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Dear Sirs,

[Response to early consultation proposals by WSCC and the SDNPA on the background documents for the proposed new joint minerals local plan for West Sussex.](#)

We appreciate the opportunity to comment on the five background papers that are intended to inform your development of a long term joint minerals local plan policy within West Sussex (including the South Downs National Park) that we understand you hope to be in a position to adopt in late 2017 and which would then run until 2031.

The Campaign to Protect Rural England, Sussex Branch CIO is a registered charity with about 2,000 members within Sussex and many more beyond. Our charitable purpose is to work for the protection and enhancement of Sussex's unique and essential countryside, and for thriving local communities within it, so that together they can continue to sustain, enchant and inspire future generations. We are the only independent charitable organisation committed nationally and locally to examining the impact of development proposals on our countryside and rural heritage.

Save where we comment below, which we do by reference to the specific questions you ask us to answer, please assume that we support your background papers or have no view on their content.

### **Background Paper 1: Spatial Portrait**

#### **Q.1.1 Are there any omissions or additions to the Spatial Portrait and key challenges/issues identified?**

The background papers fail to recognise or discuss a number of materially different issues that arise in respect of hydrocarbon exploration and exploitation. That failure gives us cause for concern that there is not currently the basis for the formulation of a sound hydrocarbons minerals policy<sup>1</sup>. Please see our more detailed response to Q.2.9 in particular.

We consider that a fair assessment of the background landscape for the development of a sound minerals policy needs to take full account of and record

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<sup>1</sup> You already have copies of the CPRE national fracking policy guidance and the amplified version adopted by the CPRE Sussex branch. We will assess the draft policies that emerge in the coming months against the criteria set out in our policies.

- the conclusion of a recent survey by the British Geological Society of the potential for shale gas and oil beneath the Weald<sup>2</sup> (the “**BGS Weald Study**”) that there are likely to be very considerable reserves of shale oil beneath the Weald, but that the extent to which those reserves will be commercially exploitable will depend on further exploratory drilling; a conclusion which raises the prospect of a proliferation of applications to explore for shale oil, and to exploit identified free shale oil deposits, in the coming months and years with many of those applications envisaging the use of unconventional drilling techniques;
- the potential for hydrocarbon exploration and exploitation to have locally significant adverse environmental, landscape and health hazards that, in appropriate cases, can be mitigated via sound planning policies and processes (including policies to preclude drilling in sensitive areas) for which MPAs have responsibility under the planning regime;
- the economic and social benefits provided by a properly protected countryside, as well as the environmental ones, and the need to give proper weight to all these benefits in policy terms when balancing the pros and cons of development choices;
- the level of scientific and environmental uncertainties surrounding unconventional hydrocarbon drilling techniques in particular, and the need to apply precautionary principles where the scientific impact of a proposal is uncertain;
- the recommendation in the BGS Weald Study that “*shale oil exploration and potential development should progress cautiously to ensure that the activity is safe and the environment is properly protected*” with its long term monitoring implications;
- the need to build public confidence in those regulatory processes for which the MPAs are responsible by full transparency, and via policies that work to involve affected communities fully in the planning and operational processes.

We would welcome a separate background paper dealing specifically (and in more detail than the section dedicated to hydrocarbons in Paper 2) with the issues that will inform the nature and scope of the future policy covering hydrocarbons. Exploration and production of shale oil in the countryside is a highly controversial issue with the potential for significant negative environmental and economic impacts. It also involves difficult site selection and infrastructure support challenges and mitigation opportunities through the planning process.

Such a paper would be of particular value given that there is liable to be a disturbing hiatus of over 3 years before the new policy is adopted - a crucial period during which many more exploration applications, and some extraction permissions, could come up for determination in the absence of any clear and up to date current local hydrocarbons minerals plan.

