Our line on fracking

1 Our policy position in short

Based on current evidence, Freshwater Habitats Trust is against the advent of shale fracking and other forms of unconventional gas exploitation in the UK. This is because:

(i) Climate change is one of the major national and world-wide threats to freshwater habitats. Fracking maintains our reliance on fossil fuels and risks additional release of methane to the atmosphere at a time when the UK is pledged to reduce greenhouse gas emissions.

(ii) Fracking results in increased local and regional risks to freshwater habitats through abstraction, land take and pollution. Given insufficient information and much controversy about the level of some of these risks, the precautionary principle is to avoid fracking until better data, over longer timescales, are available.

(iii) Based on current evidence of freshwater habitat protection in the UK, we have insufficient confidence that, should a fracking industry begin, there will be adequate monitoring or mitigation of the impacts on freshwater habitats.

2 The issue

Hydraulic fracturing (fracking) of shale involves injecting water, sand and chemicals into the ground, to extract oil and gas trapped within hardened mudstone rocks. Typically shale fracking involves drilling vertically to 1-3 km depth, then sideways for up to 2 km. The borehole is cased in concrete which is perforated so that fracking fluid can be pumped into the rock, and gas and fluids can get out. To fracture the shale, considerable volumes of hydraulic fracturing fluids (mainly water plus chemicals, and proppant; commonly sand) are pumped into the borehole under extremely high pressures. Cracks opened-up in the rock are then kept open by the injected sand, so that after the pressure is released, trapped gas or oil can escape through the permeable sand-filled fractures, up the production well to the surface.

Evidence from the USA, where the shale gas industry has developed rapidly over the past 10 years, and in other countries such as Australia, Canada and South Africa, shows that fracking has the potential to create a range of substantial environmental hazards. For the water environment and freshwater biodiversity there are four main areas of risk:

- **Climate change** impacts through exploitation of additional fossil fuel reserves and from methane released through the fracking process
- **Over abstraction** of water required to provide hydraulic fracturing fluids, potentially resulting in drying out of, and long-term damage to, freshwater ecosystems
- **Land take** required for the well heads and associated activities, damaging or destroying important freshwater and wetland habitats
- **Water pollution,** through either:
  (i) Sub-surface pollution of groundwater by ‘leaking’ hydrocarbons or saline water from deeper underground rocks, or from the chemicals in the hydraulic fracturing fluids
  (ii) Surface water pollution, either as a result of accidents, or from consented disposal of polluted wastewater returned to the surface.

The extent of shale gas exploitation in the UK

The extent of likely shale gas exploitation is not yet known and depends on many factors, including the accessibility and productivity of UK reserves. However estimates for the Upper Bowland Basin

in Lancashire, which would be likely to be the main focus for UK fracking, have suggest that recovery of 15 per cent of shale gas from this area would need 33,000 wells on 5,500 pads[1].

3 What is the evidence of risks to the water environment?

3.1 Climate change

Climate change is likely to have a huge, and predominantly damaging, impact on the freshwater environment and its biodiversity worldwide (see Freshwater Habitats Trust's Climate Change Policy). Fracking in the UK has the potential to increase the risks of climate change because:

(i) Developing a UK fracking industry locks the UK into exploiting reserves of fossil fuel which need to remain in the ground, and undermines the UK's policy to reduce reliance on carbon-based energy.

(ii) Fracking has the potential to release considerable volumes of additional methane which is a particularly potent greenhouse gas

(i) Fracking undermines the UK's move towards a low carbon economy

It is generally accepted that to minimise levels of climate warming, the world needs to leave most of the known fossil fuel reserves in the ground. Exploitation of the world's shale gas reserves would almost inevitably warm the earth by many degrees[2]. Whilst carbon capture and storage (CCS) could potentially be used to limit emissions, CCS has not yet been demonstrated as a viable and practicable methodology.

In the UK, the development of a shale gas industry appears to be incompatible with the UK's pledge to help restrict global warming to 2 °C above pre-industrial levels. The Climate Change Act 2008 requires a UK reduction in CO_2 emissions by at least 80% relative to 1990 by 2050. Many believe that the UK needs to completely decarbonise much earlier [3].

There is a commonly cited argument that fracked gas is a more climate friendly hydrocarbon than coal[4] and so could be used as a stop-gap in the UK to help wean us off coal, as we transition to a low carbon economy. In practice, however, the report of the Chief Scientist to the Department of Energy and Climate Change concludes that it is more likely that, rather than replace coal, shale gas would merely be used to reduce imports of natural gas, with minimal emission benefits.

