | 4.5 |
| 3 | East Farm | 333689 | 141559 | 4.5 |
| 4 | 99 Woolavington Road | 333658 | 141623 | 4.5 |
| 5 | Homestead Farm | 334473 | 143272 | 4.5 |
| 6 | Cote Lea | 335072 | 144215 | 4.5 |
| 7 | Elm Cottage | 335036 | 144238 | 4.5 |
| 8 | Sunningdale | 335051 | 144289 | 4.5 |
| 9 | Cripps Farm | 336054 | 145133 | 4.5 |
| 10 | Cripps Farm Caravans | 335950 | 145230 | 4.5 |
| 11 | Merry Farm | 335720 | 145286 | 4.5 |
| 12 | Willow Cottage | 336488 | 147305 | 4.5 |
| 13 | Yardwell House | 336465 | 147449 | 4.5 |
| 14 | Wainbridge | 336438 | 147625 | 4.5 |
| 15 | Dwelling | 336370 | 147649 | 4.5 |
| 16 | Wainbridge Farm | 336468 | 147660 | 4.5 |
| 17 | The Yews | 336820 | 147681 | 4.5 |
| 18 | Court Farm | 336720 | 147699 | 4.5 |
| 19 | Court Villa | 336771 | 147707 | 4.5 |
| 20 | Little Dean | 336782 | 147709 | 4.5 |
| 21 | Ashdene | 336795 | 147713 | 4.5 |
| 22 | Portland Cottage | 336828 | 147726 | 4.5 |
| 23 | Victory House | 336718 | 148296 | 4.5 |
| 24 | Sunnydene | 336698 | 148301 | 4.5 |
| 25 | Withy Cottage | 336534 | 148356 | 4.5 |
| 26 | Poachers Cottage | 336386 | 148389 | 4.5 |
| 27 | Vole House Farm | 336920 | 149286 | 4.5 |

| Receptor Ref. | Receptor Name | Ordnance Survey co-ordinates | | |
|---|---|---|---|---|
| | | x | y | z (AGL), m |
| 28 | Pillrow | 337099 | 150173 | 4.5 |
| 29 | Acacia Farm | 337237 | 152422 | 4.5 |
| 30 | Laurel Cottage | 337177 | 152463 | 4.5 |
| 31 | The Willows | 337251 | 152483 | 4.5 |
| 32 | Little Willows | 337202 | 152488 | 4.5 |
| 33 | Flat above Garage | 337427 | 152492 | 4.5 |
| 34 | Tarnock Cottage | 337444 | 152533 | 4.5 |
| 35 | South View | 337528 | 152553 | 4.5 |
| 36 | Tarnock Farm | 337469 | 152555 | 4.5 |
| 37 | Willow Cottage | 337568 | 152586 | 4.5 |
| 38 | Ty Barah | 337591 | 152589 | 4.5 |
| 39 | Moorland Park | 341697 | 164232 | 4.5 |
| 40 | Heathgate | 341821 | 164431 | 4.5 |
| 41 | Middle Elm | 341881 | 164466 | 4.5 |
| 42 | Primrose Cottage | 341187 | 167066 | 4.5 |
| 43 | Orchardside | 341207 | 167073 | 4.5 |
| 44 | Rose Lea Cottage | 341258 | 167092 | 4.5 |
| 45 | Hope Farm | 341477 | 167474 | 4.5 |
| 46 | Homeground | 341493 | 167492 | 4.5 |
| 47 | Oakland Farm | 341312 | 167680 | 4.5 |
| 48 | Rose Bungalow | 342452 | 168135 | 4.5 |
| 49 | Manor Farm | 342532 | 168454 | 4.5 |
| 50 | Causeway House | 345819 | 170756 | 4.5 |
| 51 | Yeovil | 346207 | 171677 | 4.5 |
| 52 | Little Orchard | 346148 | 171697 | 4.5 |
| 53 | Furze | 346221 | 171730 | 4.5 |
| 54 | Lavender Cottage | 346610 | 171731 | 4.5 |
| 55 | Stone Edge Farm | 346529 | 171734 | 4.5 |
| 56 | Stone Edge Barn | 346561 | 171744 | 4.5 |
| 57 | Stonewell Barn | 346640 | 171758 | 4.5 |
| 58 | 1 Clevedon Road | 346495 | 171759 | 4.5 |
| 59 | 2 Clevedon Road | 346505 | 171759 | 4.5 |
| 60 | Stone Edge Cottage | 346500 | 171759 | 4.5 |
| 61 | Honeysuckle Cottage | 346479 | 171770 | 4.5 |
| 62 | Wellhouse Farm | 346604 | 171777 | 4.5 |
| 63 | The Gables | 346558 | 171788 | 4.5 |
| 64 | The Granary | 346531 | 171795 | 4.5 |

| Receptor Ref. | Receptor Name | Ordnance Survey co-ordinates | | |
|---|---|---|---|---|
| | | x | y | z (AGL), m |
| 65 | 12 Clevedon Road | 346272 | 171812 | 4.5 |
| 66 | The Elms | 346586 | 171815 | 4.5 |
| 67 | 11 Clevedon Road | 346279 | 171816 | 4.5 |
| 68 | Dwelling (Stone Edge) | 346355 | 171843 | 4.5 |
| 69 | Inn | 346403 | 171861 | 4.5 |
| 70 | Naish Cottage | 348086 | 172739 | 4.5 |
| 71 | Hunters Croft | 348070 | 172858 | 4.5 |
| 72 | Birchwood | 347671 | 172922 | 4.5 |
| 73 | Deep Acres | 347739 | 172957 | 4.5 |
| 74 | Spindlewood | 347825 | 172963 | 4.5 |
| 75 | Cuckoos Mead | 348037 | 172965 | 4.5 |
| 76 | Naish Lodge | 348028 | 173550 | 4.5 |
| 77 | Cole Acre | 349566 | 175591 | 4.5 |
| 78 | The Meadow | 349578 | 175626 | 4.5 |
| 79 | 18 Elm Tree Park + Others | 349737 | 175714 | 4.5 |

Note:- Receptors 77 to 79 relate only to preferred route (Option A).

# 3 Scoped out receptors

3.1 The receptors highlighted in Table 2 are assessed due their proximately to the overhead line and relative background noise level. The following spans contain residential receptors within 200m of the overhead line, but have been scoped out from detailed noise assessment. This is because there is a clear indication from the generic noise assessment curves (**Volume 5.14, Appendix 14F**) that the magnitude of effect at all properties is negligible or low (and hence there is not a significant effect), due to either the proximity of the properties to the line and/or the high ambient noise background.

- LD93-94
- LD103-104
- LD108-LD113
- LD119-120
- P-LD97-98

# 4 Methodology for Assessing the Significance of Operational Noise Effects

4.1 The assessment criteria for the sensitivity of noise sensitive receptors are shown in Table 3.

Table 3 Sensitivity of Receptor – Operational Noise

| **Sensitivity of Receptor** | **Receptor Description** |
|---|---|
| **High** | Patients in hospitals/hospices etc. – defined as a "vulnerable subgroup" with very high or continuous rates of occupancy |
| **Medium** | Residential receptors |
| **Low** | Area used primarily for leisure activities, including Public Rights of Way (PRoW), sports facilities and sites of historic or cultural importance |
| **Negligible** | All other areas such as those used primarily for industrial or agricultural purposes |

**4.2** The assessment criteria for the magnitude of effect of operational noise effects are shown in Table 4.

Table 4 Magnitude of Effects – Operational Noise

| **Magnitude of Effect** | **Operation Noise - Substation or Overhead Line - Dry and Wet Noise** |
|---|---|
| High | Predicted rating levels are 5dB or more above the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |
| Medium | Predicted rating levels are between 5 - 0dB(A) above the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |
| Low | Predicted rating levels are between 0dB(A) above and 5dB(A) below the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |
| Negligible | Predicted rating levels are between 5dB(A) and 10dB(A) below the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |
| No effect | Predicted rating noise levels are 10dB or more below the higher of existing background noise levels or 30dB (background noise levels for wet noise assessment include noise levels due to rainfall) |

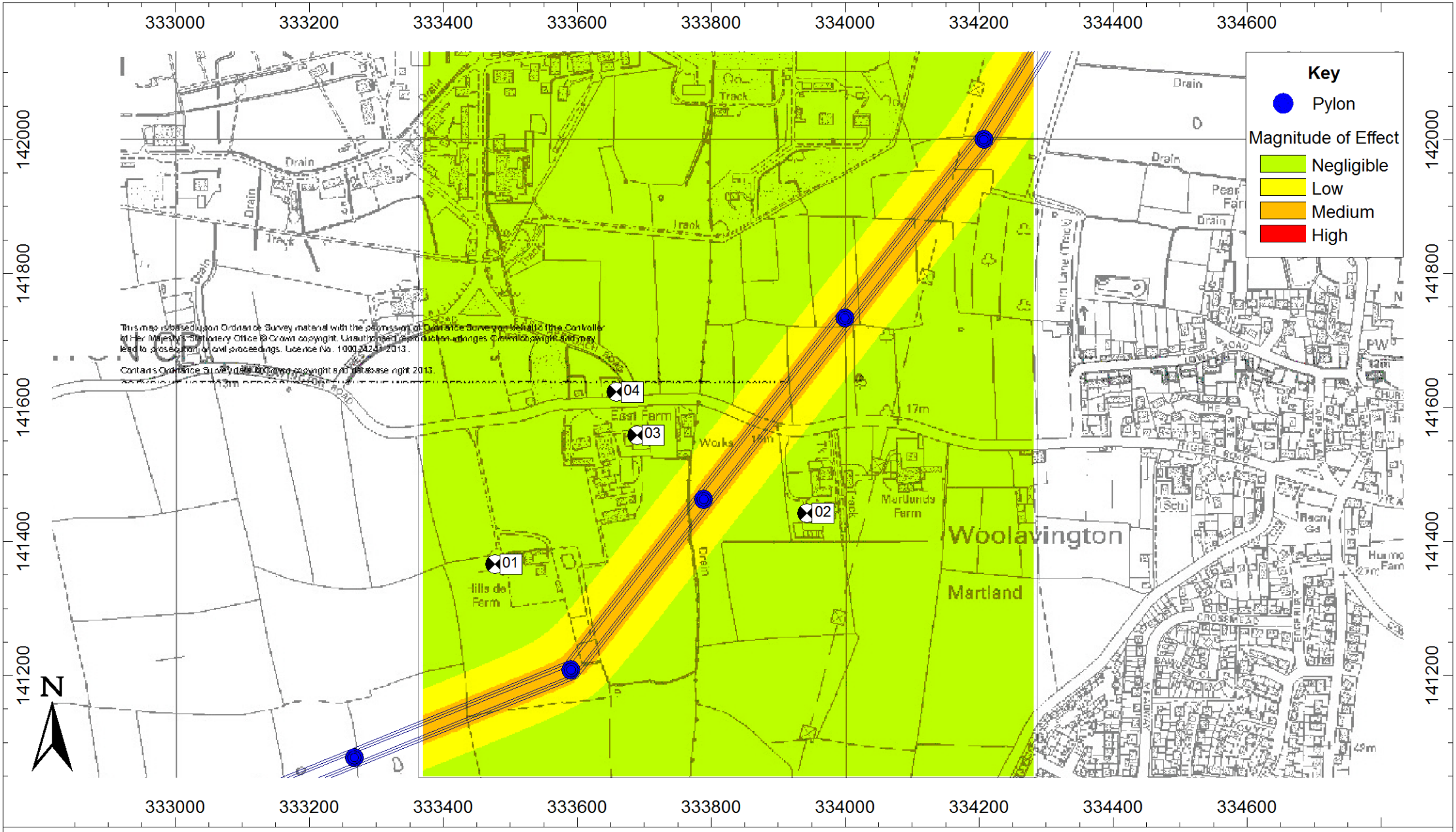
4.3 The assessment criteria for the significance of operational noise effects are shown in Table 5.

Table 5 Significance of Effect – Operational Noise

| **Significance of Effect** | **Receptor Sensitivity** | | | |
|---|---|---|---|---|
| **Magnitude** | High | Medium | Low | Negligible |
| High | Major | Major | Moderate | Minor |
| Medium | Major | Moderate | Minor | Negligible |
| Low | Moderate | Minor | Negligible | Negligible |
| Negligible | Minor | Negligible | Negligible | Negligible |

# 5 Model outputs

5.1 Insets 1 to 16 show graphical CadnaA representations of assessment of effect of noise from overhead line noise for conditions. Insets 17 to 32 show CadnaA graphical representations of assessment of effect from noise from overhead line noise for wet conditions. A summary of results is presented in Table 6 for dry conditions and Table 7 for wet conditions.






**NOTES:**

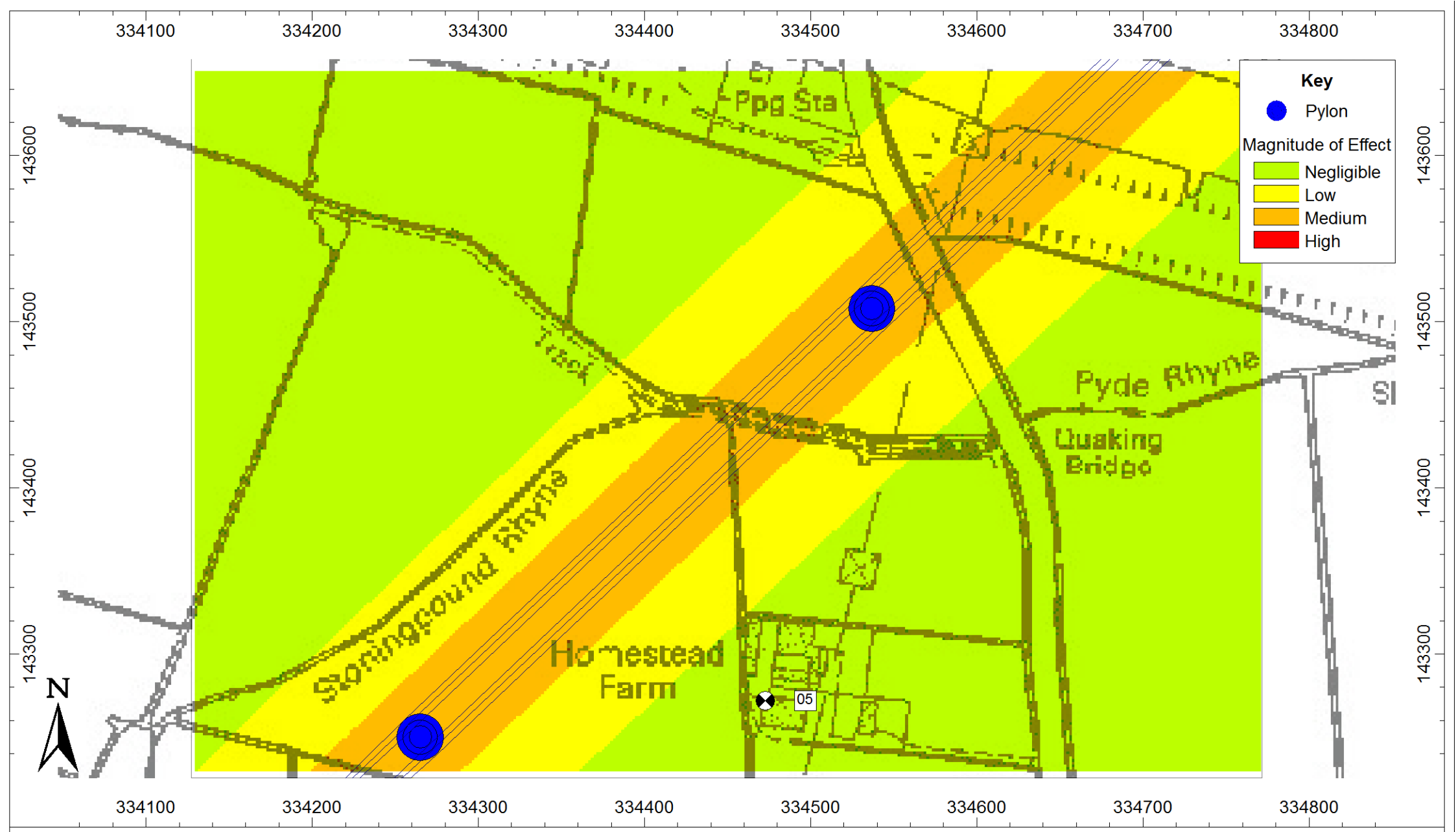
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

# 400kV Overhead Line Noise Modelling

Span: ZGA7-9
Background Noise Level: 32dB LA90
Dry Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/1 |
| Date | 06.03.14 |

BUREAU VERITAS




NOTES:

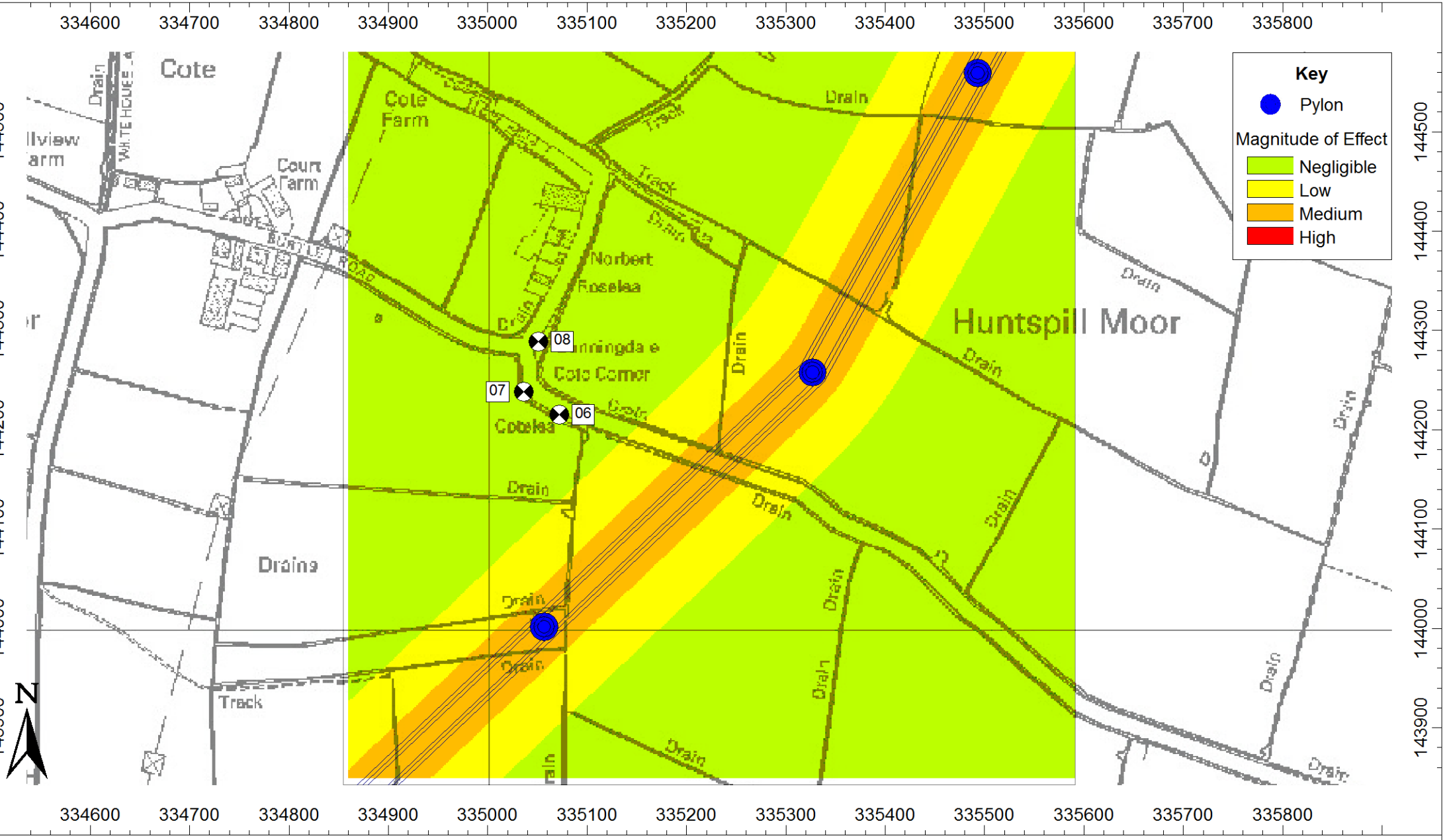
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

