Cenovus General Response:

Environmental assessment (EA) of production in the White Rose Field focuses on the effect of activities on fish and fish habitat (including the water column and substrate). EAs (Husky Oil Operations Limited 2000, LGL 2006; Husky Energy 2012) as part of development of the White Rose Field indicated that drill cuttings and associated alterations to sediment physical and chemical characteristics could extent to 9 km from discharge source. Effects to date have been well within that 9-km zone of influence, with most limited to within 1 to 1.5 km from a drill centre. The EA Amendment concluded that with mitigation, the potential residual environmental effects of synthetic-based mud cuttings on fish and fish habitat would be not significant.

The White Rose Environmental Effects Monitoring (EEM) program has been conducted 11 times since 2004 (plus a baseline program 2002), with the objective of determining the effects the project has had on the environment and comparing them to the predictions made in the environmental assessment[1]. To date there have been 50 development wells drilled in the White Rose Field (Southern Drill Centre: 12, Northern Drill Centre: 3, Central Drill Centre: 16, North Amethyst Drill Centre: 12, South White Rose Extension: 7), 1 exploration / delineation well, 2 exploration wells, and 10 delineation wells, for a total of 62 wells within the White Rose Safety Zone. An additional 12 wells (9 delineation, 3 exploration) have been drilled within a 16 km area from the West White Rose Platform.

Data from the EEM programs indicate the substrate in the White Rose Field is predominately sand (96.5% to 98.5%) and the benthic community is comprised primarily of polychaetes and some arthropods. The White Rose Field does not contain significant benthic habitat, and there are no corals or sponges identified in the area. As such, the PNET of 1.5 mm (pertaining to corals) and 6.5 mm (pertaining to significant benthic habitat) defined in DFO's *Regional Guidance on Measures to Protect Corals and Sponges During Exploratory Drilling in the Canada-Newfoundland and Labrador Offshore Area* are not applicable to the White Rose Field.

The EEM program does not focus on extent of drill cuttings thickness but rather on the effects of the project on fish and fish habitat. Three components are assessed: sediment quality, water quality and commercial fish. Sediment quality is assessed using the Sediment Quality Triad to determine alterations in sediment chemistry and physical characteristics, sediment toxicity and benthic community structure. To date, the results from the EEM program for White Rose indicate that environmental effects at White Rose are consistent with those anticipated in the White Rose environmental assessments and the overall environmental assessment prediction of no significant effect on fish and fish habitat, including the benthos, and that there is no evidence that additional mitigation measures are required.

The approved EEM design has been modified at various times to incorporate changes to the field (i.e., addition of new drill centres). The most recent redesign incorporates the West White Rose Platform and was approved in July 2023 by the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) following Fisheries and Oceans Canada (DFO) and Environment and Climate Change Canada review and acceptance[2].

[1] All EEM program reports are reviewed and approved by C-NLOPB, ECCC and DFO. Reports are made available via https://www.cnlopb.ca/environment/projects/ - White Rose tab

[2] White Rose Environmental Effects Monitoring Program Design Report – Revised 2023. (https://www.ctnlohe.ca/wp-content/uploads/eem/Cenovus-Energy-White-Rose-Environmental-Effects-Monitoring-2023-Revised-Program-Design-Report.pdf)

From: C-NLOPB Consolidated Review Comments – Dec 19, 2023 (Blue represents new information from Round 1 Review Comments and Responses)

Fisheries and Oceans Canada (DFO)
Review of Cenovus Responses to Round One Comments:

DFO Comment 1 (Round 1) – Section 2.4 Summary of Updated Modelling, page 3 of 10
A more detailed description of modelling results would be helpful, such as thicknesses (maximum, average) at various distance ranges from the origin, as was provided for the original drill cuttings deposition model.

Cenovus Response (Round 1):
SINTEF Ocean AS (SINTEF) has conducted a lifecycle analysis of different methods for handling solids during and after drilling operations (West White Rose Platform Solid Control Drill Cuttings Dispersion Modelling – WH-DAC-RP-0019). SINTEF used the Dose-related Risk and Effects Assessment Model (DREAM) to assess environmental risk in combination with the resulting discharges of the remaining waste to the marine environment after different solid treatment options (shaker / dryer vs. Thermomechanical Desorption Unit).

