Sustainable Water Network (SWAN) policy position: Impacts of hydraulic fracturing for shale gas on water resources.

Interactions with the Water Framework Directive (WFD) & Groundwater Directive (GD) and implications for the status of Ireland's waters

Due to the many documented impacts on water attributed to hydraulic fracturing for shale gas, combined with the absence of a coherent effective governance and regulatory framework for the industry in Ireland, it is the Sustainable Water Network (SWAN) position that hydraulic fracturing should not be permitted in Ireland and is calling for the introduction of primary legislation - such as a Shale Gas Act - to prohibit it.

It is SWAN's view that the carrying out of hydraulic fracturing and other shale-gas activities in Ireland is not consistent with the achievement of good status for our surface waters or ground waters, nor with the prevention of deterioration in water status, and therefore should not be permitted in the context of meeting EU Water Framework Directive (WFD) and Groundwater Directive (GWD) objectives.

What are the grounds for SWAN's opposition to hydraulic fracturing for shale gas?

SWAN's position is based on the comprehensive, independent research report it commissioned, '*Hydraulic Fracturing — Interactions with the Water Framework Directive & Groundwater Directive and Implications for the Status of Ireland's Waters'*. The key rationale for our position, also based on this research, is set out in this position paper.

I. Impacts on surface water and groundwater resources

There are many documented impacts to water resources attributed to shale gas production using hydraulic fracturing in the scientific literature over the past decade which are very relevant to Ireland:

1. Contamination of surface water and groundwater

Contamination of surface water and groundwater has significant potential to occur via hydraulic fracturing and associated shale gas production activities, which can contaminate both surface and groundwater by increasing hydraulic connectivity of the shale layer with the aquifer above, carrying contaminants; through poor well integrity leading to leaking wellbores and through poor wastewater management.

Hydraulic connectivity: Hydraulic fracturing used for shale gas production increases the permeability of shale layers through the creation of artificial fractures and there is a risk of these fractures extending into existing natural fracture and fault systems, facilitating the transport of contaminant gas and fluids up into overlying rock formations and freshwater aquifers.

Well integrity: One of the main causes of contamination is a lack of well integrity and there is evidence of this from the US and Canada. Contamination occurs through migration of contaminants from the wellbore into the surrounding bedrock through inadequate sealing of the

wellbore from a lack of cement application, or through cracks in the well casing, including due to changes in pressure and temperature or poor construction.

The fluid discharged by such leaks is made up of *a)* fracturing fluid which contains a mixture of chemical additives, including acids, alcohols and hydrocarbon mixtures, some of which are hazardous to human and environmental health and *b)* formation fluids which occur naturally in the shale and can contain elevated concentrations of chlorine, bromide, sodium, strontium, arsenic, iron and manganese as well as elevated concentrations of Naturally Occurring Radioactive Materials (NORMs).

The risk of leaking wellbores is high, with an estimated industry average of around 6%[1]. While this may not seem large, given the number of wells involved[2], if only 1% of Irish shale gas wells experienced leaks, this could total more than 100 compromised wells. Therefore, it is extremely likely that contaminated fluids would be released into water bodies in Ireland.

Disposal of wastewater: Hydraulic fracturing creates large, unavoidable volumes of highly saline wastewater and it has been determined that disposal of this poses the greatest shale gas-related risk to surface waters and groundwater and their ecology.

Leaks and accidental spills of wastewater caused by either operator error or equipment failure have been documented near drilling locations and have led to the contamination of soil, surface water and shallow groundwater with organic compounds, salts, oils, metals and other constituents. Overflow of lined holding ponds can occur during heavy rainfall and leaching of material into groundwater can occur through failures in the lining.

Many common wastewater treatment systems are ineffective for oil and gas wastewater due to the high salt concentration, presence of hydrocarbons, silts and clays, and process additives. Current facilities in Ireland would not be sufficient to treat this. Disposal of inadequately treated wastewater then causes environmental contamination. In Pennsylvania, high chlorine levels in effluent are believed to have resulted in algal blooms in rivers and high levels of shale-gas specific toxic metals, organic constituents and radionuclides in receiving surface waters were linked to shale gas discharge sites.