# 400kV Overhead Line Noise Modelling

Span: LD2-3
Background Noise Level: 30dB LA90
Dry Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/2 |
| Date | 27.02.14 |

BUREAU VERITAS




NOTES:

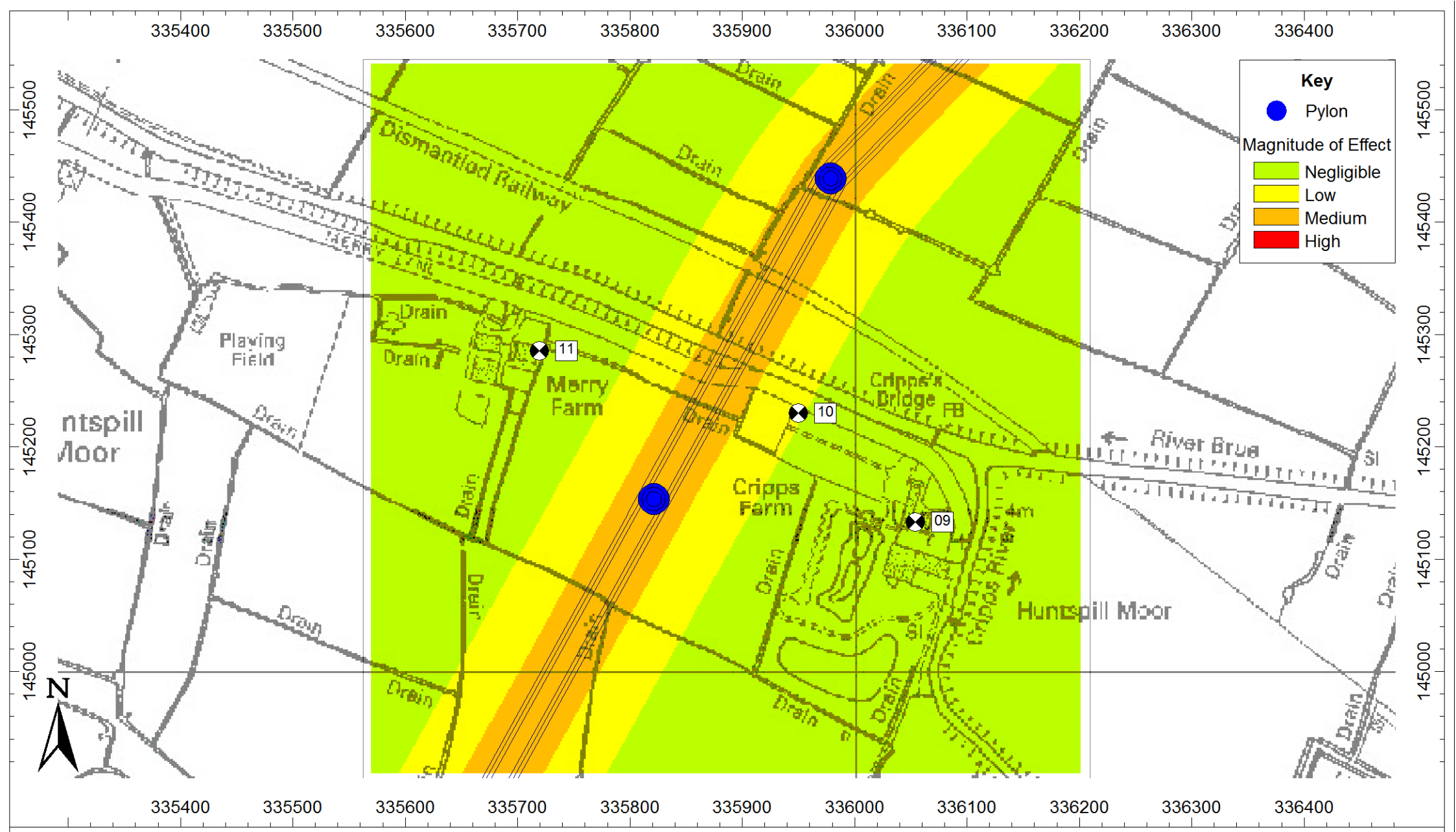
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

**400kV Overhead Line Noise Modelling**

Span: LD5-7
Background Noise Level: 30dB LA90
Dry Conditions

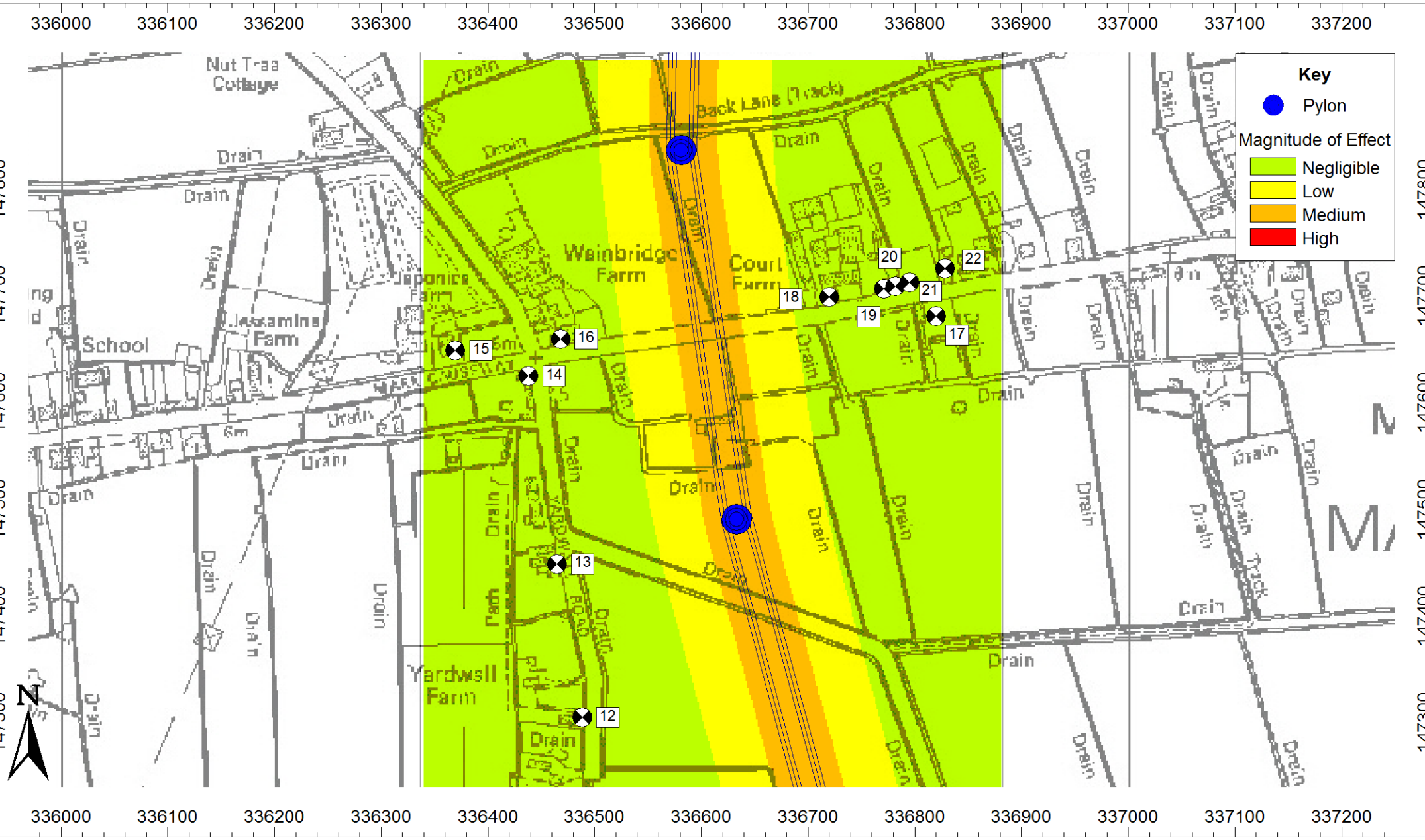
| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/3 |
| Date | 27.02.14 |

BUREAU VERITAS



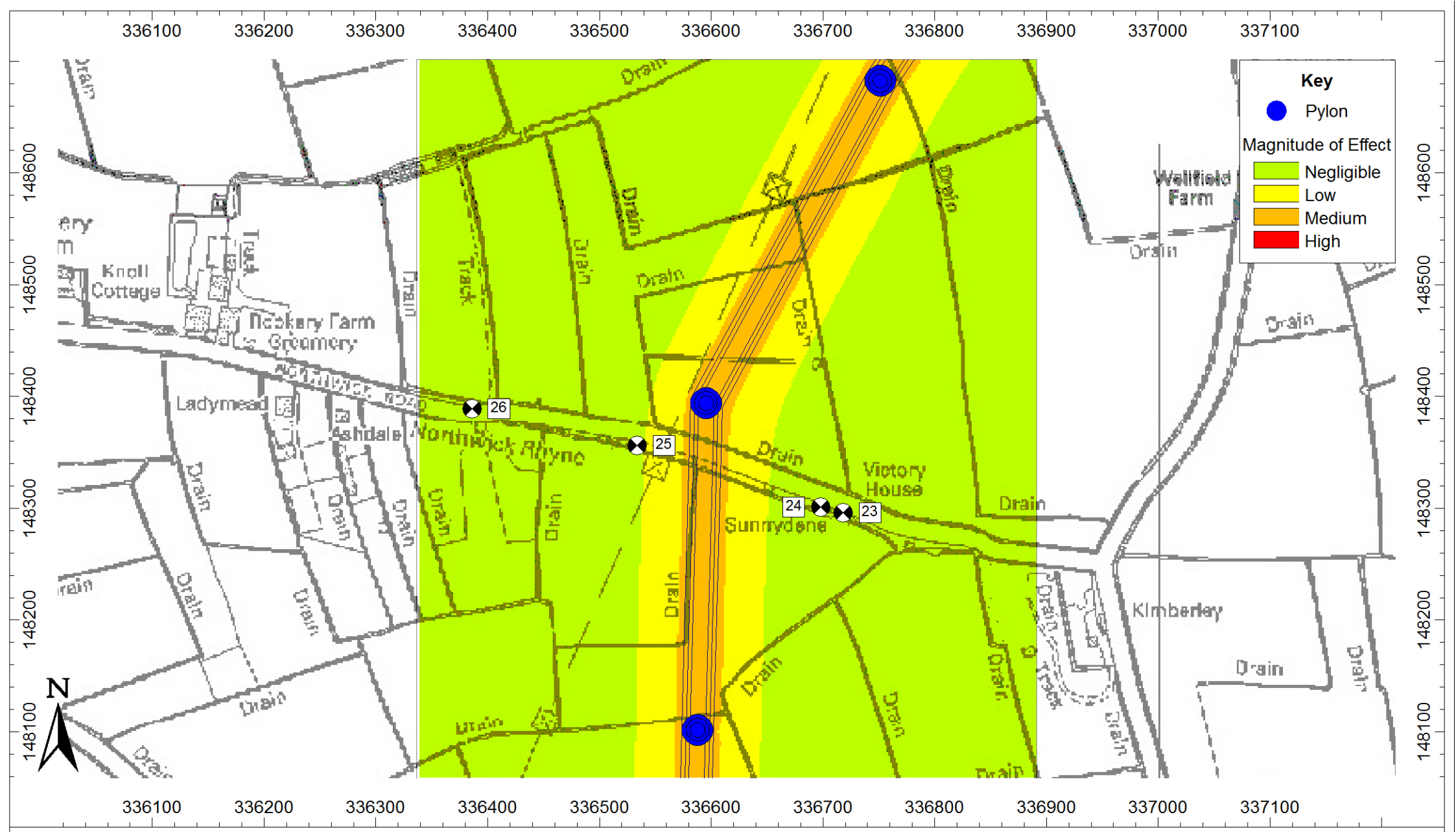

| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling**<br><br>Span: LD8-10<br>Background Noise Level: 30dB LA90<br>Dry Conditions | Project No. | 8046613 |
| | Checked by | D Bradley | | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/4 |
| | | | | Date | 27.02.14 |

BUREAU VERITAS



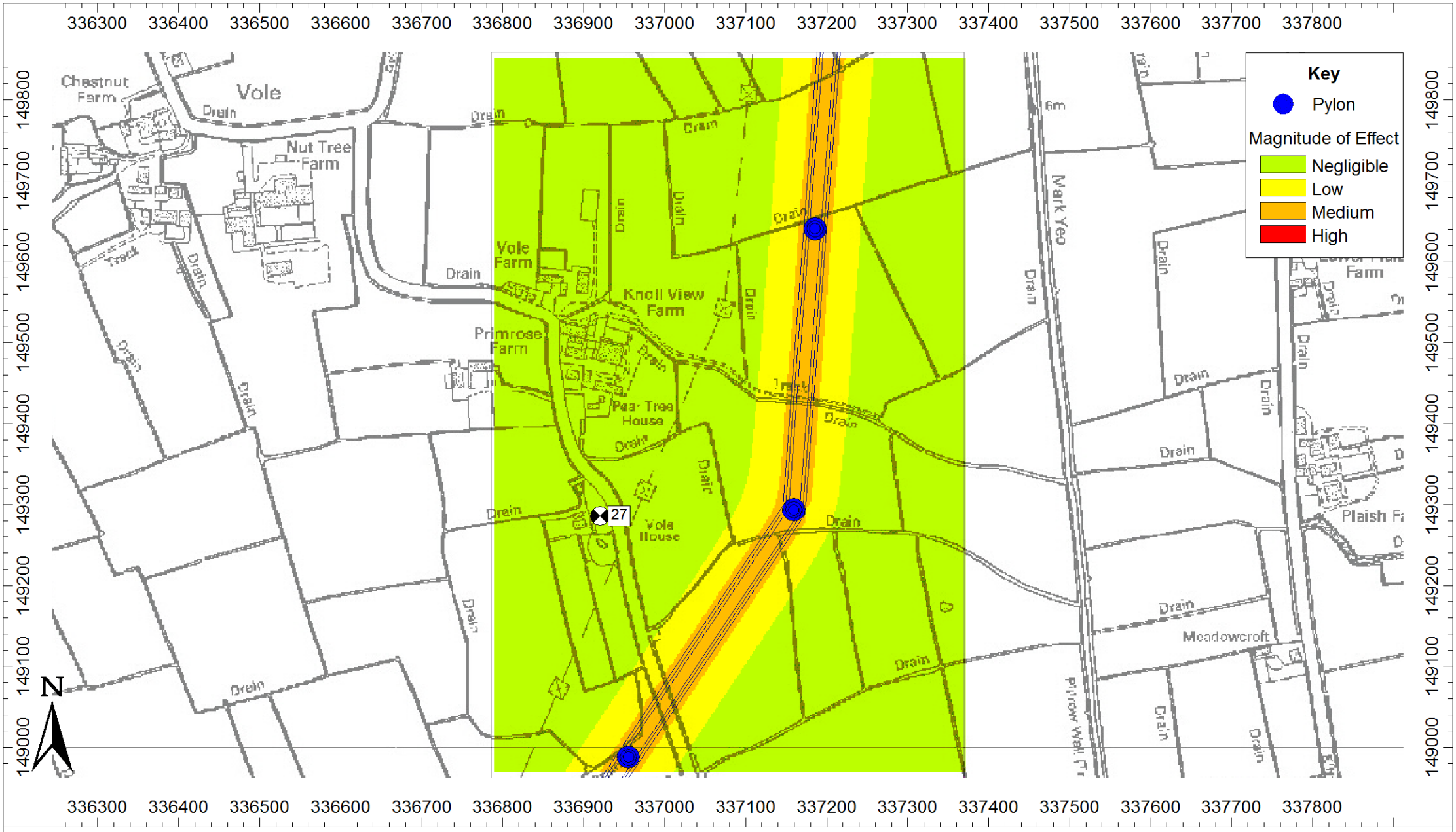

| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling**<br><br>Span: LD16-18<br>Background Noise Level: 30dB LA90<br>Dry Conditions | Project No. | 8046613 |
| | Checked by | D Bradley | | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/5 |
| | | | | Date | 27.02.14 |

