Additional Hearings 24 and 25 January 2019

Matter: Unconventional Oil and Gas

Questions 5 and 6

500m Buffer Zone

> 5. I would like to get a better technical understanding of what the potential impacts of hydraulic fracturing might be on nearby sensitive receptors within this 500m zone. Information should be provided on whether there are reasonable prospects of mitigation measures being used to reduce impacts to an acceptable level within this zone.
>
> 6. The MPAs should build on their *"Supplementary note about the 500m distance for hydrocarbons development"* (LPA/89) with more technical detail. I am particularly interested in noise and why the MPAs believe it is generally unlikely that noise could be mitigated to an acceptable level within this zone without creating other unacceptable impacts.

As set out in the Supplementary note about the 500m for hydrocarbons development (LPA/89) the purpose of the buffer is not to prescribe an absolute measure and the 500m zone stated in Policy M17 and justified in the supporting text (paragraph 5.146) is also not an absolute in the determination of planning applications. The modification proposed [LPA/98] is intended to clarify that this is a guide to maintaining "adequate separation distances" to sensitive receptors recognising that any applications will need to be determined ultimately on a "case by case basis" (paragraph 5.146) and that receptors within 500m are likely to be more vulnerable to adverse effects. Proposals within 500m, which can demonstrate that the appropriate protection to sensitive receptors can be achieved, would be consistent with this policy. The 500m buffer identified in the policy must be viewed in this context.

The Authorities consider that this approach is sound due to a combination of considerations as set out in the Supplementary note LPA/89 including noise and tranquillity, lighting intrusion and visual impact. The approach is consistent with the core planning principle in the Framework (paragraph 17) of both allowing local people to shape their surroundings and providing a practical framework within which planning applications can be determined predictably and efficiently, subject to an appropriate degree of flexibility. It is also consistent with the core principles of recognising the intrinsic character and beauty of the countryside and contributing to the conservation of the natural environment as well as reducing pollution. The Framework also makes it clear that Local Plans should ensure that permitted minerals development does not have an unacceptable impact on the environment (paragraph 143) and policies that provide a clear indication of how a decision maker should react to a development proposal should be included in the Plan (para 154). The approach to the 500m separation

distance is considered to be consistent with this policy, as well as guidance in the PPG which advises that policies relating to hydrocarbon development should set clear guidance and criteria for the assessment of hydrocarbon extraction (ID: 27 – 106 – 20140306).

Further technical details are provided below to build on Supplementary Note LPA/89.

Noise and Tranquillity

Existing Background Noise Levels around North Yorkshire, North York Moors and City of York Council

As previously stated in the Joint Plan Authorities' Supplementary Note LPA/89 noise levels across the area are known to vary and to be very low in places. Previous noise monitoring carried out by the MPAs at a number of sites around the area found background noise levels to be as low as 21dB(A) L_{90} one hour during the daytime period of 07:00 to 23:00, with night time levels 20dB(A) L_{90} one hour between 23:00 and 07:00.

Details of the noise monitoring results may be found in the table below

Table to show measured background noise levels across MPA's Area

Location	Lowest 1 Hour Daytime L_{90} (07:00 to 23:00) (dBA)	Lowest 1 Hour Night Time L_{90} (23:00 to 07:00) (dBA)
Redmire	27	24
Kirbymoorside	21	20
Great Ouseburn	27	24
Easingwold	29	28
Barlby	36	21

Previously a background level of 30 to 32 $dB(A)_{LA90}$, 1 hour was considered to be a reasonable starting point for assessing the impact of noise, but as the above figures show there are a number of locations where existing background levels fall well below this level and there are likely to be places where levels are lower still than 21dBA L_{90}, particularly in more remote locations.

Setting of a suitable standard for noise associated with mineral operations

Mineral Planning Practice Guidance published in October 2014 states that:

"Mineral planning authorities should aim to establish a noise limit, through a planning condition, at the noise-sensitive property that does not exceed the background noise level (LA90,1h) by more than 10dB(A) during normal working

hours (0700-1900). Where it will be difficult not to exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55dB(A) LAeq, 1h (free field).

