Offshore Petroleum Regulator
for Environment & Decommissioning

The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020

Regulation 14(3)
Secretary of State Decision

BG International Limited

Jackdaw Field Development

To: [redacted]

Decision recommendation:

That you agree, on behalf of the Secretary of State, to the grant of consent by the Oil and Gas Authority (OGA[1]).

As set out further below, taking into account the relevant considerations, I have concluded that the project will not have any significant effects on the environment and have decided the conditions that should be attached to the agreement to the grant of consent.

From: [redacted]

Date: 27 May 2022

ES Title:	Jackdaw Field Development
Developer:	BG International Limited
Consultants:	Genesis Oil and Gas Consultants Ltd
OGA Field Group:	Central North Sea (CNS)
ES Report No:	D/4260/2021
ES Submission Date:	6 May 2021
Block No/s:	30/02a, 30/03a, and 30/02d
Project Type:	Ultra-High Pressure High Temperature (uHP/HT) gas / Condensate field development
OGA Reference No:	PCON/5800

Project description

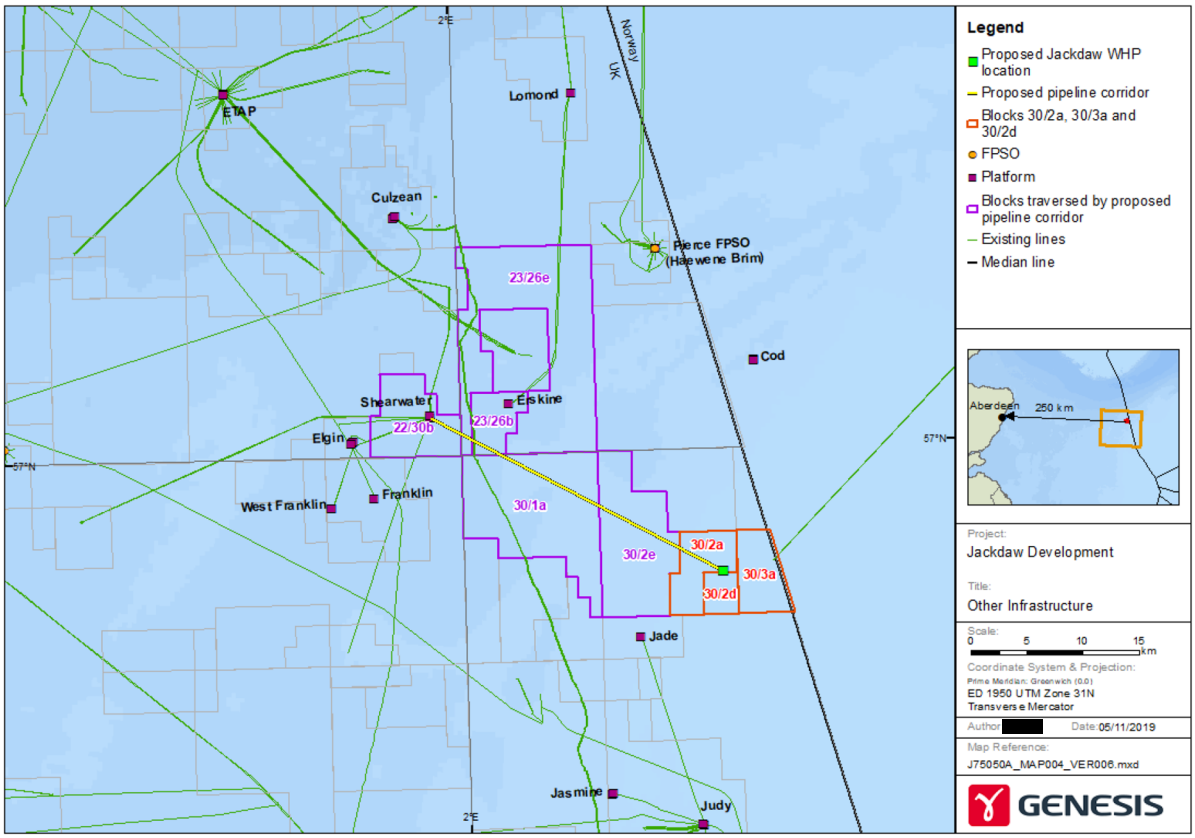
The Jackdaw field is an ultra-high pressure / high temperature (uHP/HT) gas condensate field. The proposed project involves developing the field via a new wellhead platform (WHP). The proposed project will be located in the Central North Sea, approximately 250 km east of Aberdeen and 30 km southeast from the Shearwater platform and adjacent to the

[1] The Oil and Gas Authority now operates under the business name of the North Sea Transition Authority (NSTA).

UK/Norwegian median line. Water depth at the Jackdaw area is approximately 78 m.

The development proposal is to develop the field which will consist of four production wells drilled at the Jackdaw WHP using a heavy-duty jack-up rig (HDJU). Jackdaw fluids will be commingled at the WHP and exported to the Shearwater platform via a new 31 km 12" nominal bore pipeline to the existing Shearwater platform, where the fluids will be processed with gas exported via the Fulmar Gas Line (FGL) and condensate exported via the Forties Pipeline System (FPS). The WHP will be operated as a not permanently attended installation (NPAI) with control, monitoring, and shutdown and operational support provided by the Shearwater host.

To support the development of the Jackdaw field, there will be some additional minor modifications at the Shearwater A WHP and Shearwater C process, utilities and quarters platform. At the Shearwater A WHP new reception facilities including a new riser and blowdown module will be installed. At Shearwater C modifications to the acid gas removal unit (amine unit) will be undertaken.