BUREAU VERITAS



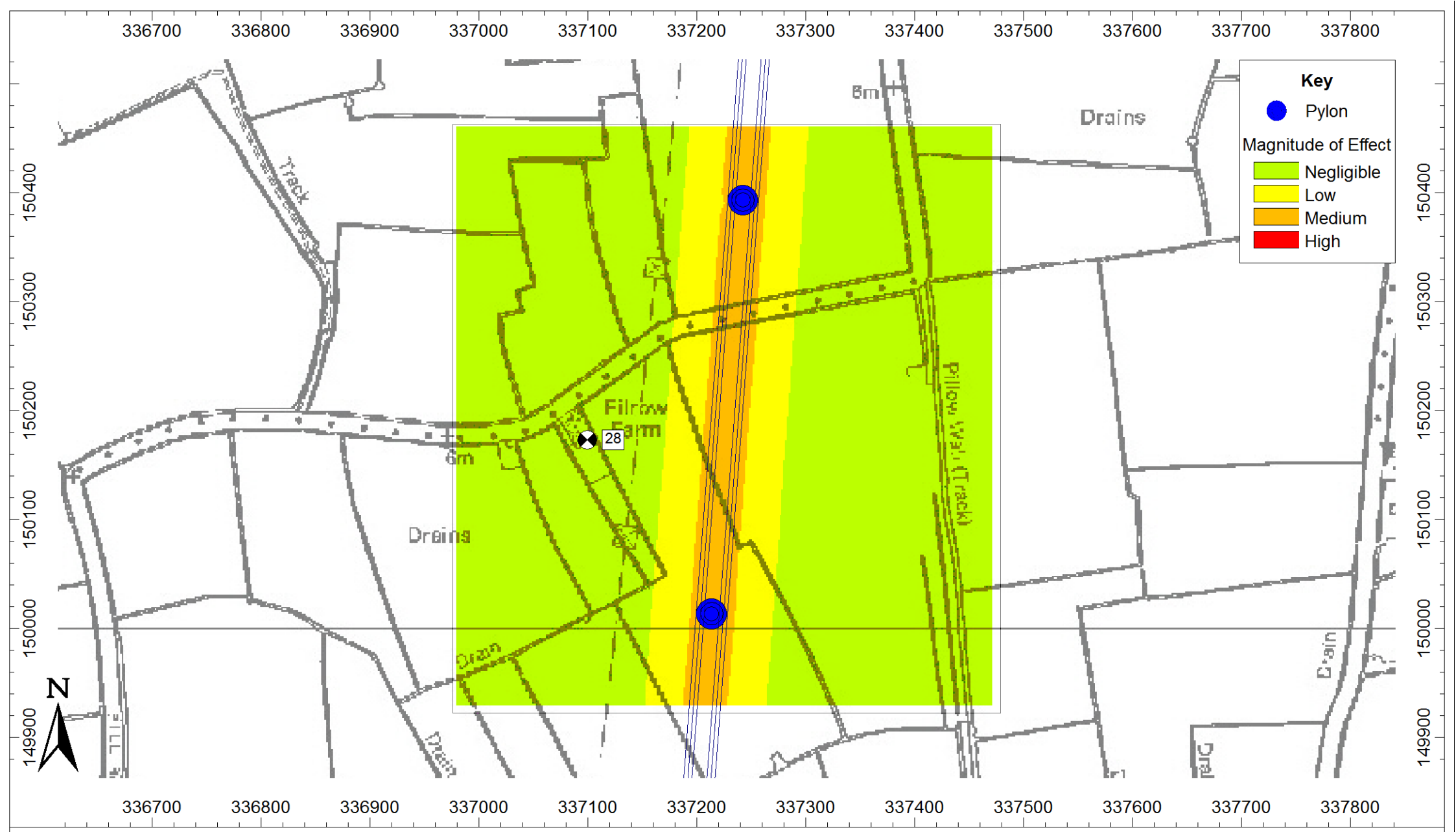

| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling**<br><br>Span: LD19-21<br>Background Noise Level: 32dB LA90<br>Dry Conditions | Project No. | 8046613 |
| | Checked by | D Bradley | | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/6 |
| | | | | Date | 27.02.14 |

BUREAU VERITAS



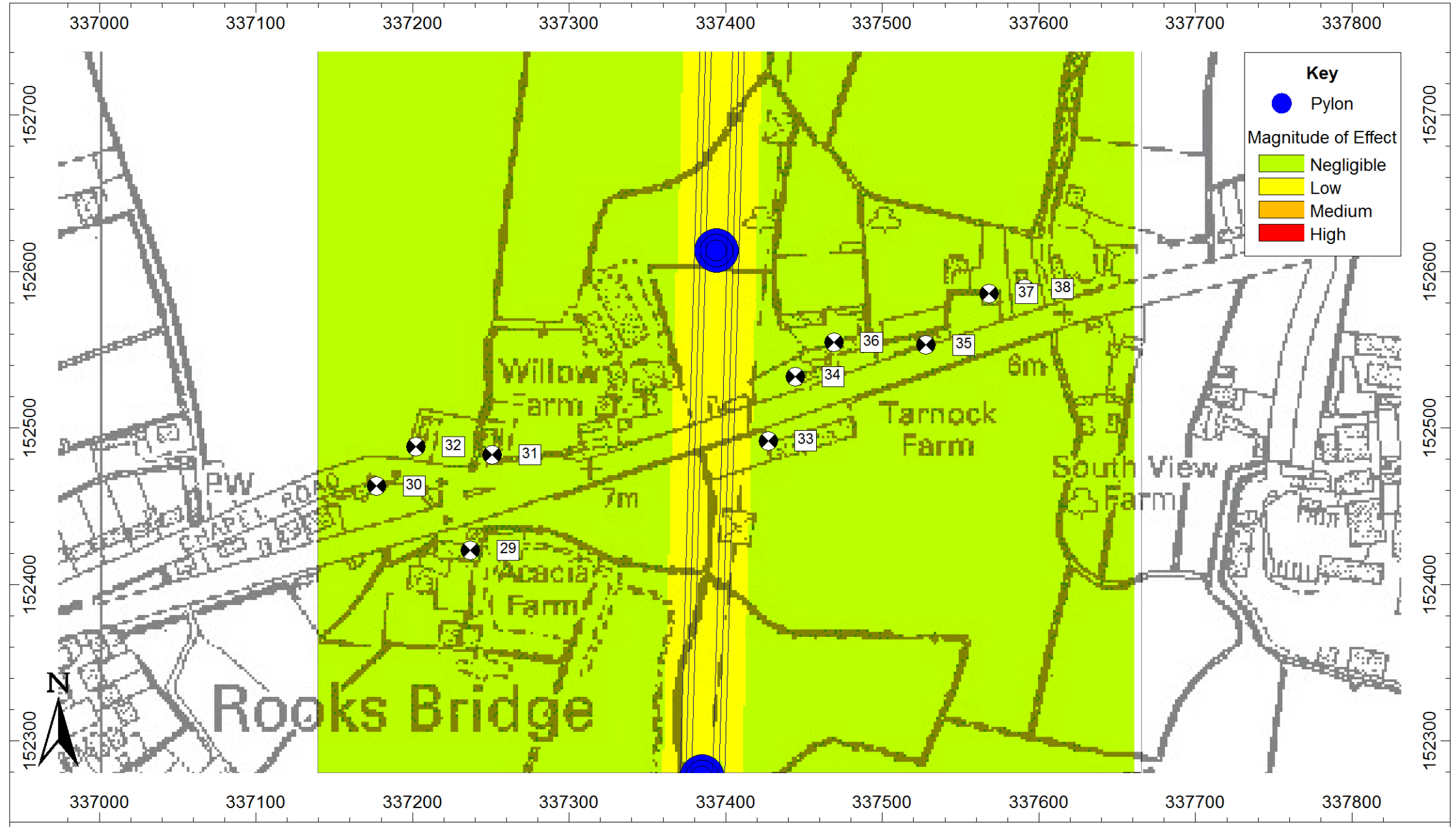

| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling** | Project No. | 8046613 |
| | Checked by | D Bradley | Span: LD22-23<br>Background Noise Level: 32dB LA90<br>Dry Conditions | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/7 |
| | | | | Date | 27.02.14 |

BUREAU VERITAS




| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling**<br><br>Span: LD25-26<br>Background Noise Level: 32dB LA90<br>Dry Conditions | Project No. | 8046613 |
| | Checked by | D Bradley | | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/8 |
| | | | | Date | 27.02.14 |

BUREAU VERITAS




**NOTES:**

| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

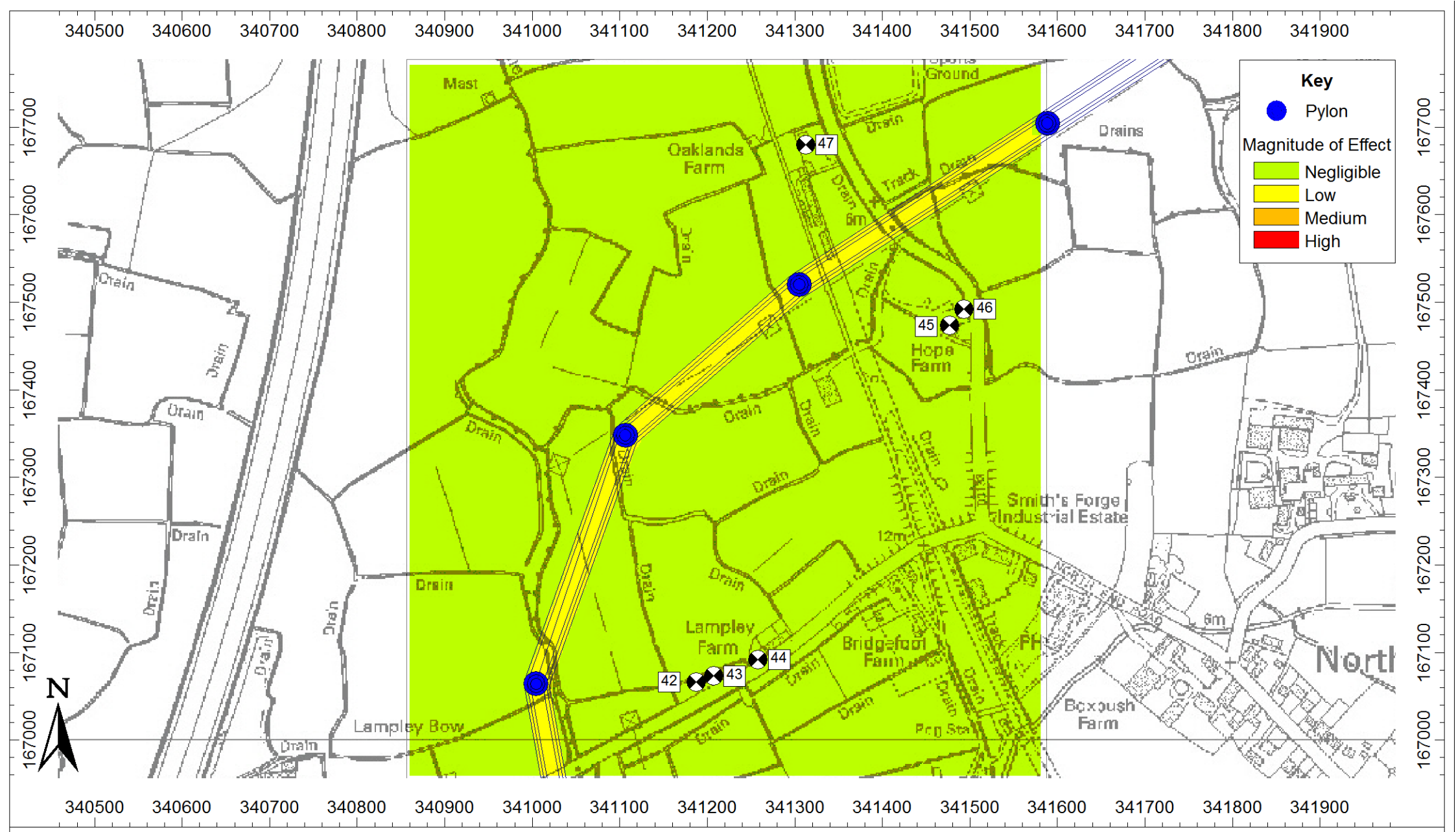
Span: LD31-32
Background Noise Level: 36dB LA90
Dry Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/9 |
| Date | 27.02.14 |

BUREAU VERITAS


| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling**<br><br>Span: LD50-52<br>Background Noise Level: 37dB LA90<br>Dry Conditions | Project No. | 8046613 |
| | Checked by | D Bradley | | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/10 |
| | | | | Date | 27.02.14 |

BUREAU VERITAS




**NOTES:**

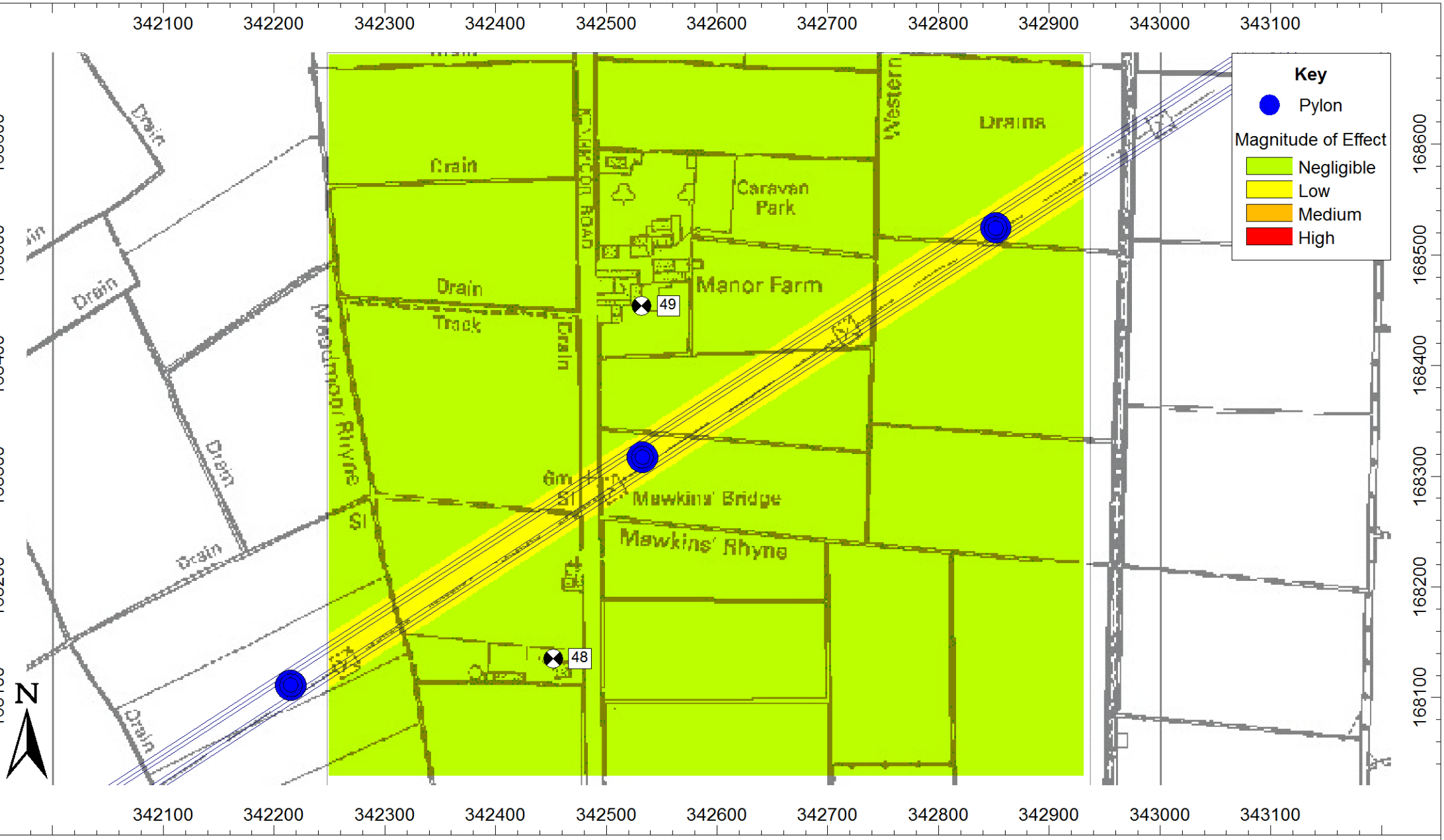
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

Span: LD59-63
Background Noise Level: 38dB LA90
Dry Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/11 |
| Date | 27.02.14 |

BUREAU VERITAS




**NOTES:**

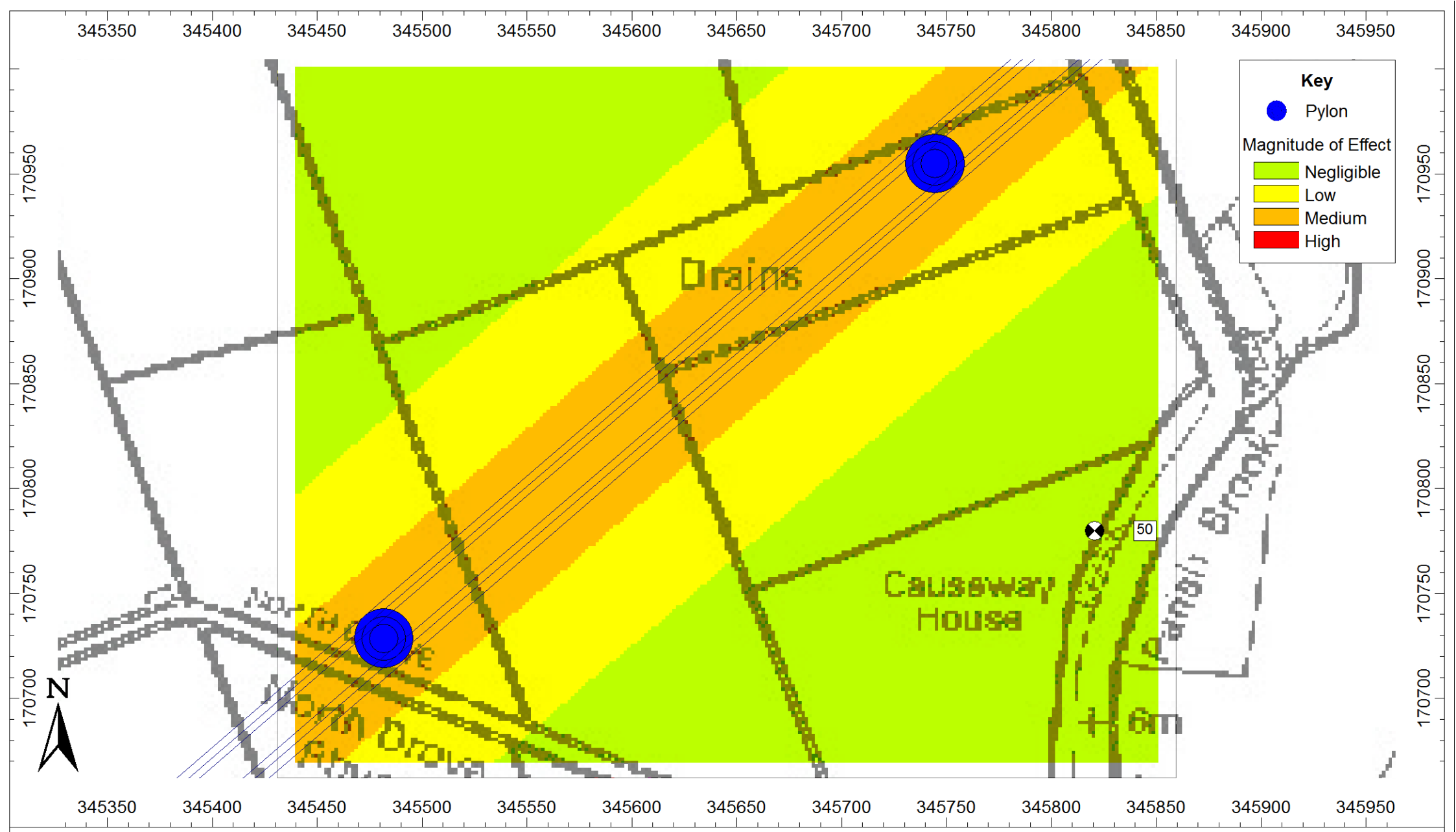
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

