

**CUADRILLA RESOURCES  
LIMITED**



**APPENDIX - D**

**BACKGROUND NOISE SURVEY AND  
NOISE PREDICTIONS**

**Cuadrilla Resources Limited  
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Lower Stumble Hydrocarbon Exploration Site  
Planning Application [January 2010].  
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**Noise Impact Assessment  
Lower Stumble Exploration Site  
Balcombe, West Sussex**

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SECTION	TITLE	PAGE
0.	SUMMARY .....	1
1.	INTRODUCTION .....	2
2.	AMBIENT NOISE SURVEY .....	2
2.1	GENERAL .....	2
2.2	NOISE SURVEY DETAILS .....	3
2.3	NOISE SURVEY PROCEDURE AND INSTRUMENTATION .....	3
2.4	NOISE SURVEY RESULTS .....	4
3.	CONSTRUCTION NOISE .....	5
3.1	NOISE FROM CONSTRUCTION WORKS .....	5
3.2	ASSESSMENT OF CONSTRUCTION NOISE LEVELS .....	6
4.	ENVIRONMENTAL NOISE FROM EXPLORATION WELL SITE .....	7
4.1	NOISE FROM DRILLING OPERATIONS .....	7
4.2	PROJECTED NOISE AT COMMUNITY LOCATIONS .....	7
5.	ASSESSMENT OF NOISE FROM EXPLORATION WELL SITE .....	8
5.1	ASSESSMENT CRITERION .....	8
5.2	NOISE ASSESSMENT .....	9
6.	CONCLUSIONS .....	10

Appendix A: Figure 1 showing location of exploration well site and noise monitoring positions

Appendix B Noise contour map (Figure 2)



## 0. SUMMARY

A noise assessment has been completed to establish the noise impact of the proposed Lower Stumble exploration well site, situated near Balcombe, in West Sussex. The sensitive reference positions for the assessment have been chosen as the nearest residential locations to the proposed site.

Measurement of the existing background noise levels has been made at the reference community locations. During the most sensitive early night time period (23:00-02:00) background noise levels are largely controlled by distant road traffic and occasional local traffic. Night time background noise levels have been established as being at a very low level of LA90 26dB(A).

Predictions of daytime noise from construction works associated with preparing the proposed exploration well site have been made, using sound power level data provided in BS 5228 Part 1, for the equipment proposed. The predictions indicate that construction activities will typically produce an LAeq(1hour) contribution of 47dB(A) at the nearest residential location. Construction noise will therefore be well within a typical range of acceptability for these works (LAeq 60-65dB(A)) and also be below the existing daytime ambient LAeq noise levels in the nearby community. Consequently adverse impact from the temporary construction works will be minor.

Environmental noise levels have been predicted for drilling operations by use of computer noise modelling and based on the sound power level for the type of drilling rig being considered for use on the exploration well site. The predicted specific noise level from drilling operations, at the nearest residential locations to the exploration site, is between LAeq 28 - 35dB(A).

An assessment of noise levels predicted for the drilling operations has been completed by comparing noise emission levels with measured background noise levels and also an absolute noise level of LAeq(1 hour) 42dB(A), defined as the night time limit in Minerals Policy Statement – 2: Noise (MPS-2). These assessment figures are shown in the following table.

Residential Location (Ref. Figure 1)	Predicted LAeq level from drilling rig dB(A)	Mean night (2300- 0200) background noise LA90 dB(A)	Assessment Level (Background excess) Column 2 - Column 3	Comparison with LAeq 42dB(A) free- field criterion
1. Kemps Farm	35	26	+9	-7
2. Unitroy Cottages	28	26	+2	-14
3. Bowders Farm	32	26	+6	-10

**Table 0:** Predicted specific LAeq noise level from drilling operations, at residential positions, compared with measured early night time background LA90(2300-0230) and MPS-2 night time criteria

An assessment level of +9dB at the nearest residential location to the exploration site meets the MPS-2 indicated first aim of achieving a noise limit based on background level +10dB(A) at the nearest residential properties to the site.