Summary of Procedural History

6 May 2021	Environmental Statement (ES) submitted to OPRED
17 June 2021	OPRED request for further information
28 June 2021	Developer submits further information
28 September 2021	Decision made, on behalf of the Secretary of State, to refuse to agree to the grant of consent
14 October 2021	Following developer's proposal of changes to the project, OPRED requests further information
22 February 2022	Developer submits further information, in the form of a revised ES and revised summary of the project

13 May 2022	OPRED request for further information
17 May 2022	Developer submits further information

Key environmental effects

The ES identified and discussed the following as having the potential to cause an environmental impact:

- Effects on users of the sea (e.g., commercial fishing & shipping) from the physical presence of temporary and permanent infrastructure;
- Effects on the sediment, seabed habitats, fauna and flora from seabed disturbance caused by the placement of temporary and permanent infrastructure:
- Effects on water quality, flora and fauna from discharges to sea caused by drilling, commissioning and operational produced water;
- Effects on marine mammals and fish from underwater noise caused by piling of infrastructure and vessel traffic;
- Effects on the water quality, protected species and habitats, fauna and flora from an accidental event resulting in an oil release; and
- Effects on the local air quality and climate from the discharge of atmospheric emissions generated from the project.

Key environmental sensitivities

The ES identified the following environmental sensitivities:

- Fish and shellfish: The project area lies within multiple nursery and spawning areas of fish species. Fish such as anglerfish, blue whiting, cod, haddock, herring, lemon sole, ling, mackerel, Norway pout, plaice, sandeels, spurdog and whiting are known to be found in the project area. Site specific survey footage verified the presence of flatfish, cod and haddock. Cod, spotted ray and spurdog are also listed on the OSPAR list of threatened and/or declining species in the project location. Sandeels are known to have a particularly important ecological function as a prey item for other fish, seabirds and marine mammals. There is evidence that the presence of fines in the sediment reduces the seabed's suitability to sandeels.

- Seabirds: Multiple species of seabird could be present at the project area in various levels of abundance. The highest abundancy of species is attributed to the Northern fulmar, common guillemot, and Atlantic puffin. The abundancy of these species is moderate (between 5-10 individuals per km^2). Sensitivity of seabirds in the project area is generally low throughout the year with exceptions in May and June when sensitivity is extremely high in block 30/08, medium in block 30/03. In September and October, the sensitivity is regarded as high in block 23/26.

- Protected habitats and species: There are no Special Areas of Conservation within 40 km of the project area. The Fulmar Marine Conservation Zone (MCZ) is approximately 32 km from the project area. The MCZ has been designated for its subtidal sand, mud and mixed sediments as well as the Ocean Quahog. During site specific surveys juvenile Ocean Quahog were observed in samples. Horse mussels were observed at some of the site survey transects in the project area, but none of the areas were observed to meet criteria of reefs.

- European Protected Species and pinnipeds: Cetaceans such as harbour porpoise, minke whale, white beaked dolphin and Atlantic white-sided dolphin are likely to occur in the project area, predominantly during the months from May to November.

Pinnipeds, such as the grey seal and the harbour seal, may occur in the project area in very low densities, but are far more common close to shore.

- Other users of the sea: Commercial fishing effort in the project area has been assessed as “low” representing less than 1% of the total UK fishing effort. The majority of fishing effort in the project area is focussed on the summer months. Demersal and shellfish fishing gear is most prevalent, but pelagic gear is also used in the project area.

  Shipping density in the area ranges from very low to moderate. The project area sits within a well-established location for offshore oil and gas infrastructure. The closest platform to the proposed WHP location is the Jade installation, situated approximately 10 km to the southwest of the WHP location. The closest installation to the pipeline route is the Erskine installation, which is approximately 4 km to the northeast of the pipeline route, with the Elgin platform located 8 km west-southwest of the Shearwater host facility. The project area is not used for military exercises. There are no wrecks within 10 km of the WHP, but a wreck has been identified 4.3 km from the proposed pipeline route.

- In-combination, cumulative and transboundary sensitivities: The project area is adjacent to the Norway / UK median line and closest (8 km South) to a Norwegian Particularly Valuable Area for mackerel spawning. The installation of infrastructure (siting the WHP and associated 500 metre safety zone) will reduce availability of natural environment to activities such as fishing, but this will be offset by trenching and burying the pipeline so that fishing activities can continue in those locations. No other oil and gas construction activities are planned in the project area at the time installation and commissioning of the Jackdaw project would take place. The project has the potential to add cumulatively to the produced water discharge and atmospheric emissions at Shearwater.

Public consultations

Three public consultations have been carried out in relation to the ES and further information provided by the developer:

1. The ES and the summary of the project was subject to public consultation, for which the public notice was published on 10 May 2021 and ended on 9 June 2021. There were no public representations received.

2. Some of the further information provided on 28 June 2021 engaged regulation 12(3), and was subject to further public consultation, for which the public notice was published on 6 July 2021 and ended on 5 August 2021. There were no public representations received.

3. The further information provided on 22 February 2022 engaged regulation 12(3) and was subject to further public consultation, for which the public notice was published on 18 March 2022 and ended on 18 April 2022. Two public representations were received.

The public representations raised a number of points. The following is a summary of those points and how they were taken into account in reaching a conclusion on the significant effects of the project on the environment:

a) The changes to the project set out in the revised ES submitted on 22 February 2022

fail to alter the project philosophy, in particular in failing to consider use of the Judy platform as a host facility as a reasonable alternative.