Span: LD65-67
Background Noise Level: 37dB LA90
Dry Conditions

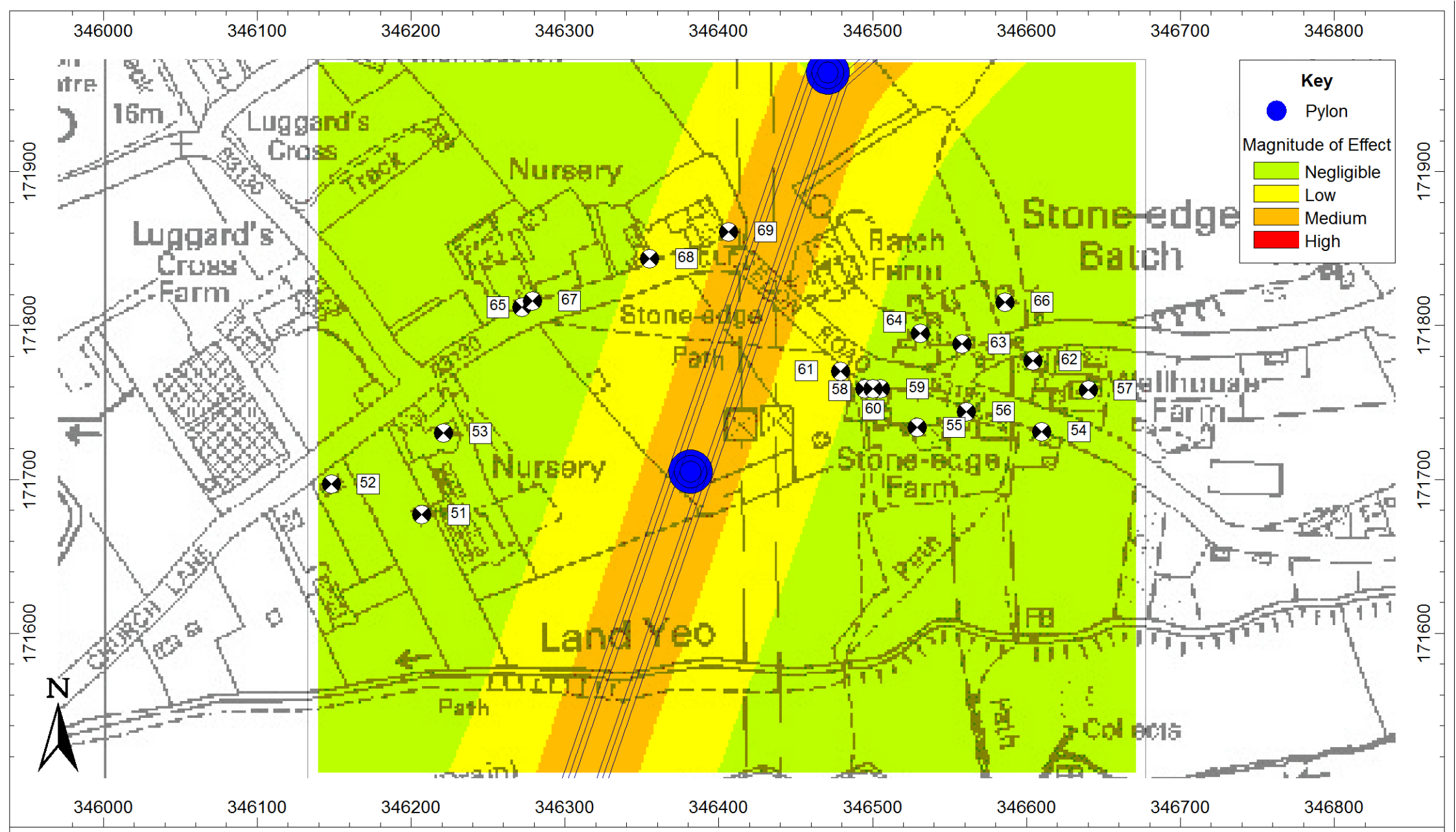
| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/12 |
| Date | 27.02.14 |

BUREAU VERITAS




| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling**<br><br>Span: LD77-78<br>Background Noise Level: 30dB LA90<br>Dry Conditions | Project No. | 8046613 |
| | Checked by | D Bradley | | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/13 |
| | | | | Date | 27.02.14 |

BUREAU VERITAS




**NOTES:**

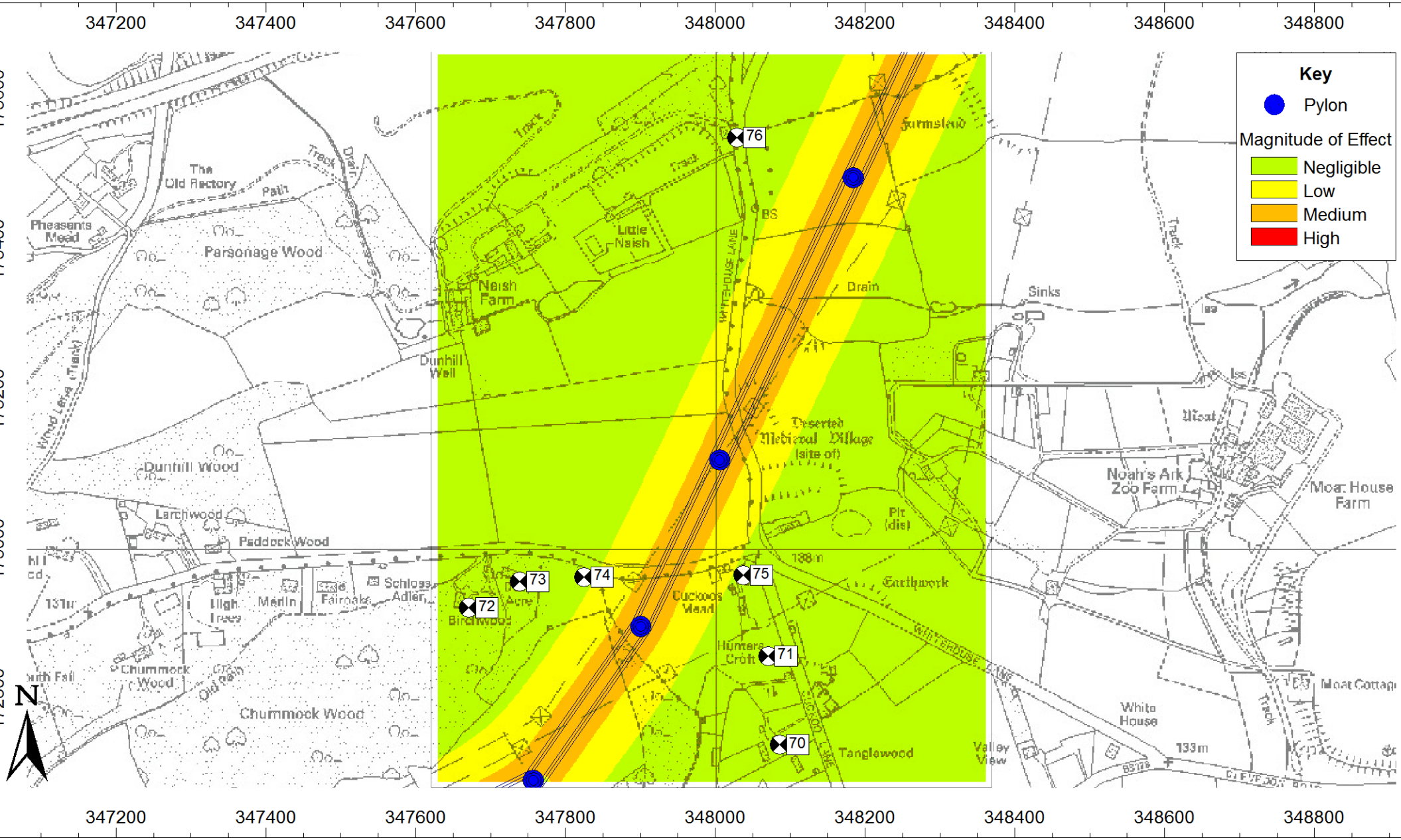
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

**400kV Overhead Line Noise Modelling**

Span: LD80-82
Background Noise Level: 30dB LA90
Dry Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/14 |
| Date | 27.02.14 |

BUREAU VERITAS




**NOTES:**

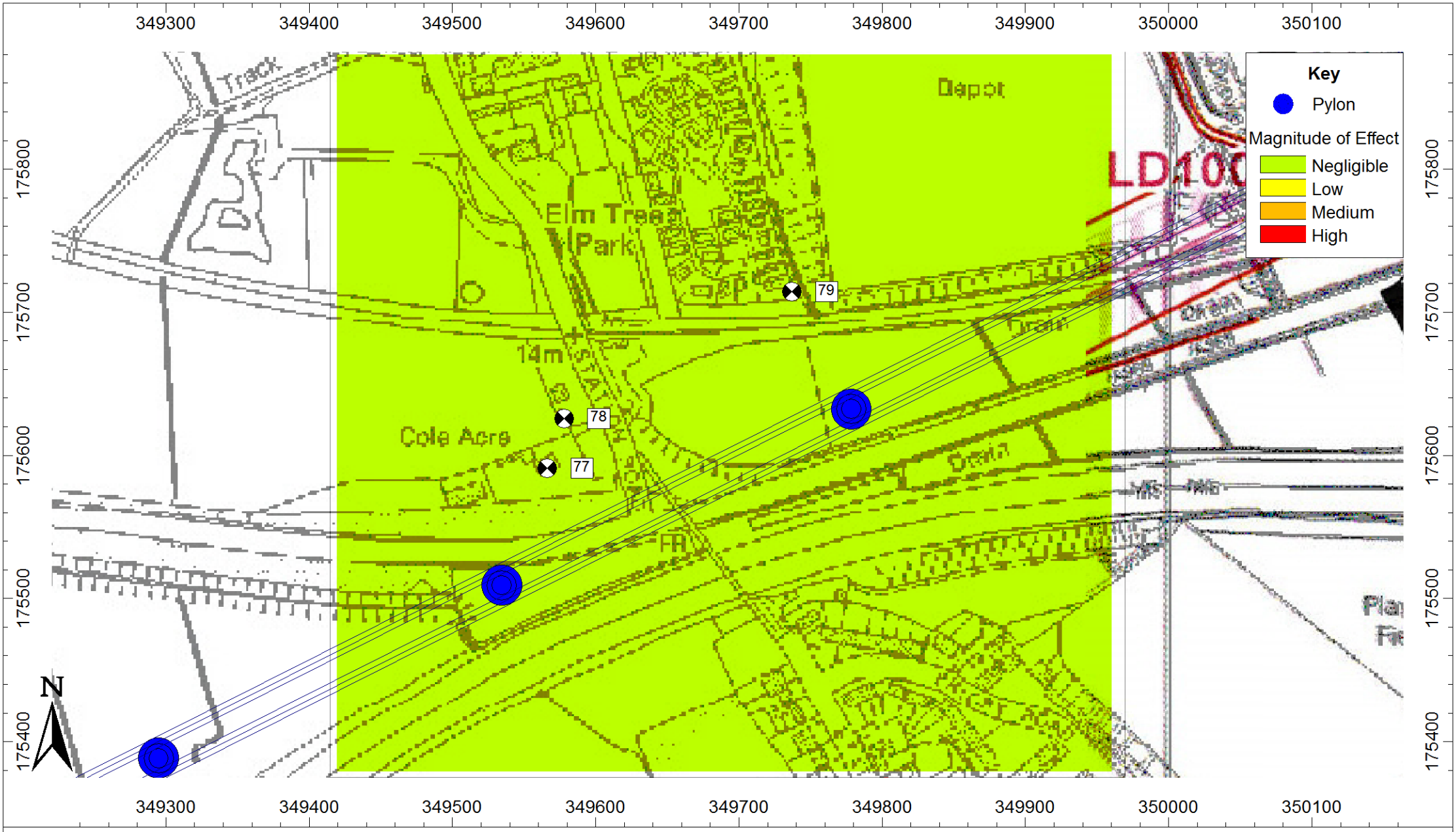
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

Span: LD86-90
Background Noise Level: 30dB LA90
Dry Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/15 |
| Date | 27.02.14 |

BUREAU VERITAS




**NOTES:**

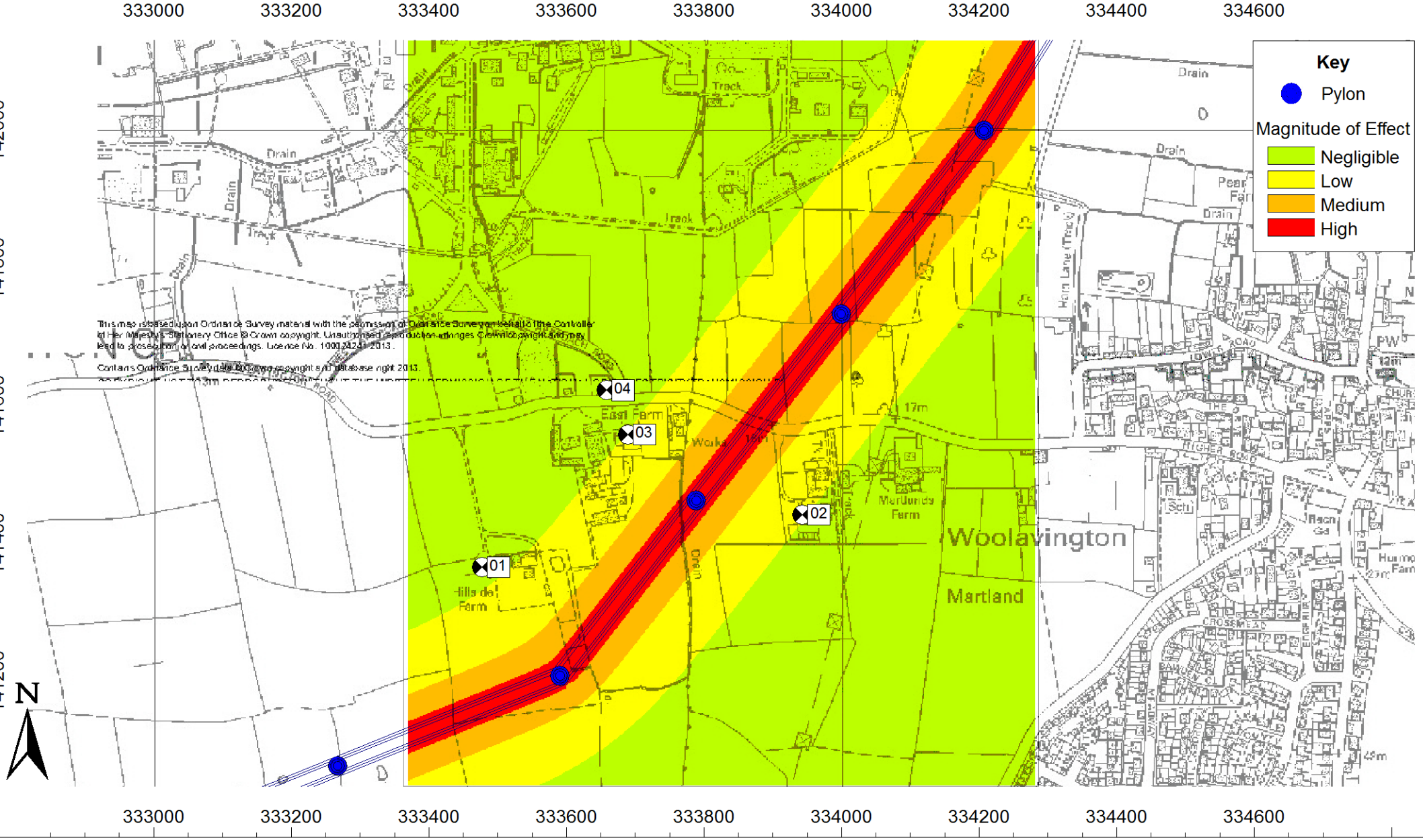
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

Span: LD97-100
Background Noise Level: 42dB LA90
Dry Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/16 |
| Date | 27.02.14 |

BUREAU VERITAS






**NOTES:**

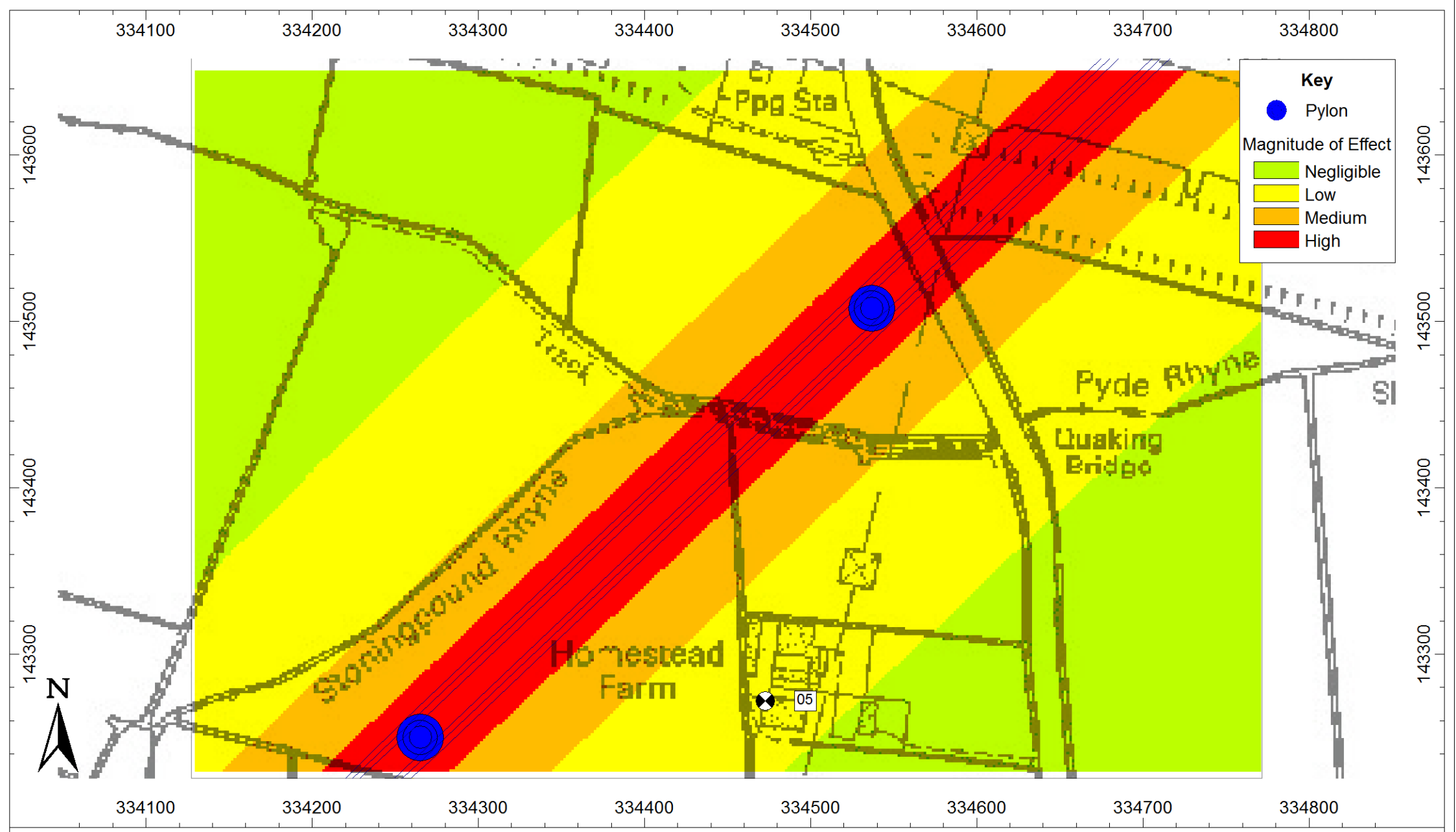
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