In further consideration of the fact that that projected noise levels from drilling operations are within the MPS-2 recommended outside night time noise limit of LAeq(1 hour) 42dB(A) (free-field), at all residential locations, the assessment has indicated that there is likely to be only a minor adverse impact upon the residential community from the aspect of noise, particularly as the exploration well site is a temporary, rather than permanent, installation.



## 1. INTRODUCTION

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Cuadrilla Resources Limited has commissioned Spectrum Acoustic Consultants to undertake an environmental noise impact assessment in support of the planning application for the proposed Lower Stumble Exploration site, to be situated near Balcombe, in West Sussex.

To establish the current neighbourhood background noise levels the report presents the results of an ambient noise survey completed over representative daytime and night time periods at the closest community positions to the proposed exploration site.

Using measured noise data from the types of drilling rig being considered for use on the exploration well site the report provides an assessment of the potential impact of this development, by comparing the predicted noise levels from drilling operations with background noise levels measured at the nearest residential locations to the site and also absolute noise limits taken from guidance provided in Minerals Planning Statement - 2: Noise.

Daytime noise levels during construction works associated with the preparation of the exploration site have been predicted using equipment noise data provided in BS5228-1:2009 'Noise and Vibration Control on Construction and Open Sites'. Part 1: Noise.

The information provided in this report is intended to supplement the planning application for the proposed exploration site development, to be submitted to the Local Planning Authority

## 2. AMBIENT NOISE SURVEY

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### 2.1 GENERAL

To assess the environmental noise impact of a proposed industrial related development it is generally accepted that predicted noise levels from the development need to be compared with existing background noise levels, or defined absolute noise limits, at the nearest sensitive residential locations to the site.

Unless the background noise environment is very low i.e. below LA90 30dB(A), the difference between the specific development noise level and the background level generally correlates with likelihood of complaint and associated adverse impact. There are also recommended absolute noise limits that may be used to assess impact, particularly in the circumstances where the background environment is at a low level.

Further detail on the recognised Standards and planning guidelines, which have been applied to the assessment of noise from this exploration site development, is provided in Section 5.1 of the report.



## 2.2 NOISE SURVEY DETAILS

A description of the nearest residential receptor positions chosen for the noise impact assessment is provided in the following list.

<p><b>Position 1:</b> Kemps Farm, London Road</p>	<p>This position is at Kemps Farm; a farmhouse located off London Road, south of Balcombe and situated 400m north of the proposed exploration well site. This position is representative of the nearest residential property to the exploration site.</p>
<p><b>Position 2:</b> Unitroy Cottages, Haywards Heath Road</p>	<p>This position is at Unitroy Cottages situated alongside the Haywards Heath Road 750m northeast of the proposed exploration site. This position is representative of the nearest residential properties situated along Haywards Heath Road, which runs in a north-south direction, 700m east of the proposed exploration site.</p>
<p><b>Position 3:</b> Bowders Farm, Haywards Heath Road</p>	<p>This position is at Bowders Farm, situated west of Haywards Heath Road and 650m east of the proposed exploration site. This position is representative of the nearest individual residential property to the east of the exploration site.</p>

The residential locations situated along Haywards Heath Road, to the east of the exploration site, are all in a similar position, in terms of distance to the site and position along Haywards Heath Road. Consequently the background noise measurements taken on the track opposite position 2 (Unitroy Cottages) will be valid for all these additional residential positions.

The planned position of the exploration site is on a former well site situated in an area of copse (Lower Stumble Wood), between London Road and the railway line. The land height to the north of the exploration site rises from 55m to 80m at Kemps Farm (position 1), rising more steeply to the east from 55m to 110m at Haywards Heath Road (positions 2 and 3).

There is therefore screening benefit afforded to the sensitive north and east directions by both the land topography and the presence of earth-bundings around the perimeter of the exploration site.

A plan showing the exploration well site and the residential receptor positions is illustrated in Figure 1, included in Appendix A of the report.