In contrast, the main concern is that, at a time when we need to move rapidly to a low carbon economy, and are at ever-increasing risk of missing our emissions targets[5], the development of fracking will lock the UK into carbon-based energy emissions for many decades to come. As well as directly impacting our carbon target and increasing the cumulative total of emissions[6], this has the potential to reduce investment in innovation, development and deployment of (a) lower-carbon or zero-carbon options, including renewables, such as solar power, and (b) increased energy efficiency. Both are urgently required to limit climate risks. The current energy policy debate and recent announcements of major government incentives and investments in shale gas production - coupled with the sharp reduction in support for the renewable industry - show that this danger is already a real one in the UK.

[1] http://drillordrop.com/2014/03/04/33000-shale-gas-wells-in-lancashire-professor-estimates/
[2] New scientist 2956 February 2015
[3] Broderick L & Anderson K (2012) Has US Shale Gas Reduced CO2 Emissions? Examining recent changes in emissions from the US power sector and traded fossil fuels, Briefing Report, Tyndal Manchester Climate Change research. Manchester University.
[4] Per kilowatt-hour of electricity generated, shale gas produces less than half the carbon emissions of coal, although this does not take into account release of gasses (particularly methane) through venting and other activities arising from production. For example. Kevin Anderson of the University of Manchester, reported that, overall, the expansion of fracking in the US increased rather than reduced emissions.
[5] http://www.theguardian.com/environment/2015/jul/03/decc-staff-cuts-90-percent-threaten-uks-climate-change-plans-experts
[6] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/237330/MacKay_Stone_shale_study_report_09092013.pdf

(ii) Methane release into the atmosphere

In addition to the CO_2 release from *burning* of shale gas, fracking brings the risk of releasing other emissions, particularly methane, to the atmosphere as by-products to fracking. Methane is an exceptionally damaging greenhouse gas: the Intergovernmental Panel on Climate Change's assessment is that the global warming potential of methane is up to 86 times higher than carbon dioxide over a 20-year period. Broderick & Anderson (2012), estimate that, in the US, the impact of uncontained methane release from the expansion of fracking increases, rather than reduces emissions.

Methane is released from fracking though fugitive gas, including from poorly sealed and abandoned wells[7]. Fluids can also accumulate in older wells, blocking the gas from being extracted. These wells are vented to remove this fluid, sometimes up to several times per day, which can release considerable amounts of methane into the atmosphere.

A UK government commissioned study which reviewed the available evidence, found that if adequately regulated, local greenhouse gas emissions from shale gas operations should represent a small proportion of the total carbon footprint of shale gas. However, this relies on a very strict regulation including minimising flaring and venting, high levels of surveillance during drilling operations for leak detection, and effective long term aftercare to monitor and maintain capped wells.

3.2 Water take

Fracking requires a lot of water. The amounts vary considerably depending on drilling and geological conditions. Based on US data water consumption can be up to 10 million litres per well and on average requires the equivalent of use by c1000 citizens pr yr[6]. Onshore fracking in the UK will require that this water comes from aquifers or surface water sourced directly from the environment, or purchased from the water companies and piped or tucked to the drilling site. Most water use is up-front, in the days and weeks during the initial drilling and fracking process.

Evidence presented by the Environment Agency to the Parliamentary 'Environmental risks of fracking inquiry' suggested that water usage at a peak level would be considerable – around 0.1% of national usage[8], the impact on local water availability in affected areas could be considerable, particularly acute in water stressed SE England, where some catchments are already over-abstracted[9,10]. In these water-scarce areas, use for fracking could induce domestic water shortages or conflicts with other water users. In these circumstances there is particular risk that the need to maintain aquifers to protect critical freshwater bodies and wetlands will be outweighed by the financial interests of shale fracking. Given the current staffing capacity at DECC, the HSE and the EA, and the financial pressure these departments are under, we are uncertain whether the best-case scenarios for monitoring, and mitigation can be applied.

3.3 Land take

Shale gas formations typically cover wide area underground, and will require multiple surface entry points. A typical well pad may be approximately one hectare, which may increase if there were multiple wells on a single well-site. For example December 2013 DECC Strategic Environmental Assessment report indicates that 2-3 hectares of land would be required per pad[11]. Estimates that fracking in the Upper Bowland Basin in Lancashire could need a total of 33,000 wells on 5,500 pads to extract 15% of gas reserves. This suggests the likelihood of considerable land-take in high-density gas fields, with the risk of destruction of high quality freshwater habitats, and the need for translocation of threatened species. The record of success for freshwater species translocation is particularly poor (see below), and some wetland habitats are not simply re-creatable.

