9.0A NOISE AND VIBRATION

A1 Chapter Alterations

A9.1 This chapter of the ES Addendum updates the ES with respect to the following:

1. **Inclusion of more detail in respect of sound propagation in different wind directions, and the assessment of screening by bunding, landform and other objects such as buildings;**
2. **Inclusion of reference to Planning Practice Guidance (March 2014);**
3. **Clarification of the results in respect of the inclusion or otherwise of ambient noise in the predicted overall levels;**
4. **An additional Table has been included in order to present the results of the daytime background noise survey in greater detail;**
5. **Clarification has been provided with respect to the potential impacts of vibration;**
6. **Two additional figures (Figures 9.5 and 9.6) to show anticipated noise levels with distance from the Application Site during construction and drilling have been included to illustrate the propagation of noise from the Proposed Development in the local area (the original figures remain valid and have not been resubmitted);**
7. **An additional Appendix (Appendix 9.1) has been included which presents the results of the noise and vibration assessment in simpler terms;**
8. **Clarification has been provided on the potential impacts of noise and vibration on livestock (text and Appendix 9.2 added); and**
9. **Clarification of terminology used throughout the ES.**

Introduction

9.1 This chapter of the ES assesses the likely significant effects of the Proposed Development in terms of noise and vibration, and is supported by the accompanying Figures.

9.2 The chapter describes the assessment methodology; the baseline conditions currently existing at the ~~Assessment~~ **Application** Site and surroundings; the likely significant environmental effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual effects after these measures have been employed. This chapter has been prepared by ACIA Engineering Acoustics, Stockport.

Planning Policy Context

National Planning Policy

National Planning Policy Framework, 2012 (Ref. 9.1)

9.3 The National Planning Policy Framework (NPPF) was published in 2012 and replaced Planning Policy Guidance (PPG) 24: Planning and Noise, and Minerals Policy Statement (MPS) 2: Controlling and Mitigating the Environmental Effects of Mineral Extraction in England. The NPPF provides the following guidance on noise, planning and minerals.

9.4 The NPPF states at paragraph 123 that planning policies and decisions should avoid noise giving rise to 'significant adverse impacts … on … quality of life', and mitigate the adverse impacts through the use of conditions, but recognise that development will often create some noise.

9.5 Under Section 13 – Facilitating the sustainable use of minerals, paragraph 143 says that when developing noise limits local planning authorities should;

> **"recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction".**

9.6 The NPPF also states at paragraph 144, that when determining applications local planning authorities should;

> **"ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source".**

~~*Technical Guidance to the NPPF, 2012* (Ref 9.2)~~

~~9.7 The Technical Guidance to the NPPF deals with noise emissions from mineral workings at paragraphs 28 and 29. Paragraph 30 defines noise standards for minerals sites as follows.~~

~~9.8 Subject to a maximum of 55dB $L_{Aeq,1h}$, mineral planning authorities should aim to establish a noise limit that does not exceed the background noise level by more than 10dB.~~

~~9.9 Recognising that this may impose unreasonable burdens on mineral operators, the daytime noise limit should be set as near that level as practicable (07.00h – 19.00h). Evening limits (19.00h – 22.00h) should not exceed background noise by more than 10dB, and night-time limits should not exceed 42dB $L_{Aeq,1h}$ (free field) at noise-sensitive dwellings.~~

~~9.10 This night-time limit is identical to that in the previous MPG11 and MPS2 guidance, and is also based on the assumption of permanent night-time working.~~

Planning Practice Guidance March 2014

9.10a The Planning Practice Guidance (PPG) published online in March 2014 states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. It refers to the Noise Policy Statement for England (NPSE) which has three stated aims: to avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development; to mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development; and where possible, to contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development. The concepts of 'no observed effect level', 'lowest observed adverse effect level', and 'significant observed adverse effect level' (NOEL, LOAEL and SOAEL) as applied by the WHO are introduced by the NPSE and referred to by the PPG, although no specific guidance is provided.

9.10b The PPG on minerals states that a noise assessment should identify all sources of noise and, for each source, take account of the noise emission, its characteristics, the proposed operating locations, procedures, schedules and duration of work for the life of the operation, and its likely impact on the surrounding neighbourhood.

9.10c The PPG states that proposals for the control or mitigation of noise emissions from minerals sites should consider several factors, including:

- **the main characteristics of the production process and its environs including the location of noise-sensitive properties;**
- **assessing the existing noise climate around the site including background noise levels at nearby noise-sensitive properties;**
- **estimating the likely future noise from the development, and its impact;**
- **proposals to minimise, mitigate or remove noise emissions at source; and**
- **monitoring noise emissions to ensure compliance with appropriate environmental standards.**

Local Planning Policy

The West Sussex Minerals Local Plan, 2003 (Ref 9.3)

9.11 Policies within the Minerals Local Plan have been saved until they are replaced by new documents to be prepared as part of the Minerals and Waste Development Framework. Saved Policy 19 of the Minerals Local Plan deals with residential amenity and the built environment. It states that in considering planning applications for mineral extraction, attention will be given to the effect upon residential and other amenity, and measures to mitigate the impact.

9.12 Saved Policy 60 states that conditions will be imposed requiring that acceptable maximum levels of noise are not exceeded, and appropriate monitoring points will be identified on site boundaries and/or at appropriate locations outside the site. However, the preceding explanatory paragraph 6.53 refers to MPG11, dating from April 1993, which was replaced by MPS2 Annex 2 — Noise, 23 May 2005, which in turn was specifically replaced by the NPPF.

9.13 Saved Policy 64 states that buffer zones to reduce the impact of operations upon the neighbourhood may be required, particularly in relation to residential areas and other noise-sensitive areas.

9.14 The implication of applying the provisions of the Minerals Local Plan to the Proposed Development is that a noise limit will be imposed by planning condition. Such a limit would be determined primarily with reference to the NPPF Guidance

Chichester District Council Local Plan, 1999 (Ref 9.4)

9.15 Policy B5 of the saved Chichester Local Plan states that proposals in rural areas should not generate noise from machinery, vehicle movements or other activity which, when measured against the existing ambient noise levels, would be likely to unduly disturb adjacent residents (as assessed in relation to BS.4142) or the quiet enjoyment of the countryside.

National standards and legislation

BS.5228 part 1: 2009 (Ref 9.5)

9.16 BS.5228-1: 2009 gives recommendations for basic methods of noise control relating to construction and open sites where work activities or operations generate significant noise levels. The legislative background to noise control is described and recommendations are given for procedure for the establishment of effective liaison between developers, site operators and local authorities. Part 1 provides guidance concerning methods of predicting and measuring noise and assessing its impact on those exposed to it. It is applicable to the construction phase of the proposed development, but greater protection of amenity is normally considered appropriate for the 24-hour, seven-day production and testing phases of well site operations.

ISO 9613-2:1996 (Ref 9.6)

9.17 This international standard, *Attenuation of sound during propagation outdoors* provides a general method for the calculation of environmental noise levels at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favourable to propagation from sources of known sound emission. The method consists of octave-band algorithms (with nominal midband frequencies from 63Hz to 8kHz) for calculating the attenuation of sound which originates from a group of point sources. The physical effects of geometrical divergence, atmospheric absorption, ground effect attenuation, reflection from surfaces, and screening by obstacles are allowed for. The method is applicable to most situations concerning industrial noise sources, construction activities and many other ground-based noise sources.

Report of the Noise Review Working Party, Department of the Environment, October 1990 (Ref. 9.7)

9.18 The points addressed in the 1990 Department of the Environment report, wherein the transitory nature of noise from onshore oil and gas exploration sites was discussed, included a view that noise from such sites may be best controlled by the use of Section 60 of the Control of Pollution Act, in conjunction with a specific Code of Practice for such sites.

Environmental Protection Act, 1990 (Ref 9.8)

9.19 Section 79 of the EPA defines statutory nuisances caused by (*inter alia*) noise emitted from premises so as to be prejudicial to health or a nuisance. Where a local authority is satisfied that a statutory nuisance exists, it is to serve an abatement notice requiring the abatement of the nuisance, restricting its occurrence or recurrence, or requiring steps to be taken as necessary.

9.20 Subject to some other provisions, it is a defence to prove that the best practicable means have been used to prevent or counteract the effects of the nuisance. The relevant parts of the Act would apply to all phases of the proposed development.
Control of Pollution Act, 1974 (Ref 9.9)

9.21 Some of the provisions of the Control of Pollution Act relating to construction noise are still in effect: Section 60 allows a local authority to require construction works to be carried out in a particular way in order to control noise as far as is reasonably practicable.

9.22 Section 61 allows for a developer to apply for prior consent for construction works in respect of the method by which the works are to be carried out, and the steps proposed in order that noise arising from the works is minimised.

Hampshire County Council ISVR Report

9.23 In the 1980s the Wolfson Unit of the ISVR prepared an internal report for Hampshire County Council which recommended a noise limit of 35dB L_{A90} for a long-term oilfield development in a rural area with nearby housing. The report was never published but saw wide use at the time.