## 2.3 NOISE SURVEY PROCEDURE AND INSTRUMENTATION

Instrumentation used to measure noise levels included the following items. All equipment is calibrated annually, using equipment referenced to the British Calibration Service and the National Physical Laboratory:-

- Bruel & Kjaer Type 2260 Sound Level Meter s/n 1772232
- Bruel & Kjaer Type 4189 Microphone s/n 2469838
- Bruel & Kjaer Type 4231 Acoustic Calibrator s/n 1234621

With the drilling rig at the proposed exploration site having a 24-hour operation, background noise measurements were recorded at each receptor position between the most sensitive early night time hours 2300-0200. Samples of daytime ambient noise levels were also recorded for the purpose of assessing impact from daytime construction works.



Noise measurements were recorded during the period 23 to 24 September 2009. Weather conditions were dry, with light wind, presenting acceptable conditions for noise monitoring purposes.

Noise samples of 15 minutes duration were recorded to provide information on prevailing ambient noise levels. All measurements were recorded in accordance with procedures outlined in BS4142: 1997 "Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas". Noise samples were recorded, in terms of the following parameters:

- LAeq, the equivalent continuous noise level
- LA90 percentile level

Briefly, LAeq the equivalent continuous noise level is used as the measure of total ambient noise or noise from a specific source. LA90 is defined in BS4142, as the measure of background noise, when it is applied to the residual noise level (the noise in the absence of the specific noise being assessed).

## 2.4 NOISE SURVEY RESULTS

The results of the ambient noise measurements recorded at two of the defined community receptor positions applicable to the Lower Stumble exploration site are detailed in table 1 below. Position 3 was not accessible for the noise survey however the background noise data taken at position 2 may be taken as being applicable to position 3, due to the similar proximity to the east of the site.

The LA90(2300-0200) night time level shows the mean of the LA90(15 min) levels taken over the most sensitive early night time period 23:00 – 02:00, which will be used in the assessment of specific drilling operation noise against background level.

Measurement Position	Date	Sample Time		Mean of Measured Noise Samples (15 min)			
		Start	Finish	Daytime(07-23)		Night time (2300-0200)	
				LAeq	LA90	LAeq	LA90
1. Kemps Farm London Road	23 Sept	10:30	10:45	54.7	36.2		
	23 Sept	12:00	12:15	53.4	36.8		
	23 Sept	13:30	13:45	54.6	36.8		
	23 Sept	15:00	15:15	56.3	45.2		
	23 Sept	23:00	23:15			54.4	26.6
	24 Sept	00:30	00:45			51.7	25
			<b>Mean</b>		<b>54.8</b>	<b>38.8</b>	<b>53.1</b>
2. Unitroy Cottages Haywards Heath Rd	23 Sept	11:15	11:30	65.1	43.2		
	23 Sept	12:45	13:00	66.4	44.8		
	23 Sept	14:15	14:30	65.1	40.8		
	23 Sept	15:45	16:00	65.8	46.6		
	23 Sept	16:00	16:15	65	41.4		
	23 Sept	23:45	00:00			57.2	25.4
	24 Sept	01:15	01:30			54.4	26.6
		<b>Mean</b>		<b>65.5</b>	<b>43.4</b>	<b>55.8</b>	<b>26.0</b>

**Table 1:** Summary of measured ambient noise measurements at positions 1 and 2



As indicated by the results, mean early night time (23:00-02:00) background LA90 noise levels at the nearest community locations to the proposed exploration site are at a very low level of 26dB(A)

Noise levels during the early night time hours were generally produced by occasional traffic on local roads, together with distant road traffic. The low background noise reflects the absence of any significant steady noise sources in this rural area.

Daytime noise levels in this area are largely produced by distant and more frequent local road traffic, together with occasional rail noise. Daytime ambient LAeq noise levels at position 2 are significantly higher than at position 1, due to the close proximity to Haywards Heath Road, which is quite busy during the daytime, with a steady traffic flow.

### 3. CONSTRUCTION NOISE

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#### 3.1 NOISE FROM CONSTRUCTION WORKS

Preliminary construction works are required for ground levelling, preparation of the site foundation and drainage. Any excavated earth may be utilised for the preparation of a temporary earth-bund along selected sections of the site perimeter.