#### Q. 1.2 Are there any omissions or additions to the Spatial Strategy which should be considered?

1. Paper 1 highlights the Government’s economic push to see shale oil and gas exploited. But it lacks any discussion of the economic and social benefits of a protected countryside that need to be factored into development planning policy, and given proper weight. There is, for example, no mention anywhere in the background papers of the potentially adverse impact on the hugely important local tourist industry of extensive mineral exploration and exploitation of minerals in sensitive areas. Nor is

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<sup>2</sup> British Geological Survey/DECC study “The Jurassic shales of the Weald Basin: geology and shale oil and shale gas resource estimation, 2014. (Andrews, I.J.) (<https://www.gov.uk/government/publications/bgs-weald-basin-jurassic-shale-reports>)

there discussion of the health and wellbeing social benefits recognised by Government in its Natural Environment White Paper ‘The Natural Choice: securing the value of nature (June 2011)<sup>3</sup> and its related Biodiversity 2020 strategy<sup>4</sup>. Para 3.45 is a wholly inadequate summary of the social implications.

2. There is a need for a detailed on-line map that records the location of all different aggregates resources, including hydrocarbons (using simplified version of the map in British Geological 2014 Weald survey report at table 1) and overlays principal towns/ villages, and all specially designated locations.

Please also see our response to Q.1.1 and Q.2.9.

**Q.1.3** Are there any omissions or additions to the monitoring framework for [sic] which should be considered?

Yes, additions in three respects:

1. The effective application and enforcement of the minerals policy, at least insofar as it applies to hydrocarbons, should be the subject of annual, or biannual, independent audit. Self-policing and self-reporting on the MPAs’ compliance with its own policies will not suffice to engender and maintain public confidence in a regulatory process that will be much in the public eye and in respect of highly controversial processes, much of them performed in very sensitive countryside.
2. Long-term monitoring of the suitability of policies that apply to hydrocarbon extraction given the considerable current scientific, geological and environmental uncertainties, the development of further knowledge over time as to the levels of commercial recoverability of shale oil, and the likelihood of future regulatory change. This would also give effect to the recommendation in the BGS Weald Study that “*shale oil exploration and potential development should progress cautiously to ensure that the activity is safe and the environment is properly protected.*”
3. In relation to the sufficiency and suitability of the expertise available to the MPAs in such a technical and fast changing area as shale oil extraction.

Effective monitoring also implies a robust and enforced regime of operator activity, with appropriate sanctions that are sufficient to deter non-compliant behaviour. We would expect to see the Minerals Plan afford assurances of resources and commitment in this respect.

## **Background Paper 2: Minerals in West Sussex**

**Q.2.1** Is the data used to calculate the shortfall (presented above and within the LAA) of aggregates accurate? Is there any other data/evidence that should be used?

We are not currently competent to answer this question.

**Q.2.2** Are there any other issues or evidence which should be considered for the purposes of planning for a steady and adequate supply of soft sand and sharp sand and gravel through the Plan period?

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<sup>3</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/228842/8082.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228842/8082.pdf). See e.g. para 4.25 that explains the economic benefits to human health of the natural environment, and para 8, which says: “**8.** Economic growth and the natural environment are mutually compatible. Sustainable economic growth relies on services provided by the natural environment, often referred to as ‘ecosystem services’. Some of these are provided directly, such as food, timber and energy. Others are indirect, such as climate regulation, water purification and the productivity of soil.”

<sup>4</sup> <https://www.gov.uk/government/publications/biodiversity-2020-a-strategy-for-england-s-wildlife-and-ecosystem-services>

Intelligent planning in the context of the question needs to be informed by the assessed need for aggregates across the entire potential market area together with anticipated or planned for output from other local authorities. Intelligent planning to ensure a steady and adequate supply of the aggregates in question cannot be expedited without that essential baseline information.

Q.2.3 The Authorities feel that the economic activity in the coming 10-15 years will not result in a significantly increased demand for aggregates supplied in West Sussex. Do you agree? If no, please provide evidence (with particular reference to specific schemes if possible).

The crucial issue here is that the authors of the document do not explain why they feel that “the economic activity in the coming 10-15 years will not result in a significantly increased demand for aggregates supplied in West Sussex”. As it stands this is an opinion expressed without supporting evidence, which does not provide a sound basis for the assessment of future demand.

Q.2.4 Are there any additional issues or evidence required for clay that have not been identified?

We are not currently competent to answer this question.

Q.2.5 Are there any additional issues or evidence required for sandstone that have not been identified?

We are not currently competent to answer this question.

Q.2.6 Are there any additional issues or evidence required for chalk that have not been identified?

We are not currently competent to answer this question.

Q.2.7 Are there any additional issues or evidence required for recycled and secondary aggregates that have not been identified?