Span: ZGA7-9
Background Noise Level: 42dB LA90 (32dB+41dB)
Wet Conditions

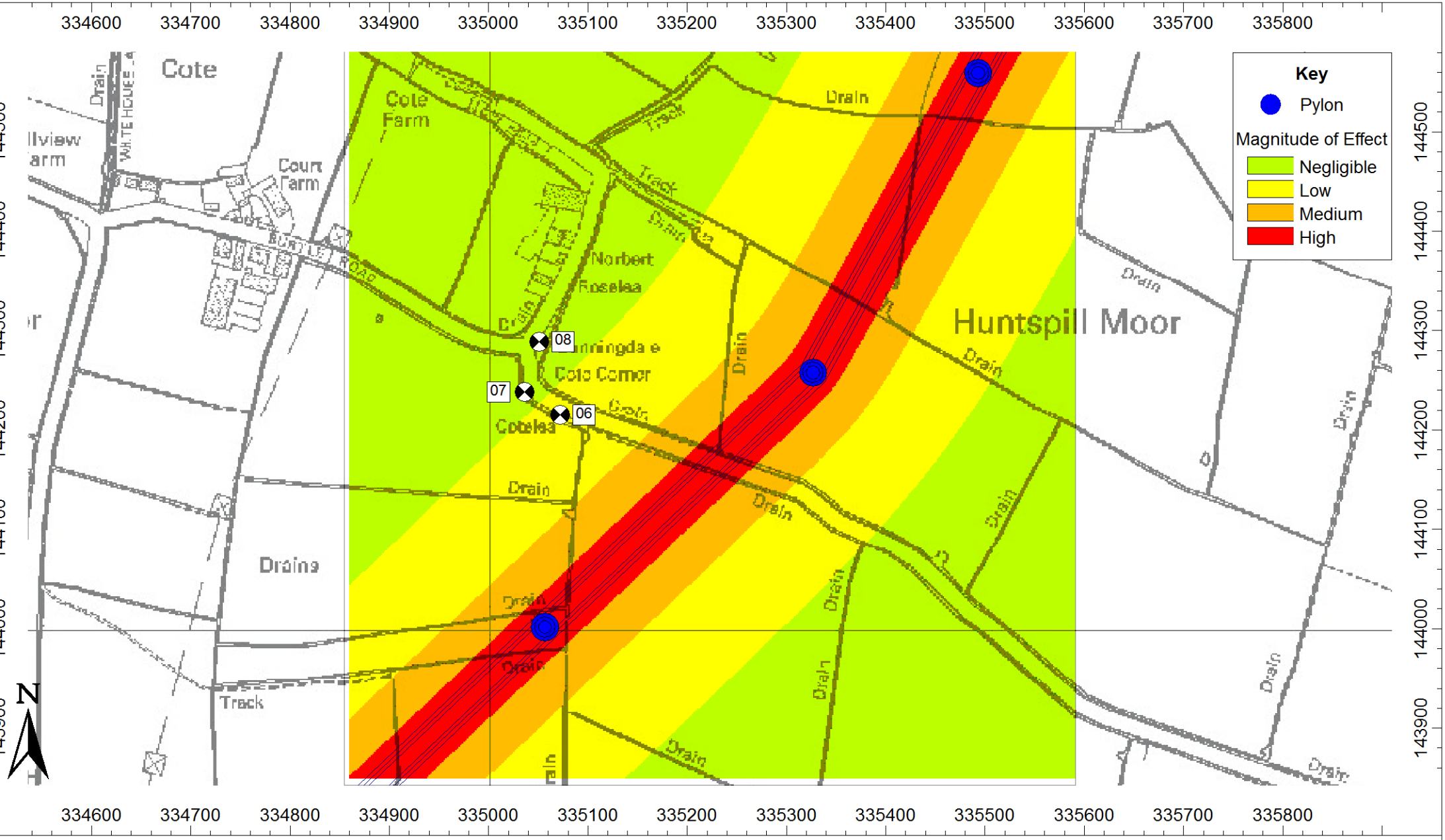
| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/17 |
| Date | 20.03.14 |

BUREAU VERITAS



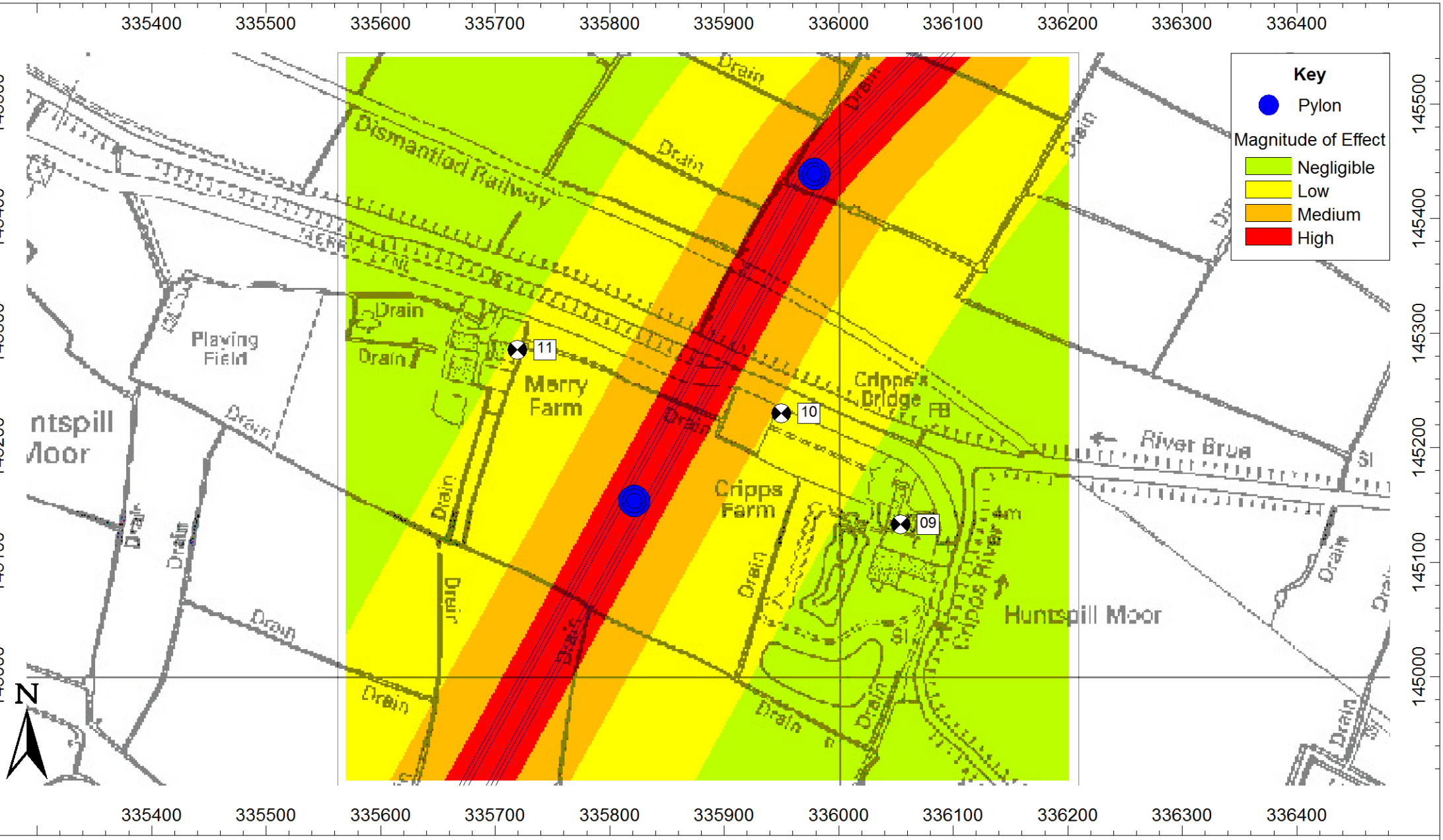

| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling**<br><br>Span: LD2-3<br>Background Noise Level: 41dB LA90 (30dB+41dB)<br>Wet Conditions | Project No. | 8046613 |
| | Checked by | D Bradley | | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/18 |
| | | | | Date | 20.03.14 |

BUREAU VERITAS




| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling** | Project No. | 8046613 |
| | Checked by | D Bradley | Span: LD5-7<br>Background Noise Level: 41dB LA90 (30dB+41dB)<br>Wet Conditions | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/19 |
| | | | | Date | 20.03.14 |

BUREAU VERITAS




**NOTES:**

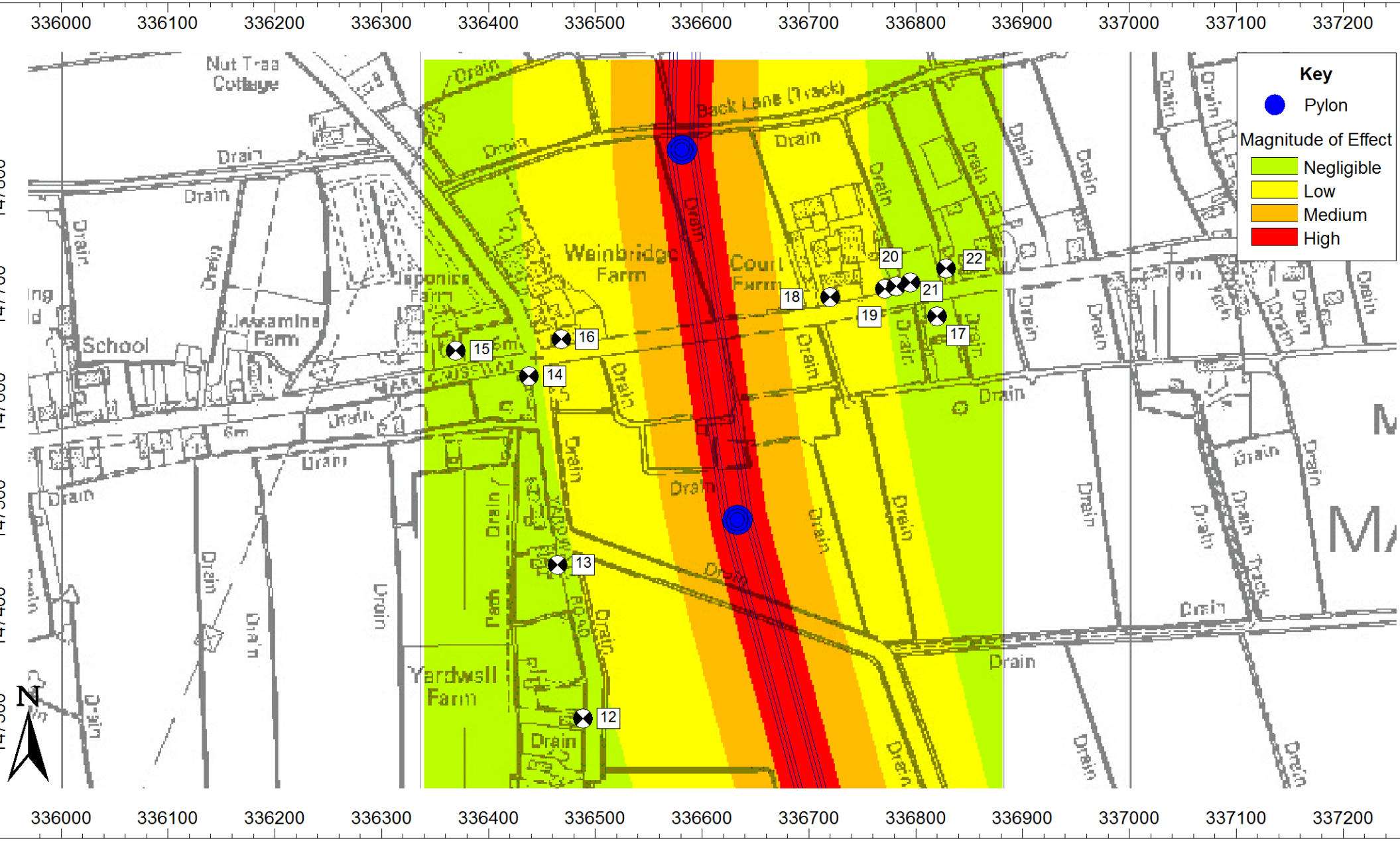
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

Span: LD8-10
Background Noise Level: 41dB LA90 (30dB+41dB)
Wet Conditions

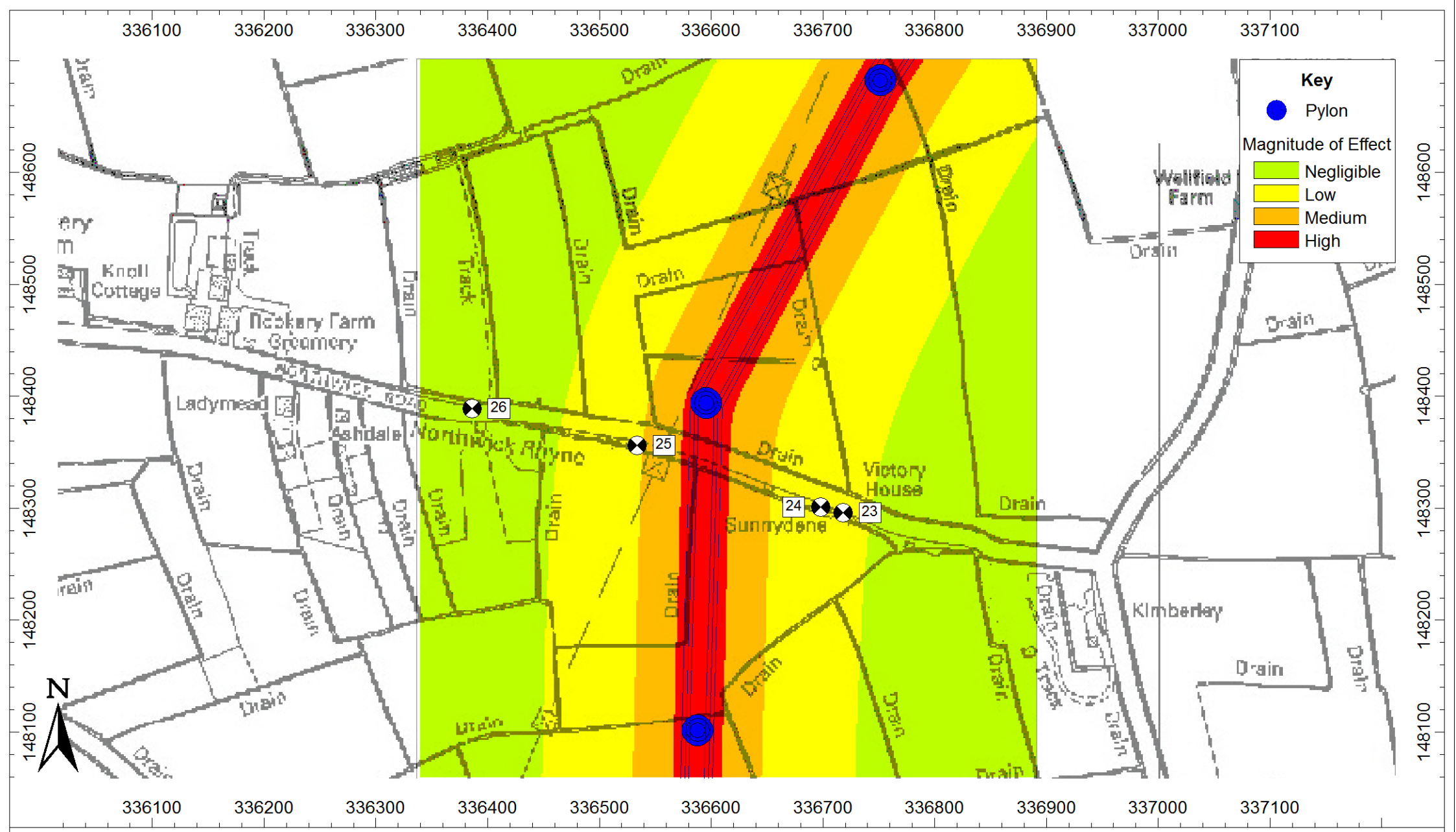
| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/20 |
| Date | 20.03.14 |