The impact of the changes to the project, in particular in relation to the effect on the environment of atmospheric emissions, are discussed in more detail below. Taking into account the additional information provided by the developer in relation to the Judy platform, I consider that it does not constitute a reasonable alternative to the developer's chosen option for the reasons set out in Appendix E to the revised ES submitted on 22 February 2022.

b) The upstream emissions from the project are excessive.

The effect of these emissions on the environment is discussed in more detail below.

c) The ES fails to assess downstream emissions related to oil and gas produced by the Jackdaw project.

In general, OPRED does not consider that emissions resulting from end use of oil and gas produced from offshore field development projects such as Jackdaw are a matter for individual project environmental statements. This is for three reasons: (i) the management of greenhouse gas (GHG) emissions from the use of oil and gas are carefully considered elsewhere under wider Government policy; (ii) it would not be possible for OPRED or the developer to assess with any degree of certainty the impact of the end use of the produced hydrocarbons, as the information on the nature and extent of the end use of these products will not be known at this stage; and (iii) the EIA process is concerned with assessment of the impacts of the project in question on the environment, not the end use of a product resulting from the project. In this case, taking into account those reasons, the nature of the Jackdaw project, the information provided about the hydrocarbons to be produced from the field, and the matters raised in the public representations, I do not in any event consider that there is a sufficient degree of connection between the project and the effect of any end-use emissions for those to constitute an effect of the project that must be taken into account in the EIA.

d) The developer has failed to assess properly the impacts of the Jackdaw project on the marine environment.

These effects are discussed in more detail below.

e) The developer may have used inconsistent and/or optimistic assumptions in the assessment of cold vented methane quantities resulting in an under-estimate of the associated emissions.

The developer clarified that the assumptions used in the assessment of cold vented emissions represent an accurate reflection of the proposed activity. The methane quantity used is the maximum estimated methane venting from Jackdaw WHP during initial commissioning. The total venting requirement is based on warming of wellheads from the lowest ambient condition. Should this be undertaken during summer/autumn, as planned the duration of venting required to warm up the initial well will be shorter and quantity of vented gas lower than predicted. One long term shutdown is planned to take place every four years with one short term shut down in other year. Total venting quantity used in the ES represents an average figure for these years.

f) The developer has not given reasonable and due consideration of the alternatives to cold venting, in particular the potential for indirect heating to allow fluids to be routed to export and/or ignition on-demand flaring to ensure substantive combustion prior to emission.

Key development options considered which enabled the developer to optimise the value of the field and surrounding infrastructure, through a safe and environmentally responsible development are summarised in the ES. Having considered all available options for the safe disposal of cold vented emissions the developer has included details on the most technically, economic and environmentally feasible options within the ES.

Consultation with other authorities

The Joint Nature Conservation Committee, Ministry of Defence, Northern Lighthouse Board, Marine Scotland, and Maritime Coastal Agency have been consulted on three occasions in relation to this project:

1. The authorities were consulted on the summary of the project and the ES submitted on 6 May 2021. All the authorities submitted responses and none of the authorities had objections to the ES.

2. The authorities were consulted on the further information provided on 28 June 2021 that engaged Regulation 12(3). All the authorities submitted responses and none of the authorities had objections.

3. The authorities were consulted on the revised ES and summary of project provided by way of further information on 22 February 2022. All the authorities submitted responses and none had objections.

Consultation with other countries

Given the location of the project proposal, Norway was contacted to offer the opportunity to participate in the EIA process. However, no response was received and they therefore did not participate in the EIA process.

Further information

As noted above, further information has been requested and provided on three occasions:

1. Further information was requested on 17 June 2021 in relation to areas such as licence information, environmental effects from atmospheric emissions, future phases of development and timings of project works, produced water, and corrosion resistance. Further information was provided in response to the request on 28 June 2021. The further information was considered, and it was concluded that some of the further information engaged regulation 12(3) requirements. Further consultation was carried out in respect of that information in accordance with Regulation 12(5).

2. Following the decision of 28 September 2021, but before the OGA notified the developer of its decision regarding whether to grant consent for the project, the developer proposed changes to the project. On 14 October 2021, in accordance with regulation 12(2), OPRED directed the developer to provide further information under Regulation 12(1) about the proposed changes to the project. The developer provided

further information on 22 February 2022, in the form of a revised ES and revised summary of the project. The further information was considered, and it was concluded that it engaged regulation 12(3) requirements. Further consultation was carried out in respect of that information in accordance with Regulation 12(5).

3. Further information was requested from BG International Limited on 13 May 2022 in relation to the phasing or rephasing of the Shearwater drilling programme to reduce vented emissions levels, the impact associated with mattresses, quantities of cold vented methane from the Jackdaw WHP, emissions figures associated with the production at the WHP in relation to the power generation and venting, and the reduction in amine vent emissions based upon the export concentration. Further information was provided in response to the request on 17 May 2022. The developer outlined the commitment to phasing or rephasing the Shearwater drilling programme as part of the Jackdaw project in the revised ES and how this would enable a higher proportion of the CO_2 to be exported. Typographic errors were acknowledged in the tables relating to the impact associated with mattresses and total emissions associated with the production at the WHP in relation to the power generation and venting, which did not impact on the environmental significance. Additional clarification on how figures presented on cold venting were quantified was also provided. The further information provided clarified and confirmed the information previously provided in the revised ES, and I did not consider that the further information provided by the developer was directly relevant to reaching a conclusion on whether the project is likely to have a significant effect on the environment, and it was therefore not subject to further public notice.

Conclusion on the significant effect of the project on the environment

I have reviewed the following:

- The ES;
- Further information provided under regulation 12 as summarised above;
- The representations received from other authorities as summarised above;
- Any representations received pursuant to regulations 11, 12 and 13, as summarised above; and
- Any conditions that may be attached to the agreement to the grant of consent.