DREAM includes tailored modules for modelling transport and fate of the discharged solids and chemicals including nearfield modelling, dispersion, advection, and settling, as well as biodegradation, oxygen depletion, grain size change and burial with resulting restitution time for the sea floor and impacted sediments.

Environmental risk is measured in terms of an environmental impact factor (EIF) which is defined as a reference area (seafloor) and volume (water column) where the risk for a negative impact on 5% or more of the most sensitive species is considered above accepted levels and contributes to the EIF.

The modelling results show that due to the design geometry of West White Rose Platform (WWRP), the majority of large-particle cuttings will accumulate on the base caisson roof and perimeter cells of the Concrete Gravity Structure (CGS) and not reach the sea floor; however, the remaining sea floor area exhibits risk above accepted levels for oxygen depletion and grain size change in different degrees for the considered cases.

DFO Comment (Round 2):
A description of the results outlined in the Wood Modelling Report should be referenced and elaborated on in the EA Amendment, instead of just the SINTEF Report. Please provide thicknesses (max, average) at various distance ranges from the origin, as was provided for the original drill cuttings deposition model.

Cenovus Response (Round 2):

Cenovus conducted cuttings deposition modelling of 40 wells (Wood 2019). Key results include:

- Approximately 62 percent of the total cuttings material released is predicted to have settled on the Platform roof and perimeter cells within approximately 100 m of the Platform origin, with another 5.5 percent settling on the seabed out to 1 km.

Percent Total Cuttings Material Settles by Distance, 40 wells (Table 5-1 from Wood, 2019)

Distance from Platform Origin	COBBLE-PEBBLE	GRANULE	V.COARSE-COARSE	MED. SAND	FINE-V.FINE	MEDIUM SILT-CLAY	Total
0 to 100 m	100.00%	99.99%	95.66%	77.51%	0.30%	0.30%	62.30%
100 m to 500 m	0.00%	0.01%	4.34%	22.49%	1.24%	1.25%	4.89%
500 m to 1 km	0.00%	0.00%	0.00%	0.00%	1.75%	1.75%	0.58%
1 to 2 km	0.00%	0.00%	0.00%	0.00%	15.32%	15.31%	5.10%
2 to 5 km	0.00%	0.00%	0.00%	0.00%	43.55%	43.57%	14.52%
5 to 10 km	0.00%	0.00%	0.00%	0.00%	27.82%	27.82%	9.27%
10 to 16 km	0.00%	0.00%	0.00%	0.00%	8.91%	8.91%	2.97%
16 to 22.6 km	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total Settled	100.00%	100.00%	100.00%	100.00%	98.90%	98.90%	99.63%
Drifts Outside Model Domain	0.00%	0.00%	0.00%	0.00%	1.10%	1.10%	0.37%

- Mean total cuttings thickness values are predicted to be approximately 0.5 mm between 500 m and 1 km away from the Platform origin, approximately 0.9 mm between 1 to 2 km, and approximately 0.5 to 0.7 mm out to 16 km. For distances outside of 5-6km, patches are quite sparsely located and relatively small in size.

Total Cuttings Thickness by Distance, 40 Wells (Table 5-2 from Wood, 2019)

	Distance from Platform Origin							
	0 to 100 m	100 m to 500 m	500 m to 1 km	1 to 2 km	2 to 5 km	5 to 10 km	10 to 16 km	Outside 16 km
	Cuttings Thickness (mm)							
Mean	422	2.3	0.5	0.9	0.6	0.5	0.7	0.01
SD	1,379	4.4	1.1	1.6	1.6	1.2	1.5	0.01
Maximum	7,033	48.5	8.6	15.4	25.1	16.3	16.2	0.05

Comment 2 (Round 1) – Section 3.1 Findings of the Original Environmental Assessment, page 5 of 10, paragraph 2

The Proponent should provide a brief explanation as to why Sensitive and Special Areas and Fisheries VCs do not need to be assessed. Revision recommended.

Cenovus Response (Round 1):

The nearest federally designated Sensitive and Special Areas is a small Significant Benthic Area of small gorgonian corals located 110 km west of the WWRP and spotted wolffish critical habitat located 60 km northeast of the WWRP (Figure 1[3]). The nearest internationally designated Sensitive and Special Area is a shrimp closure area located 15 km from the White Rose Safety Zone (Figure 2[1]).