BUREAU VERITAS



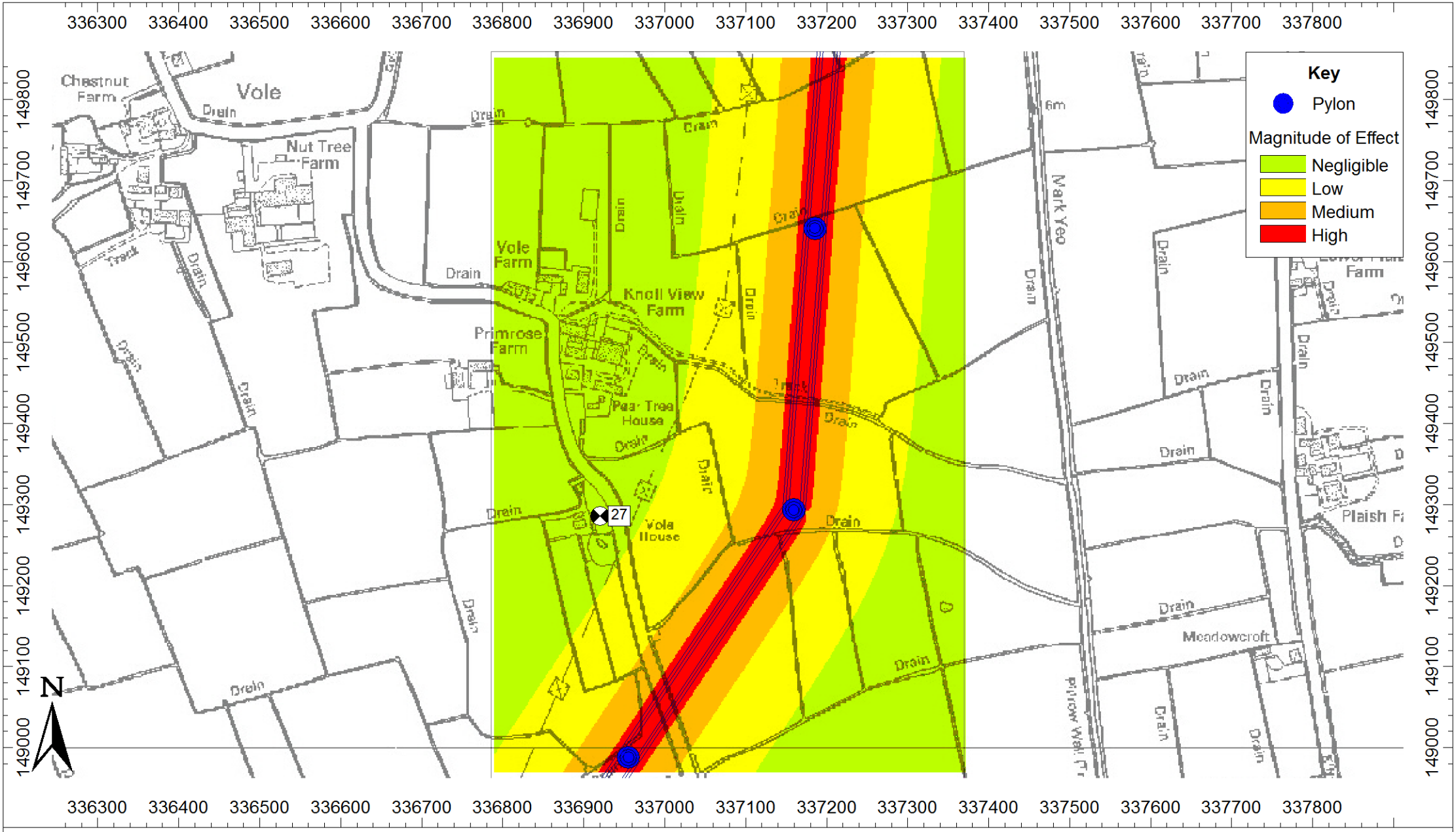

| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling** | Project No. | 8046613 |
| | Checked by | D Bradley | Span: LD16-18<br>Background Noise Level: 41dB LA90 (30dB+41dB)<br>Wet Conditions | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/21 |
| | | | | Date | 20.03.14 |

BUREAU VERITAS



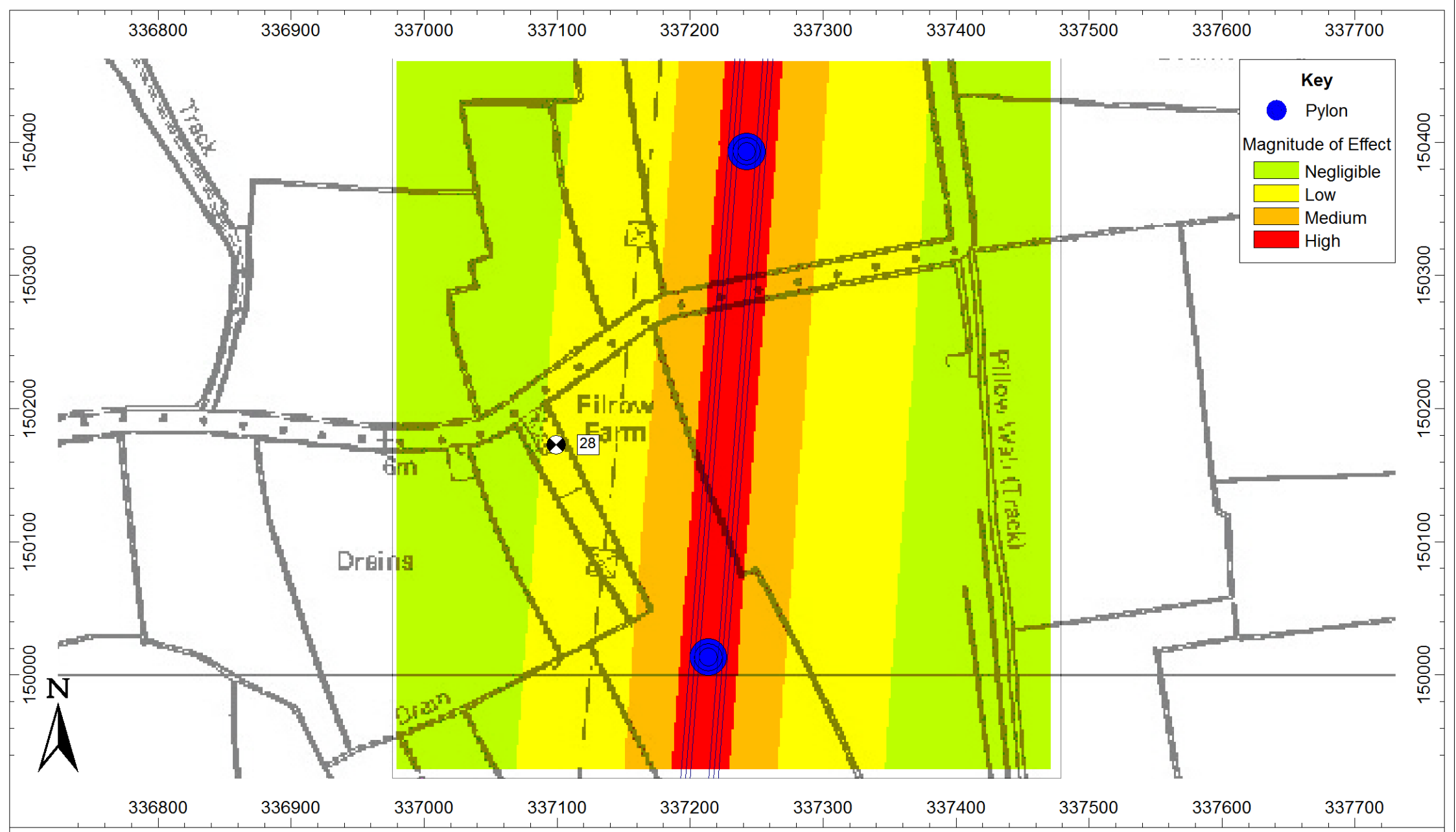

| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling** | Project No. | 8046613 |
| | Checked by | D Bradley | Span: LD18-21<br>Background Noise Level: 42dB LA90 (32dB+41dB)<br>Wet Conditions | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/22 |
| | | | | Date | 20.03.14 |

BUREAU VERITAS



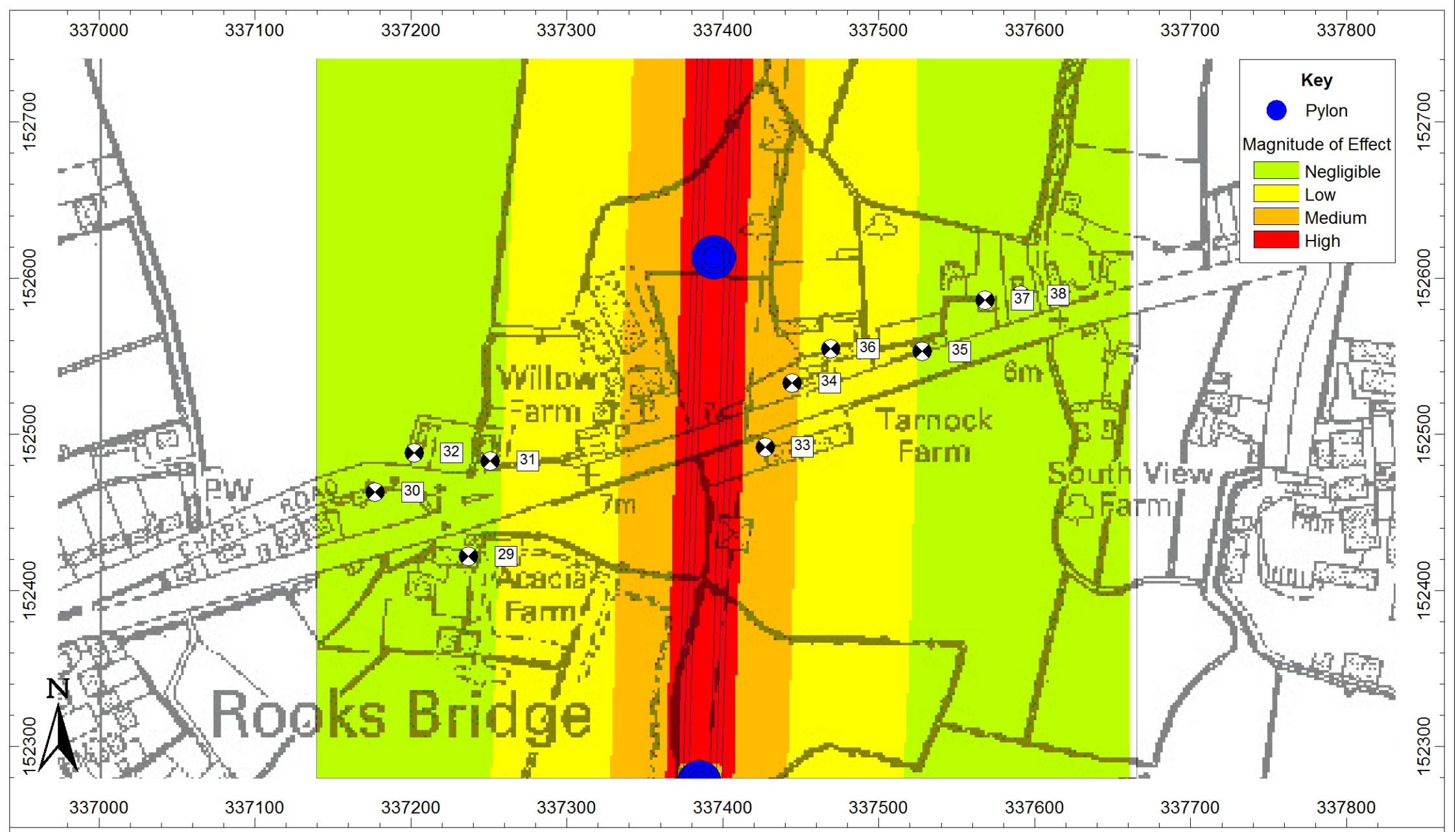

| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling**<br><br>Span: LD22-23<br>Background Noise Level: 42dB LA90 (32dB+41dB)<br>Wet Conditions | Project No. | 8046613 |
| | Checked by | D Bradley | | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/23 |
| | | | | Date | 20.03.14 |

BUREAU VERITAS



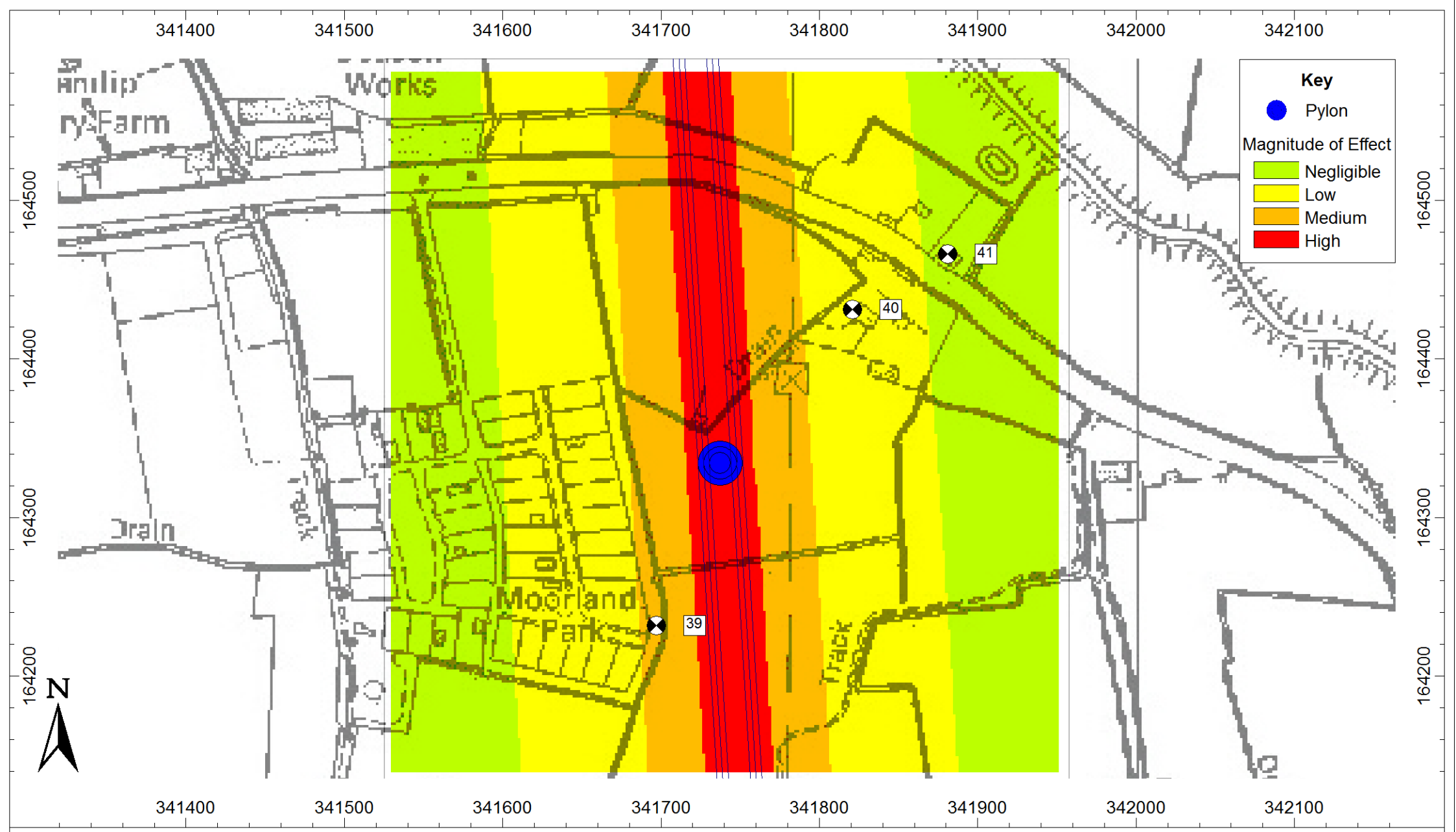

| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling**<br><br>Span: LD25-26<br>Background Noise Level: 42dB LA90 (32dB+41dB)<br>Wet Conditions | Project No. | 8046613 |
| | Checked by | D Bradley | | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/24 |
| | | | | Date | 20.03.14 |

BUREAU VERITAS




| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling**<br><br>Span: LD31-32<br>Background Noise Level: 42dB LA90 (36dB+41dB)<br>Wet Conditions | Project No. | 8046613 |
| | Checked by | D Bradley | | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/25 |
| | | | | Date | 20.03.14 |

BUREAU VERITAS




NOTES:

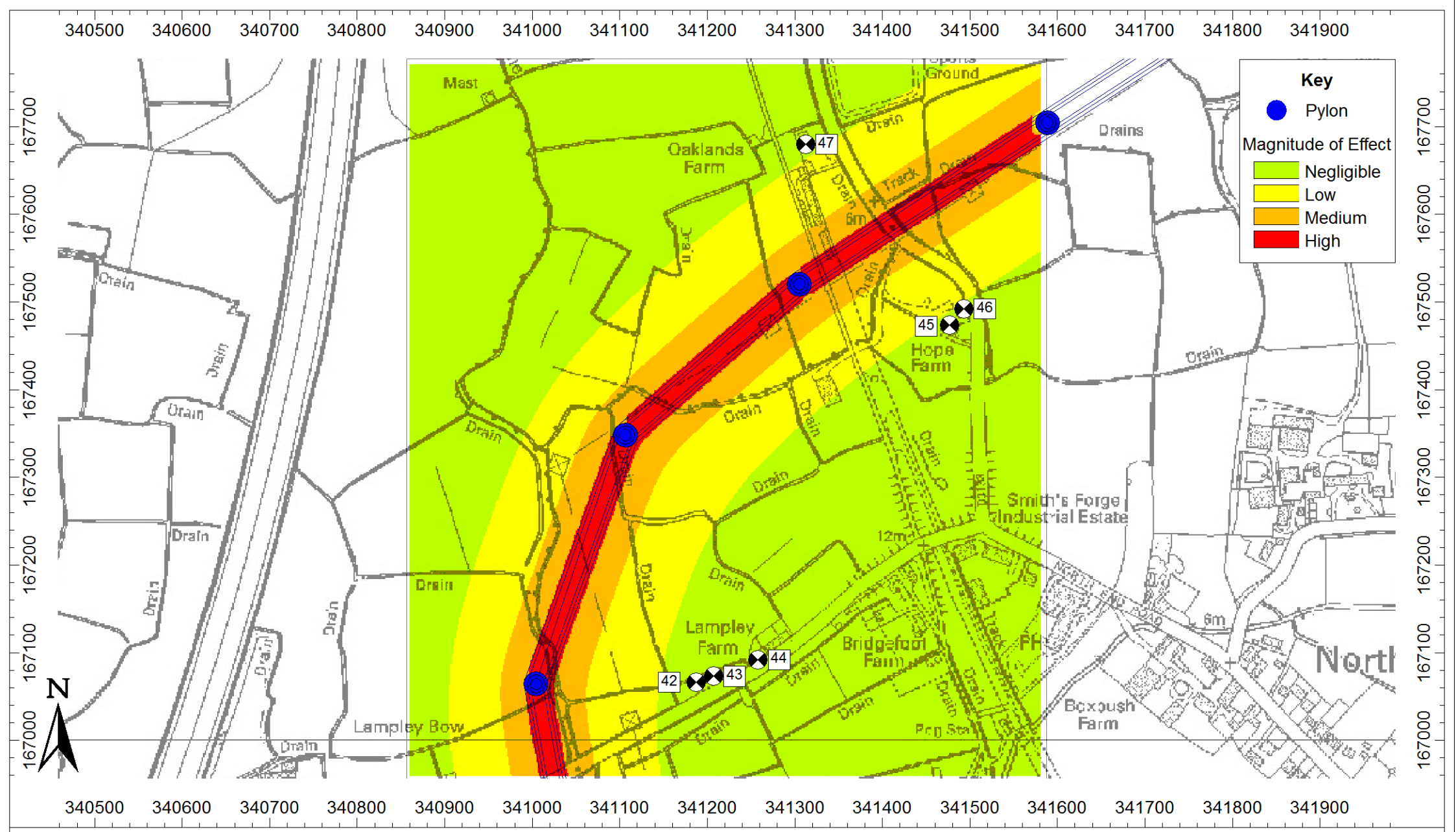
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

**400kV Overhead Line Noise Modelling**

Span: LD31-32
Background Noise Level: 42dB LA90 (37dB+41dB)
Wet Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/26 |
| Date | 20.03.14 |