9.24 For short-term drilling, the ISVR determined that noise levels up to 5dB noisier than the long-term criterion would probably not cause significant nuisance, so values of 40dB L_{A90} were therefore acceptable outside local residential properties.

9.25 It is a characteristic of conventional rotary drilling that for the typical rig the L_{Aeq} emitted is generally 3 to 4 dB numerically higher than the L_{A90}. Thus, making an appropriate adjustment, it follows that the environmental noise limit for noise levels during drilling would be in the range 43 to 44 dB L_{Aeq} at the nearest properties at night. This is in step with the provisions of the NPPF guidance.

Assessment Methodology

Significance

9.26 The significance criteria adopted for this assessment are set out in **Table 9.1**. These were formulated with regard to the National Planning Policy Framework (NPPF) which states that the planning system has an environmental role to help use natural resources prudently and minimise pollution.

9.27 Minerals planning authorities are expected to ensure that plan proposals do not have an unacceptable adverse effect on the natural environment.

Table 9.1: Significance criteria

Significance	Criterion
CRITICAL	These effects are generally, but not exclusively, associated with sites and features of national or regional importance. A change in a regional or district scale feature may also enter this category. Mitigation measures are unlikely to remove such effects. It is inconceivable that noise impact would ever fall within this category.
MAJOR	These effects are likely to be important considerations at a local or district scale, but if adverse, are potential concerns to the project, depending upon the relative importance attached to the issue during the decision-making process. Mitigation measures and detailed design work are unlikely to remove all of the effects upon the affected communities or interests.
MODERATE	These effects, if adverse, while important at a local scale, are not likely to be key decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource. They represent issues where effects would be experienced but mitigation measures and detailed design work would ameliorate/enhance some of the consequences upon affected communities or interests so that the adverse effects are not unacceptable.
MINOR	These effects may be raised as local issues but are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in enhancing the subsequent design of the proposed development the consideration of mitigation measures, and the imposition of planning conditions.
NEGLIGIBLE	No effects or those which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error. A change in noise level less than 1dB is regarded as a negligible effect.

9.28 The public response to noise arising from the Proposed Development depends on the pre-existing level of background noise, the amount by which the 'new' noise exceeds it, and the duration of any increase in noise levels. Noise from short-term activities is more acceptable than noise at the same level from more permanent activities. Noise during the evening and at night is less acceptable than the same noise occurring during the normal working day.

Noise limits

9.29 Achieving an appropriate noise limit is a way of determining the significance of an effect. All phases of the Proposed Development described in Chapter 4 have been assessed. Nevertheless, all noise sources can be regarded as temporary, with drilling expected to take place over a period of a few weeks only. The four phases of the Proposed Development are (1) construction; (2) mobilisation and drilling; (3) testing and (4) aftercare. A different noise limit is appropriate for each phase.

9.30 Noise limits would normally be applicable at the nearest point on the curtilage of neighbouring properties, or another appropriate location where local circumstances dictate.

9.31 Noise from permanent installations, in contrast, should not give rise to increases in environmental noise levels outside local noise-sensitive properties. This means that in order to constitute valid planning conditions any noise limits imposed should be applicable at a location where compliance can be monitored and verified: in the case of well testing a noise limit at the Proposed Development site boundary would be appropriate.

9.32 In order to keep conditions as simple and effective as possible, an identical noise limit should apply to all noise-sensitive locations. The noise level resulting from drilling operations on the proposed well site should, according to various recommendations, not exceed 45dB $L_{Aeq,5min}$ at night. The ~~NPPF Technical Guidance~~ **Planning Practice Guidance (March 2014)** suggests a night-time noise limit of 42dB for long-term or permanent

minerals extraction operations. The definition of 'night-time' is sometimes a matter of local preference, but 22:00h to 07:00h can be regarded as the night-time period when most residents expect undisturbed sleep.

9.33 The ~~NPPF Technical~~ Guidance recommends that the daytime noise limit should not be set higher than 55dB $L_{Aeq,5min}$. This is in step with the well-established BS.5228-1 standard and in view of the expected duration of drilling activities which is comparable with a small construction project the same limit is appropriate here. The same daytime noise limit is applicable to the restoration phase of the Proposed Development.

9.34 The construction and drilling noise limits are appropriate for the assessment of the possible short-term test phase if hydrocarbons are found, but in the event that the contingent horizontal well is drilled, and the worst case scenario of 26 weeks of testing occurs, the extended well test noise limits would be applicable.

9.35 The noise limits adopted for this assessment are shown in **Table 9.2**.

Table 9.2: Proposed noise limits at noise-sensitive locations, dB

activity	**daytime $L_{Aeq,1h}$**	**evening $L_{Aeq,5min}$**	**night $L_{Aeq,5min}$**
construction	55	N/A	N/A
drilling	55	42	42
short-term testing	55	42	42
extended well test*	40*	35*	35*
site ~~reinstatement~~ **restoration**	55	N/A	N/A

* applicable at **Application Site** ~~site~~ boundary

Vibration

9.36 Given that the separation distances between the Proposed Development and the nearest residential properties are of the order of hundreds of metres, only a brief qualitative vibration assessment was conducted. The levels of vibration depend not only on the input excitation, but also on the ground conditions close to the surface (in the unconsolidated layer) and the nature of the property in which vibration might be detected. None of these can be predicted other than in terms of the order of magnitude.

Calculation of construction noise

9.37 The aggregate noise levels at neighbouring noise-sensitive properties resulting from the operation of earthmoving machinery were calculated in terms of the overall A-weighted equivalent continuous noise levels. Corrections were then applied to allow for the 'on-time' of each machine in a given hour of operation, as recommended by BS.5228 part1: 2009 (ref.9.5), and the total equivalent continuous noise level calculated on the assumption that the equipment was operating at the well location. No allowance was made for any screening effects, but geometrical effects (separation distances), soft ground attenuation and atmospheric absorption were included as set out in BS EN ISO 9613-2:1996 (ref 9.6).

9.38 The resulting sound pressure levels L_p at each of the noise prediction locations were calculated from the expression:

$$L_p = L_w - 20 \log r - 11 + DI + \Sigma A \text{ [dB]}$$

9.39 Where r is the separation distance in metres between the noise source and the receiver; DI is the directivity index, assumed to be +3dB for sound propagation over a reflecting plane surface; and ΣA is the aggregate excess attenuation resulting from the ground effects attenuation A_G and the atmospheric absorption A_A. The source height was assumed to be 1m, which is typical for diesel-engined plant, and the reception points

were each taken to be 1.2m above ground, this being a conventional microphone height for compliance measurements.

Calculation of drilling noise

9.40 Assuming that all the noise sources on the drilling site are contributors to the overall noise level, **regardless of whether a vertical or lateral well is being drilled,** the decay of sound levels with distance (geometric effects) was taken into account according to the basic acoustical principle of hemispherical radiation. The attenuation effects as sound passes over soft ground, and the absorption of high frequencies by the atmosphere, were also taken into account using the well-established base data for open country shown in ISO.9613-2:1996 (ref.9.6). Calm weather was assumed, as this is generally the condition under which sound propagates most readily, and thus the worst case was modelled. A direct line of sight was assumed between the drilling site and each of the residential locations.

9.41 Input sound power information for ~~a typical~~ **the noisiest** drilling rig of appropriate power was obtained from previous measurements by ACIA at various sites. Noise survey reports by others are also available. The resulting sound pressure levels L_p at each of the noise prediction locations were again calculated from the expression:

$$L_p = L_w - 20 \log r - 11 + DI + \Sigma A \text{ [dB]}$$

9.42 Where r is the separation distance in metres between the noise source and the receiver; DI is the directivity index, assumed to be +3dB for sound propagation over a reflecting plane surface; and ΣA is the aggregate excess attenuation resulting from the ground effects attenuation A_G and the atmospheric absorption A_A. The source height for drilling noise was assumed to be 2.5m, this being the typical height of noise-emitting equipment on the rig, and the reception points were each taken to be 1.2m above ground, this being a conventional microphone height for compliance measurements.

Road traffic noise

9.43 Noise from road traffic movements is often predicted with reference to the Department of Transport's 1988 document Calculation of Road Traffic Noise (CRTN) (Ref. 9.7) which is designed to assess the changes in road traffic noise arising from a new road or a modified carriageway.

9.44 The noise from a traffic stream is not constant but varies from one moment to the next, and it is necessary to use an index to arrive at a single-figure estimate of traffic noise for assessment purposes. CRTN uses the $L_{A10,18h}$ index which is the noise level exceeded for 10% of an eighteen-hour period during the daytime and evening (06.00h – midnight). This has been used for road traffic noise for more than 25 years because it correlates well with subjective responses. However, the $L_{Aeq,16h}$, the parameter in more general use nowadays because it can readily be compared with WHO guideline noise limits inside dwellings.