[7] New Scientist Magazine issue 3034, 15 August 2015
[8] http://www.publications.parliament.uk/pa/cm201314/cmselect/cmsctech/272/272we03.htm
[9] http://drillordrop.com/2014/03/04/33000-shale-gas-wells-in-lancashire-professor-estimates/
[10] Groundwater Body, Groundwater Quality Reports (Environment Agency – Southern Region. 2008.
[11] Department of Energy and Climate Change Strategic Environmental Assessment for Further Onshore Oil and Gas Licensing. UK Govt DECC.

During 2015 the UK government has vacillated over its policy for drilling in areas that are protected as critical for biodiversity (including National Parks and Sites of Special Scientific Interest), and important for water quality and quantity (e.g. Groundwater Source Protection Zones). Given the importance and vulnerability of these areas, it is essential that they are exempt from drilling, and adequately buffered to prevent impacts around their borders. In addition, there are many critical freshwater habitats and species outside of these areas, and when undertaken over a wider area, with multiple installations, land take for fracking could potentially result in a significant fragmentation or loss of freshwater habitats.

3.4 Water pollution

A frequently expressed concern associated with shale gas operations is that contamination of groundwater and surface-waters could occur as a result of fracking. Contamination could arise from a number of sources:

(i) The water-based fluids used for the fracking process may include of a wide range of chemical additives such as hydrochloric acid, sulphuric acid, polycrylamide and biocides used, for example, to clear out debris from drilling and reduce corrosion and friction. Risks from these chemicals in the UK are likely to be reduced as all chemicals need to be classified as 'non-hazardous' by the Environment Agency and, in the ground, they will be much diluted by pumping fluids[12]. However, they could potentially constitute a threat to fresh water life if surface spills occur in their concentrated forms.

(i) Fracking releases formation water that is naturally present in the rocks that are drilled and fractured. This water is returned to the surface, with the hydraulic fracturing fluids as a result of drilling. If the borehole is deep, formation water is usually very salty and can contain and a number of toxins, including high levels of radioactive radon, heavy metals and other NORM (Naturally Occurring Radioactive Materials) and toxins.

Near surface aquifers maintain many important freshwater habitats including springs, streams, lakes, ponds, fenland drains and many types of wetland. There is potential for *underground* pollution of these shallow aquifers from either fracking fluids or formation water as a result of acute or chronic failure of the shale gas borehole, or if contaminants travel upwards from the target fractures through subsurface pathways. The extent to which these process are a risk is hotly debated, with many claims and counter claims[5,13]. Difficulties getting at the truth are compounded in the US, where fracking has continued for longest, because legal settlements and non-disclosure agreements prevent access to documentation of incidents, and in some cases the Department of Environmental Protection has seemingly 'mishandled' cases[14].

On the *currently available* evidence, *surface* pollution of waterbodies seems likely to be a more significant threat to the freshwater environment than sub-surface pollution of shallow aquifers. Surface water pollution can occur as a result of onsite spills or leaks, or the disposal of the considerable volumes of contaminated or saline water returned to the surface from the fracturing process. There are well documented examples of pollution including a fracking well in Bradford County, US, which malfunctioned in April 2011, spilling thousands of gallons of contaminated fracking water for more than 12 hours. There are also published data of surface water impacts resulting from the accumulation of toxic and radioactive elements (e.g. radium isotopes) in stream sediments near fracking disposal sites[4,15].

[12] Department of Energy & Climate Change (2014). "Fracking UK shale: Water"
[13] Vengosh, Jackson, Warner, Darrah & Kondash (2014) A Critical Review of the Risks to Water Resources from Unconventional Shale Gas Development and Hydraulic Fracturing in the United States. *Environ. Sci. Technol.*, 48, 8334–8348
[14] http://publicherald.org/public-herald-30-month-report-finds-dep-fracking-complaint-investigations-are-cooked/
[15] http://www.nytimes.com/2011/02/27/us/27gas.html?_r=2&hp

3.5 Likelihood of adequate monitoring and mitigation

It is clear that in the US there has sometimes been considerable environmental damage as a result of fracking. However in some states the industry has been minimally regulated and there is now greater understanding of the need to mitigate fracking risks. In the UK the pro-fracking argument is that, the levels of protection employed would minimise damage because of (i) experience from failures elsewhere, (ii) high scrutiny and interest (iii) our more stringent EU and UK laws.

Based on our own experience, Freshwater Habitats Trust remains rather sceptical about the likely effectiveness of freshwater wildlife protection for fracking and indeed development more widely. To give a single example for freshwater mitigation projects: species like Great Crested Newts (see case study), which are amongst the most highly protected in the UK and Europe, have been shown to have poor outcomes from projects to mitigate damage by new development [16]. Given the many millions of pounds spent to protect Great Crested Newts from development impacts, this does not bode well for the safety of any freshwater species or habitat threatened by new developments such as fracking.