No commercial fishing occurs within the White Rose Safety Zone. While fishing does occur east of the White Rose Safety Zone, there has been no commercial fishing activity in the area of the White Rose Safety Zone for at least the past decade (Figure 3[1]).

DFO Comment (Round 2):

The extent of 1.5 mm drill cuttings may extend outside the Safety Zone (see above comments). Otherwise satisfactory.

Cenovus Response (Round 2):

Wood Figure 5-3 Total Drill Cuttings Deposition, 40 Wells, 16-km view indicates that while 1.5 mm drill cuttings may extend outside the Safety Zone, it is limited and extremely patchy between 5 to 16 km from the well site. Approximately 97% of cuttings material settles within 10km of the platform (see Comment 1 above).

[3] Figures refer to Cenovus Response to EA Amendment Review Comments – Round 1 https://www.cnlopb.ca/wp-content/uploads/whiterose/cenovusresponse.pdf

Comment 3 (Round 1) – Section 3.2 Summary of Existing Conditions
To assist DFO in completing a risk assessment to evaluate effects on fish and fish habitat, we would appreciate if the Proponent could provide a description of the habitat within the updated modelled dispersion area (0.1 mm boundary), as well as in the vicinity. The Proponent has provided information on aquatic species (including species at risk). If there is additional information on species in the updated modelled dispersion area (0.1 mm boundary), that would also be appreciated.

Cenovus Response (Round 1):
Environmental Effects Monitoring (EEM) Stations 21 and WWRP2 are within the 0.1 mm boundary. Particle size analysis characterized Station 21 as 97.9% sand, 3.4% gravel, 0.89% clay, and 0.81% silt. Station WWRP2 was characterized as 96.2% sand, 1.40% gravel, 1.39% silt, and 1.01% clay. This is consistent with the White Rose field as a whole, and as in previous years, sediments collected in the 2022 EEM program were predominantly comprised of sand. Median gravel content was 0.9%, median organic carbon content was 0.9 g/kg, and median percent fines (i.e., silt and clay fractions combined) content was 1.45%.

Station 21 has a long / large benthic invertebrate dataset and Station WWRP2 was sampled during the recent (2022) EEM cycle. In 2022, Station 21 recorded a maximum of 172 individuals in 24 taxa and Station WWRP2 recorded 381 individuals in 31 taxa)

DFO Comment (Round 2):
Is this description representative of the updated modelled dispersion area (0.1 mm boundary), as well as in the vicinity, for repeated drillings of 40 wells? If not, please provide additional habitat and species information to assist in DFO's assessment of impacts on fish and fish habitat.

Cenovus Response (Round 2):
SINTEF reported that the environmental risk for repeated drilling (up to 40) for the shaker/dryer discharge option could extend to 4km² (Figure 1). This represents a distance of 1.17km from platform, where the Wood model predicts 67.8% of the cuttings material to have settled to a mean thickness of 0.5mm (see Comment 1 above).

One EEM sediment station exists within the SINTEF 0.1mm boundary; WWRP2, whereas an additional five stations are within the 1.17km radius; WWRP1, WWRP3, C3, C4, and 21. To date, there have been no significant differences in the PSA analyses and benthic community composition amongst these stations, and these stations are representative of the habitat within and around the White Rose Field.