9.45 The usefulness of CRTN in the present project is limited, because it relates to the noise resulting from steady traffic flows rather than sporadic vehicle movements, although equations are given in CRTN which relate the resulting noise levels at housing to the number of vehicle movements expected. No changes in the highway layout are proposed as part of the Proposed Development, so the only potential changes in noise level from the road network are those arising from increases in the numbers of vehicle movements during the construction and drilling phases.

9.46 The Design Manual for Roads and Bridges (DMRB) volume 11 (ref. 9.8) gives advice on the environmental assessment of noise from changes in road traffic. Its objective is to establish the magnitude of significance for noise changes where the current traffic levels are likely to increase by 25% or reduce by 20%. These changes are equivalent to an increase or decrease of 1dB in traffic noise levels. For DMRB purposes there is not necessity to quantify changes of less than 1dB, the inference being that such slight changes in noise level are so small as to be imperceptible. This would be an effect of negligible significance.

9.47 In order to assess road traffic noise resulting from each phase of the Proposed Development, the expected numbers of vehicle movements **per phase as shown in Table 4.1 of Chapter 4A Project Description,** were superimposed on present traffic volumes and the likely increases in the $L_{Aeq,16h}$ index calculated.

Baseline Conditions

Noise survey details

9.48 Surveys of ambient noise levels were undertaken during the night in the area of the proposed well site. The survey took place in the small hours of Friday 22 February 2013.

9.49 As the proposed well site is a considerable distance from any residential property, noise measurements were made at three locations chosen to represent the nearest residential properties to each side of the proposed drilling site. N1 was directly opposite Skiff Farm, Kirdford Road, at the entrance to a trailer storage area. N3 was outside the gate to Barkfold Manor, Kirdford Road. N3 was at the entrance to Lower Sparr Farm, Skiff Lane (**Figure 9.1**). Although the measurements were attended by a qualified acoustical engineer throughout, the results were noted automatically by the equipment without any need for further intervention. The measurement locations are shown in **Table 9.3** and **Figure 9.1**.

Table 9.3: Noise measurement locations

ref	location	OS grid reference	m from well
N1	opposite Skiff Farm	504161 E, 126915 N	514
N2	gate to Barkfold Manor	502992 E, 126470 N	738
N3	Lower Sparr Farm	503947 E, 127199 N	551
	well location	503689 E, 126712 N	-

Instrumentation and method

9.50 A Rion type NL-32 sound analyser was used to monitor the background noise levels affecting the areas of potentially noise-sensitive dwellings. It was used in conjunction

with a Rion type UC-53A half-inch condenser microphone, and a foam windshield was fitted for all measurements. The unit was mounted on a tripod with the microphone 1.2m above the ground. The entire measurement chain was subject to calibration checks before and after the surveys by means of a Bruel and Kjaer type 4231 electronic calibrator: no drift was observed. The meter is subject to regular laboratory calibration, the most recent having been on 23 March 2012.

9.51 Five-minute measurement periods were monitored from 00:30h to 03:15h on 22 February 2013, at the three locations in sequence. The equivalent continuous sound pressure level L_{Aeq}, together with the statistical indices L_{A90} and L_{A10} were noted for each five-minute period. Sample daytime measurements were also made in the late morning of 22 February 2013.

Weather and other observations during measurements

9.52 The weather throughout the night-time survey was dry, with an air temperature of 1°C. There was no measurable wind, full cloud cover, but no precipitation. There were no vehicle movements whatsoever past the microphone.

9.53 The daytime sample measurements also took place in calm conditions and the air temperature reached 5°C. It was found that passing vehicles were the predominant noise source, and these controlled the measured L_{Aeq} values, but the volume of traffic was judged insufficient to affect the underlying L_{A90} index.

Results of noise measurements

9.54 The results of the night-time noise surveys are presented in **Table 9.4** below and in **Figures 9.2, 9.3** and **9.4**. **The results of the daytime noise measurements are presented in Table 9.4a.**

Table 9.4: Night-time ambient noise levels, dB

start, h	end, h	L_{Aeq} dB	L_{A90} dB	L_{A10} dB
R1 Skiff Farm				
00:30	00:35	24.1	19.5	25.3
00:35	00:40	23.4	19.4	27.0
00:40	00:45	23.0	19.6	25.1
R2 Barkfold Manor				
00:50	00:55	27.9	25.4	29.7
00:55	01:00	27.6	25.1	29.0
01:00	01:05	27.6	25.2	29.1
R3 Lower Sparr Farm				
01:10	01:15	23.9	20.9	24.7
01:15	01:20	24.2	20.7	24.6
01:20	01:25	24.4	21.4	25.4
R1 Skiff Farm				
01:35	01:40	23.7	21.4	25.3
01:40	01:45	24.4	21.3	25.4
01:45	01:50	23.8	20.7	24.7
R2 Barkfold Manor				
01:55	02:00	27.2	25.4	28.4
02:00	02:05	27.4	25.0	28.8
02:05	02:10	27.7	25.2	29.0
R3 Lower Sparr Farm				
02:20	02:25	24.0	21.1	24.6
02:25	02:30	23.8	20.7	25.3
02:30	02:35	24.5	20.9	25.3
R1 Skiff Farm				
02:40	02:45	24.1	20.9	25.0
02:45	02:50	25.2	19.8	26.0
R2 Barkfold Manor				
03:00	03:05	27.6	25.5	29.0
03:05	03:10	28.0	25.3	29.5
R3 Lower Sparr Farm				
03:20	03:25	24.1	21.8	25.1
03:25	03:30	23.8	20.5	24.3

Table 9.4a: Daytime ambient noise levels, dB

start, h	end, h	L_{Aeq} dB	L_{A90} dB	L_{A10} dB
R1 Skiff Farm				
10:10	**10:15**	**41.3**	**35.4**	**44.5**
10:15	**10:20**	**44.0**	**36.1**	**47.4**
R2 Barkfold Manor				
10:30	**10:35**	**48.1**	**35.0**	**49.0**
10:35	**10:40**	**40.3**	**37.2**	**42.5**
R3 Lower Sparr Farm				
10:50	**10:55**	**41.6**	**36.4**	**42.6**
10:55	**11:00**	**41.7**	**36.7**	**43.1**
R1 Skiff Farm				
11:05	**11:10**	**47.2**	**34.8**	**46.5**
11:10	**11:15**	**40.5**	**35.6**	**41.0**
R2 Barkfold Manor				
11:25	**11:30**	**45.8**	**37.9**	**48.3**
11:30	**11:35**	**43.4**	**36.6**	**47.0**
R3 Lower Sparr Farm				
11:45	**11:50**	**44.4**	**37.4**	**45.2**
11:50	**11:55**	**40.0**	**35.9**	**41.2**

9.54a The noise levels during the night-time fell to around 19dB $L_{A90,10min}$ which was as low as would typically be expected on the calm night with no precipitation.

9.55 The noise levels outside ~~Skiff Farm and Barkfold Manor~~ **all three monitoring locations** in the late morning were very dependent on passing road traffic, but the underlying background noise level was approximately 35dB $L_{A90,5min}$.

Assessment of effects

Phase 1: Construction of the access road and well site

9.56 Noise levels arising during site construction were calculated for the six neighbouring residential properties which are shown in **Figure 9.1**. In each case the OS grid coordinates chosen, as identified in **Table 9.5**, represent the nearest point on the façade of the building that faces the well site.

Table 9.5: Noise prediction locations

ref	location	OS grid reference	m from well
R1	Skiff Farm	504125 E, 126889 N	471
R2	Apple Tree Cottage	504234 E, 126795 N	551
R3	Wisborough Villa	504292 E, 126715 N	603
R4	Barkfold Manor	502828 E, 126467 N	895
R5	Stud Bungalow	502882 E, 126617 N	813
R6	Barkfold Farmhouse	502844 E, 126843 N	855
R7	Lower Sparr Farm	504003 E, 127188 N	570
	well location	503689 E, 126712 N	-

9.57 Construction of the drilling site, in terms of the noise produced, is mainly a matter of levelling the site and laying loose stone chippings over the area. The equipment used will typically consist of a tracked excavator, with a sound power level of 112dB(A), a dozer, 114dB(A), and a road roller, 108dB(A). The sound power levels were taken from Table D.3 of BS.5228-1:2009. There will also be deliveries of stone and other materials by roadgoing dumper truck. Construction would normally occur during an extended working day only which is anticipated to be between 7am and 7pm (Monday to Friday) and 8am-1pm on Saturdays. The aggregate noise levels at each of the noise-sensitive properties identified in **Table 9.5**, resulting from the operation of all three earthmoving machines individually and concurrently, were calculated in terms of the overall A-weighted equivalent continuous noise levels assuming the source noise spectrum shape to be that of a typical large turbocharged diesel engine and exhaust. Corrections were then applied to allow for the 'on-time' of each machine in a given hour of operation, as recommended by BS.5228 part1: 2009, and the total **worst-case** equivalent continuous noise level calculated on the assumption that the equipment was operating at the well location. No allowance was made for any screening effects **since these would not be present (if at all) until the construction of bunding was complete**.