The preparation works would commonly involve use of excavators, bulldozers and gravel compacting rollers. In order to provide a preliminary assessment of construction noise impact, noise level predictions have been made, based on the typical noise levels produced by the operation of this type of construction plant.

Predictions have been made in accordance with guidelines and procedures contained in BS5228-1:2009 'Noise and Vibration Control on Construction and Open Sites. Part 1: Noise'. The procedure involves identifying the main items of plant and equipment and then assigning a sound power level, based on equipment noise data included in an appendix of the Standard. Where a number of sound power levels are given for similar plant, or activities, an average of the data is used.

Predictions of community noise levels are made by applying corrections to the sound power of each equipment source, to account for the following operational and environmental factors: -

- Typical periods of operation of plant
- Separating distances from source to receiver
- Presence of natural land topography screening or artificial barriers.

Overall LAeq(1 hour) and LAeq(16 hour) dB(A) noise levels have been predicted at the closest residential location to the exploration site at Kemps Farm (Position 1), 400m to the north of this site. The results are summarised in table 2 below.





Plant Type	Sound Power Lw	Adjustments dB(A)		Result Lp dB(A)	On time %	Activity LAeq(1hr)	Operating Period (hrs)	LAeq 16 hr
		Dist.	Screening					
Excavator	112	-60	-5	47	30	42	10	40
Bulldozer	114	-60	-5	49	30	44	10	42
Rollers	108	-60	-5	43	30	38	10	36
Total Plant						47		45

**Table 2:** Predicted noise levels from construction works at position 1, Kemps Farm.

The predictions indicate that the noisiest construction activities will typically produce an LAeq(1 hour) contribution of 47dB(A) at the most sensitive community locations, resulting in an overall daytime level of LAeq(16 hour) 45dB(A).

### 3.2 ASSESSMENT OF CONSTRUCTION NOISE LEVELS

Construction site 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 the construction works are a transient operation. Whilst local considerations and circumstances need to be taken into account a typical range of acceptability for daytime construction noise is LAeq(1 hour) 60-65dB(A).

The predictions have demonstrated that during the typical construction operations at the exploration site, noise levels of LAeq(1 hour) 47dB(A) will be produced at the nearest residential location. Whilst some noise from the construction work on the exploration site is inevitable this noise level will be well below the current daytime ambient noise level, measured as LAeq 55dB(A) at position 1 (Kemps Farm).

Construction noise levels are also expected to be well within a reasonable acceptability range for these works (60-65dB(A)) and consequently will provide a temporary minor adverse affect with respect to noise impact, at the nearest residential positions to the exploration well site.

For the majority of construction works, which, as in this case, have no particular sensitivity from a long-term contract period, night time works, or very close proximity to houses, Local Authorities commonly set no specific noise limits, but rely on the contractor to ensure that works are completed in accordance with the 'best practice' guidelines outlined in the various parts of BS5228. A typical general requirement set by the Local Authority would be as follows:

*To ensure that noise levels produced by the noisiest activities, are adequately controlled, such works will be completed in accordance with the guidelines provided in BS5228-1:2009 'Noise and Vibration Control on Construction and Open Sites, with particular reference to Part 1: Codes of Practice for basic information and Procedures for Noise Control.*



## 4. ENVIRONMENTAL NOISE FROM EXPLORATION WELL SITE

### 4.1 NOISE FROM DRILLING OPERATIONS

At this stage the specific type of drilling rig to be used at the exploration site has not been finalised. This is common procedure, as choice of drilling rig is largely dependent on which rigs are available at the time and until all consents are granted such decisions cannot be made.

However, an accurate prediction of noise from the exploration site can be made, based on measured noise levels from the typical range of drilling rigs that operate in the UK. Spectrum has completed sound power tests on several different types of operating rigs, for a range of contractors. Example noise data from four drilling rigs are included in Table 3.