For operations during the evening (1900-2200) the noise limits should not exceed the background noise level (LA90,1h) by more than 10dB(A) and should not exceed 55dB(A) LAeq, 1h (free field).

For any operations during the period 22.00 – 07.00 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42dB(A) LAeq,1h (free field) at a noise sensitive property.

Where the site noise has a significant tonal element, it may be appropriate to set specific limits to control this aspect. Peak or impulsive noise, which may include some reversing bleepers, may also require separate limits that are independent of background noise (e.g. Lmax in specific octave or third-octave frequency bands and that should not be allowed to occur regularly at night.)

Care should be taken, however, to avoid any of these suggested values being implemented as fixed thresholds as specific circumstances may justify some small variation being allowed". [Reference ID: 27-021-20140306].

In view of this guidance it is considered by the MPAs that the following noise limits are appropriate within the North Yorkshire, City of York Council and North Yorkshire Moors areas.

During the daytime (07:00 to 19:00) the totality of sound levels arising from any hydrocarbon development should not exceed 10dB above the lowest background level during the normal working day or 55dB(A) L_{eq}, whichever is the lowest of these two values. Given the low background sound levels experienced within the MPA's areas, then it is likely that in most cases the limit will be the 10dB above background.

The MPAs consider that the 10dB above background limit identified within the Mineral Planning guidance is a maximum threshold above which noise levels should not occur during daytime working, since levels 10dB above or greater would be likely to result in significant adverse impacts.

When combined with measured background levels across the MPA's areas working limits are likely to be as low as 31dB(A) Leq 1 hour ,or lower still in more remote locations. This level being 10dB above the lowest measured background level of 21dB(21dB (A) LA90 1 hour.

In practice adverse impacts are likely to occur at levels of 5dB above background noise levels, as demonstrated by BS4142:2014 (Methods for rating and assessing industrial and commercial sound), (Appendix 1) where a rating level of +5dB or more is likely to be an indication of adverse impact, depending on the context.

In addition the impact of the noise source may also be exacerbated by other factors such as the characteristics of the sound source itself, such as tonality, impulsivity and intermittency. All of these sound characteristics, if present, would be likely to increase the perceived noise impact of any noise heard and thus increase the significance of impact. Such factors are not considered within the mineral planning guidance.

Using procedures detailed within BS4142:2014 (Appendix 1) such sound characteristics can increase the perceived impact by up to 18dB, or by up to 6dB per sound characteristic type. Thus the actual impact could be considered to be greater still

The MPAs, therefore, consider that for the purposes of determining policy it is necessary to take a conservative approach in order to protect the amenity of residents and so a daytime limit of 31dB(A) Leq is considered to be reasonable.

During the night time period the Mineral Planning Guidance recommends that the noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42dB (A) not exceed 42dB(A) LAeq 1 hour free field. However this is the absolute night time limit.

Given the very low background noise levels experienced across the MPA's area, a lower level is proposed, to reduce to a minimum any adverse impacts. It is therefore proposed that during the night time a level similar to that proposed during the daytime hours and based on the measured background night time level plus 10dB is used or 42dB(A) LAeq 1 hour, which-ever is the lowest.

Given that the lowest measured background level was found to be 20dB(A) LA90 1 hour, then it is considered reasonable for the purposes of determining policy to set a night time limit of 30dB(A) LAeq 1 hour. In practice night time noise levels are likely to be less than 20dB(A) LA90 1 hour in more remote locations.

This approach is considered by the MPAs to be reasonable and corresponds with the principles of BS4142 where the level of impact is determined by comparison with the background sound level regardless of whether or not it is daytime or night time.

<u>Sources of noise associated with hydraulic fracturing.</u>

It is considered by the MPA's that the primary sources of noise associated with hydraulic fracturing are associated with the drill rig itself, specifically the top drive unit, and from generators, pumps and fans used for the hydraulic fracturing process.