9.58 **Worst-case** construction noise levels (L_{Aeq}) at the noise-sensitive properties nearest to the proposed sites were calculated using octave band sound power levels as shown in **Table 9.6** to the nearest whole decibel. These source levels represent the equivalent continuous sound power propagating from the machine in each case.

Table 9.6: Construction equipment noise level spectra $L_{eq,T}$ dB

	31.5	63	125	250	500	1k	2k	4k	8k	'A'
excavator	127	114	112	102	114	105	98	85	77	112
dozer	129	116	114	104	116	107	100	87	79	114
roller	123	110	108	98	110	1001	94	81	73	108

9.59 The instantaneous levels experienced would change over time but the values used enable the equivalent continuous noise levels $L_{Aeq,1h}$ to be calculated. The results ~~are~~ **as** shown in **Table 9.7 do not include the possible additive effects of pre-existing background noise.**

Table 9.7: Predicted **worst-case** noise levels during construction

	location	excavator	dozer	roller	all plant*
R1	Skiff Farm	42	44	38	**41**
R2	Apple Tree Cottage	40	42	36	**40**
R3	Wisborough Villa	39	41	35	**39**
R4	Barkfold Manor	35	37	31	**34**
R5	Stud Bungalow	36	38	32	**35**
R6	Barkfold Farmhouse	35	37	31	**35**
R7	Lower Sparr Farm	40	42	36	**39**

* The figures in the individual machine columns assume continuous operation. The figures in the 'all plant' column allow for 30% 'on-time' of each of the three types of machinery in a given one-hour period.

9.60 Noise during construction is potentially of moderate significance, in that operations may sometimes be audible during the daytime at local noise-sensitive properties. The predicted maximum noise levels in terms of $L_{Aeq,1h}$ are in the range 35 to 41 dB, which are comfortably within a 55dB parameter advised in BS.5228-1. **Figure 9.5 shows the anticipated noise levels with distance from the site during construction.**

9.61 There will be no sources of significant ground vibration during construction ~~which~~ **other than a road roller, which may be of a vibratory type. Such a machine vibrates only the roller/ground contact surface and its immediate vicinity, which means that there is a rapid dissipation of vibrational energy close to the machine. Vibration is not transmitted through the unconsolidated ground close to the surface, and no additional vibration** will be detectable inside neighbouring properties.

Road traffic movements

9.62 Some noise during the construction period, from heavy goods vehicles travelling on the public highway, is unavoidable. There will be ~~an average of one additional vehicle movement~~ **a typical maximum of 50 additional 2-way vehicle movements per day (equivalent to between five and six** per hour) during the normal working day (8am to 5pm) and **pro-rata** on Saturday mornings (8am to 1pm) during the ~~6 – 10~~ **ten-**week construction period.

9.63 The increase in traffic noise in terms of $L_{Aeq,16h}$ (the usual parameter) resulting from these movements is less than 1dB and therefore negligible, although individual vehicle movements will give rise to localised increases in noise level for a matter of seconds.

Phase 2: Mobilisation of drill rig and drilling operations

9.64 During the mobilisation of the rig, site work will occur between 8am and 8pm daily, but not at night. Noise levels will not exceed those occurring during site construction. Thereafter the rig will operate 24 hours a day, seven days a week.

9.65 Noise levels from the drilling phase **(for both vertical and lateral wells)** were calculated for the six neighbouring residential properties identified in **Table 9.5**. The OS grid coordinates chosen in each case represent the nearest point on the façade of the building that faces the well site. This basis was adopted, rather than the more usual closest point within the curtilage of the property (in the garden) because drilling is a continuous 24-hour operation and night-time noise levels are almost invariably found to be more critical: **night-time noise emissions therefore represent the worst case for the drilling phase**.

9.66 It is the Applicant's intention to use a rotary drilling rig of which the British Drilling and Freezing Rig 28 and Edeco Rig 10 are typical examples. The BDF 28 is the noisiest under most conditions and has been used for the purposes of this assessment thus representing the worst case. The sound power level L_{wA} emitted in any given direction is

between 104 and 110 dB. Drilling rigs have directional characteristics, so the actual value measured at a particular point will vary according to the actual rig used, and its orientation. For prediction purposes it was assumed that the rig orientation will be with its pipe racks directed just north of west (289°), meaning that the maximum sound power level will be directed towards the south-west.

9.67 Noise levels (L_{Aeq}) at the noise-sensitive properties nearest to the proposed sites were calculated using the octave band sound power levels in **Table 9.8**. These source levels represent the maximum equivalent continuous sound power propagating from the rig towards the receiver location in each case. The actual levels experienced would vary slightly depending on weather and wind direction, but the values used are for drilling ahead in calm weather using standard solids control equipment and two diesel-driven mud pumps, as measured by ACIA on a drilling site in north-west England.

Table 9.8: Average sound power emitted by drilling rig BDF 28, L_{eq} dB

Hz	31.5	63	125	250	500	1k	2k	4k	8k	'A'
$L_{eq,T}$	131	122	120	108	107	104	96	85	81	110

9.68 The attenuation due to the effects of separation distance only at each receptor is shown in **Table 9.9**.

Table 9.9: Geometrical attenuation dB

	receptor	distance m	-20 log *r* dB
R1	Skiff Farm	471	53.5
R2	Apple Tree Cottage	551	54.8
R3	Wisborough Villa	603	55.6
R4	Barkfold Manor	895	59.0
R5	Stud Bungalow	813	58.2
R6	Barkfold Farmhouse	855	58.6
R7	Lower Sparr Farm	570	55.1

9.69 **Table 9.10** shows the predicted overall noise level, L_{Aeq}, and the octave equivalent continuous levels produced by the rig itself (in the absence of background noise) at each of these locations. The levels indicated take account of the directivity (effects of

orientation) of the rig, soft ground attenuation and atmospheric absorption, but disregard the screening effects which might result from the presence of physical barriers between the noise source and a receiver. **The results are net of any pre-existing ambient noise.**

Table 9.10: Predicted worst case noise levels from drilling (screening ignored)

Hz	31.5	63	125	250	500	1k	2k	4k	8k	'A'
R1	59	52	42	24	31	36	30	6	-	**38**
R2	57	51	41	22	30	34	28	2	-	**36**
R3	57	50	40	21	29	33	27	-	-	**35**
R4	51	44	38	24	26	32	27	-	-	**34**
R5	51	45	39	24	27	33	29	-	-	**35**
R6	51	45	38	24	27	32	28	-	-	**35**
R7	57	53	37	17	23	29	21	-	-	**32**

9.70 Since drilling will continue 24 hours a day, seven days a week, noise is generally more likely to be noticed at night than during the daytime, not least because daytime background noise will be considerably greater. The predicted levels at night (in terms of the $L_{Aeq,T}$ emitted by the rig) may significantly exceed the current levels of background noise on a calm night, as described below. However, the levels would remain within a night-time noise limit of 42dB $L_{Aeq,5min}$ (as appropriate for permanent installations) even at the closest noise-sensitive properties. A daytime noise limit of 55dB $L_{Aeq,1h}$ as recommended by the **PPG** ~~NPPF Technical Guidance~~ will always be met.

9.71 The maximum predicted level of 38dB L_{Aeq} produced by the rig itself (in the absence of background noise) at the nearest noise-sensitive location (R1 Skiff Farm) can be compared with the minimum ambient noise level of 20dB $L_{A90,5min}$ and 24dB $L_{Aeq,5min}$. This level will be in excess of the pre-existing minimum background noise level of 23dB $L_{Aeq,5min}$ so noise from the drilling site will cause a temporary increase of up to 14dB in night-time noise. Given the relatively short-term nature of drilling operations (~~typically six weeks,~~ maximum ~~ten~~ **14** weeks **for vertical drilling and another 12 weeks for lateral drilling**) these levels of noise are of moderate adverse significance. **Figure 9.6 shows the anticipated noise levels with distance from the site during drilling. These noise levels are equally valid for vertical ~~(exploration)~~ and lateral ~~(appraisal)~~ drilling. Noise emissions arising during the erection of the drilling rig (up to one week) and**

dismantling and removal of the rig (up to one week) will not exceed those from the site construction phase and are therefore not considered further.

9.71a The predictions are valid for a dry night with no significant wind, which experience shows to be likely worst case. At times when a measurable wind occurs, the noise propagation in an upwind direction from the Proposed Development may be reduced somewhat, but the downwind propagation at the relevant source-to-receptor distances is not significantly increased. The effects of wind direction are considerably less significant than the concomitant increase in background noise from wind-generated sources such as leaves rustling and small, loose wind-blown objects.

9.71b Although the landform in the area of the Proposed Development is gently undulating, there are no natural barriers to sound propagation towards noise-sensitive locations, and no hollows or areas of open water which might reduce the expected degree of ground-borne attenuation.