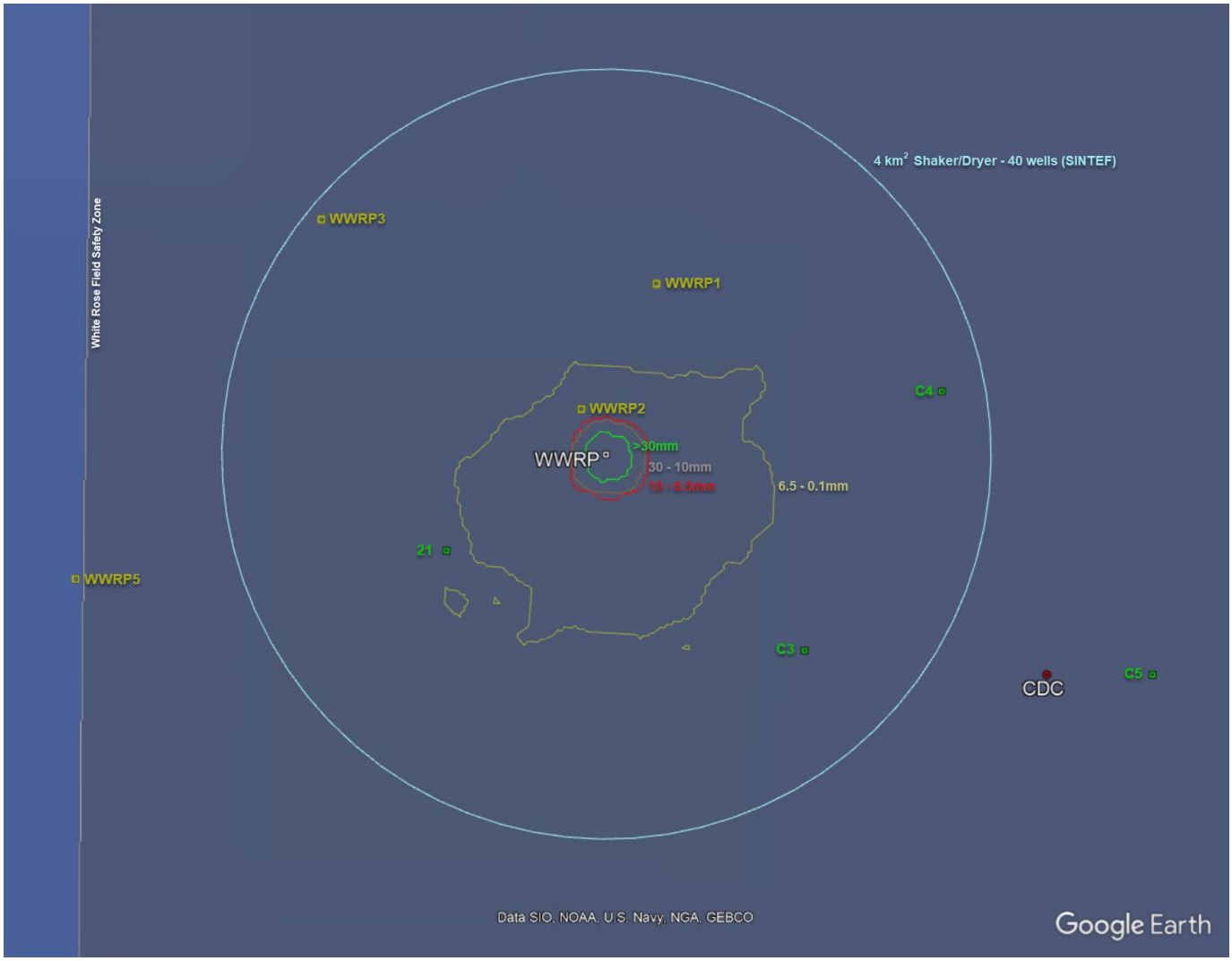


Figure 1 Environmental Effects Monitoring (EEM) program stations relative to particulate matter deposition boundaries (adapted from Figure 4.11 SINTEF). WWRP: West White Rose Platform. CDC: Central Drill Centre

Additional DFO Review Comments for Round Two

General Comments

DFO Comment 1 (Round 2)
The EA Amendment should discuss results shown in the "West White Rose Project, Far-Field Drill Cuttings Dispersion Modelling" Wood Report, instead of only referencing the SINTEF report. The EA Amendment should present the greatest possible effects from the Project (e.g., 40 wells, greatest extent, maximum thicknesses). Revisions recommended.

Cenovus Response:
- See Cenovus General Response and *DFO Comment 1 (Round 1)* above.

DFO Comment 2 (Round 2)
To assist DFO in completing a risk assessment to evaluate effects on fish and fish habitat, it would be helpful to include the total footprint (in m^2) of the drill cuttings deposition (1.5 mm and 6.5 mm thicknesses) for 40 wells. If 1.5 and/or 6.5 mm were not specifically modelled, then the nearest values below those would be fine.

Cenovus Response:
- See Cenovus General Response and *DFO Comment 2 (Round 1)* above.

