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[redacted], **Environmental Manager**

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**20th January 2023**

Dear [redacted]

**Talbot Field Development D/4273/2021, Harbour Energy response to Notice Under Regulation 12(3)**

This letter has been prepared in response to the notice received on 17th January 2023 from the Offshore Petroleum Regulator for Environment and Decommissioning ("OPRED") under section 12(3) of The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations in relation to the Talbot Field Development Environmental Statement.

OPRED acting on behalf of the Secretary of State for Business, Energy and Industrial Strategy ("the Secretary of State") has received further information relating to the Talbot Field Development Project.

OPRED informed Chrysaor Petroleum Company U.K. Limited (a Harbour Energy company) by means of a Regulation 12(3) notice that the Secretary of State considers that the following further information ("the Further Information") ought to be made public because the information is directly relevant to reaching a conclusion on whether the Project is likely to have a significant effect on the environment.

The further information requested is listed below and then the full text of the regulation 12(1) notices and email containing further information requests are provided in the following pages:

a) All further information provided in response to comments 6 and 20 in the Regulation 12(1) notice sent to Chrysaor Petroleum Company U.K. Limited on the 21st October 2022;

b) All further information provided in response to comments 1, 5, 6 and 7 in the Regulation 12(1) notice sent to Chrysaor Petroleum Company U.K. Limited on 25 November 2022;

c) Information in relation to the integrated manifold sent by email from Chrysaor Petroleum Company U.K. Limited on 21 December 2022.

The information provided by Harbour Energy will address the Notice Under Regulation 12(3) for the Talbot Field Development.

Yours sincerely,

[redacted]

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Environmental Manager, Harbour Energy
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**Further information as provided in Regulation 12(1) Notices**

a) ***All further information provided in response to comments 6 and 20 in the Regulation 12(1) notice sent to Chrysaor Petroleum Company U.K. Limited on the 21st October 2022;***

**OPRED Comment 6:** ***"Section 3.5.5 – The cuttings transportation system mentioned here should be described in further detail, with information given on its use including the predicted location, nature, scale and extent of the discharged cuttings resulting from its use."***

Cuttings modelling has been undertaken to demonstrate predicted location and scale of cuttings deposition. The cuttings transportation system (CTS) is now unlikely to be utilised, but its use represents a worst-case in terms of cuttings deposition away from the well site and largest impact area; therefore we have used this as a precautionary assessment approach for cuttings modelling. The DRA applications for the Talbot wells have detailed descriptions of the cuttings transportations operating system and cuttings deposition associated with its use. In summary the system pumps cuttings as they are generated away from the wellsite at the drilling template up to about 60m. The system capacity can equal the rate of the cuttings being generated.

In terms of impact - the use or non-use of the CTS doesn't make a significant difference. It is the same volume of cuttings and in terms of MCZ impact is still effectively very localised due to discharge of cuttings directly to seabed in the immediate vicinity of the well site and rig location as opposed to cuttings being discharged from the rig at sea level and then descending through the water column where a much larger area (of thinner cuttings) is the result.

Modelling was undertaken for 3 wells discharges using a ParTrack module within SINTEF's Dose related Risk and Effect Assessment Model (DREAM). The results gave a cuttings pile of two peaks, due to the bidirectional horizontal discharge ports of the CTS. The Environmental Impact Factor predicted was zero- suggesting the seabed impact from drilling of the Talbot wells was very small. If the CTS is deployed, then it will be located on the seabed approximately 60 m from the Talbot template centre point and the cuttings will be discharged at one location simultaneously out of two discharge ports in easterly and westerly directions.

Xodus modelling (Xodus, 2022) showed that the cuttings and mud produced from the drilling of the three Talbot TA, TB and TC wells are predicted to produce one cuttings pile discharged from the CTS. The cuttings pile above the 10 mm threshold for burial of non-mobile organisms is approximately 60 m in diameter. Due to the mud and cuttings being discharged from one location horizontally in opposing directions at the CTS, the cuttings pile produced is not an elongated conical mound as is typical of vertical mud and cuttings discharges at the seabed but is composed of two peaks. The thickest area of mud and cuttings pile is predicted to be predominantly formed to the immediate east and west of the CTS location if that is the position of the discharge points (as modelled). The maximum thickness of the cuttings pile peaks are 1,371.5 mm and 1,351.6 mm, which rapidly decrease to <2 mm within 400 m of the discharge point (Xodus, 2022). The direction of the wider-scale deposition of sediment is dominated by prevailing currents to the south-east at levels that are not easily detectable in the environment.