Taking those matters into account, I have concluded that there will be no significant effects of the project on the environment resulting from the following:

Physical Presence of temporary and permanent infrastructure

The physical presence of the drilling rig and support vessels whilst the project is under construction, will displace other users of the sea, which is predominantly shipping and fishing. These activities have been described above as very low to moderate respectively within the project area. There will be additional temporary exclusion zones (500 m safety zone centred on the drilling rig) during construction, which will also exclude vessels from the project area. A new safety zone associated with the Jackdaw WHP will exclude vessels for the lifespan of the field, however vessels will not be excluded from the pipeline area. The safety zone associated with the Jackdaw WHP will remove a small area from availability to fishing vessels. Fishing in the area is considered low and mostly undertaken with demersal fishing gear with some pelagic gear also used in the project area. Subsea infrastructure will be buried and covered by rock in places, the burial and rock cover will be designed to allow for safe fishing interaction. The project area is not subject to strong ocean currents and has

low sediment mobility. It is therefore unlikely that the pipeline will be scoured and freespans able to develop. I agree with the assessment, that the impacts resulting from the physical presence of drilling rigs, vessels and associated infrastructure, will not have a significant effect on the environment.

Placement of infrastructure on the seabed

The planned four new wells will be drilled using a heavy-duty jack-up rig (HDJU). The drilling rig footprint will occupy two positions (stand-off and final) and will be deployed multiple times during the commissioning phase of the project. The disturbance to the seabed will be reduced by placing the rig in the original seabed depressions. The disturbance to the seabed from the rig is the footprint of the spudcans from the HDJU, and when the anchors and chains are deployed when the rig is required to be located next to the WHP.

Permanent infrastructure will be placed on the seabed for the lifetime of the field, and these will include WHP jacket, SSIV and tie in spools and jumpers, cooling manifold and protective material (mattresses, grout bags and rock). The seabed will also be disturbed when trenching the pipeline system. Taking all the above into account, the worst-case permanent area of impact to the seabed is expected to be 0.138 km^2. The contributing factors to the permanently impacted area are the WHP jacket, subsea infrastructure and protection material (assessed as contingency worst case). Pipelaying will cause displacement and resuspension of sediments, for the trenching and backfilling of the trench (with the displaced sediment).

Upper well sections will be drilled using Water Based Mud (WBM), and the lower sections utilising Oil Based Mud (OBM). The latter will either be skipped and shipped to shore or treated and discharged to sea, whilst the WBM and cuttings will be discharged to the seabed. The risk to the seabed from the cuttings is a smothering effect which is the dominant mechanism of ecological disturbance, however this is expected to be localised and of short duration. The impact of this is contained to an area of 0.063 km^2 from the rig. On completion of drilling, the area where the combined risk to more than 5 % of the most sensitive species in the sediment is predicted to be approximately 0.328 km^2. This reduces rapidly to 0.058 km^2 during the first year following discharge due to re-colonisation by opportunistic species.

Proxy pipeline trenching modelling indicates that the Jackdaw pipeline would not result in a significant impact to the benthic environment, noting that the affected seabed area prone to covering from sediment will likely recover within a period of months. Disturbed cuttings at Shearwater are likely, but the impact would be constricted to an area within 500 m of the platform, with the risk to sensitive species rapidly reducing over time.

The widespread introduction of hard substrate (deposits of protective material such as rock and mattresses) can change the local seabed type to one that adversely affects species with a sand/gravel sediment habitat preference. The hard substrate introduced to the seabed are expected to be colonised but are not expected to result in a physical change to another habitat type.

Due to the presence of some sensitive benthic habitats and species and identification of Ocean quahog in the vicinity of the pipeline route sensitivity for sediment and habitat quality is considered to be medium. The level of fish sensitivity is also deemed to be medium on the basis of their conservation significance. There are no Annex 1 habitats within the project area. No significant impacts to benthic communities are considered likely as a result of the placement of infrastructure and protective material.

I agree with the assessment that there will be temporary impacts to the seabed, but these will be insignificant in terms of environmental effects given the ability of the environment to

recover. Sediments will be displaced, however this will be short term and temporary, with the benthic community able to recover over time. The discharge of drill cuttings and mud into the water column will cause short term smothering effects over a small area around the wellheads. The species found in the area are considered resilient to the effects of sediment disturbance and will be able to recolonise quickly. I would therefore agree with the assessment that the cumulative impacts of the project on the seabed will not be significant on the environment.

I agree with the assessment that that the impact resulting from placement of infrastructure on the seabed will be insignificant.

In the decision of 28 September 2021, OPRED noted that selecting an alternative host facility (export via Judy installation) would reduce area of impact from the project but would not have a significant effect in terms of placement of infrastructure on the seabed. As noted above, this option has not been considered further as, on the basis of the further information provided by the developer, I am content that export via the Judy installation is not a reasonable alternative.

Discharges to sea

There will be limited discharges to sea, with the majority coming from the drilling of the wells and from produced water discharge. Water Based Muds and the associated cuttings from drilling the top section will be discharged to sea. An assessment of the environmental risk to the water column from drill cutting discharges was modelled. The discharge of drilling cuttings is expected to result in a very localised reduction in water quality in the lower part of the water column (approximately 10 m above the seabed). The modelling predicts that the potential impacts are localised and very transient. Due to the good hydrographic conditions sensitivity of the project location is low. Sensitivity to fish and shellfish assessed as medium. The same level of sensitivity is also assigned to marine mammals for their protected status.