Additional sources of noise are also likely to impact the overall noise levels arising from a site and increase noise levels further, with these other noises arising from operations including vehicle noise and other machinery and plant.

Information on sound power levels associated with the hydraulic fracturing process may also be found in the information provided with planning application for the Preston New Road and Roseacre Wood sites in Lancashire.

This shows the following sound power levels to exist from fracturing plant.

Sound Power Level Data for one hydraulic fracturing unit

Location	Octave Band Centre Frequencies (Hz)								SWL dB	SWL dBA
	63	125	250	500	1000	2000	4000	8000		
Fan	115	116	113	112	110	104	98	93	121	114
Pump	88	94	102	105	103	100	94	90	109	107
Engine	103	112	111	112	111	112	106	100	119	117

At any one time all three components are likely to be operating and, according to the New Preston Road site application, up to six fan, pump and engine units could be operating simultaneously.

Information on sound levels associated with drilling process is based on that provided with the planning application for the Preston New Road and Roseacre Wood sites in Lancashire.

This provided the following sound power data for drilling equipment

Sound Power Level Data for drilling operational equipment

Equipment	**Octave Band Centre Frequency (Hz)**							**SWL dB**	**SWL dBA**
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**		
Centrifuge	92	89	83	80	78	76	75	95	84
Generator	103	108	96	92	90	84	78	110	96
Mud Pumps	101	101	104	98	94	91	90	108	101
Pumps and hopper	92	92	95	89	85	82	81	99	92
Shale shaker	102	99	93	90	88	86	85	105	94
Hydraulic Power Unit (HPU)	96	98	101	94	88	87	84	104	97
Top Drive	95	92	95	93	90	85	78	101	95

In particular the New Preston Road site identified the drilling rig, shale shakers, mud pumps and generators to be the principal factors in determining off site noise levels.

At any one time it is understood that the following items could be operating simultaneously and also 100% of the time.

Number of items operating during drilling process

Equipment	SWL dB
Centrifuge	**1**
Generator	**3**
Mud Pumps	**3**
Pumps and hopper	**1**
Shale shaker	**3**
Hydraulic Power Unit (HPU)	**1**
Top Drive	**1**

Potential Mitigation Measures

For the drilling operations it is understood that a number of different mitigation measures were proposed at the Preston New Road site in Lancashire, in order to reduce noise levels. Such measures, as detailed in the noise report submitted as part of planning application, included a 7 metre high barrier around the main rig and hydraulic power unit, acoustic louvres to the hydraulic power unit, sound absorption to the shale shakers, sound absorption to the generators, enclosures around the drilling rig mud pumps, and rubber bushings to pipework.

An assessment of the potential impact of such measures was undertaken by Jacobs UK Ltd, on behalf of Lancashire County Council (Appendix 2), and identified the following anticipated levels of sound reduction associated with the proposed mitigation measures.

Mitigation measures identified in Preston New Road planning application

Mitigation Measure	Predicted Attenuation (dB)
Interventions to the hydraulic power unit (e.g. acoustic louvres), attenuation to generator exhausts	**1**
Sound absorption in enclosures to drilling rig shale shakers	**5**
Sound absorption in enclosures to generators, including louvres	**4**
Enclosures in drilling rig mud pumps	**Non anticipated**
Rubber bushings to reduced pipework vibration	**Not quantifiable**

7 metre high sound barrier around the main rig and hydraulic power unit	**5**

In terms of mitigation for plant and equipment it is understood that at the Preston New Road site a 5 metre high solid noise fence was proposed, to be located 2 metres away from the generators and plant.

No details could be found for the Preston New Road site on the level of attenuation expected from the provision of a 5 metre high barrier. However using the Maekawa method, for the prediction of the level of sound attenuation provided by a barrier, a reduction of 23dB is predicted by the MPAs at a distance of between 300 to 700 metres away from the sound barrier. This being based on the combined sound power level and frequency distribution of the fracturing noise source.