2. Water abstraction

Large quantities of water abstracted from both surface water and groundwater sources are required for the development of shale gas for drilling, transportation, processing, cementing and fracturing. While water use on average may be lower compared to other energy industries, water abstraction issues are experienced on local scales as abstraction can reduce in-stream flow, adversely affecting river and floodplain habitats and the wildlife dependent upon them.

[1] In Pennsylvania, between 2005 and 2013, 6.3% of surveyed wells were reported to authorities for infringements related to well barriers or integrity failure.

[2] The authors report an average well pad density of 2 well pads / km^2, with approximately 8 individual wells per pad, potentially over 1000km^2 in Ireland, resulting in up to 16,000 wells.

3. Legacy impacts of hydraulic fracturing

Following completion, shale gas wells need to be plugged with cement to avoid environmental damage. Improper remediation of abandoned well sites can lead to continued leaking of fugitive methane and formation fluid into local waters. Furthermore, without surface restoration at well sites, soil erosion can occur, silting surface waters and degrading stream quality. In the US, there are cases of abandoned wells having been sold off to smaller companies who later declare bankruptcy to relinquish their responsibilities regarding remediation and upkeep, increasing the risk they pose[3].

II. Governance and regulatory weaknesses

For effective governance of shale gas in Ireland, were it to go ahead, two factors would be required. The first is a thorough understanding of the likelihood of the above impacts occurring and their potential magnitude (risk), and the second is strong, effective regulation which would be capable of ensuring compliance with stringent standards.

4. Lack of understanding of the risk

Emerging technologies pose strong challenges for governance when multiple impacts and scientific uncertainty about the technology exist, as is the case with shale gas activities. The varying geology and the lack of baseline data from regions already exploiting shale-gas, and the short time in which large-scale shale-gas activities have been occurring all result in considerable uncertainties regarding a quantitative understanding of risk and the application of shale gas extraction in an Irish context.

While a general overview of the geology of the Northwest Carboniferous and Clare basins, where onshore petroleum licensing options were awarded, is available, there is a paucity of publicly available, detailed geological information or an adequate quantification of the risks of shale-gas activities under those particular geological conditions.

5. Problems with the current regulatory system

Even with a thorough understanding of the risks, a strong and effective regulatory system would be required, which does not exist. There are three significant issues of concern with the current system:

Regulatory and organisational gaps and fragmentation: There is a diverse and disjointed range of regulations and planning controls that would come into play regarding shale gas under the current legislative approach. These in turn are overseen by a disparate array of Government departments, state agencies and competent authorities with a broad range of regulatory functions from petroleum licensing, planning and water to transport and emissions licensing. These include the Department of Communications, Climate Action & Environment; the Department of Housing, Planning, Community & Local Government (also covers water); EPA; Commission for Energy

3 This was examined comprehensively in a 2011 paper on the regulatory framework for shale gas well site reclamation in Pennsylvania. See research report for citation.

Regulation (CER); Local Authorities; An Bord Pleanála and National Parks and Wildlife Service (NPWS).

The four-way split between petroleum licensing (the Minister), pollution (IPC licences under the EPA), regulations by the CER, and the planning process strongly militates against any one regulator being capable of assuming adequate oversight of the total environmental impacts of a proposed project on the environment.

The risk of this ineffective system has been illustrated in the US, where environmental degradation has occurred in regions where regulation has typically lagged behind industry; it is imperative that we learn from these costly debacles.

In addition to this fragmentation of regulatory functions, the current state of law is incomplete with gaps in existing controls. EU legislation was developed before high volume hydraulic fracturing was used in Europe so there are significant gaps, including in relation to environmental assessment, underground risk assessment and requirements for monitoring. It is unclear whether shale-gas activities would be subjected to mandatory Environmental Impact Assessment (EIA) or Strategic Environmental Assessment (SEA), and in addition, the EU Commission itself has identified doubts as to the suitability of the European regulatory regime, especially in relation to water protection. The lack of mandatory Environmental Impact Assessment, in particular, is a fundamental flaw at the heart of this primary piece of law designed to eliminate or reduce environmental harm from development.