As a result of the dynamic nature of the hydrographic conditions at the proposed Jackdaw project location, there will be significant dilution and dispersion within the water column and any deterioration in water quality will be localised and short-term, with the potential for limited traces of contaminants to affect sensitive marine organism receptors in the close vicinity of the discharge point.

The impact to water quality from drilling is assessed as insignificant, which I agree with. The potential impacts to water quality and marine organisms from Jackdaw wellbore clean-up, well completion and pipeline hydrotest fluids are associated with the chemical dosed within these water-based fluids. Upon release, these discharges will be rapidly dispersed and diluted by seabed and surface currents such that any possible impact will be localised, short-lived and any effect unlikely to be detectable above background levels, and I agree that the impact to water quality and biological receptors from the drilling discharges will be insignificant.

Comingling of the Jackdaw and Shearwater produced water is not expected to result in a significant impact on water quality at Shearwater. During the operational production phase of the project, the introduction of Jackdaw fluids to the Shearwater processing system reduces the discharge dosage of the most toxic chemical used at Shearwater currently. Jackdaw has been designed to tolerate corrosion (using corrosion resistant alloys on the pipeline and topside pipework) rather than treat it by use of chemicals. The increase in the volume of produced water as a result of processing the hydrocarbons at Shearwater is an unfavourable outcome because it introduces more chemicals and oil in water to the environment, which I agree with. Aside from this negative impact, there is a positive by-product in that it reduces environmental risk from the most toxic corrosion inhibitor currently in use at the Shearwater

platform. The cumulative contribution of Jackdaw to the potential increase of oil in water compared to UKCS level is deemed to be insignificant.

I conclude that the impacts from discharge to sea from the project will not have a significant effect on the environment.

Underwater noise

The primary source of noise during the project derives from the piling activity during the installation of the WHP jacket. A maximum of four piles will be required to install the WHP jacket with each pile expected to be up to 108" (2.74 m) in diameter and approximately 91.5 m in length with a target penetration depth of around 73 m. It is expected that the installation of each pile will take a maximum of eight hours to drive to the required penetration depth and that all piles will be installed within ten days. The piles will be installed with an impact hammer with a maximum capacity of 3,500 kJ, although the estimated maximum hammer energy required to install all piles is 2,835 kJ.

Marine mammals and fish are the main receptors of underwater noise. All cetaceans are protected, but the project is not in a protected area. Cetaceans with frequencies ranging between low and high may be present during piling operations with the likelihood of presence increasing during summer months. The risk to cetaceans is greatest for high frequency cetaceans (harbour porpoise) given their thresholds to noise. Given the vulnerability, value, and protection status of the species the sensitivity level is moderate, which I agree with.

The radius to Permanent Threshold Shift (PTS) from the activity is 1,100 m when piling is at maximum sound pressure level. The radius to PTS sound exposure level is 380 m for high frequency cetaceans and 590 m for low frequency cetaceans with a 50 minute soft start where the animal is fleeing at 2 m/s. This translates to 180 m in high frequency cetaceans and 60 m in low frequency cetaceans when fleeing at 3 m/s. The behavioural disturbance from the activity could affect 0.334% of high frequency cetacean populations and 0.060% of the low frequency cetacean populations.

The developer has stated that JNCC mitigation guidelines will be followed during all piling operations, which includes the use of soft starts, MMOs and PAM. Considering the impact on the assumption of flee speeds, and the fact that the PTS and TTS will not be breached out with 500 m from the WHP jacket, the risk of hearing damage to any species of cetacean or fish is negligible. I agree with the assessment and that the proposed project will not have a significant impact resulting from underwater noise.

Accidental events

The ES assesses three worst case spill scenarios, which are a pipeline rupture, a loss of diesel inventory from the drilling rig or a vessel and a well blow-out. Although worst case modelling of the spill scenarios has been presented, due to procedural and operational controls that will applied during the Jackdaw Project the likelihood of any of the three hydrocarbon releases occurring is considered to be remote.

In the unlikely event that the worst case pipeline release should occur subsea, condensate would be expected to rise and concentrate in the upper water column due to pipeline pressure and oil buoyancy, with a large proportion initially dispersing in the water column. Surface sheen would be predicted to cover a small area and would mostly disappear within 15 days of the release, with a low probability of crossing the median line. Modelling suggests that over 70% of the released condensate would either evaporate or biodegrade by the end of the 30-day simulation, with 30% of the condensate evaporating within the 1st day. There would be a medium probability of condensate in the water column crossing the Norwegian

median line within a day after the release, but only 17 tonnes (te) would remain dispersed through the 12.5 km^3 of the water column by the end of 30 days. No oil would be expected to reach any coastlines. 25% of the originally dispersed oil would be predicted to be deposited on the sediments. However, the maximum predicted concentration (0.04 g/m^2) would be significantly below the environmental threshold (5 g/m^2). On the basis of the project design and implementation of engineering controls and operational procedures it is considered that the likelihood of a large release of hydrocarbons from a pipeline release is remote.

A worst case surface diesel spill would be predicted to initially result in a surface sheen lasting 2 to 3 days, after which dispersion, evaporation and biodegradation processes would start. Modelling suggests that 68% of the released diesel would either evaporate of biodegrade within 30 days, with 30% evaporating within 2 days of the release. Most of the diesel would remain in the upper part of the water column. There would be a 74% probability of diesel in water column crossing the Norwegian median line within a day after the release, but only 1.3 te would remain dispersed through the 24 km^3 of the water column by the end of 30 days. There would be a very low, (1%) probability that traces of hydrocarbons would reach the Norwegian coastline, well below the defined thresholds. Some diesel originally dispersed in the water column would be predicted to be deposited on the sediments, with 31% of the total amount predicted to be deposited by the end of the 30-day simulation. However, the predicted concentrations (maximum 0.45 g/m^2) would be significantly below the environmental threshold.