9.72 The shale shakers located next to the drilling rig itself, and forming part of the solids control equipment, are ~~significant~~ sources of vibrational energy since their operation, as the name implies, depends on passing the returned drilling fluids through a set of reciprocating (vibrating) screens. This vibration is detectable on the solids control structure itself, and can sometimes just be detected by an observer standing on the ground next to the machinery. This vibration is dissipated within a matter of a few metres and is undetectable beyond the confines of the site. ~~There will be no sources of significant ground vibration during rig operations which will be detectable inside neighbouring properties.~~

9.72a Vibration arising at the drill bit, hundreds of metres below ground level, can occasionally be detectable on the drill floor because of direct transmission up the drill string. None of this vibration passes through the ground to areas beyond the rig itself, and no ground vibration during rig operations will be detectable inside neighbouring properties. The levels of vibration inside these properties will be several orders of

magnitude lower than the architectural damage criteria given in BS.7385-2:1993, and at least two orders of magnitude below the levels perceptible to a human observer.

9.72b Some older types of solid control equipment can emit tonal noise at low frequencies, typically in the 31.5Hz and 63Hz octave bands, as shown in the source noise data (Table 9.8), but on the latest types of equipment this tendency has been largely eliminated. Over the separation distances between the Proposed Development and the nearest noise-sensitive receptors, which are of the order of 500m, the worst-case low frequency noise will be 57 to 59 dB. The human hearing system is much less sensitive to low-frequency sounds than to mid-frequency and high-frequency sounds, so the effects are of moderate significance at a small number of properties only.

Road traffic movements

9.73 Some noise from heavy goods vehicles travelling on the public highway will arise during the rig mobilisation period of **up to one week** ~~3 – 4 days~~. ~~There will be 140 additional vehicle movements, mainly HGVs, equating to approximately 3 per hour during the normal working day and on Saturday mornings.~~ **On the basis of Table 10.11, showing two-way typical daily vehicle movements, there will be 62 additional two-way daily vehicle movements over a period of one week, of which 24 will be heavy goods vehicles. The maximum numbers of two-way heavy vehicle movements during rig mobilisation will thus be three per hour during the normal working day.**

9.74 The increase in traffic noise in terms of $L_{Aeq,\ 16h}$ resulting from these movements is negligible, although individual vehicle movements will give rise to localised increases in noise level for a matter of several seconds at a time.

9.75 During drilling there will be ~~4 to 6~~ a **maximum of six** movements of HGVs daily, ~~with up to 30~~ **and 38** movements of light vehicles, **most of which will occur** at shift changes (8am and 8pm daily). The increase in traffic noise in terms of $L_{Aeq,\ 16h}$ resulting from these movements less than 1dB and thus negligible.

9.75a HGV noise will also occur when the rig is demobilised and removed from the Application Site, which will also take up to one week. Since the equipment referred to in Table 6.2 will all be travelling in the opposite direction, there will again be 62 additional vehicle movements. There will be 62 additional two-way daily vehicle movements over a period of one week, of which 24 will be heavy goods vehicles. The maximum numbers of two-way heavy vehicle movements during rig mobilisation will thus be three per hour during the normal working day. The demobilisation stage does not therefore differ from the mobilisation stage and a noise assessment would reach identical conclusions.

Phase 3: Testing (gas and oil)

9.76 Noise levels during **the initial two-week period of** short-term testing will be similar to, but will not exceed, those during the drilling phase, as the drilling rig will remain on site. These levels of noise are of moderate adverse significance. **The rig will be removed after the initial two weeks, or after having drilled a lateral well, whichever is applicable.**

Phase 3b: Extended Well Test (EWT)

9.77 ~~**In the event that the initial short term testing provides encouraging results, Celtique may decide to run an Extended Well test (EWT)**~~ **The main period of the extended well test (EWT) would run for up to 26 weeks. If a workover rig is used on site, it would be mobilised and installed on site which would take a week. During the 26 week testing period it may be demobilised (one week) then remobilised (one week). The rig would then be demobilised over the course of a week after the 26 week testing period (refer to Table 4.1 of Chapter 4A Project Description).**

9.78 **T**emporary production facilities **would be installed** including:

- Storage tanks for produced oil and formation water contained in a bunded area;
- An oil/water/gas separator for the separation of the produced well stream, also contained within the bunded area;

- Transfer pumps to transfer fluids between the storage tanks and also to road tankers for export;
- A flare stack to vent or flare any produced gases;
- A pumping unit on the well to produce (it is unlikely that the oil will flow to surface naturally);
- An emergency shutdown system on the well to stop production and shut-in the well in the event of an emergency;
- Portacabin offices to house the pumping unit control equipment and provide an office and facilities for the well operators;
- A packaged electrical generator.

9.79 Once this equipment has been installed and commissioned, production operations would continue 24 hours a day, seven days a week throughout the designated period. Production and pressure data would be gathered to allow the Applicant to evaluate the long term production potential of the well and collect bottom hole fluid samples for analysis.

9.80 The only significant noise sources involved in the EWT are the well head pump, which would operate continuously, the transfer pumps, which would operate intermittently when required, the generator and the flare stack. The well head pump is likely to be a linear rod pump, which operates by means of a small electric motor driving reciprocating pump via a rack and pinion. The electric motor is the only source of noise, and this will not exceed 60dB(A) at a distance of 1m. Transfer pumps will be small units mounted at ground level and are unlikely to emit more than 55dB(A) at 1m: for the great majority of the time they will not operate, and will therefore be silent. The electrical generator will be a relatively small packaged unit complete with acoustic enclosure, silenced exhaust system and air intake and outlet attenuators. The typical noise output of such a unit is approximately 65 to 70dB(A) at 1m. The total sound power level emanating from the site during the extended well test is therefore 84dB(A).

9.81 The resulting contributions of such operations at the nearest noise-sensitive locations will be noise levels ($L_{Aeq,5min}$) well below the expected minimum ambient noise levels**, the**

effects of which are omitted from the calculations. The results include the effects of local screening on site and are shown in **Table 9.11**.

Table 9.11: Predicted noise levels from extended well testing

Hz	receptor	dB $L_{Aeq,5min}$
R1	Skiff Farm	16
R2	Apple Tree Cottage	16
R3	Wisborough Villa	14
R4	Barkfold Manor	11
R5	Stud Bungalow	11
R6	Barkfold Farmhouse	11
R7	Lower Sparr Farm	14

9.82 Noise during extended well testing is potentially of minor significance, and operations will not be audible at local noise-sensitive properties.

9.83 None of the equipment described above is capable of transmitting significant levels of vibration into the ground, and no vibration will be detectable within neighbouring residential properties.

9.83a Road traffic associated with the first period of well testing will be limited to 44 additional movements in any 24-hour period, of which just six will be heavy vehicles. This is insignificant compared with the baseline traffic volumes and the noise effects will be negligible. Road traffic associated with mobilisation and demobilisation for the extended well testing will consist of a maximum of 36 daily vehicle movements (20 being heavy vehicles) for the workover rig, and will be limited to 12 daily movements including four heavy vehicles during the test period. The increase in traffic noise in terms of $L_{Aeq,\ 16h}$ resulting from these movements is negligible, although individual vehicle movements will give rise to localised increases in noise level for a matter of several seconds at a time.

9.83b An alternative approach to the extended well test may be adopted. This would involve the temporary installation of a workover rig, which is typically a trailer-mounted drilling rig with a relatively small derrick. The noise levels emitted by such a rig would

not exceed those of the noisiest rotary drilling rig whilst the vertical or lateral wells were drilled, and will not be continuous whilst the workover rig is on location. The rig engine is in general required only to lower and raise equipment in the well bore. Road traffic movements associated with extended testing using the workover rig will not be significantly different from those for the extended well test using temporary production equipment. A shale shaker is not required.

*Site ~~reinstatement~~ **restoration***

9.84 Noise levels during site ~~reinstatement~~ **restoration** will not exceed those from construction. Conventional earthmoving machinery and roadgoing dumper trucks will again be required although the scale of operations will be less.

9.85 The site landowner may choose to retain some or all of the stone brought onto site, which will reduce the number of lorry movements necessary during ~~reinstatement~~ **restoration** compared with those during construction.

9.86 Noise during site restoration is potentially of minor significance. Operations may occasionally be audible during the daytime at local noise-sensitive properties but will in general be unnoticeable.

Site retention

9.87 There are no ongoing activities in the event of site retention which will give rise to noise audible beyond the site boundary. This effect is of negligible significance.

Mitigation Measures

Phase 1 – Construction

9.88 Noise from construction will be controlled primarily by the restriction of working hours. It would be usual practice to allow potentially noisy activities only during the normal working week and on Saturday mornings, subject to local practice.

9.89 BS.5228-1 states that good relations with people living and working in the vicinity of the site operations are of paramount importance. Surrounding residents would be kept informed of the progress of works via regular correspondence from Celtique issued to coincide with key project and operational milestones. A notice would also be erected next to the entrance to the Application Site. On both materials a Freephone contact number would be available for any residents who wished to contact Celtique during works.

9.90 Quiet working methods should be adopted including the use of the most suitable plant and reasonable hours of working for noisy operations. Noise should be controlled at source and on-site noise levels monitored regularly. Local authorities may consider it appropriate to lay down or agree work programmes and periods of use of certain equipment.