Predicted attenuation from 5 metre high barrier around drilling and fracturing

Distance	Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
300 to 700 m	-12.7	-15.3	-18.1	-21.0	-24.0	-27.0	-33.0	-30.0.

Predicted levels of sound from operations at nearby sensitive receptors

In order to assess the potential impact of drilling and hydraulic fracturing on the communities located within the MPA's areas, noise levels at a number of different distances away from potential hydraulic fracturing sites were predicted. Predictions were carried out in accordance with the principles of ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors General method of calculation.

For the purposes of the calculations according to this method it has been assumed that noise from the equipment acts as omnidirectional point source. For fracturing operations all noise source have been assumed to be at a height of 1.5 metres above ground level. For noise associated with drilling operations a source height of 50 metres has been assumed to represent the worst case associated with the use of the drill top drive and hydraulic power unit, with all other items of plant being located at a height of 1.5 metres above ground level.

Weather conditions have been assumed to be 10^{O}C and 70% humidity, these being considered to be typical of UK. It has also been assumed that the ground conditions around any plant would be soft with a value of 1.0 for value G.

Based upon the predicted noise levels from source, the mitigation measures proposed, and the attenuation afforded by distance (geometric divergence), air absorption and ground attenuation, the following sound levels from drilling and fracturing operations are predicted.

Predicted overall sound Levels arising from fracturing operations at 1.5 metres above ground level without mitigation measures

Distance (m)	Octave Band Centre Frequencies (Hz)							dB	dBA
	63	125	250	500	1000	2000	4000		
300	63	61	48	52	59	57	44	67	**62**
400	60	57	46	50	56	54	39	64	**59**
500	58	54	44	47	54	51	33	61	**56**
600	56	51	40	46	52	48	28	59	**54**
700	55	49	41	44	50	46	24	58	**52**

Predicted overall sound Levels arising from fracturing operations at 1.5 metres above ground level with mitigation measures

Distance (m)	Octave Band Centre Frequencies (Hz)							dB	dBA
	63	125	250	500	1000	2000	4000		
300	50	46	30	31	35	30	14	51	38
400	47	42	28	29	32	27	9	49	35
500	45	39	26	26	30	24	3	46	32
600	44	36	24	25	28	21	-2	45	30
700	42	34	22	23	26	19	-6	43	29

Predicted overall sound Levels arising from drilling operations at 1.5 metres above ground level without mitigation measures

Distance (m)	Octave Band Centre Frequencies (Hz)							dB	dBA
	63	125	250	500	1000	2000	4000		
300	51	52	43	38	39	35	29	55	44
400	49	49	40	36	36	33	27	52	41
500	47	46	38	34	34	31	25	50	39
600	45	44	37	32	33	29	23	48	37
700	44	40	35	31	31	28	22	46	36

Predicted overall sound Levels arising from drilling operations at 1.5 metres above ground level with mitigation measures

Distance (m)	Octave Band Centre Frequencies (Hz)							dB	dBA
	63	125	250	500	1000	2000	4000		
300	38	36	30	26	25	21	13	40	30
400	35	32	28	23	22	19	10	38	27
500	33	30	26	21	20	17	8	36	25
600	32	28	24	20	19	15	7	34	23
700	30	23	23	18	17	14	5	32	22

Impact of predicted noise levels on existing background levels

As previously discussed the MPAs consider that a suitable target noise level from mineral operations is a maximum of 10dB above the measured background L90 sound level during the day, this being 31dB(A) Leq. During the night time a suitable target noise level is a maximum of 10dB above the background L90 sound level during the night time, this being 30dB(A) Leq.

Comparison of the predicted levels at various distances against these two standards are shown in the tables below for operations where mitigation measures are provided.