We are not currently competent to answer this question.

Q.2.8 Are there any additional issues or evidence for silica sand that have not been identified?

We are not currently competent to answer this question.

Q.2.9.1 What are the key issues which should be taken into account when considering the potential impact of onshore hydrocarbon development?

Background documents give scant attention to the planning implications of exploratory or extraction drilling for oil or gas in West Sussex. Different, material, strategic and site planning issues arise from those that apply to solid aggregates, especially where unconventional hydraulic fracturing processes are involved. This is a significant issue following the BGS Weald Study. This study concluded that there were likely to be significant volumes of shale oil present beneath West Sussex (including below the South Downs National Park, the High Weald AONB<sup>5</sup>, the Chichester AONB and other specially designated areas), but that the extent of commercially extractable reserves could only be reliably determined via exploratory drilling. We can only read that as being an encouragement to the industry to increase their prospecting for free shale oil under the Weald.

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<sup>5</sup> Parts of the High Weald AONB are EU protected SAC and SPA sites and enjoy still greater protection rights by virtue of regulations passed to implement the Habitats Directive.

The background documents need, we believe, to give attention to the implications of the detailed conclusions of the draft Strategic Environmental Impact Assessment by Amec Environment and Infrastructure UK Ltd for the Department of Energy & Climate Change in December 2013 (the “Amec EIA Report”<sup>6</sup>). That report concludes that unconventional oil and gas drilling has the potential to have negative environmental impacts, impacts which could be locally significant if there is significant drilling. It also makes the point that planning policy and the planning process have a vital role in mitigating those effects. The Appendix to this submission extracts verbatim Amec’s key relevant findings.

There is a strong likelihood therefore that there will be very considerable pressure on the County’s MPAs in the next few years (including during the period before the Authorities’ new minerals policy can be adopted) to permit extensive exploratory drilling for hydrocarbons across the County and, potentially, for its extraction. This could be on a wholly different scale from that experienced within Sussex over the last century. It is also likely that much of the proposed drilling will involve hydraulic fracturing and other unconventional drilling techniques where the science is uncertain, the environmental hazards are materially greater, key political decisions remain to be taken, and the level of public confidence is low.

We appreciate that the MPAs are at an early stage in their policy development process and that the background papers being consulted on now are intended to be no more than stage setters for future policy development consideration. We also recognise that there are significant aspects of hydrocarbon extraction policy, including environmental regulation, that fall outside the remit of the MPAs. Nonetheless any sound minerals policy needs to address the broad range of issues and uncertainties that are peculiar to the exploration for, and exploitation of, hydrocarbon minerals within West Sussex; and in particular where unconventional drilling techniques are involved.

The Amec EIA Report identified that unconventional drilling for hydrocarbons is distinguishable from conventional drilling by:

- (a) use of fracking techniques,
- (b) the need for considerably more well bores and (at production stage) over a wider area with additional related seismic activity work,
- (c) the additional geological risks from the fracking,
- (d) the need for large volumes of water, mixed with low concentrations of hazardous chemicals (para 4.31 should acknowledge the hazardous nature of the added chemicals),
- (e) the need for decontamination of those large water volumes, and high volumes of HGV traffic over extended periods to remove the contaminated fluids,
- (f) risk of contamination to water sources from methane escape from fractured shale rock, and from leakage of fracking fluids below ground and at surface level,
- (g) additional air quality health hazards from chemicals used in the fracking process and methane, and
- (h) the availability of financial benefits to affected communities.

Arising from these factors, it seems clear to us that the MPAs’ future minerals policy needs to take account of, inter alia:

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<sup>6</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/273997/DECC\\_SEA\\_Environmental\\_Report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/273997/DECC_SEA_Environmental_Report.pdf). CPRE has provided a response to the DECC on this draft report.

1. The different infrastructure issues that arise in respect of hydrocarbon extraction as compared to solid aggregates: these include
  - (i) the potential need to drill a series of bores at sites over a considerably wider area;
  - (ii) the need for very large volumes of available water as a necessary part of the fracking process at each drill site in an area of acknowledged water stress;
  - (iii) the piping of extracted oil (or gas) across open country to a remotely located terminal (and for the terminal facilities themselves) - whether or not fracking techniques are used);
  - (iv) the extensive need to transport not only drilling equipment to and from each site but also, throughout the life of the drilling operations, large volumes of contaminated water for off-site decontamination treatment and recycling. Decontamination facilities are themselves a necessary asset.