Drilling Rig	Sound Power level Lw	Octave Band Sound Power Levels (dB)								
		31	63	125	250	500	1k	2k	4k	8k
Rig A	106	116	114	108	103	102	102	98	93	86
Rig B	104	114	112	109	104	100	99	96	92	84
Rig C	106	118	116	110	104	101	100	100	96	90
Rig D	103	115	117	110	103	102	96	92	86	79
<b>Average</b>	<b>105</b>	<b>116</b>	<b>115</b>	<b>109</b>	<b>104</b>	<b>101</b>	<b>99</b>	<b>97</b>	<b>92</b>	<b>85</b>

**Table 3:** Drilling rig sound power level data

As shown in the table, drilling rig noise levels are commonly in the sound power level range Lw 103-106dB(A).

### 4.2 PROJECTED NOISE AT COMMUNITY LOCATIONS

To accurately evaluate the overall effect of the proposed exploration well site development, at the nearby community locations, it is necessary to consider the additional noise that is likely to be generated by the drilling operations, at these residential locations.

The overall drilling rig mean sound power level of 105dB(A), is used as the starting point for the purpose of predicting noise levels in the surrounding environment and at specified community receptor locations around the site, using an environmental noise propagation model.

For the purpose of this study a proprietary noise model, the Bruel and Kjaer, 'Predictor', has been used. This model is based upon noise propagation corrections (including distance attenuation, ground effects and atmospheric absorption), as advised in ISO 9613, to determine numeric results. This model calculates levels around a site simultaneously and allows the reporting of the results visually through the construction of noise contours.

The noise map, showing noise contours produced by the drilling operations is provided in Figure 2, included in Appendix B of the report. Specific receptor co-ordinates can be specified in the noise propagation model, to get results at example locations. Predicted levels at the specific receptor locations are provided in table 4 below.



Measurement Position	dB(A)	Octave Band Sound Pressure Levels (dB(A))								
		31	63	125	250	500	1k	2k	4k	8k
1. Kemps Farm	<b>35.3</b>	11	23	25	22	29	30	29	19	-
2. Unitroy Cottages	<b>27.5</b>	8	19	16	15	22	22	18	-	-
3. Bowders Farm	<b>32.2</b>	15	27	18	16	23	28	25	8	-

**Table 4:** Predicted specific noise level from drilling rig operation at community locations 1 to 3

As indicated in the table, projected noise levels at the nearest community locations to the exploration site are between LAeq 27-35dB(A).

It should also be noted that drilling rigs exhibit a degree of source directivity (slightly noisier on one side than others), however, this does vary with rig type, equipment layout and position of any perimeter earth bund. As the layout of the exploration site is not known at this stage, non-directional hemispherical noise propagation has been assumed, for prediction purposes.

## 5. ASSESSMENT OF NOISE FROM EXPLORATION WELL SITE

### 5.1 ASSESSMENT CRITERION

The impact of noise from industrial related developments, or operations, on the surrounding residential community, is dependent upon several factors and there are a number of references and Standards available, which discuss in detail what these factors are, together with their relative importance.

Relevant guidelines for assessing environmental noise associated with minerals extraction operations are included in Minerals Policy Statement 2 (MPS-2): Controlling and Mitigating the Environmental Effects of Minerals Extraction in England. Annex 2: Noise – March 2005, issued by ODPM.

This guidance document states that 'where appropriate' planning conditions should be used to ensure that minerals operations are carried out in such a way that noise emissions are minimised and controlled to acceptable levels. Accordingly, planning conditions may be used to apply controls on noise emissions by setting noise limits, preferably at the nearest noise sensitive properties.

MPS-2 suggests that Mineral Planning Authorities (MPA's) should aim to set noise limits in accordance with the following criteria:

First aim: Background noise level (LA90) + 10dB(A), for all periods

*However, in the cases where this noise limit restriction imposes an unreasonable burden on operations, the following limits to be applied:*

Daytime 0700-1900

Increase over background LA90 to be as near to + 10dB(A) as is practicable, subject to an upper limit of 55dB(A) LAeq(1 hour) free-field



Evening 1900-2200  
Background LA90 + 10dB(A).

Night time 2200-0700  
42dB(A) LAeq(1 hour) free-field.