Predicted Impact during daytime due to fracturing operations with mitigation

Distance (m)	Mitigated Level (dBA)	Target Level (dBA)	Difference
300	38	31	+7
400	35	31	+4
500	32	31	+1
600	30	31	-1
700	29	31	-2

Predicted Impact during daytime due to drilling operations with mitigation

Distance (m)	Mitigated Level (dBA)	Target Level (dBA)	Difference
300	30	31	-1
400	27	31	-4
500	25	31	-6
600	23	31	-8
700	22	31	-9

Predicted Impact during night time due to fracturing operations with mitigation

Distance (m)	Mitigated Level (dBA)	Target Level (dBA)	Difference
300	38	30	+8
400	35	30	+5
500	32	30	+2
600	30	30	0
700	29	30	-1

Predicted Impact during night time due to drilling operations with mitigation

Distance (m)	Mitigated Level (dBA)	Target Level (dBA)	Difference
300	30	30	0
400	27	30	-3
500	25	30	-5
600	23	30	-7
700	22	30	-8

Predictions show that during the daytime and night time sound levels from fracturing operations, with mitigation measures provided, are likely to exceed the daytime level of 31dB(A) and night time level of 30dB(A) at a distances of less than 600 metres from any plant.

Such predictions do not consider the impact of other noise sources which may also occur at the same time, including traffic and vehicle movements.

In addition these predictions take no account of any additional perceived impacts due to the effect of tonality, impulsivity, intermittency or other sound characteristics, all of which can increase the significance of impact of any noise heard by a received.

As a result it is considered by the MPAs that at distances of less than 500 metres or less noise arising from hydraulic fracturing operations is likely to result in an unacceptable impact on receptors, unless additional noise mitigation measures are provided. This being based on a reasonable approach to potential noise and mitigation measures arising from hydraulic fracturing developments.

Where additional mitigation measures are required, over and above those considered at the Preston New Road site in Lancashire, then the costs to provide any such measures could significantly increase. As distances decrease between a noise source and receptor then it becomes more difficult to achieve improved levels of noise attenuation. Furthermore where further mitigation measures are provided, if feasible, this would be likely to result in adverse visual impacts too due to the scale of measures required.

It is not suggested by the Authorities that this will be so in all cases, but the nature of the hydraulic fracturing activity and the noise environment of the wider area mean that it is appropriate, on noise grounds alone, to propose a suitable zone in which it is necessary for details on additional noise mitigation measures to be provided on a case by case basis. In addition where background noise levels are found to be higher than 20 or 21dB(A) LA90 then the exact level of attenuation required would need to be determined on a case by case basis.

In terms of C weighting of sound levels, C weighting is often used for measurement of peak sound pressure levels. A weighting is normally used to assess the impact of noise on humans as the weighting used reflects the response of the human ear to sound, in that it cuts off the lower and higher frequencies that the average person cannot hear.

Visual Impact

The previous supplementary document [LPA/89] set out the MPAs key considerations in relation to visual impacts and light pollution. This conveyed that the importance of topography and landscape character in the Joint Plan area outside of the AONBs and National Parks in understanding landscape and visual impact. In summary, the landscape is accepted to be predominantly low lying and flat with slight undulations. Although there are small variations across the area, the key characteristic of the landscape is that it is predominantly flat and has a general absence of woodland with a strong sense of openness due to the dominant arable use. Consequently, it is identified that there is "*High visual sensitivity as a result of the predominantly open character and flat landform which facilitates long distance views across the landscape and promotes strong indivisibility with adjacent Landscape Character Types*" [LPA/83].

Consideration for the long-range views across the landscape is important in understanding the effects of hydrocarbon development on sensitive receptors in the plan area. Critically, development of scale and height is likely to be visible in the open landscape and have negative effects by changing the character of the rural landscape. Further, the duration of effects and whether there is successive exploration/extraction needs to be given due consideration.

United Kingdom Onshore Oil and Gas (UKOOG) state that "The average height of a normal drilling rig is about 125ft [38m], *which is equivalent to a 10 or 11 storey building or around two-fifths the size of the clock tower of Big Ben"* [1]. However, rig heights can also be 60m high.