BUREAU VERITAS




**NOTES:**

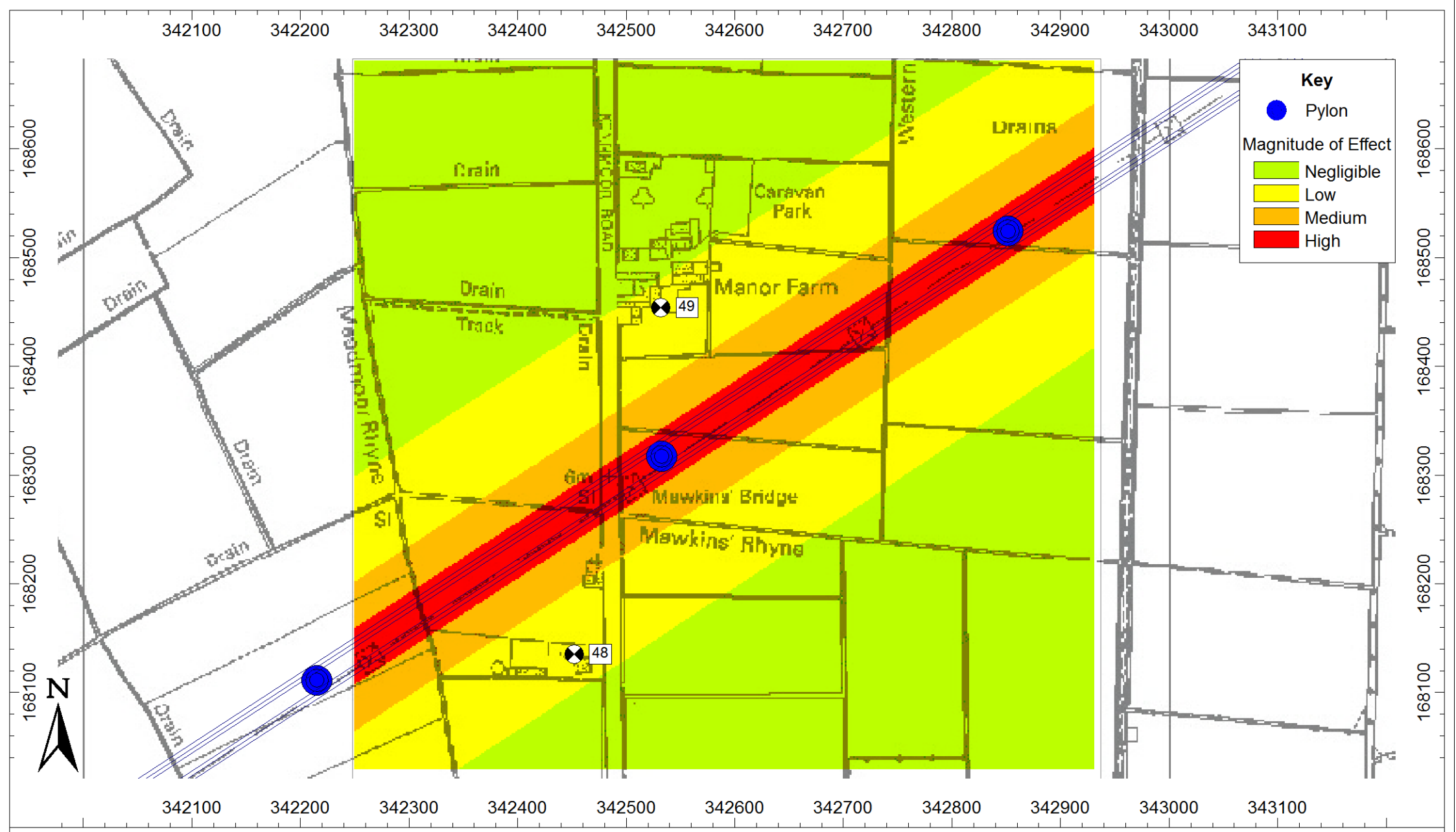
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

Span: LD59-63
Background Noise Level: 43dB LA90 (38dB+41dB)
Wet Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/27 |
| Date | 20.03.14 |

BUREAU VERITAS




**NOTES:**

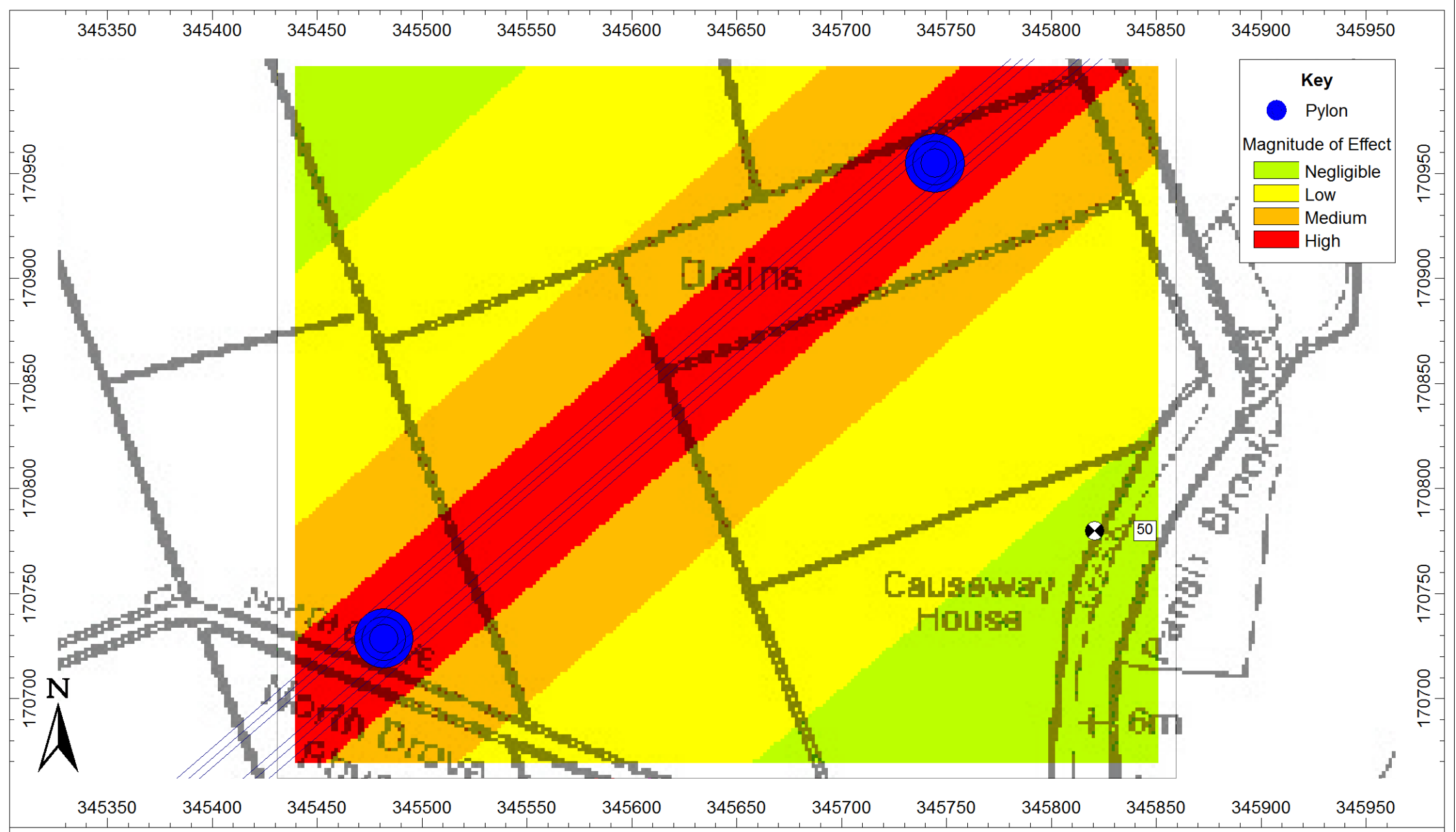
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

Span: LD65-67
Background Noise Level: 43dB LA90 (37dB+41dB)
Wet Conditions

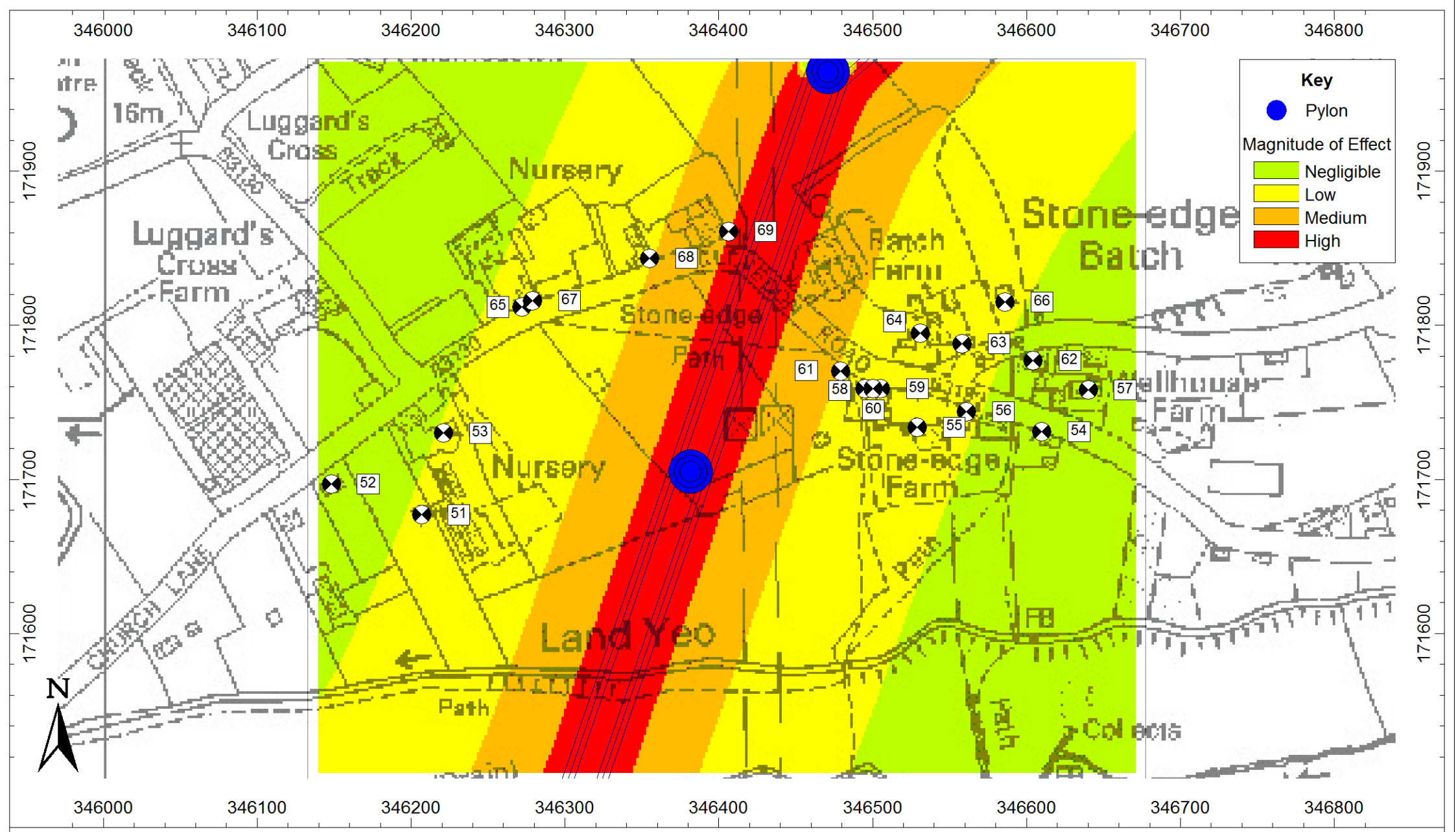
| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/28 |
| Date | 20.03.14 |

BUREAU VERITAS




| | | | | | |
|---|---|---|---|---|---|
| **NOTES:** | Author | D Gray | **400kV Overhead Line Noise Modelling** | Project No. | 8046613 |
| | Checked by | D Bradley | Span: LD77-78<br>Background Noise Level: 41dB LA90 (30dB+41dB)<br>Wet Conditions | Project Title | Hinkley Point C Connection Project |
| | Scale | Defined | | Drawing No. | 8046613/OHLApp/29 |
| | | | | Date | 20.03.14 |

BUREAU VERITAS




**NOTES:**

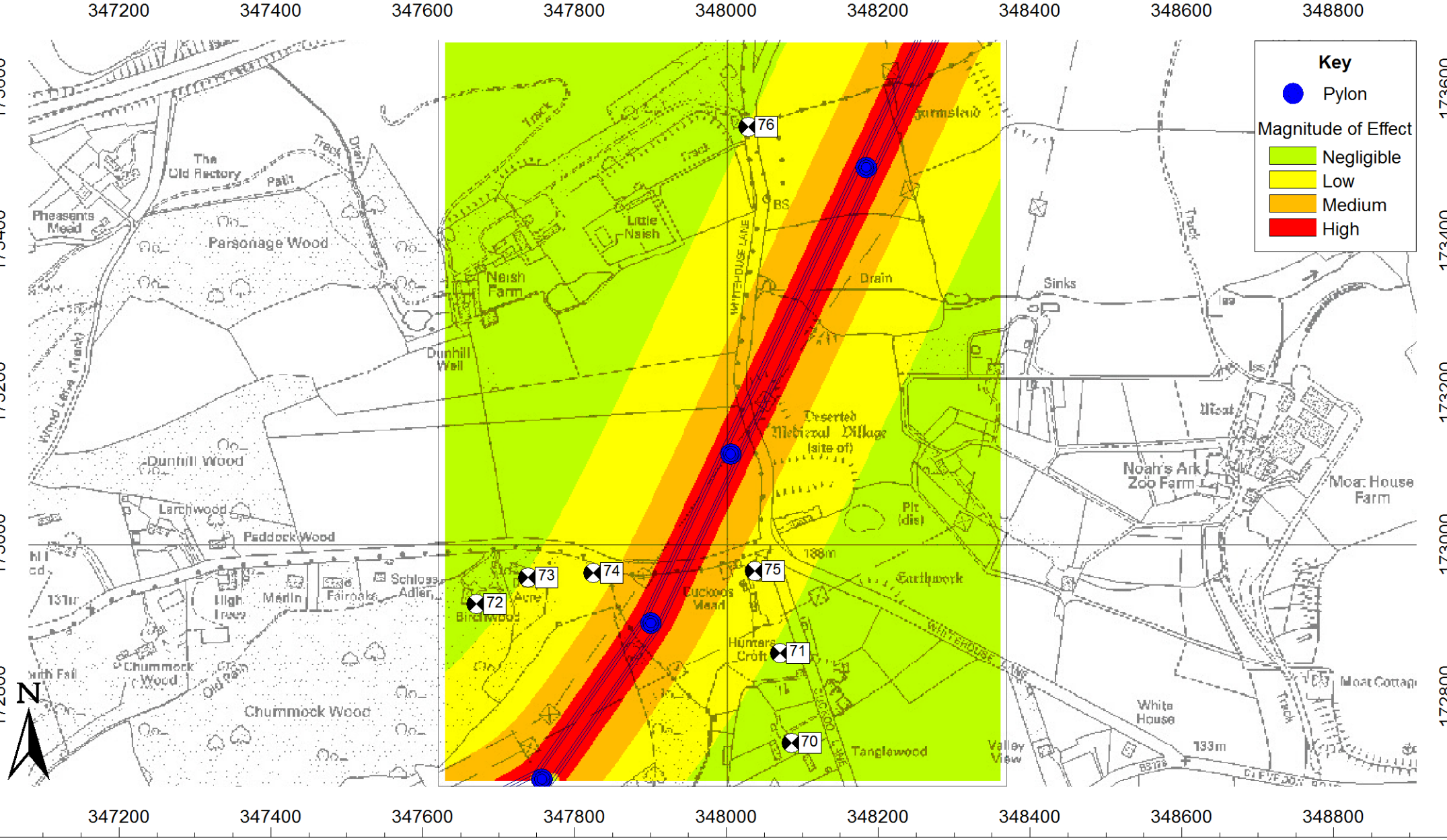
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

Span: LD80-82
Background Noise Level: 41dB LA90 (30dB+41dB)
Wet Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/30 |
| Date | 20.03.14 |

BUREAU VERITAS




**NOTES:**

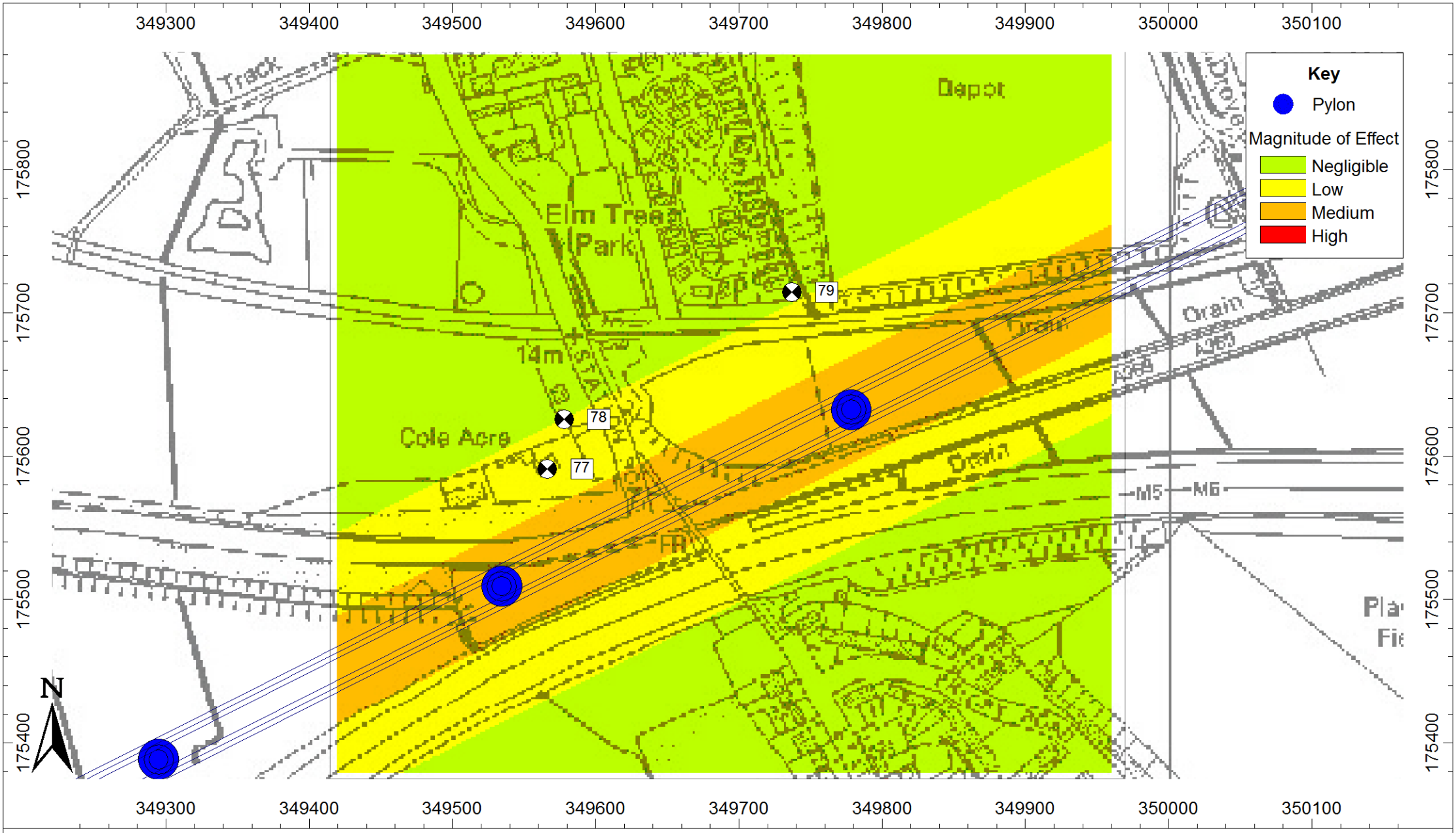
| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