None of these issues is canvassed in the background papers being consulted on.

2. All hydrocarbon drilling, but especially unconventional drilling, has potentially significant adverse implications on landscape, tranquility, ecology and the vital tourist economy that must be given attention in the establishment of a sound minerals planning policy. Contrary to the impression given in paras 4.50 and 4.51 of Background Paper 2, the MPAs are given the responsibility in the National Planning Policy Framework (“NPPF”) to *“set out environmental criteria, in line with the policies in this Framework, against which planning applications will be assessed so as to ensure that permitted operations do not have unacceptable adverse impacts on the natural and historic environment or human health ....”* (para 143) and to *“ensure, in granting planning permission for mineral development, that there are no unacceptable adverse impacts on the natural and historic environment, human health .... and take into account the cumulative effects of multiple impacts from individual sites and/or a number of sites in a locality ”* (para 144). They are also made responsible for making *“information about the significance of the historic environment gathered as part of plan-making or development management publicly available”* (para 141). The MPAs approach to their obligations in this regard requires spelling out in a background paper and, in due course, to be fleshed out in the minerals policy. Reference could also usefully be made to the Councils’ duty under s.40 of the Natural Environment and Rural Communities Act 2006 to embed biodiversity conservation into their policies and decision making.
3. The potential for multiple applications and the fact that hydraulic fracturing typically requires the drilling of a number of well bores over a fairly wide area combine to make the need to consider the cumulative impacts of particular significance in policy terms.
4. The background paper should explain more fully the EU and domestic regulatory regime that underpins the minimum requirements for strategic environmental assessments whenever an application is made for permission to explore for or extract hydrocarbons. It should, in our view also address the need for a policy decision to be made when the MPAs will require environmental impact assessments and what (if any) minor application exceptions there should be from such a requirement. CPRE will argue for use of EIAs as a statutorily required part of the process for considering all planning applications for both exploratory and extraction drilling permission that are



within, or may affect, specially designated areas (including also SSSIs and other ecologically sensitive sites) since such drilling is bound to have significant environmental effects<sup>7</sup>.

5. We refer to a range of suitable site selection issues in answer to Q.2.9.2.
6. The Amec EIA Report refers to the important role that planning conditions will play in mitigating the significant adverse local impacts of hydrocarbon exploitation on the landscape, environment and public health. The opportunities and options for planning conditions to be imposed by the MPAs that would be effective to implement that needed mitigation need to be canvassed fully.
7. We address at para 1 of our comments on Q.1.3 the case for protecting human health in the context of the economic benefits of protecting the countryside. This is mentioned in passing at para 4.21 of Paper 2. But that paragraph addresses two different themes in two non-sequitur sentences, and the paragraph has no obvious point or purpose. It does not address the implications of its opening sentence, as it should.

**Q.2.9.2** Are different policy approaches required for different landscape areas (e.g. landscape character areas and/or designated landscapes) or the different type of oil and gas development in West Sussex? If yes, please indicate the approach to be considered and the evidence to support such an approach.

Yes, in relation to exploration for and extraction of hydrocarbon minerals.

Firstly there is the potential need to prohibit as unsustainable all unconventional exploration and exploitation drilling within the SDNP, the Chichester and High Weald AONBs, Biodiversity Opportunity Areas and other sites designated as of special landscape, scientific, ecological or heritage value under UK or EU legislation/regulation and to which the presumption in favour of sustainable development within the NPPF does not apply. Any such proposal would, in our view, constitute major development<sup>8</sup>. Such a policy would be consistent with NPPF para 147 (first bullet)<sup>9</sup>. It would be justified on the basis that, given the widespread shale deposits nationally<sup>10</sup>, and the absence of evidence of commercially exploitable reserves beneath these specially designated areas, there is no identifiable national interest need to explore for, or exploit, shale deposits located there that justifies overriding the high level of statutory

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Our policy is that, whether or not fracking is expected at test drilling stage, we will expect the MPA to screen effectively in every case to determine the likelihood of material adverse environmental implications by an effective screening process that covers the full lifecycle of the operation and beyond<sup>7</sup>, and to require a full Environmental Impact Assessment for all cases for a site on a sensitive location or where the potential for significant environmental effects is identified in the screening process. This will enhance transparency of the process and facilitate an informed discussion of its implications.