In the case of a blow-out there would be a 90-100% probability that a visible sheen could extend approximately 160 km east from the source of the spill and a 25% probability that it could reach up to 520 km east. The deterministic modelling of the worst case predicts the total area of condensate sheen >0.3 µm thick over the entire course of the simulation would be approximately 97,200 km^2. The maximum thickness estimated anywhere at the sea surface would be 1,296 µm (1.3 mm). In the event of a blowout occurring the maximum probability of shoreline oiling is 55%. The minimum arrival time for condensate to reach the shore would be 20 days for Denmark. Deterministic modelling of the worst case blow-out scenario predicts that less than 1% of condensate would reach the shore. The threshold of 100 g/m^2 would be predicted to be exceeded along 36.77 km of coastline (southern Norway and northern Denmark) at the end of the simulation (160 days). There would be a low probability of condensate reaching coasts of UK (5%), Netherlands (4%) and Germany (6%).

Impacts of the accidental release of condensate and diesel have been evaluated in the ES by considering the predicted modelling results in relation to the environmental receptors that could be impacted. Sensitivity scores have been assigned to each of the worst case spill scenarios. The sensitivity score for water quality for a diesel or pipeline release has been classified as low due to the location in open water conditions which will naturally disperse and dilute marine discharges. In the case of a well blow-out, the receptor sensitivity has been considered to be high due to the wider area and potential sensitive coastal environments that could be affected. Magnitude of the impacts is deemed to be major.

The developer has also used in the assessment a likelihood criteria which helps determine an environmental risk level for unplanned events. This helps to understand the level of impact and risk of what is an unlikely environmental effect. For a blow-out, the environmental risk is considered to be moderate and the environmental impact on the water column significant. I agree with the assessment that the impact from a well blow-out on other receptors (sediment quality, benthos, fish, seabirds, marine mammals, and offshore protected areas) would be significant. I also agree with the assessment provided for fisheries and aquaculture, coastal protected areas and local communities.

I agree with the conclusion that an accidental event, in this case a well blow-out from a

Jackdaw well, has the potential to have a significant effect on the environment. As set out further below, the developer has committed to put in place mitigation measures that will avoid, and/or reduce the unlikely significant adverse effects on the environment from an accidental event. Combining the known control and mitigation measures with the unlikely possibility of the significant effect, I agree with the assessment of the environmental effects attributed to the accidental events.

Atmospheric emissions

The primary receptors considered in relation to the atmospheric emissions from the project were local air quality, ocean acidification and climate change. The dispersion of atmospheric emissions is directly influenced by meteorological conditions which are by nature relatively dynamic in the offshore North Sea environment.

The principal climate change objective considered when assessing the effects of emissions on climate consisted of the targets set out in the Climate Change Act 2008 (as amended). Consideration was also given to supporting industry commitments and initiatives developed to facilitate progress towards Government targets set out in the North Sea Transition Deal and the Energy White Paper including the Balanced Net Zero Pathway. The magnitude of the impact from Jackdaw emissions was considered alongside reported UK and UKCS emissions, the UK carbon budgets, the predicted UK total emissions based on recent UK government estimations and the emissions levels consistent with emissions reduction targets outlined in the North Sea Transition Deal.

The ES has considered atmospheric emissions from Jackdaw that are incremental to the baseline of the projected emissions from the existing (or 'native') Shearwater hub development covering multiple existing onstream fields. Assessment of the atmospheric emissions from the construction phase considered fuel combustion from the HDJU rig, drilling support vessels and helicopters and installation and support vessels. During the Jackdaw WHP commissioning phase, atmospheric emissions associated with WHP commissioning power generation, and venting and flaring during Jackdaw well start-up were also assessed. Emissions from the production operations considered emissions from energy demand, combustion of fuel, emissions from intermittent venting and emissions associated with transits to the field.

As set out in the decision of 28 September 2021, it was previously concluded that the project as set out in the ES submitted on 6 May 2021, and the further information submitted on 28 June 2021, would have a significant effect on the environment resulting from atmospheric emissions. The developer subsequently proposed changes to the project, as set out in the revised ES submitted on 22 February 2022. The developer has stated that the key proposed changes to the Jackdaw project are an optimisation of the existing Shearwater gas processing facilities (including chemical change at the amine unit), maximising volumes of CO_2 that can be blended into the export pipeline, and phasing of the Shearwater drilling programme to reduce atmospheric emissions levels for the period Jackdaw is producing. These changes reduce offshore emissions relative to the previous proposal.

The 28 September 2021 decision noted that selecting a reasonable alternative host facility (export via Judy installation) to manage the Jackdaw fluids could avoid, prevent or reduce the likely significant effect of the project's atmospheric vented emissions. As noted above, this option has not been considered further as, on the basis of the further information provided by the developer, I am content that export via the Judy installation is not a reasonable alternative.