Resource & institutional constraints: There is an absence of capacity and the very specific expertise required for shale gas regulation across all relevant agencies in Ireland. In fact, there are strong concerns that resource constraints make it difficult or impossible to ensure robust regulatory supervision of hydrocarbon activities that are currently licensed.

The Petroleum Affairs Division has come in for sustained criticism for its perceived lax approach to oil and gas companies. Furthermore, it is our considered opinion that it suffers from persistent staff shortages and a lack of geological expertise. The EPA appears to suffer similar staff constraints and its prosecutorial functions are heavily weighted towards local authority, light industrial and foodstuff activities, with no record at the time of research of EPA prosecution for violations of a licence granted to an extractive activity since 2000.

As a result of this inability to grapple with, and proactively supervise the extractive industry, there is a perception that regulators are unhealthily reliant on the co-operation of those regulated. This situation would only be intensified by the introduction of hydraulic fracturing, an emergent industry for which there is little or no institutional expertise in Ireland.

The function of an Bord Pleanála: The Board operates under considerable pressure and has been repeatedly criticised for the opacity of its decisions and the brevity of the rationale upon which it justifies the decision to approve or reject major infrastructure projects. This is particularly the case where the Board's Inspector recommends refusal of the project even in very trenchant

terms yet the application is approved without any fulsome explanation.[4] This has led to calls for an institutional overhaul of the Board and to questions being raised over its ability to adequately process and assess complex applications with interrelated environmental effects.

Secondly, the Board only has authority to consider matters directly related to planning, the built environment and environmental effects from these. It does not generally consider the operational effects of large extractive facilities, which are left to the EPA or the CER, as appropriate, with interaction between these voluntary rather than mandatory. This approach means that at no point does a single regulator or regulatory body have all of the collated information in relation to construction, operation and wind-down and associated environmental risks before it, in order that a holistic and integrated view on the proposed operation can be taken.

III. Conclusion:

In light of the evidence of significant risk of serious impacts on the water environment, combined with the large gaps in legislation and an utterly inadequate regulatory system, SWAN is of the firm view that hydraulic fracturing for shale gas must be prohibited in Ireland.

[4] See for example the decision of the Board to approve the upgrading of the N86 from Dingle to Annascaul in November 2014 where the Board's Inspector had been highly critical of the decision of Kerry County Council to split the road into two sections for the purpose of EIS.

Appendix:

Sustainable Water Network (SWAN): Introduction and Member Organisations

The Sustainable Water Network (SWAN) is an umbrella network of 26 of Ireland's leading environmental NGOs, national and regional, working together to protect and enhance Ireland's water resources and aquatic environment through coordinated participation in water policy development and implementation, including the Water Framework Directive (WFD), the Marine Strategy Framework Directive (MSFD), the Floods Directive and other water-related policy and legislation. SWAN member groups are as follow:

SWAN National Groups		**SWAN Regional & Local Groups**	
1.	An Taisce	15.	Carra Mask Corrib Water Protection Group
2.	Bat Conservation Ireland		
3.	Birdwatch Ireland	16.	Cavan Leitrim Environmental Awareness Network
4.	Coastwatch Europe Network		
5.	Coomhola Salmon Trust Ltd.	17.	Celebrate Water
6.	Eco-UNESCO	18.	Cork Environmental Forum
7.	Friends of the Earth	19.	Cork Nature Network
8.	Friends of the Irish Environment	20.	Longford Environmental Alliance
9.	Irish Peatland Conservation Council	21.	Macroom District Environmental Group
10.	Irish Seal Sanctuary	22.	Save Our Lough Derg
11.	Irish Water and Fish Preservation Society	23.	Save Our Lough Ree
12.	Irish Whale and Dolphin Group	24.	Save The Swilly
13.	Irish Wildlife Trust	25.	Shannon Whale & Dolphin Foundation
14.	Voice Of Irish Concern for the Environment (VOICE)	26.	Slaney River Trust