<sup>8</sup> Note that the Town and Country Planning (Development Management Procedure) Order 2010 Article 2 defines major development as development involving..... :-  
"(a) the winning and working of minerals or the use of land for mineral-working deposits.... Note also the decision in *Aston v SSCLG* [2013] EWHC 1936 that, for the purpose of NPPF para 116, major development within an AONB must be considered in the context of its impact on the locality of the development site and not on the AONB as a whole.

<sup>9</sup> NPPF para 147: *Minerals planning authorities should also: when planning for on-shore oil and gas development, including unconventional hydrocarbons, ..... address constraints on production and processing within areas that are licensed for oil and gas exploration or production; .....*

<sup>10</sup> It is expected that about 60% of England, Wales and Scotland will be covered by exploration licenses after the next licensing round.

protection that they enjoy and which it is the legal duty of the planning authorities to enforce<sup>11</sup>. Such a policy would be further supported by the additional environmental hazards involved in fracking and the unsuitability of local infrastructure (see above).

There are other site issues specific to hydrocarbons that require mention in relation to future policy determination:

- (i) The statements in the background papers that aggregates can only be exploited where they are located is only partly true in relation to shale oil given that underground formations containing exploitable reserves may be relatively extensive, affording some flexibility to the siting of individual bore wells;
- (ii) Policy should preclude borehole development within a certain distance of any building or location of human use on health, safety and amenity grounds;
- (iii) Permitted borehole siting should be influenced by the risks of water contamination within nearby aquifers, rivers and reservoirs. There is some history in the USA of methane contamination of aquifers containing water extracted for human use. Whilst the British Geological Survey have published what they call an “overview study” of this issue and a number of specific location geological maps, they admit that the level of scientific knowledge is limited, and that they have not examined the implications for methane contamination arising from its potential upwards migration through the unusually extensive geological faulting within and above shale layers below parts of Sussex. Unstable rock formation also puts borehole integrity at risk. The BGS Weald Study does not address this important issue in any detail. It is a one that depends on site locational geology and geography. It should fundamentally influence decisions on the safety of drilling proposals. It also gives rise to the need for very long term pollution risk monitoring where drilling is permitted;
- (iv) The suitability of the location for the types and heavy volume of traffic likely to be involved. CPRE believes that the MPAs should have a policy that requires operators to submit a Transport Assessment and a Traffic Management Plan with planning applications which show how the fullest possible use has been made of non-road transport and how traffic movements can be mitigated, how necessary movements by road can be carried out safely and without unacceptable impacts on local communities and local roads, and how the cost of road repairs caused by site operations is to be funded.

Our comments at para (iv) above re the suitability of the location from a transport infrastructure perspective applies equally, of course, to all types of mineral site.

**Q.2.10** Is there a need to allocate mineral sites, other than sand and gravel sites, in the Plan? If yes, please set out the additional allocations which should be considered and provide reasons to justify such an approach.

No.

### Background Paper 3: Site Identification and Assessment Methodology

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<sup>11</sup> There is no practical difference between the degree of protection afforded by NPPF para 115 to the landscape and scenic beauty of the SDNP and the High Weald AONB. The fact that the minerals policy will be a joint one between WSCC and the SDNPA should not allow the protection of designated areas other than the SDNP to be overlooked or afforded secondary status. See also footnote 5.



Q.3.1 Are there any additional issues that you feel should be considered within the site assessment and identification methodology? If yes, please provide further information.

1. It should be a stated principle that demand for a mineral should not override identified material adverse environmental impacts of its extraction at a particular location where that demand can be satisfied from another existing facility whether or not from within the county. Supply targets from local facilities need to take that principle into account.
2. Background Paper 3 fails to address the question of whether any site identification and/or assessment methodology is required in relation to hydrocarbon resources. Whilst we recognise that national policy does not require MPAs to identify specific sites intended to deliver specific levels of hydrocarbon development, or to set local targets for hydrocarbon extraction, we consider it highly desirable for the minerals policy to set out a hierarchy of types of site that may be suitable for both conventional and, particularly, unconventional drilling operations.