9.91 General measures that can reduce noise levels at source include the avoidance of unnecessary revving of engines, switching off equipment when it is not required, minimising the drop height of materials, and starting up plant and vehicles sequentially rather than all together. Audible reversing alarms should be of types that have a minimum noise effect on persons outside the **Application Site.** ~~site.~~

Phase 2 – Mobilisation and Drilling

9.92 There will be additional screening effects on drilling rig noise as a result of the intervening topsoil bund to the north side of the Application Site, and the subsoil bund to the east of the Application Site. No screening was allowed for in the noise assessment

because it cannot be guaranteed that any individual noise-sensitive receptor will in fact benefit from the loss of line of sight between itself and a noise source on the Proposed Development. Therefore a "worst case" has been assessed. The volume of topsoil and subsoil available for the construction of bunds may vary owing to site conditions, which might affect the overall length and height of a bund. Moreover, different drilling rigs have slightly different configurations when mobilised on site, so that a particular noise source that would be screened by a bund for one rig might just be visible for a different rig.

9.92a The effect of screening by earth bunds or other objects is typically to reduce the resulting noise level in the acoustic shadow zone by approximately 5dB overall. This only applies where there is no direct line of sight between the noise source or sources and the receptor location. No allowance was made in the assessment for screening by any intervening object, whether an earth bund, dense woodland or building, although such effects may well be present depending on the exact receptor location.

9.93 The identity of the rig to be contracted for the drilling phase is not yet known. This depends on the suitability and availability of the drilling rigs on the market at a future time. Although a worst-case scenario was assumed for the noise predictions, noise survey reports on candidate rigs will be requested at the procurement stage in order to ensure that their noise emissions do not exceed the assumed levels in this chapter of the ES.

9.93a The rig will not emit significant low frequency sound energy or noise of a tonal nature. The diesel exhaust systems are equipped with high-performance silencers which are designed to prevent the characteristic exhaust notes of large diesel engines emerging from the tailpipes. The high-frequency noises from drawworks brake squeal, which in the past were often a characteristic of a rotary drilling rig, have been eliminated on present-day rigs by the use of disc-brakes on the drawworks, and by the use of a top drive rather than a rotary drilling table to turn the drill string.

9.93b Deliveries and tanker visits to site would all be planned to occur in the daytime only. This would only change in an emergency situation where additional deliveries and emergency vehicles are required. The telescopic handler would therefore be most often used during the daytime, to offload deliveries amongst other duties and will have a reduced usage at night. The most frequent cause of complaint from mechanical handling machinery is 'bleeper' reverse warning alarms, and this can be mitigated by using 'white noise' audible warning signals instead.

9.94 As the predicted background noise levels at nearby residential properties are acceptably low, further noise mitigation measures are not expected to be required, but any decrease in noise level is regarded as beneficial and further noise control measures may be practicable. It will be necessary in any event to confirm that the noise control measures on the individual rig, including diesel exhaust silencers, attenuators allowing cooling air into and out of acoustically-enclosed machinery, and the enclosures themselves, are all kept in good repair in order to ensure that the overall sound power levels used for the acoustical modelling are valid.

9.95 When the rig is fully mobilised on site, access doors to all noisy equipment must be kept closed at all times. No detailed proposals are presented at this stage, but good site management practice will maintain acceptably low drilling rig noise throughout the life of the project.

9.96 Some of the fields in the locality of the Application Site are used to provide grazing for horses and other animals, and horse-riding activities also take place. There are no standards for acceptable noise levels in relation to equine species although it is a matter of observation that noises perceived by horses to be non-threatening are simply disregarded. For example, horses are frequently seen grazing at the side of a motorway at locations where the noise level can exceed 60dB(A).

9.97 The British Horse Society has guideline limits for separation distance between horses and wind turbines, although this is more concerned with visual than aural stimuli. A steady noise source such as a drill rig has little potential to startle or 'spook' an animal.

Nevertheless, good site management practice will minimise any sudden noise from the drill site.

9.97a It is common for drilling rigs to be deployed in farmland, and the behaviours of cattle and sheep are unaffected by the steady noise levels and occasional engine noise arising on site. The noises produced do not differ significantly from those of agricultural machinery, which are familiar sights and sounds. There is no evidence that drilling rig noise and noise from any associated activities have any adverse effect whatsoever on farm stock. It is commonly observed that cattle graze contentedly quite close to significant sources of man-made or machinery noise, such as in fields next to the major road network, at the bases of wind turbines, and neighbouring industrial plants. Published research suggests that steady noise at a reasonable level does not cause any adverse reaction in cattle, and that cows quickly become acclimatised to background noise at any reasonable level. The noise levels from the drilling rig are calculated to be in the range 50 to 60 dB(A) at the nearest approaches of pasture to the site. These levels of noise are considerably below the lowest values at which any reaction has been observed in cattle. Indeed, most of the well site compound itself will be subject to noise below this threshold level, and 80dB(A) will only be exceeded at localised points close to noise-emitting equipment. A letter to the Applicant on this subject is at Appendix 9.2.

Phase 3 ~~3a/3b~~ – Testing ~~(gas and oil)~~

9.98 No noise mitigation measures are necessary during the possible extended well test programme.

Phase 4a – Restoration

9.99 Similarly to the construction phase, noise from site restoration can also be controlled by the restriction of working hours. It would be usual practice to allow potentially noisy activities only during the normal working week and Saturday mornings.

Phase 4b - Retention

9.100 No noise mitigation measures are necessary.

Residual Effects

Phase 1 – Construction

9.101 Residual noise effects as a result of construction activities would be negligible.

Phase 2 – Mobilisation and Drilling

9.102 Residual noise effects of rig mobilisation and drilling would be negligible.

Phase 3 ~~3a/3b~~ – Testing ~~(gas and oil)~~

9.103 Residual noise effects of extended well testing would be negligible.

Phase 4a – Restoration

9.104 Residual noise effects of site restoration would be negligible.

Phase 4b – Retention

9.105 Residual noise effects of site retention would be negligible

Cumulative Effects

9.106 The two committed developments set out in Chapter 2 have been considered in the assessment of likely significant cumulative effects. The solar park would be located 3.5km to the north-west, and 30 new dwellings would be located off Billingshurst Road, 1.4km to the south-east.

9.107 The solar park will not produce any noise audible beyond its own site boundary and can be disregarded.

9.108 There may be noise during construction of the new dwellings but this will occur only during the working day assuming that normal working hours are enforced by the LPA as is usual practice. It will not make any contribution to the noise levels at neighbour noise-sensitive receptors to the Proposed Development.

9.109 Road traffic concerned with any of the above may give rise to temporary increases in road traffic noise level at a given moment. However, it remains the case that the overall increase in traffic noise in terms of $L_{Aeq,16h}$ will be less than 1dB because of the likely infrequency of vehicle movements even when these are concurrent with the Proposed Development.

9.110 Cumulative noise effects in terms of noise would therefore be negligible.

Summary

9.111 Noise levels arising during site construction will sometimes be audible outside local noise-sensitive dwellings during the daytime only. This will not be a cause of noise nuisance and the amenity of residents will be unaffected provided that construction activities are limited to the normal working day and Saturday mornings.

9.112 The noise from 24-hour drilling operations will inevitably cause a temporary increase in ambient noise. The predicted noise levels at local dwellings are based on the noisiest rig likely to be used for the Proposed Development, and alternative rigs may be available for contract at the time. Specific noise control measures will be applied as necessary and appropriate.

9.113 Extended well testing is unlikely to be audible beyond the site boundary at any time.

9.114 Site restoration is similar to construction in terms of the noise emitted, but activity will be less intensive and mostly at lower levels.