This height can be compared to other known visible landmarks across Yorkshire:

- Ferrybridge Power Station cooling towers 115m
- Wind Turbine (average height) 75 m
- York Minster 72m
- Clifhanger @ Flamingo Land Theme Park 55m

In addition, UKOOG acknowledge that: "At a typical exploration site there will be:

- Flood lights, which only light up the site itself and are switched on at dusk and off again at dawn.
- Rig equipment
- Piping and storage
- Mobile portacabins for offices
- Worker restrooms
- The well head itself".

Furthermore, the phasing of development and duration of effects is an important aspect to consider in relation to landscape and visual impacts. UKOOG present their expected phasing as:

1. Exploration – 4-6 months
2. Preparation of the Pad – 30-60 days
3. Drilling the well – 9 weeks minimum
4. Hydraulic Fracturing – 7 weeks minimum

[1] https://www.ukoog.org.uk/community/what-it-looks-like

In terms of the likely visual impact of the equipment, the drill rig for the drilling of a new well is likely to be the most prominent item in the landscape by way of its height. The height of a drill rig for the purposes of drilling the initial vertical well at Preston New Road was cited as being 53 metres; and in the case of Altcar Moss in Lancashire as 60 metres. The Inspector at the initial inquiry at Roseacres, Lancashire imposed a height of 36m stating "*the reduction in height would constitute a distinct and real improvement in their visual amenity compared to the situation with a 53m rig in place"* (See inspectors report in Appendix 3).

In addition to the rig, there would likely be additional well infrastructure including a Coil Tubing Tower, Silos to store the fracking sand (propant) (assumed approx. 15m height), flare stacks (assumed approximately 10m height) and other miscellaneous equipment would include site offices, welfare facilities and stores. Typically lighting towers of significant height will also be required as part of a 24/7 operation, including for example lighting towers for site operations and lighting on the derrick of the rigs for operational and safety purposes. Furthermore, there would likely be acoustic sound barriers in place adding to the urban form of development albeit potentially screening low level operations.

Adding to the visual impact of a combination of the aforementioned structures, would be the visual impact of many large vehicular movements including HGVs and tankers for the construction of the site and installation of equipment and the tankering off-site of the flowback fluid. The number of tanker movements is significantly increased if the site is not serviced by an existing pipeline such that water needs to be transported by road haulage. An increase in HGV movements is likely to be noticeable, which will contribute to a strong visual sense of major development at close proximity to sensitive receptors.

In comparison to alternative methods, shale gas fracturing differs in that the process is extremely likely to continue with consecutive drills within the same site thus presenting more than a temporary operation and insidiously becoming a semi-permanent fixture in the landscape. The duration of these effects and at what stage they occur in the process is relevant and is material in understanding the overall potential harm.

In determining the 500m distance, consideration has been given to the scale and nature of the development (and the potential for negative psychological associations with the industry) and the potential protracted presence/semi-permanence of it, by way of sequential operations.

At a distance of less than 500m, the drill and workover rig and coil tubing towers plus the high crane used for installation and removal of equipment, are likely to constitute a highly visible and obvious, incongruous addition to views of the landscape.

In line with evidence from the industry, should shale gas fracturing prove viable, it is more than likely that one well would follow on from another. Thus there is a risk that the temporary nature of each individual application may in effect have a semi-permanent presence given the likelihood of sequential operations, i.e. the

magnitude of effect could increase from e.g. 'medium', to 'high' adverse, (at its worst in the winter months), within 500m.

It is highly likely that within 500m of a well site the taller equipment employed during the various phases of investigation, drilling, and extraction would be visible over the tops of trees and hedgerows across level and undulating land due to the height of the equipment. Therefore the visual impact could not be easily mitigated.