Therefore, where the cuttings are thick enough to have any potential seabed impacts, they are likely to remain highly localised to the discharge point. Impacts on the MCZ's designated features, specifically the ocean quahog will therefore be insignificant on a population basis given the small area impacted. The Talbot appraisal well was surveyed 60 days after the rig left and this clearly shows

cuttings around the well site to a thickness of approximately 1.3m but very little change in seabed depth immediately (a few metres) from the well site suggesting a very small impact area (no CTS was used in the appraisal well). This Survey visual is included in the figures supporting this response (Figures 1 and 2).

**Figure 1 – Bathymetry of Talbot Appraisal Drill-Site Location**

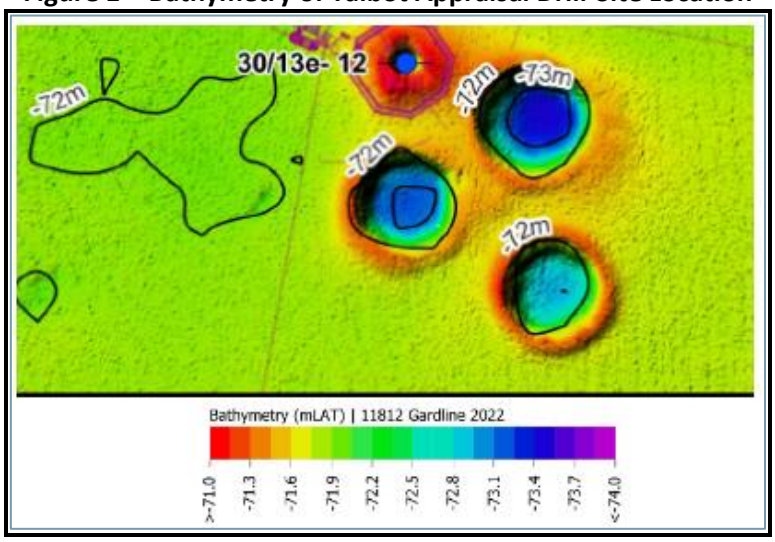
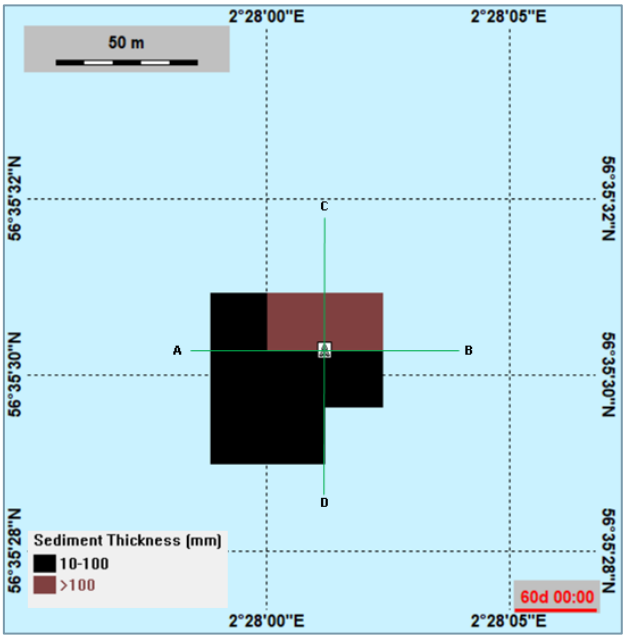



**Figure 2 – Cuttings Modelling Output**




***OPRED Comment 20: "Table 6:7 – The figures for pipelay and trenching in this table (along with a later reference to 0.178 km² in Section 6.4.1) do not match the total figures given in Table 6:3. Please check and confirm the correct area of seabed disturbance expected from pipelaying and trenching activities."***

This value should be 0.184638 km, as per Table 6.3. This will result in an increase in the summary total in Table 6.7 to 0.2023 km$^2$ (0.049596 km$^2$ of Fulmar MCZ footprint). Table 6.7 from the environmental statement has been updated below (refer to Tables 1 and 2).