The project as now proposed includes optimising the Shearwater gas processing facility, including the amine unit in order to maximise the volume of CO_2 exported to St Fergus. Jackdaw reservoir gas naturally contains approximately 4% CO_2 and the largest contribution to GHG emissions from Jackdaw production would come from the vented emission of that CO_2 (approximately 380,000 te CO_{2e} over field life). To ensure gas exported from Shearwater is within the export specification, an amine unit treats the gas to remove and discharge a proportion of that CO_2. Tying the Jackdaw field to the Shearwater hub and making use of the existing infrastructure enables the developer to modify Shearwater gas processing facilities to redirect that CO_2 currently discharged via the flare to a new dedicated discharge point (vent). The Shearwater amine system would be optimised to minimise the emission of CO_2 at Shearwater and maximise the CO_2 content of the export gas whilst protecting the ability to export. Routing the amine unit emissions at Shearwater away from the LP flare system to a new vent discharge point would improve flare efficiency and avoid an estimated additional 209,000 te of CO_2 emissions associated with combustion of supplementary fuel gas at the LP flare or additional emissions from venting hydrocarbons, such as methane, at the flare should the LP flare be extinguished. In optimising the existing Shearwater process, the developer has reduced the expected vented Jackdaw emissions of CO_2 by approximately 14% relative to the previous proposal (433 kt to 380 kt).

In order to further minimise the cumulative vented emissions of CO_2 at Shearwater, the developer in the changes to the project has committed to managing the phasing of the Shearwater drilling programme for the period Jackdaw is producing. Phasing the drilling programme in combination with the other measures outlined above results in cumulative vented emissions of CO_2 of 456 kt for Jackdaw and Shearwater combined for the period Jackdaw is producing, which the developer has indicated would result in a reduction of 43% relative to the previous proposal (800 kt to 456 kt).

The Jackdaw operational incremental emissions amount to 543 kt CO_{2e} with the native baseline of the Shearwater hub amounting to 2550 kt CO_{2e} (from 2025), with the worst case total annual CO_{2e} emissions from Jackdaw expected to be 131 kt. The 2018 UKCS emissions form the basis of the North Sea Transition Deal (NSTD) target reduction and are used as the benchmark comparator. The worst case estimated annual CO_{2e} emissions from the Jackdaw project is anticipated to represent 0.028% of the 2018 overall UK emissions and 0.9% of the UKCS emissions. When considered cumulatively, Jackdaw and Shearwater (including fields tied back to Shearwater), the worst case estimated annual emissions would reflect 0.1% of the 2018 overall UK emissions and 3% of the 2018 reports UKCS emissions. Inclusion of Shearwater emissions in a cumulative sense is important, as without Jackdaw, Shearwater's longevity would be notably shortened. The developer is committed to working towards the Government's Net Zero target driven by an active GHG Emissions Management Plan, which includes reducing emissions and preinstalling a J-tube to accommodate an electrification retrofit should a local or regional supply of green electricity become available during Jackdaw field life.

UKCS vented emissions are a small subset of the overall UKCS CO_{2e} emissions and in 2018 were estimated at 677,640 te. Gas venting in the Central North Sea (CNS) region for 2018 for CO_{2e} was 380,573 te. The worst-case annual volume of CO_{2e} from the amine unit in 2026 would represent 24% of the vented emissions in the CNS. Vented GHG emissions represent a minor component of the total GHG emissions of the UKCS and UK CNS, with the majority of emissions resulting from power generation and gas compression. The total Shearwater and Jackdaw vented emissions equate to 0.02% of overall UK emissions in 2018 and 0.64% of total UKCS emissions in 2018.

The Jackdaw Project and operation spans the 4th, 5th and 6th carbon budget periods. The ES describes that, overall, the Jackdaw Project will contribute to 0.0154%, 0.0134% and 0.0012% of the UK 4th, 5th, and 6th carbon budget allowance respectively and therefore represents a relatively minor percentage increase to the wider UK GHG emissions. The ES also compares CO_{2e} emissions from Jackdaw and Shearwater with the NSTD reduction targets set for 2025, 2027 and 2030. Jackdaw total emissions in 2025, 2027 and 2030 account for 0.307%, 1.177% and 0.555% of the total UKCS emissions that would achieve the targets of 10%, 25% and 50% reduction respectively. It was therefore considered that emissions from Jackdaw as a proportion of the forecast emissions from the UKCS would not hinder the progress towards the targets, or affect the ability of the oil and gas industry to meet them.

GHG intensity is the emission rate of CO_{2e} relative to the amount of hydrocarbon production (expressed in tonnes of CO_{2e} per tonne of hydrocarbons produced from Jackdaw). Energy intensity is the ratio of energy required in GJ per tonne of hydrocarbons produced. The change to the Jackdaw schedule in the revised ES results in the Jackdaw project now benefiting from an increase in the available ullage capacity at the Shearwater export compressors. This increase in capacity reduces the additional energy requirements for the Jackdaw project and also reduces some of the power emissions resulting from Jackdaw production. The utilisation of spare ullage capacity and changes to the amine unit results in a GHG intensity performance of 0.061 tonnes of CO_{2e} per tonne of hydrocarbon, which is a 25 % improvement in GHG intensity (0.082 tonnes of CO_{2e} per tonne of hydrocarbon in the previous proposal). The average GHG intensity data for the European region published by IOGP in 2017 is 0.092 tonnes of CO_{2e} per tonne of hydrocarbon. With the addition of the Jackdaw production, the energy intensity at Shearwater will be improved from 9.2 GJ/ton HC to 3.4 GJ/ton HC for Shearwater Native and Jackdaw collectively, which represents a 170% improvement averaged over the Jackdaw production period.

Taking into account the changes made to the Jackdaw Project since the decision of 28 September 2021, it is my assessment, that when taken in the wider context of UK atmospheric emissions the aggregate volume of estimated emissions is such that that there will be no significant effect on the environment. As set out further below, the developer has committed to put in place measures that will avoid, prevent, reduce or offset any significant adverse effects on the environment from atmospheric emissions. The measures include an optimisation of the existing Shearwater gas processing facilities (including chemical change at the amine unit), maximising volumes of CO_2 that can be blended into the export pipeline, and phasing of the Shearwater drilling programme to reduce vented emissions levels for the period Jackdaw is producing. I agree that the atmospheric emissions contribute to global and transboundary effects that are of high sensitivity for environmental impact. Atmospheric emissions associated with the Jackdaw Project would make a relatively minor contribution to increased atmospheric concentrations of GHG, and it is not anticipated that the project would significantly impact upon the requirement to meet the current or future emissions targets. I agree with the assessment of the environmental effects from the atmospheric emissions, including from vented emissions.