Specific Comments

DFO Comment 3 (Round 2) - Section 2.4; Page 3; Paragraph 2

> " The outcome of the SINTEF modelling predicted that, for SBM cuttings treated with Shaker + Dryer +centrifuge, most (89.4 %) threat comes from oxygen depletion related to biodegradation of chemicals in areas with cuttings deposition > 0.3 g/m² and that this effect may extend up to 1000 m from the origin for a 40 well program".

Is this statement referring to Figure 6.3 in Section 6.3 (page 53), which illustrates deposition mass from repeated drillings (results from the model postprocessed for repeated drillings)? In Figure 6.3, deposition mass above 0.3 g/m² (< 1 kg/m² from the Figure scale) extends 1 km from the center when drilling 1 well was modelled; deposition mass above 0.3 g/m² extends more than 2 kms from the center for 40 wells. Statement should be updated to indicate which section/figure(s) from the SINTEF modelling report is being referred to and accurately characterize results for a 40 well program.

Please include details on why 0.3 g/m² was selected as the threshold for oxygen depletion in the EA Amendment.

Cenovus Response:

This statement is not referring to SINTEF Figure 6.3 in Section 6.3 (page 53), but rather Section 4.2 Sea Floor Results (page 38) in which Scenario 2 – 5.5% SOC is presented. The following Figure 2 superimposes *SINTEF Figure 4.13 – Deposited Mass Over 0.3 g/m²* with *SINTEF Figure 4.17 (t-r) Maximum Risk for Oxygen Depletion*. The >5% risk zone for oxygen depletion (total EIF contribution = 89.42%) extends to the perimeter of the 10 to 30 g/m² sediment deposition zone rather than the >0.3 g/m² zone as was implied in the original submission. The 10 to 30 g/m² extends approximately 1,000 m from the platform.