Thus, as we argue in response to Q.2.9.2, CPRE considers that all unconventional drilling for hydrocarbons should be prohibited in the SDNP, the two AONBs within the county and other specially designated areas there; and that other factors can and should be set out that would make certain types of site wholly unsuitable, or less suitable, for drilling. We are open minded as to whether the MPAs should go further by promoting specific development locations for shale oil drilling away from sensitive locations as mooted at para 4.24.

3. In para 4.13, surely the Chichester and High Weald AONB Units should be external consultees on all proposals within, or capable of affecting the setting of, their AONB given that the protection status of AONBs under NPPF para 115 is on a par with national parks, and that the AONBs do not have a formal plan making role in relation to the Minerals Plan. There is a case for consulting an independent organisation concerned with landscape and countryside conservation to complement the input you intend to seek on wildlife from the Sussex Wildlife Trust.

#### Background Paper 4: Safeguarding Minerals Infrastructure

Q.4.1 As set out throughout this paper, there are a number of issues surrounding the safeguarding of wharves and railheads in West Sussex.

Do you feel that there are any issues or evidence which the Authorities have not presented here which must be considered? Please provide any relevant evidence.

Whilst we have no expertise in relation to likely future wharving and railhead needs, we do wonder whether over the proposed lifetime of this plan, industry methods of transportation and shipping might change sufficiently to render the assumptions made in this Background Paper 4 outdated and unreliable.

Please see our answer to Q.2.9.1 re the need for long term infrastructure needs relating to hydrocarbon extraction in terms of suitable roads, oil storage terminals and fracking fluid decontamination units.

#### Background Paper 5: Safeguarding Mineral Resources

Q.5.1 Is there any evidence to suggest a need to amend the MSA areas identified on the maps? If yes, please provide this information. This could include additional borehole information.

We are not currently competent to answer this question.

Q.5.2 Is there any evidence to suggest a need to amend the MCA areas identified on the maps? If yes, please provide this information.

We are not currently competent to answer this question.

Q.5.3 Is there any evidence to suggest the extension of the MCA to 250m beyond the boundary of the safeguarded mineral resource sites/areas should be extended or reduced? If yes, please provide this information.

We are not currently competent to answer this question.

Q.5.4 Is there any evidence to suggest the extension of the MCA to 250m beyond the boundary of the safeguarded minerals infrastructure sites should be extended or reduced? Please supply evidence to support your response.

We are not currently competent to answer this question.

Q.5.5 Are there any additional ways in which the Joint Minerals Local Plan could address the issue of safeguarding mineral resources?

Background Paper 5 does not mention the safeguarding of hydrocarbon resources. We acknowledge that there is unlikely to be a process available to safeguard those resources (other than controlling extraction volumes) that can be made part of the Minerals Plan.

Q.5.6 Are there any additional exemptions which should be considered?

Background Paper 5 does not address, as it should, the question of exemptions in respect of the need for planning consent for hydrocarbon related operations. We assume therefore that the MPAs do not consider that any such exemptions ought to be offered. CPRE would agree with that proposition.<sup>12</sup>

Q.5.7 Are there any alternative methods of ensuring adequate resource safeguarding or are there any modifications necessary to the above process which should be considered?

We are not currently competent to answer this question.

Yours faithfully,

Michael A. Brown, Trustee

on behalf of Campaign to Protect Rural England, Sussex Branch CIO

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<sup>12</sup> We have submitted representations to the DEFRA consultation on its recent proposals to abolish the regulation of certain activities in respect of smaller scale oil exploratory work for which the exploration company has obtained an exploration and development licence. We oppose those proposed changes: see [https://consult.defra.gov.uk/atmosphere-local-environment-team/oil-exploration/consultation/my\\_response?user\\_id=ANON-JFMW-3B63-J&key=280d592e6b569776189f90ec282881ca25b4a561](https://consult.defra.gov.uk/atmosphere-local-environment-team/oil-exploration/consultation/my_response?user_id=ANON-JFMW-3B63-J&key=280d592e6b569776189f90ec282881ca25b4a561)

***“Likely Significant Negative Effects***

It is not anticipated that there would be significant negative effects arising from conventional oil and gas exploration and production or gas storage.

For unconventional oil and gas, no significant negative effects were identified at the national level, but as compared to the effects from the existing oil and gas sector or at the local community level, likely significant negative effects were identified in relation to the climate change and waste SEA objectives.