Case study: The success of Great Crested Newt mitigation projects and its implications

Great Crested Newts (GCN) are a highly protected species in the UK, strictly protected under law. Many millions of pounds are spent annually, monitoring GCN against damage by transport, urban and industrial development projects. Although this practice is enormously costly, there have been few positive outcomes for GCN. A recent research report[1] showed that none of the GCN mitigation schemes studied were successful in maintaining their population at previous levels, and in a quarter of sites GCN were now extinct. Post-project monitoring (a statutory requirement) was often inadequate once development went ahead, and no attempts had been made to restore or improve sites where outcomes (like the newt extinction) were poor.

The lessons that can be learnt from this are that: (i) even the strongest legal protection for a freshwater species may not prevent its habitat from damage or destruction from development pressure (ii) monitoring and mitigation work, can be expensive and superficially appear to be comprehensive. However, most work may focus on getting development proposals accepted – and once agreed, monitoring and mitigation may not be either reliable or adequate.

4 Freshwater Habitats Trust's position

Freshwater Habitats Trust's current position is that we are against the development of a shale fracking industry in the UK because we believe that the UK is presently a considerable way from being able to exploit shale gas and oil resources with adequate safety for the freshwater environment.

Our greatest concern is the contributory effect of fracking on climate through increased emissions of carbon-based volatiles. Climate change is a major national and global threat to the freshwater environment through a host of processes (see our Climate Change Policy Position). Although there are no easy solutions to fulfilling UK energy needs, it is clear that we rapidly need to move away from fossil fuels towards low carbon energy with sustained investment in renewable energy sources and carbon capture and storage to decarbonise the electricity sector. There is a significant risk that the advent of fracking in the UK will undermine the UK's ability to meet our, increasingly shaky climate change commitments and renewable energy targets by helping to derail the drive to develop clean renewable energy sources and increase energy efficiency.

[16]Lewis, B, Griffiths, RA, Wilkinson, JWW and Arnell, A (2014) Examining the fate of local great crested newt populations following licensed developments. Unpublished report to Defra, WM0321. Durrell Institute of Conservation & Ecology and Amphibian and Reptile Conservation.

Experience from the USA shows fracking can be a substantial environmental hazard at local, and possibly regional level. The UK has a different, regulatory system, however the Government's Strategic Environmental Assessment itself highlights significant uncertainties associated with the impacts of shale gas. FHT remains sceptical about the likelihood that existing UK policy and legislation would adequately protect the freshwater environment from fracking impacts, particularly including groundwater abstraction. In a political climate where the protection of even the most critical natural habitats and endangered species are increasingly marginalised in national and local planning policies, we have little confidence that freshwater habitat protection would win-out against possible impacts from aquifer abstraction, damage / destruction to freshwater habitats or water pollution. Given the potential environmental costs and uncertainties associated with the fracking process and trying to clean up pollution once it has occurred, we believe that use of the precautionary principle to avoid fracking is prudent, even were climate change arguments not relevant.

What we'll do

Fracking in context
Our current evaluation is that shale fracking on the UK mainland presents a new and additional risk to freshwater habitats and wildlife.

Freshwater Habitats Trust's response to this threat needs to be proportionate: the extent of the risk to freshwaters from fracking will inevitably be orders of magnitude less than other major national threats to wildlife such as water pollution from nutrients, and habitat loss and isolation due to agriculture, urbanisation and climate change. Our focus will therefore remain on fighting to protect species and habitats against these risks.

However the possible inter*national* contribution the fracking industry could make to global climate change and to the UKs adoption of low/no carbon economy, is of concern, and *local* impacts, particularly through water-stress and potentially land take and pollution, could be very considerable in the UK if they impact waterbodies and wetlands of critical biodiversity importance.

In response to this:

- We *will* endorse appropriate campaigns to prevent fracking in the UK.
- We *will* respond to major consultations on shale fracking as an organisation and/or through our NGO umbrella organisations, Blueprint and Wildlife and Countryside LINK.
- We *will* provide letters of support for campaigns to prevent fracking on sites where there is considerable risk to high quality waterbodies or wetlands.
- We will *not* covertly support the fracking industry by endorsing or contributing to freshwater enhancement projects that are developed to mitigate the impacts of fracking proposals.
- We *will put* significant effort into minimising the impact that fossil fuel use and climate change has on our freshwater habitats through our practical and policy activities (see our Climate Change policy).
- We *will* continue to ensure that our statutory organisational pension scheme does not include investment in fossil fuel companies.
- *We will* maintain our knowledge about shale fracking and related unconventional oil and gas extraction methodologies and mitigation measures, and will update this policy statement as appropriate.

Date Completed: November 2015.