**Table 1 – Total Seabed Disturbance Area (updated)**

| Activity | Relative contribution (%) | Seabed Footprint ($km^2$) | Footprint within Fulmar MCZ ($km^2$) |
|---|---|---|---|
| Locating the rig | 2.2 | 0.004425 | 0.004425 |
| Pipelay & trenching | 91.3 | 0.184638 | 0.0414 |
| Rock placement at transitions and crossing points | 2.9 | 0.005884 | 0.000391 |
| Mattress, plinths & grout bags | 3.3 | 0.006594 | 0.002664 |
| Subsea inventory | <1 | 0.000413 | 0.00037 |
| Cuttings piles | <1 | 0.000346 | 0.000346 |
| **Total area of seabed disturbance from the Talbot Field Development *** | | 0.2023 | 0.049596 |
| | | Seabed Footprint (km2) | Footprint within Fulmar MCZ (km2) |
| | Difference from previous: | 0.0176 | 0.00396 |
| | Difference from previous (m2): | 17600 | 3960 |
| Changes to text: | | | |
| 6.4.1* Impacts to the Benthic Environment | The estimated total area of seabed impact is 0.2 km2 | | |
| 6.4.3* Impacts to Protected Habitats and Species | Compared to the total seabed area of suitable habitat that is available for the bivalve, the area disturbed by the Talbot Field Development (0.2 km2) | | |
| 6.5* Cumulative and In-Combination Impacts | The Talbot Field Development is predicted to cause a direct seabed disturbance of 0.2 km2 | | |
| 6.9* Conclusion | Based on the assessment undertaken within this ES, the disturbance will be localised. The Talbot Field Development Project has been shown to have a worst-case seabed impact of 0.2 km2, of which 0.05 km2 will be within the Fulmar MCZ | | |

**Table 2 – Total Cumulative Area of Seabed Disturbance within the Fulmar MCZ**

| Activity | Relative contribution (%) | Seabed Footprint ($km^2$) |
|---|---|---|
| Talbot Field Development (within MCZ only) | 2 | 0.049596 |
| Existing Pipeline (~188 km) | 96 | 1.95822 |
| Total existing platform footprint (four platforms) | 1 | 0.01208 |
| Subsea installation permits applied for in 2018-2020 (Table 6:7) | 1 | 0.016381 |
| **Total cumulative area of seabed disturbance within Fulmar MCZ** | | **2.036277** |
| | | |
| | **Increase of:** | **0.00396** |
| Changes to text: | | |
| 6.5* Cumulative and In-Combination Impacts | The total cumulative impact by oil and gas operations within the Fulmar MCZ has been estimated at 2.04 $km^2$, approximately 0.08% of the area of the protected site | |

* These sections refer to sections within the Talbot Field Development Environmental Statement

**b) All further information provided in response to comments 1, 5, 6 and 7 in the Regulation 12(1) notice sent to Chrysaor Petroleum Company U.K. Limited on 25 November 2022;**

***OPRED Comment 1: "Further information provided on 11 November 2022 ('the further information') discusses the results of cuttings modelling undertaken. Did the modelling include contingency WBM sections (i.e. increased cuttings quantities) that have now been applied for under the drilling screening direction applications? If an 'upper section re-drill' is being considered this should be included in the ES assessment. Additionally, the further information states that cuttings modelling was undertaken for three wells. As the ES includes provision for a potential fourth well, please quantify ''wouldn't be significantly larger' in your response for the change to the cuttings area of impact (from a fourth well)."***

There are only 4 slots on the subsea template so a re-spud of a tophole could only be done once. This contingency tophole re-spud wasn't included in the cuttings study inputs; Well Engineering advise this contingency has a less than 10% likelihood of being utilised.

A 4th Talbot Development well is no longer being considered based on the most recent assessment of the appraisal well data, further reducing the likelihood of the 4th template slot being used and further cuttings being generated.

In the unlikely event of a tophole redrill being required then the cuttings impact area would be expected to increase from 0.0032km$^2$ to a worst case of 0.0042km$^2$ for cuttings depth over 10mm (the lowest depth threshold that impacts non-mobile organisms - see Question 6). However, the nature of the discharge of cuttings is that additional cuttings would result in a larger pile with a higher pile also so the impacted area would almost certainly be less than this. Cuttings would be in the immediate vicinity of the well and the rig and very close to the appraisal well rig and appraisal cuttings and so this area would have more concentrated impact, the cumulative impact in terms of total area to the MCZ would be less as it would largely be the same area being impacted again. Should a 4th set of cuttings be generated and discharged this would still not result in a change of impact to the Fulmar MCZ in terms of impact to designated features or to any species on a population level.