Stages 2, 3 and 4 of the unconventional oil and gas exploration and production lifecycle were assessed as having a significant negative effect on **climate change** (under the high activity scenario), at the sectoral level (i.e. as compared to the effects from the existing oil and gas sector). However, these effects are unlikely to be significant in terms of emissions at the national level. The increase in domestic supplies is expected to result in substitution for imported Liquefied Natural Gas (LNG), with a negligible effect on overall national emissions.

The effects arise from greenhouse gas emissions associated with: pad preparation and drilling; emissions of carbon dioxide (CO<sub>2</sub>) and methane associated with disturbance to soils; the potential loss of carbon sequestration (i.e. of carbon absorbed in soils and growing plants); and in particular the volume of emissions arising from hydraulic fracturing and well completion. It is estimated that greenhouse gas emissions associated with Stages 2 and 3 could be up to 0.96 million tonnes of carbon dioxide equivalent (M tCO<sub>2</sub>eq) per annum under the high activity scenario. During Stage 4, emissions are likely to be associated with gas production and arising from power generation, the use of machinery, transportation, fugitive emissions and from flaring and venting. Emissions per annum are estimated as between 0.71M and 1.42M tCO<sub>2</sub>eq under the high activity scenario for the peak period when all wells are productive. This is equivalent to between 7.6% and 15.3% of the 9.3 M tCO<sub>2</sub>eq of sectoral emissions from the exploration, production and transport of oil and gas in the UK in 2011 (the most recent year for which final data is available).

As compared to the UK inventory of GHG emissions, however, these emissions would be less than 0.3% of the current total. The extent to which domestic production and consumption of shale gas would in practice affect total GHG emissions in the UK is more uncertain, but the principal effect is expected to be a displacement of imported LNG, or possibly pipeline gas, and the net effect on total UK GHG emissions is likely to be small. If LNG or other fossil fuel displaced from the UK is used elsewhere, that could lead to an increase in global GHG emissions<sup>15</sup> (although this is dependent on global energy policy and market demand).

There would be a range of wastes generated during the oil and gas exploration and production lifecycle (for example, construction and demolition wastes, drill cuttings and drilling muds). However, the largest and most significant waste stream would be likely to be flowback associated with hydraulic fracturing for shale gas (and also produced water generated through de-watering as part of virgin coalbed methane exploration and production). Flowback can have elevated levels of salinity and mineral content from contact with the rock formation that is being fracked. The volume of flowback from shale gas wells could range from 3,000 cubic metres to 18,750 cubic metres per well. Flowback can be recycled for use, with treatment involving a mixture of settlement, anti-bacteriological treatment and blending with clean water. However, it is assumed that flowback water, once it is intended for disposal, is not permitted to be re-injected into the geological formation and

will need to be treated. For the purposes of the assessment, the conservative assumption is made that this treatment has to be offsite. Under the high activity scenario, up to 108 million cubic metres of wastewater would require treatment (approximately 3% of the UK's total annual wastewater). Depending on where this treatment occurs, this volume could place a substantial burden on existing wastewater treatment infrastructure capacity. This has been assessed as having a significant negative effect on the **waste** objective. However, on site treatment and reuse could reduce the volumes of wastewater generated and lessen any effects on offsite treatment infrastructure capacity.

In addition, scrutiny through the planning system and cooperation between operators and the water industry under the Water UK and UKOOG MoU can be assumed to ensure that these effects will not be unacceptable in the local context. It is also noteworthy that the industry is not expected to be at substantial scale before the 2020s and this will allow time for further investment and development in treatment infrastructure.