The 'unreasonable burden' situation would generally occur in situations where background levels are very low (below about 45dB(A) daytime and 32dB(A) night time), when raising such low background levels, even by as much as 10dB(A), would still only result in modest absolute levels.

For this exploration site application, continuous drilling operations are required so the assessment will be provided for the worst-case night time period. Accordingly, noise levels will be assessed against noise limits based on background LA90 + 10dB(A) and 42dB(A) LAeq(1 hour) free-field.

## 5.2 NOISE ASSESSMENT

Table 5 shows a comparison of the predicted noise level from the drilling rig operations, against measured LA90 background levels at night and the LAeq(1 hour) 42dB(A) absolute night time criteria, at the three residential locations covered by the assessment.

For the purpose of assessing operational noise emission against background noise level, the mean LA90 taken over the most sensitive early night time period (2300-0230) has been used.

Residential Location (Ref. Figure 1)	Predicted LAeq level from drilling rig dB(A)	Mean night (2300- 0200) background noise LA90 dB(A)	Assessment Level (Background excess) Column 2 - Column 3	Comparison with LAeq 42dB(A) free- field criterion
1. Kemps Farm	35	26	+9	-7
2. Unitroy Cottages	28	26	+2	-14
3. Bowders Farm	32	26	+6	-10

**Table 5:** Predicted specific LAeq noise level from drilling operations, at residential positions, compared with early night time background LA90(2300-0230) and LAeq 42dB(A) night time criterion.

There are not expected to be significant tonal, or impulsive, characteristics to the predicted noise from the drilling operations. The rating level ( $L_{Ar,Tr}$  as defined in BS4142) will therefore numerically be the same as the predicted specific LAeq noise level contribution from the drilling rig.

The study predicts that at the nearest sensitive residential property to the Lower Stumble exploration site, drilling rig noise emission will provide a background noise excess of up to +9dB(A). This assessment level meets the MPS-2 stated first aim of achieving a noise limit based on background noise level (LA90) + 10dB(A), for all periods.

Using the MPS-2 additional guidance criterion of achieving a noise limit based on a free-field external night time noise level of LAeq(1hour) 42dB(A), the projected noise level from drilling operations is well within this limit at all locations.



In further consideration of the fact that the exploration site would be a temporary, rather than a permanent, installation (i.e. more akin to a temporary construction site) the noise assessment has indicated that there is likely to be only a minor adverse impact upon the nearby residential community from the aspect of noise.

## 6. CONCLUSIONS

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The potential impact of noise from drilling operations at the proposed Lower Stumble Exploration Site has been assessed and the following conclusions may be drawn from the study.