***OPRED Comment 5: "Please refer to comment #21 in Regulation 12(1) letter sent 21 October 2022. Please justify why the seabed footprint figure (for locating a rig/platform) from previous applications was deemed more relevant than the current estimates within this ES. What contingencies apply to Talbot that would not apply elsewhere? This relates directly to calculation of cumulative impact (seabed footprint) within the Fulmar MCZ."***

The figure of 3,020m$^2$ is an estimate based on Harbour's previous experience. The figure of 4,425m$^2$ that has been assumed for the worst-case estimate of the particular rig selected for the proposed operations. The value of 4,425m$^2$ would give the total area of disturbance be 0.023406km$^2$, resulting in a minor increase to impacts within the Fulmar MCZ of approximately 0.0004%, please see table 3 below.

**Table 3 – Total Impact Area Table and Footprint within the Fulmar MCZ**

| Activity | Relative contribution (%) | Seabed Footprint ($km^2$) |
|---|---|---|
| Talbot Field Development (within MCZ only) | 2 | 0.049596 |
| Existing Pipeline (~188 km) | 96 | 1.95822 |
| Total existing platform footprint (four platforms) | <1 | 0.01208 |
| Subsea installation permits applied for in 2018-2020 (Table 6:7) | 1 | 0.023406 |
| Talbot Cuttings piles (incl. 2021 appraisal) | <1 | 0.004426 |
| Total impact area from Talbot Development Operations | | 0.054022 |
| **Total cumulative area of seabed disturbance within Fulmar MCZ** | | **2.047728** |
| | Increase of: | 0.015411 |
| Changes to text: | | |
| 6.5* Cumulative and In-Combination Impacts | The total cumulative impact by oil and gas operations within the Fulmar MCZ has been estimated at 2.05 km2, approximately 0.08% of the area of the protected site. Talbot proposed operations impact 0.0022% (0.054022$km^2$) of the Fulmar MCZ. | |

***OPRED Comment 6: "Comment #24 of the Regulation 12(1) letter sent 21 October 2022 requested further information on the likely erosion of the cuttings pile over time, which has not been provided. Results have not been fully considered in light of potential impacts to sensitive benthic receptors; ocean quahog are mentioned in the further information but the impact at population level is not quantified, nor is the impact on other designating features of the Fulmar MCZ discussed. What % area of the Fulmar MCZ will be impacted? Spawning sandeel is also a sensitive benthic receptor discussed in Section 4 (as having high sensitivity to changes in siltation) that has not been considered in the further information. Is a significance of 'low' (Table 12:1 of ES) still considered correct?"***

Over time the cuttings pile, particularly the shallower parts, will be redistributed by seabed currents which will result in the effective impact area (cuttings > than 10mm depth) reducing. Bioturbation by the extant benthos will also occur with recolonisation evident within the first year.

Benthic receptors sensitivity to cuttings varies dependent on their mobility and sediments they are used to inhabiting; for benthic organisms, thresholds for burial are considered as follows (TNO, 1994):

- 10 mm for non-mobile organisms,
- 30 mm for organisms with low mobility,
- 100 mm for mobile organisms living in hard, sandy sediments; and
- 300 mm for mobile organisms living in muddy sediments.

Whilst the immediate creation of the cuttings deposition may result in some smothering of some individuals; given the relatively small area and shallower parts of the cuttings pile (and the depth of the pile reducing over time) means this will have a negligible impact on a species basis or to the Fulmar MCZ conservation objectives.

The Fulmar MCZ is designated for ocean quahog and these have been observed on the seabed in the Talbot Development Area during seabed surveys. The spawning period can vary depending on location. An assessment of the density of Ocean quahog based on the seabed imagery indicated a mean density of 0.004 individuals / $m^2$ across the survey area. Low numbers of ocean quahog were subsequently identified in the sediment samples (Gardline, 2019a). The maximum number of individuals per 0.1 $m^2$ sample was three. Of the 39 individuals identified in the sediment samples, 38 were juveniles. As such, the survey area is not considered to be particularly important for this species. No further protected species were identified (Gardline, 2019a).

Including allowance for a 4th cuttings discharge (due to re-spud of the well) the total Fulmar MCZ area impacted due to cuttings would be approximately 0.0002%. Furthermore, WBM have shown to have little or no toxicity to marine organisms (Neff, 2005), with vast majority of chemicals being used in these upper well sections being PLONOR. Sandeel spawning would be sensitive to cuttings deposition but again the area of seabed that would be impacted would be negligible to the sandeel spawning on a population basis and not be a significant impact or factor to the species success.