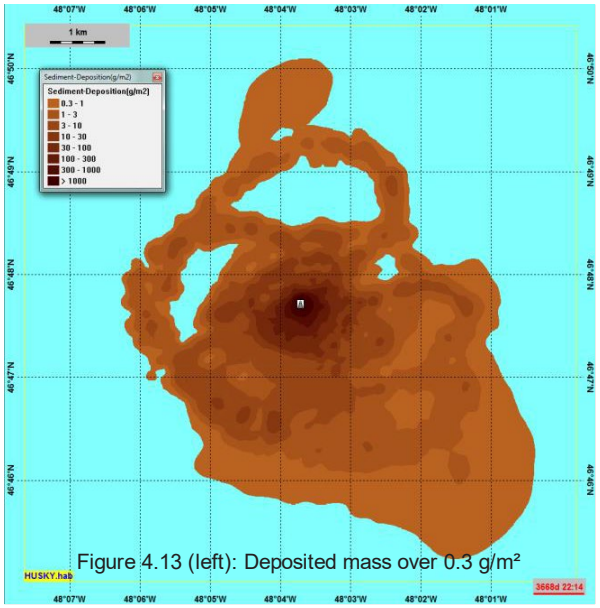


Figure 4.13 (left): Deposited mass over 0.3 g/m²

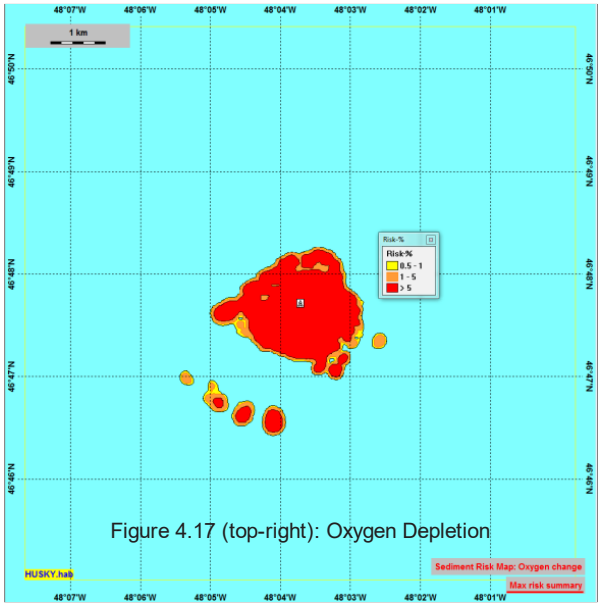
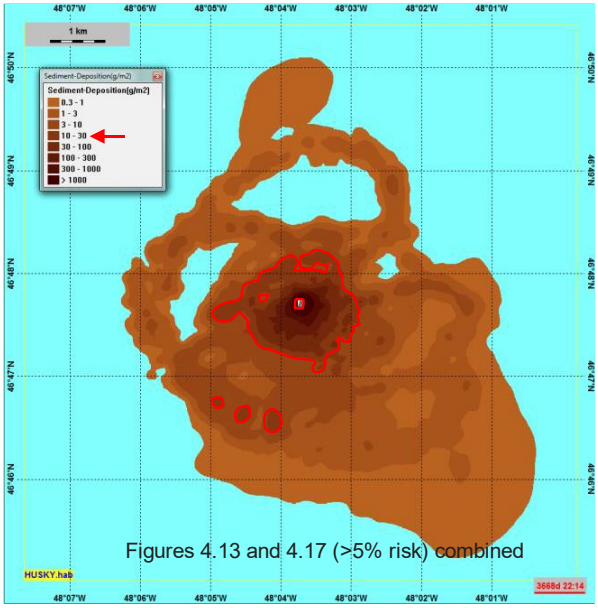


Figure 4.17 (top-right): Oxygen Depletion



Figures 4.13 and 4.17 (>5% risk) combined

Figure 2 5% Oxygen Depletion Risk (Figures from SINTEF)

DFO Comment 4 (Round 2) - Section 2.4; Page 3; Paragraph 3

> "The results of the SINTEF model are illustrated in Figure 2-1. A cross section through the deposited area shows that the area where the thickness is above the effect limit 0.65 cm is within 175 m of the discharge. The largest impacted area is the 0.1 to 6.5 mm cuttings deposition thickness (red line in Figure 2.1)."

Figure 2-1 of the EA Amendment appears to be modified from Figure 4.11 (Section 4.2, page 38) of the SINTEF report, where the deposited area described is only for a single discharge. In Section 6.2., the deposition thickness above 6.5 mm is within ~500 m of the drill centre for 40 wells. The Wood report also indicates that 6.5mm thickness will be within 500m of the drill center (if considering average +/- standard deviation). If max thickness is considered, it extends to 16 km (Table 5-2, page 27).

This statement and associated figure seem to be for 1 well, which should be clearly indicated. The EA Amendment should be updated to include results from 40 wells. Results from the Wood modelling report should be included in the discussion of thicknesses and extent of the discharge. As noted in comment 1, the greatest possible effects (e.g., 40 wells, greatest extent, max thickness) should be described in the EA Amendment. Revisions recommended.

Cenovus Response:

- See Cenovus General Response and *DFO Comment 1 (Round 1)* above.

DFO Comment 5 (Round 2) - Section 2.4; Page 3; Paragraph 3 Sentence 6

"The affected area is around the discharge location within a radius of approximately 1 km"

When referring to "affected area", it should be clarified what drill cutting deposition thickness and number of wells were taken into account. As noted above, DFO is interested in the 1.5 and 6.5 mm thresholds for 40 wells. Revisions recommended.

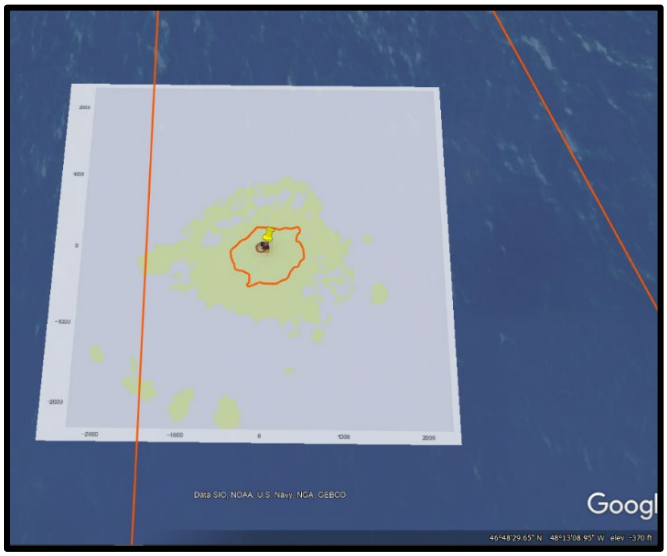
Cenovus Response:

The EA Amendment uses EEM data to determine environmental effects. The affected area, or zone of influence as referred to in an EA and EEM program, is not based on deposition thickness but rather, is based on the extent of effects to the benthic community. Results from the 2022 EEM indicate that there was evidence of project effects on benthic biomass near active drill centres and little to no evidence of effects on total abundance and richness. Decreases in biomass near active drill centre were related, in part, with decreases in the number of larger echinoderms.