Span: LD86-90
Background Noise Level: 41dB LA90 (30dB+41dB)
Wet Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/31 |
| Date | 20.03.14 |

BUREAU VERITAS




**NOTES:**

| | |
|---|---|
| Author | D Gray |
| Checked by | D Bradley |
| Scale | Defined |

## 400kV Overhead Line Noise Modelling

Span: LD97-100
Background Noise Level: 45dB LA90 (42dB+41dB)
Wet Conditions

| | |
|---|---|
| Project No. | 8046613 |
| Project Title | Hinkley Point C Connection Project |
| Drawing No. | 8046613/OHLApp/32 |
| Date | 20.03.14 |

BUREAU VERITAS

5.2 Tables 6 and 7 summarise the overhead line noise levels, predicted using CadnaA modelling in accordance with BS 9613-2, at each selected receptor location for dry and wet conditions respectively. The assessment is based on measured background noise levels as described in **Volume 5.14, Appendix 14E** *Summary of Night-time Background Noise Measurements on Route of Proposed 400kV Overhead Line.*

Table 6 Summary of predicted noise levels from overhead lines at identified sensitive receptor locations for dry conditions

| Receptor Ref. | Receptor Name | Background Noise Level, dB $L_{A90}$ | Predicted 400kV Overhead Line Noise Level, dB $L_{Aeq}$ | Assessment Level, dB | Effect Magnitude |
|---|---|---|---|---|---|
| 1 | Hillside Farm | 32 | 21.1 | -10.9 | No effect |
| 2 | The Yards | 32 | 22.2 | -9.8 | Negligible |
| 3 | East Farm | 32 | 22.1 | -9.9 | Negligible |
| 4 | 99 Woolavington Road | 32 | 20 | -12.0 | No effect |
| 5 | Homestead Farm | 30 | 22.5 | -7.5 | Negligible |
| 6 | Cote Lea | 30 | 21.9 | -8.1 | Negligible |
| 7 | Elm Cottage | 30 | 20.5 | -9.5 | Negligible |
| 8 | Sunningdale | 30 | 19.7 | -10.3 | No effect |
| 9 | Cripps Farm | 30 | 19.4 | -10.6 | No effect |
| 10 | Cripps Farm Caravans | 30 | 25.3 | -4.7 | Low |
| 11 | Merry Farm | 30 | 21.3 | -8.7 | Negligible |
| 12 | Willow Cottage | 30 | 20.1 | -9.9 | Negligible |
| 13 | Yardwell House | 30 | 20.5 | -9.5 | Negligible |
| 14 | Wainbridge | 30 | 20.7 | -9.3 | Negligible |
| 15 | Dwelling | 30 | 18.7 | -11.3 | No effect |
| 16 | Wainbridge Farm | 30 | 22 | -8.0 | Negligible |
| 17 | The Yews | 30 | 19.6 | -10.4 | No effect |
| 18 | Court Farm | 30 | 23 | -7.0 | Negligible |
| 19 | Court Villa | 30 | 21 | -9.0 | Negligible |
| 20 | Little Dean | 30 | 20.6 | -9.4 | Negligible |
| 21 | Ashdene | 30 | 20.2 | -9.8 | Negligible |
| 22 | Portland Cottage | 30 | 19.3 | -10.7 | No effect |
| 23 | Victory House | 32 | 23 | -9.0 | Negligible |
| 24 | Sunnydene | 32 | 23.9 | -8.1 | Negligible |
| 25 | Withy Cottage | 32 | 26.4 | -5.6 | Negligible |
| 26 | Poachers Cottage | 32 | 19.1 | -12.9 | No effect |
| 27 | Vole House Farm | 32 | 20.5 | -11.5 | No effect |
| 28 | Pillrow | 32 | 22.5 | -9.5 | Negligible |
| 29 | Acacia Farm | 36 | 21.2 | -14.8 | No effect |

| Receptor Ref. | Receptor Name | Background Noise Level, dB $L_{A90}$ | Predicted 400kV Overhead Line Noise Level, dB $L_{Aeq}$ | Assessment Level, dB | Effect Magnitude |
|---|---|---|---|---|---|
| 30 | Laurel Cottage | 36 | 19 | -17.0 | No effect |
| 31 | The Willows | 36 | 21.7 | -14.3 | No effect |
| 32 | Little Willows | 36 | 19.8 | -16.2 | No effect |
| 33 | Flat above Garage | 36 | 29.2 | -6.8 | Negligible |
| 34 | Tarnock Cottage | 36 | 27.2 | -8.8 | Negligible |
| 35 | South View | 36 | 21.8 | -14.2 | No effect |
| 36 | Tarnock Farm | 36 | 25.1 | -10.9 | No effect |
| 37 | Willow Cottage | 36 | 20.2 | -15.8 | No effect |
| 38 | Ty Barah | 36 | 19.4 | -16.6 | No effect |
| 39 | Moorland Park | 37 | 27.9 | -9.1 | Negligible |
| 40 | Heathgate | 37 | 24.4 | -12.6 | No effect |
| 41 | Middle Elm | 37 | 21.3 | -15.7 | No effect |
| 42 | Primrose Cottage | 38 | 21.5 | -16.5 | No effect |
| 43 | Orchardside | 38 | 21 | -17.0 | No effect |
| 44 | Rose Lea Cottage | 38 | 19.8 | -18.2 | No effect |
| 45 | Hope Farm | 38 | 22.4 | -15.6 | No effect |
| 46 | Homeground | 38 | 22.6 | -15.4 | No effect |
| 47 | Oakland Farm | 38 | 22.3 | -15.7 | No effect |
| 48 | Rose Bungalow | 37 | 23.4 | -13.6 | No effect |
| 49 | Manor Farm | 37 | 23 | -14 | No effect |
| 50 | Causeway House | 30 | 20.3 | -9.7 | Negligible |
| 51 | Yeovil | 30 | 21.4 | -8.6 | Negligible |
| 52 | Little Orchard | 30 | 19.5 | -10.5 | No effect |
| 53 | Furze | 30 | 21.2 | -8.8 | Negligible |
| 54 | Lavender Cottage | 30 | 19.7 | -10.3 | No effect |
| 55 | Stone Edge Farm | 30 | 22.4 | -7.6 | Negligible |
| 56 | Stone Edge Barn | 30 | 21.3 | -8.7 | Negligible |
| 57 | Stonewell Barn | 30 | 19.2 | -10.8 | No effect |
| 58 | 1 Clevedon Road | 30 | 24.4 | -5.6 | Negligible |
| 59 | 2 Clevedon Road | 30 | 23.9 | -6.1 | Negligible |
| 60 | Stone Edge Cottage | 30 | 24.2 | -5.8 | Negligible |
| 61 | Honeysuckle Cottage | 30 | 25.7 | -4.3 | Low |
| 62 | Wellhouse Farm | 30 | 20.4 | -9.6 | Negligible |
| 63 | The Gables | 30 | 22 | -8.0 | Negligible |
| 64 | The Granary | 30 | 23.3 | -6.7 | Negligible |

| Receptor Ref. | Receptor Name | Background Noise Level, dB $L_{A90}$ | Predicted 400kV Overhead Line Noise Level, dB $L_{Aeq}$ | Assessment Level, dB | Effect Magnitude |
|---|---|---|---|---|---|
| 65 | 12 Clevedon Road | 30 | 21.9 | -8.1 | Negligible |
| 66 | The Elms | 30 | 21.5 | -8.5 | Negligible |
| 67 | 11 Clevedon Road | 30 | 22.1 | -7.9 | Negligible |
| 68 | Dwelling | 30 | 25.7 | -4.3 | Low |
| 69 | Star Inn | 30 | 30.6 | +0.6 | Medium |
| 70 | Naish Cottage | 30 | 18.3 | -11.7 | No effect |
| 71 | Hunters Croft | 30 | 20.6 | -9.4 | Negligible |
| 72 | Birchwood | 30 | 20.1 | -9.9 | Negligible |
| 73 | Deep Acres | 30 | 21.2 | -8.8 | Negligible |
| 74 | Spindlewood | 30 | 24.2 | -5.8 | Negligible |
| 75 | Cuckoos Mead | 30 | 24.1 | -5.9 | Negligible |
| 76 | Naish Lodge | 42 | 33.1 | -8.9 | Negligible |
| 77 | Cole Acre | 42 | 26.8 | -15.2 | No effect |
| 78 | The Meadow | 42 | 25 | -17.0 | No effect |
| 79 | 18 Elm Tree Park + | 42 | 24.5 | -17.5 | No effect |

Note:- Receptors 77 to 79 relate only to preferred route (Option A).

Table 7 Summary of predicted noise levels from overhead lines at identified sensitive receptor locations for wet conditions

| Receptor Ref. | Receptor Name | Background Noise Level, dB $L_{A90}$ | Predicted 400kV Overhead Line Noise Level, dB $L_{Aeq}$ | Assessment Level, dB | Effect Magnitude |
|---|---|---|---|---|---|
| 1 | Hillside Farm | 42 | 36.1 | -5.9 | Negligible |
| 2 | The Yards | 42 | 37.3 | -4.7 | Low |
| 3 | East Farm | 42 | 37.1 | -4.9 | Low |
| 4 | 99 Woolavington Road | 42 | 34.9 | -7.1 | Negligible |
| 5 | Homestead Farm | 41 | 37.6 | -3.4 | Low |
| 6 | Cote Lea | 41 | 36.9 | -4.1 | Low |
| 7 | Elm Cottage | 41 | 35.4 | -5.6 | Negligible |
| 8 | Sunningdale | 41 | 34.7 | -6.3 | Negligible |
| 9 | Cripps Farm | 41 | 34.3 | -6.7 | Negligible |
| 10 | Cripps Farm Caravans | 41 | 40.5 | -0.5 | Low |
| 11 | Merry Farm | 41 | 36.3 | -4.7 | Low |
| 12 | Willow Cottage | 41 | 35 | -6.0 | Negligible |

| Receptor Ref. | Receptor Name | Background Noise Level, dB $L_{A90}$ | Predicted 400kV Overhead Line Noise Level, dB $L_{Aeq}$ | Assessment Level, dB | Effect Magnitude |
|---|---|---|---|---|---|
| 13 | Yardwell House | 41 | 35.4 | -5.6 | Negligible |
| 14 | Wainbridge | 41 | 35.6 | -5.4 | Negligible |
| 15 | Dwelling | 41 | 33.6 | -7.4 | Negligible |
| 16 | Wainbridge Farm | 41 | 37 | -4.0 | Low |
| 17 | The Yews | 41 | 34.6 | -6.4 | Negligible |
| 18 | Court Farm | 41 | 38.1 | -2.9 | Low |
| 19 | Court Villa | 41 | 36 | -5 | Negligible |
| 20 | Little Dean | 41 | 35.6 | -5.4 | Negligible |
| 21 | Ashdene | 41 | 35.2 | -5.8 | Negligible |
| 22 | Portland Cottage | 41 | 34.2 | -6.8 | Negligible |
| 23 | Victory House | 42 | 38 | -4.0 | Low |
| 24 | Sunnydene | 42 | 38.9 | -3.1 | Low |
| 25 | Withy Cottage | 42 | 41.5 | -0.5 | Low |
| 26 | Poachers Cottage | 42 | 34 | -8.0 | Negligible |
| 27 | Vole House Farm | 42 | 35.4 | -6.6 | Negligible |
| 28 | Pillrow | 42 | 37.5 | -4.5 | Low |
| 29 | Acacia Farm | 42 | 36.2 | -5.8 | Negligible |
| 30 | Laurel Cottage | 42 | 33.9 | -8.1 | Negligible |
| 31 | The Willows | 42 | 36.7 | -5.3 | Negligible |
| 32 | Little Willows | 42 | 34.7 | -7.3 | Negligible |
| 33 | Flat above Garage | 42 | 44.5 | +2.5 | Medium |
| 34 | Tarnock Cottage | 42 | 42.4 | +0.4 | Medium |
| 35 | South View | 42 | 36.8 | -5.2 | Negligible |
| 36 | Tarnock Farm | 42 | 40.3 | -1.7 | Low |
| 37 | Willow Cottage | 42 | 35.2 | -6.8 | Negligible |
| 38 | Ty Barah | 42 | 34.3 | -7.7 | Negligible |
| 39 | Moorland Park | 42 | 43.2 | +1.2 | Medium |
| 40 | Heathgate | 42 | 39.5 | -2.5 | Low |
| 41 | Middle Elm | 42 | 36.3 | -5.7 | Negligible |
| 42 | Primrose Cottage | 43 | 36.5 | -6.5 | Negligible |
| 43 | Orchardside | 43 | 35.9 | -7.1 | Negligible |
| 44 | Rose Lea Cottage | 43 | 34.7 | -8.3 | Negligible |
| 45 | Hope Farm | 43 | 37.4 | -5.6 | Negligible |
| 46 | Homeground | 43 | 37.7 | -5.3 | Negligible |
| 47 | Oakland Farm | 43 | 37.3 | -5.7 | Negligible |

| Receptor Ref. | Receptor Name | Background Noise Level, dB $L_{A90}$ | Predicted 400kV Overhead Line Noise Level, dB $L_{Aeq}$ | Assessment Level, dB | Effect Magnitude |
|---|---|---|---|---|---|
| 48 | Rose Bungalow | 42 | 38.4 | -3.6 | Low |
| 49 | Manor Farm | 42 | 38 | -4.0 | Low |
| 50 | Causeway House | 41 | 35.3 | -5.7 | Negligible |
| 51 | Yeovil | 41 | 36.4 | -4.6 | Low |
| 52 | Little Orchard | 41 | 34.4 | -6.6 | Negligible |
| 53 | Furze | 41 | 36.2 | -4.8 | Low |
| 54 | Lavender Cottage | 41 | 34.7 | -6.3 | Negligible |
| 55 | Stone Edge Farm | 41 | 37.4 | -3.6 | Low |
| 56 | Stone Edge Barn | 41 | 36.3 | -4.7 | Low |
| 57 | Stonewell Barn | 41 | 34.2 | -6.8 | Negligible |
| 58 | 1 Clevedon Road | 41 | 39.6 | -1.4 | Low |
| 59 | 2 Clevedon Road | 41 | 39 | -2.0 | Low |
| 60 | Stone Edge Cottage | 41 | 39.3 | -1.7 | Low |
| 61 | Honeysuckle Cottage | 41 | 40.9 | -0.1 | Low |
| 62 | Wellhouse Farm | 41 | 35.4 | -5.6 | Negligible |
| 63 | The Gables | 41 | 37.1 | -3.9 | Low |
| 64 | The Granary | 41 | 38.3 | -2.7 | Low |
| 65 | 12 Clevedon Road | 41 | 36.9 | -4.1 | Low |
| 66 | The Elms | 41 | 36.5 | -4.5 | Low |
| 67 | 11 Clevedon Road | 41 | 37.2 | -3.8 | Low |
| 68 | Dwelling | 41 | 40.8 | -0.2 | Low |
| 69 | Star Inn | 41 | 45.9 | +4.9 | Medium |
| 70 | Naish Cottage | 41 | 33.2 | -7.8 | Negligible |
| 71 | Hunters Croft | 41 | 35.6 | -5.4 | Negligible |
| 72 | Birchwood | 41 | 35.1 | -5.9 | Negligible |
| 73 | Deep Acres | 41 | 36.2 | -4.8 | Low |
| 74 | Spindlewood | 41 | 39.3 | -1.7 | Low |
| 75 | Cuckoos Mead | 41 | 39.2 | -1.8 | Low |
| 76 | Naish Lodge | 41 | 36.1 | -4.9 | Low |
| 77 | Cole Acre | 45 | 42 | -3.0 | Low |
| 78 | The Meadow | 45 | 40.1 | -4.9 | Low |
| 79 | 18 Elm Tree Park + Others | 45 | 39.6 | -5.4 | Negligible |

Note:- Receptors 77 to 79 relate only to preferred route (Option A).

5.3 All assessed receptors are of medium sensitivity.

5.4 Results indicate that the magnitude of 400kV overhead line operational noise is of low, negligible or of no effect at the majority of receptors. The significance of effect is therefore **negligible adverse** or **negligible** for negligible and no magnitude effects and **minor adverse** for low magnitude effects for both dry and wet conditions.

5.5 During dry conditions the magnitude of 400kV overhead line operational noise is of medium effect at the Star Inn. The significance of effect is therefore **moderate adverse**.

5.6 During wet conditions the magnitude of 400kV overhead line operational noise is of medium effect at the Flat above garage (Tarnock), Tarnock Cottage, Moorland Park and the Star Inn. The significance of effect is therefore **moderate adverse**.

# 6 Limits of deviation

6.1 Limits of deviation (LoD) are limits within which the authorised development is permitted to deviate. The implication of these LoD is that sections of the development may be closer or further away from existing receptors than initially proposed. With regards to noise, this implies that level of noise may deviate from those that have been assessed.

6.2 Table 8 shows the receptors where a change in route within the LoD would result in an increase of significance of effect from overhead line noise.

Table 8 Summary of potential increase in significance of effect within the limits of deviation

| Receptor Ref. | Receptor Name | Condition (Dry/Wet) | Increase in significance from: | Increase in significance to: | Movement[Þ] Required to Trigger Change, m |
|---|---|---|---|---|---|
| 10 | Cripps Farm Caravans | Wet | Minor adverse | **Moderate adverse** | 6 |
| 19 | Court Villa | Wet | Negligible Adverse | **Minor adverse** | 2 |
| 25 | Withy Cottage | Dry | Negligible Adverse | **Minor adverse** | 7 |
| | | Wet | Minor adverse | **Moderate adverse** | 4 |
| 31 | The Willows | Wet | Negligible Adverse | **Minor adverse** | 7 |
| 35 | South View | Wet | Negligible Adverse | **Minor adverse** | 4 |
| 46 | Homeground | Wet | Negligible Adverse | **Minor adverse** | 7 |
| 58 | 1 Clevedon Road | Dry | Negligible Adverse | **Minor adverse** | 7 |
| 61 | Honeysuckle Cottage | Wet | Minor adverse | **Moderate adverse** | 1 |

[Þ]Towards receptor