In relation to local air quality, the ES assesses the significance of the different types of impacts from air emissions associated with the Jackdaw project. The magnitude of the impacts is dependent on the quantity of each pollutant gas. The local air quality refers to the air quality in the vicinity of the main source of emissions, in this case the proposed Jackdaw WHP and Shearwater platform location. The Jackdaw WHP will normally be unmanned. Any

potential human exposure at the Jackdaw and Shearwater platforms and nearby platforms is considered to be limited. The nearest onshore population is 220 km east. Meteorological and offshore wind conditions will lead to rapid dispersion of emissions. Considering the sensitivity of the local air quality as a receptor which has the quality to recover rapidly, the proximity and size of exposed populations and distance from onshore human population it has been concluded that there will be no significant effect on the environment, a conclusion I agree with.

The amount of CO_2, NO_x and SO_2 generated as a result of the proposed development is very low in relation to the overall UKCS emissions. It is considered that the impact on ocean acidification is minor and considered to be as low as reasonably possible due to the low amount of CO_2, NO_x and SO_2 generated, the rapid dispersion due to meteorological conditions and management and mitigation measures in place. I agree with the conclusion that the impacts on ocean acidification will not have a significant effect on the environment.

Features of the project or measures envisaged to avoid, prevent, reduce or offset significant effects

Accidental Events

As discussed above it has been identified that a well blow-out from a Jackdaw well could potentially have a significant effect on the environment. The following key measures of the project are envisaged to avoid, prevent, reduce or offset any significant adverse effect on the environment from accidental events.

The developer has a number of measures in place to ensure that the risk and impact of a well blow-out occurring is minimised. These preventative measures are:

a. Multiple well barriers – a primary barrier provided by the suitable overbalanced drilling fluids and a secondary barrier consisting of the well casing and blow-out preventer;
b. Well control plan – which consists of well control procedures, equipment, training and drills as well as communication;
c. Relief well plans – which outlines the relevant commitments and procedures for drilling a relief well to abate any well blow-out; and
d. Oil pollution emergency plan which sets out arrangements for responding to incidents that cause marine pollution by oil.

Although a significant effect on the environment would be expected in the case of an unplanned, accidental well blow-out from a Jackdaw well, the mitigation measures and commitments in place above will seek to avoid and/or reduce the unlikely impact as far as possible.

I therefore agree with the conclusion that a well blow-out does have the potential to give rise to a significant effect on the environment, however, mitigation measures and commitments will be in place to reduce the risk of a well blow-out occurring to as low a risk as possible.

Atmospheric Emissions

As discussed above, it has been identified that there will be incremental emissions from the Jackdaw development that will contribute to an increase in global and transboundary atmospheric emissions. The developer has committed to the following project specific key measures within the ES that will avoid, prevent, reduce, or offset any significant adverse effect on the environment from atmospheric emissions. These measures are:

a. Management of the export gas specification over field life via operation of the amine unit to minimise the mass of CO_2 vented offshore;
b. Re-routing the CO_2 extracted from the produced gas to a dedicated emission point to minimise emissions from the flare;
c. Rephasing of wells relating to other fields planned to be produced via the Shearwater installation during the Jackdaw period of production, in order to minimise the cumulative mass of CO_2 vented from Shearwater over the field life;
d. WHP design includes space and weight capacities and J-tube to accommodate an electrification retrofit should green power become available.

I therefore agree with the conclusion that mitigation measures and commitments will be in place to reduce atmospheric emissions to a level that do not have the potential to give rise to a significant effect on the environment.

Decision on Conditions to the agreement of the grant of consent

In order to avoid, prevent, reduce or offset any significant adverse effect on the environment, the following conditions should be attached to the agreement to the grant of consent:

a. The export gas specification must be managed over the field life via operation of the amine unit to minimise as far as reasonably possible the mass of CO_2 vented offshore.
b. The CO_2 extracted from the produced gas must be routed to a dedicated vented emission point to minimise as far as reasonably possible emissions from the flare.
c. A meter must be fitted to the new amine unit vented emission point and that meter must meet a standard that is consistent with recognised UK industry standards and is designed, installed, operated and maintained to ensure a consistent level of uncertainty in all operational scenarios.
d. The wells relating to other fields planned to be produced via the Shearwater installation during the Jackdaw period of production must be phased so as to minimise as far as reasonably possible the cumulative mass of CO_2 vented from Shearwater over the Jackdaw field life.

Recommendation

I have set out above my conclusion on the significant effects of the project on the environment and the conditions that should be attached to the grant of consent.

I recommend that the Secretary of State should agree to the grant of consent for this project because there are no significant effects on the environment.

[redacted]

Date 27 May 2022

Offshore Petroleum Regulator for Environment and Decommissioning
For and on behalf of the Secretary of State for Business, Energy and Industrial Strategy

Agreement decision

I accept the recommendation for the reasons given.

On behalf of the Secretary of State, I therefore agree to the grant of consent.

The conditions set out above are attached to this agreement to the grant of consent.

Date 27 May 2022

Offshore Petroleum Regulator for Environment and Decommissioning
For and on behalf of the Secretary of State for Business, Energy and Industrial Strategy.