When considering the visual effects of a development the Guidelines for Landscape and Visual Impact Assessment – Third edition, para 6.27 recommends that a range of issues should be considered, including *"The distance of the viewpoint from the development and whether the viewer would focus on the development due to its scale and proximity or whether the development would be only a small, minor element in a panoramic view*. *The nature of the changes, for example....creation of a new visual focus in the view, introduction of new man-made objects....."*

The taller items of equipment are likely to be conspicuous and incongruous in an open or rural landscape by way of their contrasting, man-made nature and height, thus drawing attention to themselves by creating a new focus in a view. This effect may be augmented in-combination with any mitigation such as barriers that are put in place to attenuate noise.

As the viewer gets closer to a conspicuous object in a landscape, that object becomes a more prominent feature as the field of vision decreases. At a distance of 500m or less, the well site and the various forms of equipment are extremely unlikely to appear as small or minor elements within a panoramic view.

Whilst LVIA photomontages are technically accurate, the human eye/brain does not take in the full panorama in one go. Instead it tends to effectively zoom in to a portion of that view, thereby increasing the perceived visual impact of a change in that view. This 'human perception' is recognised by the Landscape Institute, and guidance as to how photomontages are presented to the public (as opposed to the professional carrying out the field study) has recently been revised.

In the Roseacre Wood Inquiry in Lancashire, the Environmental Statement prepared by the appellant for the Roseacre Inquiry used photomontages to demonstrate visual and landscape impact at between 400m-700m from the site. However, the technical outcomes of this were disputed and upheld because the photomontages presented the development as "*significantly under-sized and offer images that for not represent the accurate scale of the proposed development in relation to the receiving landscape... The consequences of this... are that the assessment of the magnitudes of change which underpins the process of LVIA is based on an artificially reduced perceived scale of development*". Following a site visit, the Inspector considered that alternative photomontages produced by witness proof of evidence following a new method "*provide[d] a more realistic and reliable impression of the likely impact of the proposed development*". Please refer to Appendix 4 for the photomontages accepted by the inspector. Nonetheless, this example shows how obvious the rig

is in the absence of mature planting across a relatively flat landscape. It was recognised that "*(The) equipment would be clearly visible above the intervening vegetation and a prominent vertical feature in the open landscape view . ... there would be readily noticeable changes which would alter the general perception and key characteristics of the view..... judged to result in a distinct deterioration in the existing view and therefore a moderate adverse effect*".

Any implementation of visual mitigation would likely be dependent on specific management of vegetation that is beyond the site boundary and outside the control of the applicant; for example allowing hedges to grow and be maintained at a greater height close to the observer's eye. The management of such vegetation would be difficult to include in enforceable planning conditions. Also, new planting would not become readily established in the potential short time frame between the submission of the planning application and operations on site. New mitigation planting tends to be more relevant to permanent development whereby the vegetation takes significant effect after 5-10 years of successful growth.

It has been established through example that different phases of the hydraulic fracturing process will have differing effects on landscape and visual impacts. Although site specific, the recent case in Lancashire established that significant effect on landscape and visual amenity were likely during the drilling, hydraulic fracturing and flow testing phases lasting a period of 29 months. In this situation the Inspector concluded that there would be varying degrees of impact for the duration of the permission and "*these significant landscape effects would be limited to a distance of up to 650-700m and certainly no more than 1km from the site*".

Furthermore, there is the additional factor of negative association with the built element that affects the view, which can have the affect of increasing the perceived harm; and it is the human perception that matters.

Consideration should be given to the overall experience of the viewer. The visual impact is not experienced in isolation of other potential impacts such as noise; nor is a local resident or visitor a static entity. A view from a property is a potential constant reminder of other impacts associated with the development such as additional HGV vehicle movements on the immediate roads, and greater visual impacts experienced by a resident as they travel to and from a dwelling. The intensity of the experience as a result of cumulative effects must be afforded weight.

Public concern to development and consequential impacts to peoples' mental and social well-being are also a material consideration. At the Lancashire Roseacre Wood inquiry the Health Impact Assessment (Appendix 3: Roseacre Wood Inquiry Reports) considered that the key risks to health and well-being of the residents that live near by the proposed exploration sites included stress and anxiety from uncertainty that could lead to poor mental wellbeing, noise related health effects due to continuous drilling and issues relating to capacity for flow back waste water treatment and disposal.