We would maintain that a "low" significance previously assigned in Table 12.1 is correct as the cuttings, whilst causing some inevitable impact where deposited, are ultimately confined to a relatively small area both in terms of the Fulmar MCZ and compared to the large areas over which benthic organisms are able to grow and live. The Talbot Development area and drilling area do not represent a unique area of seabed but uniform conditions both in terms of seabed sediment and depth. XODUS utilised EIF during the cuttings modelling study. The computed sediment risk (EIF) was predicted to be zero throughout model simulation run. Although the EIF is not an absolute measure of risk, it is possible to interpret the predicted seabed impact resulting from the drilling of the Talbot wells as extremely small. (XODUS, 2022)

***OPRED Comment 7: "The further information suggested that the 2021 appraisal well was the only other Talbot well drilled within the Fulmar MCZ, but the cumulative impact on the Fulmar MCZ has not been quantified. Please see comment #26 of the Regulation 12(1) letter dated 21 October 2022."***

The impacts table has been updated to add both the 2021 appraisal wells cutting pile to it and the estimated impact area from the Xodus cuttings study (the 3 wells worth of cuttings modelled which was then increased by 33% to give a worst-case value for a 4th set of cuttings being generated by a re-spud). This table contains total impact and those specifically within the Fulmar MCZ area to assess the percentage impact on the protected site itself. Please refer to table 3 above.

**c) Information in relation to the integrated manifold sent by email from Chrysaor Petroleum Company U.K. Limited on 21 December 2022.**

**<u>Integrated Manifold</u>**

At time of submission of the Talbot ES the manifold was designed only for Talbot. Since ES submission and with the potential for the Affleck Re-Development Project to tie-in to Talbot, it was possible to remove the need for an additional Affleck tie-in skid (which would have been located approximately 50m from the Talbot Manifold) and optimise the design to just one Integrated Manifold which is currently proposed.

In Talbot only terms the Integrated Manifold would result in a net increase of 70$m^2$ of footprint on the seabed. (Please see table 4 summary table below) This would take the total impact area of the Talbot Development Operations (within the Fulmar MCZ) from: 0.054022$km^2$ to a new total to 0.054092$km^2$

The integrated manifold, whilst a larger footprint, would only require the same piling as the original Talbot manifold. Looking holistically at the area, and impact to the Fulmar MCZ particularly, there are clear environmental benefits to the integrated manifold in terms of infrastructure and impact in the MCZ and around the Talbot wellsite.

Eliminating the requirement for an Affleck tie-in skid has the following benefits:

- Smaller total impact area and impact confined to one location rather than two structures
- 4 piles less required so less subsea noise compared to two structures being piled
- Overall impact area of integrated manifold is smaller than Talbot original manifold and Affleck tie-in skid combined and means one disturbance area rather than two.
- Only 1 installation so lower vessel/diver time

**Table 4 The dimensions of the options that have been considered:**

| | Talbot Manifold | Affleck TIS | Integrated Manifold |
|---|---|---|---|
| **Length (m)** | 10.61 | 9.81 | 12.04 |
| **Width (m)** | 7.86 | 7.81 | 12.79 |
| **Impacted Area (m^2)** | 83.39 | 76.62 | 153.99 |
| **Piles (no.)** | 4 | 4 | 4 |
| **Total Impacted Area (m^2) of both Talbot Manifold and Affleck Tie-in Skid** | 160.01 | | 153.99 |
| **Total Piles (no.)** | 8 | | 4 |

**References**

Neff, J.M., 2005. Composition, environmental fates, and biological effect of water-based drilling muds and cuttings discharged to the marine environment. A synthesis and annotated bibliography. Petroleum Environmental Research Forum (PERF) and American Petroleum Institute. 73pp

Gardline, 2019a. Talbot Site Survey UKCS Blocks 30/7, 30/12 and 30/13. Environmental Baseline Survey. Project Number 11385-6. Draft. 20 December 2019.

TNO (1994). Ecological risk analysis based on exceeding critical disturbance levels. A contribution to the EIA Exploratory drilling for natural gas in the North Sea coastal zone and on Ameland and the EIA Exploratory drilling for natural gas in the Wadden Sea.

Xodus, 2022. DREAM Drill Cuttings Modelling – Talbot Report