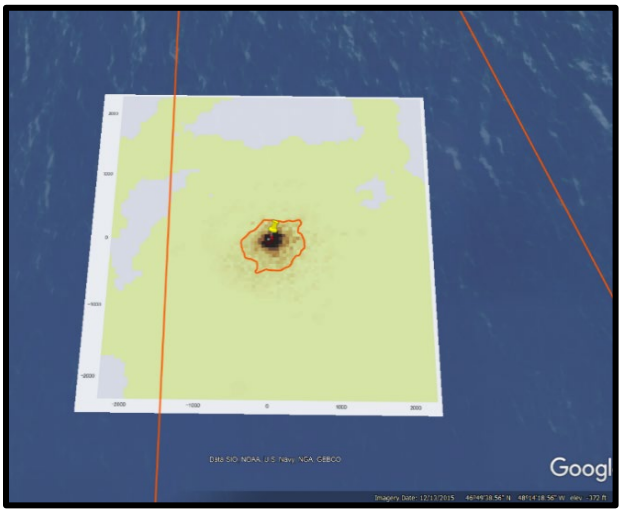
DFO Comment 6 (Round 2) - Section 3.3; Page 5; Paragraph 3

"The SINTEF model indicates that the extent of the drill cuttings at 0.1 mm depth do not extend beyond the White Rose Safety Zone (Figure 2.1)"

It is possible that drill cutting deposition at 0.1 mm may extend to the boundary or slightly beyond the safety zone after drilling 40 wells (see images below of sections from Figure 6.4, Section 6.2 – page 54 overlain on Google Earth). In the Wood report, considering the mean deposition thickness, 0.7mm extends out to 10-16km (Table 5-2, page 27). This would also be outside of the safety zone. The EA Amendment should be revised to reflect a 40 well program (with consideration of results from the Wood report).



Deposition Mass from 1 drilling operation. Straight red line is Safety Zone boundary. Red circle is the 6.5-0.1 mm thickness boundary (Figure 4.11) from Section 4.2.



Deposition Mass from 40 drilling operation. Straight red line is Safety Zone boundary. Red circle is the 6.5-0.1 mm thickness boundary (Figure 4.11) from Section 4.2.

Cenovus Response:

As noted above, DFO is interested in the 1.5 and 6.5 mm thresholds for 40 wells. These thresholds do NOT extend beyond the White Rose Safety Zone and the 0.1 mm only extends to the boundary or slightly beyond the White Rose Safety Zone. The White Rose Field does not contain significant benthic habitat, and there are no corals identified in the area. As such, the PNET of 1.5 mm (pertaining to corals) and 6.5 mm (pertaining to significant benthic habitat) are not applicable to the White Rose Field.

References:

Husky Energy. 2012. White Rose Extension Project Environmental Assessment. Submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board.

Husky Oil Operations Limited. 2000. White Rose Oilfield Comprehensive Study. Part One: Environmental Impact Statement. Submitted to the Canada-Newfoundland Offshore Petroleum Board, St. John's NL.

LGL Limited. 2006. Husky White Rose Development Project: New Drill Centre Construction and Operations Program Environmental Assessment. LGL Report SA883, by LGL Limited, St. John's, NL, for Husky Energy Inc., Calgary, AB.299 pp. + Appendices

SINTEF Ocean AS. 2019. West White Rose Platform Solid Control Drill Cuttings Dispersion Modelling. Submitted to Husky Energy. 59 pp.

Wood Environment & Infrastructure Solutions (Wood). 2019. West White Rose Project, Far-Field Drill Cuttings Modelling. Submitted to Husky Energy. 29 pp.