The MPAs therefore accept that in individual cases acceptable separation distances might be achievable depending on factors including topography and proposed mitigation measures in line with policy M17 but that effects are likely to be most significant at close range and where long range views exist across the landscape

Lighting

The MPAs Supplementary Document LPA/89 considered the impact of light pollution as a result of hydrocarbon development establishing that the Plan area has dark skies beyond the built up centres and main roads. It was stated that the absence of light pollution means that new sources of light in these areas such as from isolated well pads, are considered to potentially have significant effects. The most significant effects were considered to be within proximity of the exploration site (within 500m).

The CPRE (Campaign to Protect Rural England) set out a study of the darkest counties and districts in their document 'Night Blight: Mapping England's light pollution and dark skies' (2016). This identifies that *"...when considering which counties (out of 41 English counties) have the highest percentage of pristine night skies, free of light pollution,...North Yorkshire is the fifth darkest county with 42% of night skies in the darkest category and 70% when considering the two darkest categories".* Furthermore, the study identified that out of the 326 districts across England, North Yorkshire's four rural districts - Ryedale, Richmondshire, Craven, and Hambleton are within the top 20 darkest districts in the country, (three of them within the top 10) with Ryedale being the fourth darkest district in England. See Appendix 5 to view the Night Blight report[2].

[2] An interactive map accompanying the report is available on the CPRE website: https://www.nightblight.cpre.org.uk/maps/

It is important to note that Ryedale is part of the Plan area with the greatest concentration of PEDLs. Based upon the evidence, it is clear that introducing new lighting in areas which are initially very dark has a greater perceived impact than within areas which are already relatively light.

Lighting at a typical exploration site is acknowledged by UKOOG to require "*flood lights, which only light up the site itself and are switched on at dusk and off again at dawn*". Furthermore, experience from recent development indicates that it is likely that 24 hour security lighting would be required during production due to the levels of objection and protests.

The drill rig, the pre-stimulation workover and the hydraulic fracture stimulation and well test phases of the process require 24 hour lighting, both to provide lighting for site activities and for security. This lighting has the potential to increase ambient lighting levels within the vicinity of the well site; and due to the height of the equipment the lights are highly likely to be visible against the night sky, which in areas of dark skies would be more pronounced. Should the duration of the phase extend or sequential well pads be introduced, the impacts of this become more semi-permanent and may be perceived as a more significant effect.

The Inspector in the Roseacre Wood Inquiry also concluded that the different phasing of development would have an impact on lighting. Their conclusion states:
"The proposed development would involve the site being lit at night with 24 hour operation and security lighting throughout the life of the development. However, I also consider that there is s distinction to be made between the impact of lighting during the drilling rig, and other phases. The proposed lighting scheme would provide a degree of mitigation but there would still be an adverse impact when rigs were on the site during the first phase of development. During the extended flow testing phase, I am satisfied that there would be very limited additional impact on the landscape due to lighting."

The CPRE dark skies mapping clearly shows that the parts of the Joint Plan area with PEDLs is generally darker than those parts of Lancashire where fracking has recently been approved.

It is clear that light pollution as a result of hydrocarbon development is a particularly significant issue in the joint plan area. Given the evidence by CPRE, the area as a whole is particularly sensitive to changes in light. For sensitive receptors in the plan area, it is our view that this impact will be more significant the closer the receptor is to the development.

<u>Cumulative effects</u>

This response further demonstrates the technical argument for a 500m zone based upon consideration of noise, visual impact and lighting. However, it is important to also ensure that the cumulative effects of any hydrocarbon development are considered holistically on sensitive receptors. Whilst individual impacts have been demonstrated, in each case, the in-combination effects arising from noise, visual impact and lighting and the potential for multiple well

pads across the plan area may exacerbate the experience of the development on sensitive receptors, particularly in close proximity.

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