Table 9.12: Table of Significance – Noise and Vibration

Potential Effect	Nature of Effect (Permanent/Temporary)	Significance (Major/Moderate/Minor) (Beneficial/Adverse/Negligible)	Mitigation / Enhancement Measures	Geographical Importance*							Residual Effects (Major/Moderate/Minor) (Beneficial/Adverse/Negligible)
				I	UK	E	R	C	D	L	
Phase 1: Construction of access road and well site											
Noise nuisance at local noise-sensitive properties	Temporary	Moderate adverse	Restriction of operating hours	-	-	-	-	-	-	*	Negligible
Phase 2: Mobilisation of the drill rig and drilling operations											
Noise nuisance at local noise-sensitive properties	Temporary	Moderate adverse	Restriction of operating hours **for some equipment**	-	-	-	-	-	-	*	Negligible
Phase 3: Testing and evaluation (gas)											
Noise nuisance at local noise-sensitive properties	Temporary	Negligible	None	-	-	-	-	-	-	*	Negligible
Phase 4a: Restoration											
Noise nuisance at local noise-sensitive properties	Temporary	Minor adverse	Restriction of operating hours	-	-	-	-	-	-	*	Negligible
Phase 4b: Retention											
Noise nuisance at local noise-sensitive properties	Temporary	Negligible	None	-	-	-	-	-	-	*	Negligible

*** Geographical Level of Importance**

I = International; UK = United Kingdom; E = England; R = Regional; C = County; D = District; L = Local

References (Ref)

9.1 National Planning Policy Framework, 2012

~~9.2 Technical Guidance to the NPPF, 2012~~

9.2a **Noise Policy Statement for England, 2012**

9.2b **Planning Practice Guidance 6 March 2014 http://planningguidance.planningportal.gov.uk/blog/guidance/noise/noise-guidance/**

9.3 The West Sussex Minerals Local Plan, 2003

9.4 Chichester District Council Local Plan, 1999

9.5 BS.5228 part 1: 2009

9.6 ISO 9613-2:1996

9.7 Report of the Noise Review Working Party, Department of the Environment, October 1990

9.8 Environmental Protection Act, 1990

9.9 Control of Pollution Act, 1974

FIGURE 9.5

PREDICTED NOISE CONTOURS FOR CONSTRUCTION PHASE

Figure 9.5: Predicted noise contours for construction phase

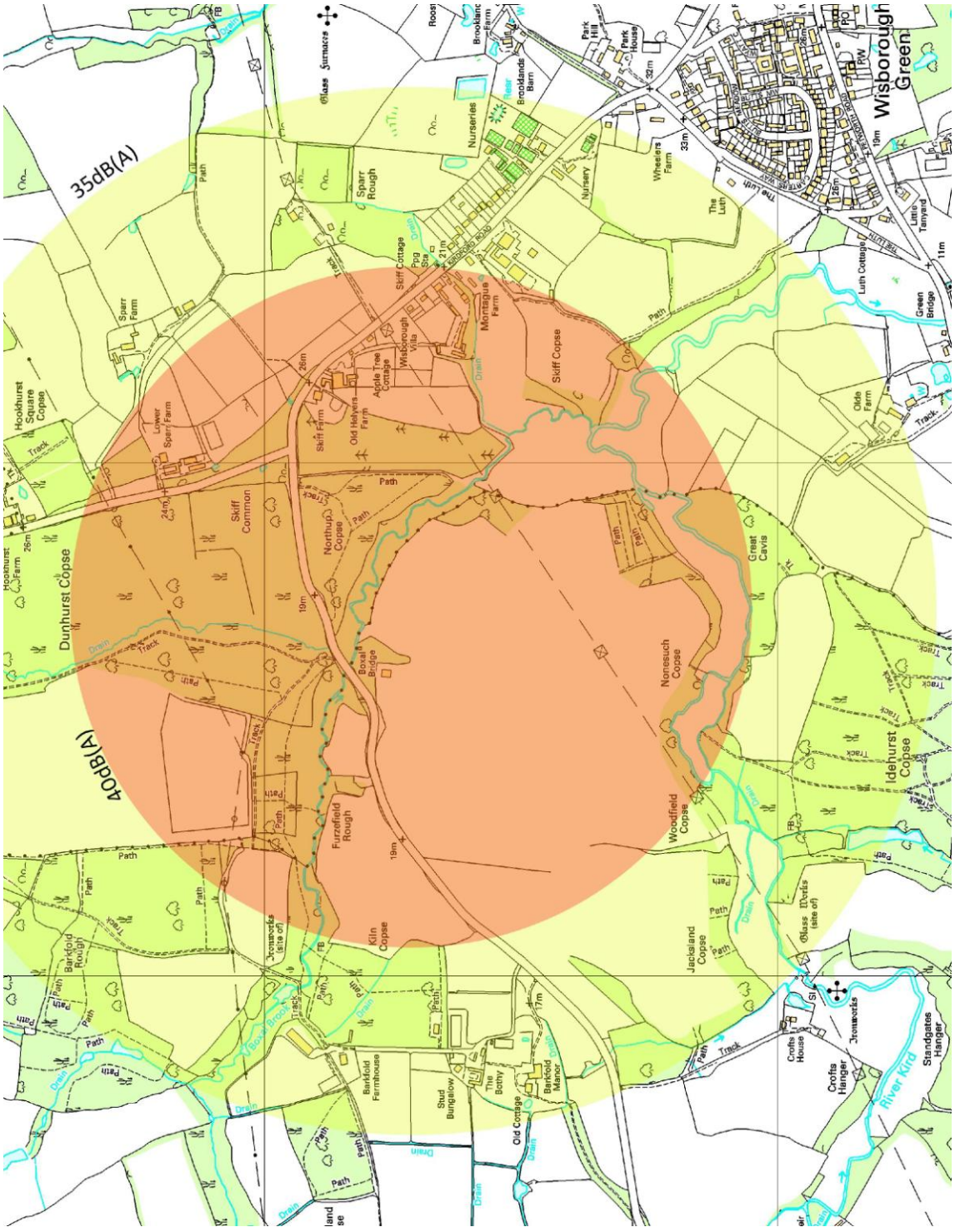
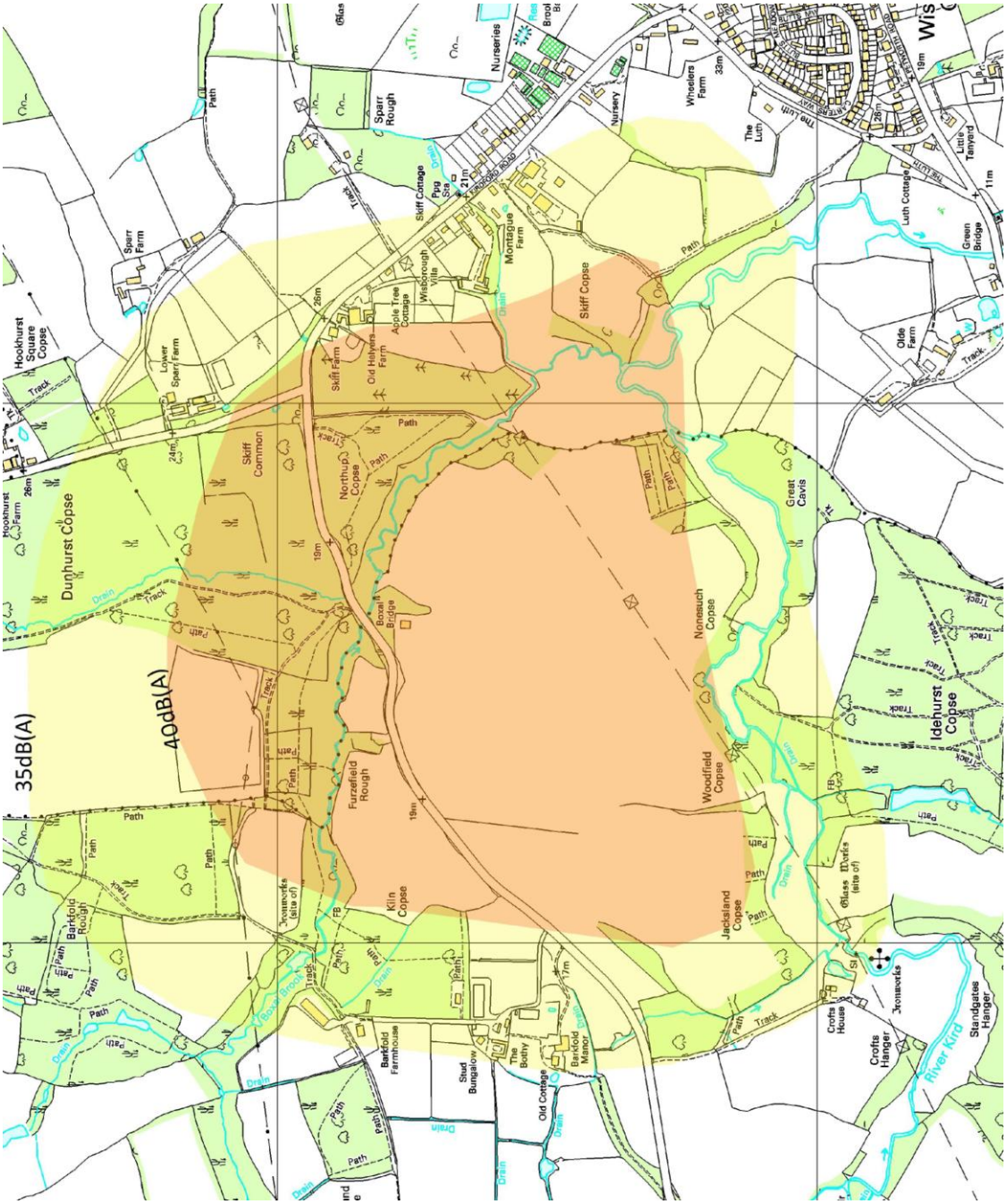


FIGURE 9.6

PREDICTED NOISE CONTOURS FOR DRILLING PHASE

Figure 9.6: Predicted noise contours for drilling phase



APPENDIX 9.1

SIMPLIFIED NOISE AND VIBRATION ASSESSMENT

APPENDIX 9.1: SIMPLIFIED NOISE AND VIBRATION ASSESSMENT

A9.1. This Appendix to Chapter 9 of the ES presents a simplified noise and vibration assessment to the requirements of the DCLG Planning Practice Guidance on minerals, published on 6 March 2014. This says that a noise assessment should identify all sources of noise and, for each source, take account of the noise emission, its characteristics, the proposed operating locations, procedures, schedules and duration of work for the life of the operation, and its likely impact on the surrounding neighbourhood.