### ***Negative Effects with the Potential to be Significant under the High Activity Scenario***

**Stage 3** of the unconventional oil and gas exploration and production lifecycle has the potential to have a locally significant negative effect on the **population** and **health** SEA objectives under the high activity scenario, although any such effects can be expected to be mitigated through planning controls. The potential is due to the adverse effect the generation of noise, dust and vibrations during construction, drilling and associated HGV movements could have on community disturbance and the health of some people in communities living close to well pads and/or HGV routes. During Stage 3, vehicle movements could range from 16 to 51 per day for up to 145 weeks, although this will be dependent on a number of factors including: the number of wells drilled and their phasing; the volumes of water needed; how water is sourced and whether it is tankered to the site; the volumes of waste and wastewater generated; the methods of waste treatment; and the extent to which treatment occurs on or off site. The effects on the local community will also be highly dependent on the location of sites, the frequency, timing and routing of HGV movements, the proximity to sensitive receptors, existing levels of noise/air pollutants and prevailing health issues, although it can be expected that actual effects at any location will be mitigated by planning scrutiny and controls. Public Health England has recently published a review of the available evidence on potential public health impacts of shale gas extraction. While noting that caution is required in extrapolating evidence from overseas into the UK context, they consider that the potential risks to public health are low if the operations are properly run and regulated.

**Stages 2 and 3** of the unconventional oil and gas lifecycle have the potential to have a locally significant negative effect on **land use, geology and soils** under the high activity scenario. Pad preparation and provision of associated infrastructure such as pipelines and road connections during this stage are likely to require the clearance of vegetation and loss of soil layers and compaction. Associated adverse effects in terms of soil function and processes are likely to be minor but where development is located on land that is of high agricultural quality, or in other sensitive areas, effects could be more significant and permanent.

The substantial volumes of water required, principally for hydraulic fracturing, under **Stages 2, 3 and 4** of the unconventional oil and gas lifecycle have the potential to have a significant negative effect on the **water** objective under both low and high activity scenarios (as compared to current water requirements of the oil and gas sector). The assessment has identified that total water consumption under these stages could be between 57.6 million and 144 million cubic metres under the high activity scenario and between 7 million and 18 million cubic metres under the low activity scenario. For the high activity scenario, annual water use could be up to 9 million cubic metres, an increase of nearly 18.5% on the approximate 48.5 million cubic metres of mains water supplied to the energy, water and

waste sectors annually, but substantially less than 1% of total UK annual non domestic mains water usage. The potential impacts this could have on, for example, water resource availability, aquatic habitats and ecosystems and water quality is, however, more uncertain. Water would typically be sourced from either a mains water supply or an abstraction from groundwater or surface water and would require an abstraction licence. For either source, additional supplies would not be permitted if they were not deemed to be sustainable or posed a risk to the security of supply to existing customers. In this context, Water UK, which represents the water industry, and UKOOG have signed a Memorandum of Understanding (MoU) which ensures their respective members will cooperate throughout the shale gas exploration and extraction process in order to minimise adverse effects on water resources and the environment.

Demand could also be substantially reduced if it could be met from recycling and reuse of flowback water (the fractured fluid injected into the shale rock during hydraulic fracturing which returns to the surface through the drilled well). Reported recycling rates in the US vary between 10% and 77%<sup>22</sup> which if applied to the high activity scenario, could lower total demand for water to between 13.2 million and 33.1 million cubic metres.

There is potential for locally significant negative effects on **air quality** during **Stage 2** (under the high activity scenario) and **Stage 3** (under both low and high activity scenarios). This principally reflects emissions to air from on-site machinery, HGV movements, drilling and hydraulic fracturing which could result in air quality impacts on sensitive receptors including residents and biodiversity. Additionally, there could also be emissions from flaring during exploration activities, which would primarily result in the production of CO<sub>2</sub> but could also result in the production of NO<sub>x</sub>, SO<sub>2</sub>, CO and Particulate Matter, and of methane from flowback water.

The extraction of hydrocarbon reserves during **Stage 4** would result in the direct loss of a primary natural resource that is non-renewable and has the potential to have a significant negative effect on **resource use**. However, the determination as to whether it would be significant cannot be made currently as: the determination of total UK shale gas resource is still at an early stage; the precise geology of host formations is unknown; and the likely yield per well is not yet possible to ascertain.

There is potential for a significant negative effect on **landscape** associated with onshore oil and gas activities. This principally reflects the potential landscape and visual impact of construction activities and associated machinery such as drilling rigs. However, the significance of the effect would be dependent on the distribution patterns of the exploration and production pads, the phasing of their development, the nature, quality and designations of the receiving landscape and the extent to which such landscape changes are visible to communities.

**More generally, scrutiny through the planning system (and other regulatory regimes), and where relevant the imposition of appropriate planning conditions, can be assumed to ensure that these potentially significant effects will in practice not be unacceptable in the local context.”**