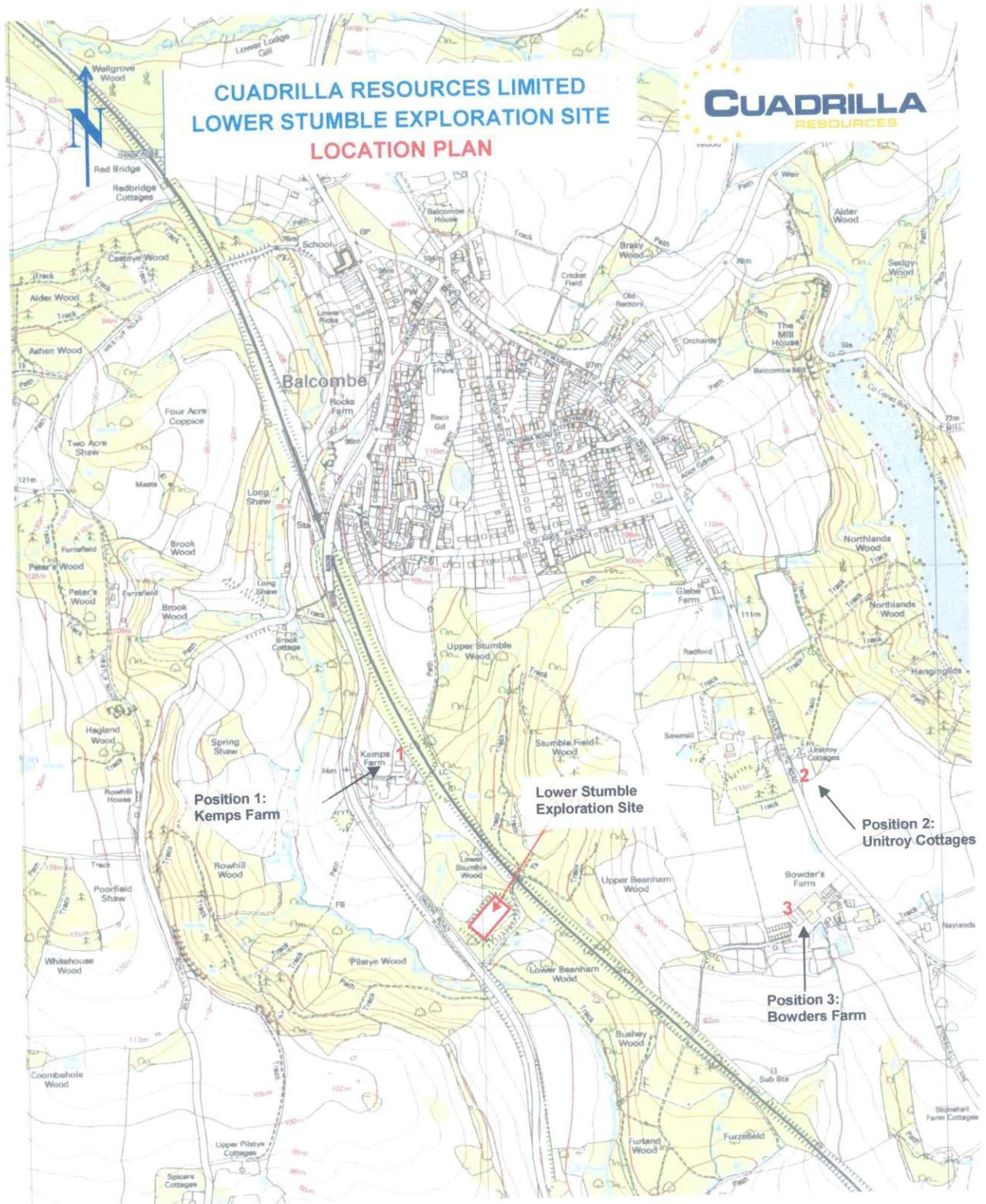
- Existing mean night time background noise levels in the environment around the exploration site have been measured at  $L_{A90}$  26dB(A) and consequently are at a very low level.
- Daytime noise from site preparation construction works has been predicted as  $L_{Aeq}(1 \text{ hour})$  47dB(A), at the nearest individual residential locations to the exploration site. This noise level is well within a typical acceptability range for construction works (60-65dB(A)) and also below existing daytime ambient noise level of 55dB(A) at the nearest residential property (Kemps Farm). Accordingly, the adverse impact of temporary construction works will be low.
- The predicted specific noise level from drilling operations, at the nearest community positions to the exploration site, is between  $L_{Aeq}$  28-35dB(A).
- The study predicts that at the nearest sensitive residential property to the Lower Stumble exploration well site, drilling rig noise emission will provide a background noise excess of +9dB(A). This assessment level therefore meets the MPS-2 stated first aim objective of achieving a noise limit based on background noise level ( $L_{A90}$ ) + 10dB(A), for all periods.
- In further consideration that projected noise levels from drilling operations also easily meet the MPS-2 additional guidance criterion of achieving a night time noise limit of  $L_{Aeq}(1 \text{ hour})$  42dB(A), at all residential locations, the assessment has indicated that there is likely to be only a minor adverse impact upon the residential community from the aspect of noise, particularly as the exploration site is a temporary, rather than permanent, installation.

Report Code: E/DR/EX



## APPENDIX A

Figure 1 showing location of exploration well site and noise monitoring positions



**Figure 1:** Plan showing Lower Stumble Exploration Site and community noise receptor positions 1 to 3.



## APPENDIX B

Noise Contour Map (Figure 2)