A9.2. The PPG states that proposals for the control or mitigation of noise emissions from minerals sites should consider several factors, including:

- the main characteristics of the production process and its environs including the location of noise-sensitive properties;
- assessing the existing noise climate around the site including background noise levels at nearby noise-sensitive properties;
- estimating the likely future noise from the development, and its impact;
- proposals to minimise, mitigate or remove noise emissions at source;
- monitoring noise emissions to ensure compliance with appropriate environmental standards.

A9.3. No production process is covered by the planning application, which is for permission to construct an exploratory well site, drill the well and (if appropriate) conduct tests. Full-scale hydrocarbons production would be the subject of a separate future planning application. Construction of the well site and access would involve the use of conventional earthmoving machinery during the daytime only. Rig mobilisation would take 3-4 days only, and would be followed by drilling, a 24 hours a day, 7 days a week operation involving the use of a rotary drilling rig, and ancillary equipment including electrical power generators, pumps and solids control equipment to process the drilling fluids.

A9.4. The most noise-sensitive properties are assumed to be those nearest the well site, of which seven were identified. Their distances from the proposed well are between 471 and 895 metres.

A9.5. The types of drilling rig likely to be used are equipped with a wide range of noise control measures, including acoustic enclosures for noisy machinery, high-performance diesel exhaust silencers, and attenuated air inlet and outlet openings for ventilation. Noise predictions were made using data for the noisiest type of rig of appropriate capacity currently commercially available, although the identity of the rig cannot be confirmed at this stage. Further noise control measures may be available depending on the rig identity.

A9.6. The background noise climate in the area of the Proposed Development was studied in field surveys conducted in February 2013. The noise levels at three representative locations were measured at night and during the normal working day. Night-time noise levels fell to 20dB $L_{A90,5min}$ and the corresponding daytime values were a minimum of 35dB.

A9.7. Within the context of the PPG, the need for estimates of future noise from a site relate to changing circumstances in a quarry or opencast mine, where the locations of the noise sources may change over time. This is not appropriate to an exploratory well site, since commercial production would be the subject of a separate planning application and assessment. The equipment necessary for the production of hydrocarbons cannot be specified at this stage since it would depend on the nature of any discovery.

A9.8. Proposals for noise monitoring will be produced for discussion and agreement with the Environmental Protection team at West Sussex County Council. These may include provision for noise monitoring at the site boundary for comparison with any noise limits included as planning conditions.

A9.9. Table A9.1 shows the assumed minimum daytime background noise levels at each location, and the resulting maximum construction and drilling noise levels, including the pre-existing background, in terms of $L_{Aeq,1h}$ dB. Table A9.2 shows the assumed minimum night-time background noise levels at each location, and the resulting maximum noise from the drilling rig, all in terms of $L_{Aeq,5min}$ dB. The column headed 'with construction' also applies to worst-case restoration activities. Background noise levels will be unaffected by testing and the overall L_{Aeq} values will be unchanged.

Table A9.1: Background noise and predicted daytime noise levels

location	background L_{Aeq}	with construction	with drilling
Skiff Farm	41	44	43
Apple Tree Cottage	41	44	42
Wisborough Villa	41	43	42
Barkfold Manor	40	41	41
Stud Bungalow	40	41	41
Barkfold Farmhouse	40	41	41
Lower Sparr Farm	40	43	41

Table A9.2: Background noise and predicted night-time noise levels

location	background L_{Aeq}	with drilling
Skiff Farm	23	38
Apple Tree Cottage	23	36
Wisborough Villa	23	35
Barkfold Manor	28	35
Stud Bungalow	28	36
Barkfold Farmhouse	28	36
Lower Sparr Farm	24	33

APPENDIX 9.2

LETTER TO APPLICANT CONCERNING EFFECTS OF NOISE AND VIBRATION

acia

Our reference: 2614.04

28 February 2014

Celtique Energy Holdings Ltd
4th floor, Newlands House
40 Berners Street
London
W1T 3NA

Attention of: Ms Jenny Massingham

Dear Sirs

Effects on cattle of noise from drilling rigs

Further to our initial comments made in advance of the Public Meeting last month I have reviewed the available information on this topic, and have pleasure in providing my findings and comments in order to provide more information to residents neighbouring the proposed Wisborough Green-1 well site.

Research

A number of research papers and learned articles have been published relating to noise and its effects on animals, notably cattle and horses. The general consensus appears to be that although loud noises can cause stress, cattle rely mainly on their eyesight to judge perceived threats, and relatively low level noise does not precipitate fear, but there is very little published research from UK sources.

The California High Speed Rail Authority undertook within the last ten years a study of the effects of train noise on dairy production, and found that there were no documented cases of disruption to cattle as a result of high speed train passes. The noise levels from such events typically reach 90dB(A) at a distance of 100 metres. The document also cites research on the noise from military aircraft overflights. It reports that general noise at a level of 105dB(A), but not at 80dB(A), can reduce milk yield. Unexpected high intensity noise such as low altitude jet aircraft overflights with a noise level exceeding 110dB(A) could provoke adverse behaviour such as kicking or stamping at milking time. Results from other studies, however, suggest that any response of dairy cows to jet noise around milking is subtle.

Other studies relate to the effects of noise in milking parlours, where the typical levels are between 75 and 85 dB(A). It was found that dairy cattle would tend to avoid noise if a quieter alternative was available, and that certain indicators such as heart rate and

restlessness, and thus transit times, increases in noisier surroundings. The effects on milk production were not reported.

I have seen part of an environmental statement for a proposed mining development in Australia, dated 2009. This was primarily directed towards the effects of the development on the local community, but an assessment was included of the effects of noise on farm animals concentrating on aircraft noise, and based (as are several such assessments) on one particular US research programme. This reported that there was no evidence that flyovers or closeness to the end of an active runway had any effect on the milk production of the herds. The research chose a number of animal 'installations' for observations on animal behaviour when sonic booms occurred. About 10,000 beef cattle, 100 horses, 150 sheep and 320 dairy cattle were observed. The results showed that the reactions of the sheep and horses to sonic booms were slight. Dairy cattle were little affected by sonic booms at 125 to 136 dB(A) and only 19 of 104 booms produced even a mild reaction such as a temporary cessation of eating, rising of heads, or slight startle effects in a few of the cattle being milked. Milk production in terms of individual and total milk yield was not affected during the test period.

Comparison with predicted noise levels

At the proposed Wisborough Green-1 well site, the noise levels from the drilling rig are calculated to be in the range 50 to 60 dB(A) at the nearest approaches of pasture to the site. These levels of noise are considerably below the lowest values at which any reaction has been observed in cattle. Indeed, most of the well site compound itself will be subject to noise below this threshold level, and 80dB(A) will only be exceeded at localised points close to noise-emitting equipment.

ACIA's experience

As a professional engineer I have provided acoustical consultancy services to the oil and gas exploration industry, among others, for some 35 years. In that time I have conducted noise measurements on and around many onshore drilling sites, in Hampshire, Dorset, Lincolnshire, South Yorkshire, Staffordshire, North Yorkshire, Lancashire, and in the Netherlands. For the majority of these sites, the drilling failed to discover hydrocarbons. This means that in accordance with the planning conditions in each individual case, the land has been returned to agricultural use and there is no longer any evidence of any such exploration. Where oil or gas was discovered in commercial quantities there may now be extraction and processing facilities on site (*eg* the North Yorkshire gas field).

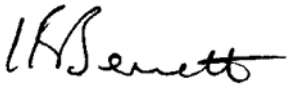
Nevertheless, I remember some sites located on farmland normally used for grazing cattle (whether this was for meat or dairy production I cannot say) and indeed, I have conducted noise measurements in fields occupied by cattle whilst drilling was in progress. I have never witnessed any anxiety or unusually nervous behaviour in the herds. As many in the farming community will be aware, cattle tend to be inquisitive, and I have on occasion had to 'shoo' them away in order to complete my measurements. I cannot say to what

extent the drilling and related operations may have affected milk yields, but on the basis that I am unaware of any such complaints I do not believe it occurred.

It is commonly observed that cattle graze contentedly quite close to significant sources of man-made or machinery noise, such as in fields next to the major road network, at the bases of wind turbines, and neighbouring industrial plants. It is my belief, supported by much published research therefore, that steady noise at a reasonable level does not cause any adverse reaction in cattle, and that cows quickly become acclimatised to background noise at any reasonable level. The noise levels predicted from the proposed Wisborough Green well site are not high. They are certainly lower than those encountered next to a motorway, and much lower than the levels from aircraft overflights.

I trust this information is helpful but please let me know if I can be of further help.

Yours faithfully



Ian F Bennett
Partner