Husky Energy

White Rose Extension Project

# Consolidated Response to Review Comments on the White Rose Extension Project Environmental Assessment and Addendum

WH-DWH-RP-0031-Rev 1

Husky Energy SUNCOR ENERGY nalcor energy

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# 1.0 Environment Canada

## 1.1 Chapter 2 Project Description

**2.3.2.2 Evaluation of Material Disposal Options**
*Will there be any discharges of deleterious substances to receiving waters?*

**Husky Response:**
No deleterious substances will be discharged into the marine environment.

**2.6.2 On-Land Construction**
*What will be the standards used for sewage treatment?*

**Husky Response:**
Sewage treatment will be discharged according to the Newfoundland and Labrador *Environmental Control Water and Sewage Regulations, 2003*

**2.6.3.1 Excavation**
*Quote: "Site surface water and groundwater from any dewatering of the graving dock will be collected, assessed and, if necessary, held in an engineered lined settling pond onsite to satisfy all regulatory requirements before being discharged into the marine environment."*

*Are the regulatory standards both federal and provincial?*

**Husky Response:**
All discharges from on land project activities will be according to the Newfoundland and Labrador *Environmental Control Water and Sewage Regulations, 2003*

**2.6.3.4 Site Dewatering and Disposal**
*Quote: "Water will be treated with a mobile treatment unit as required prior to discharge to ensure compliance with provincial and federal requirements."*

*Confirm that these standards will be used for site surface water and groundwater as above.*

**Husky Response:**
All discharges from on land project activities will be according to the Newfoundland and Labrador *Environmental Control Water and Sewage Regulations, 2003*.

## 1.2 Chapter 3 Summary of White Rose Extension Project Specific Models

**General:**
*The document did not reference the regular tanker traffic associated with the Come-by-Chance refinery. Nearshore Project Area will transect the shipping lanes for these oil tankers. What protocols will be developed to allow the safe coordination of project activities with tanker traffic in the dredging, module mating, and transportation to White Rose drilling site phases? Given weather conditions, navigational challenges, length of time required for project phases and the nature of all the vessels involved, there could be potential for close manoeuvring between vessels, which should be considered in the context of the assessment.*

**Husky Response:**
Husky will work with marine stakeholders such as FFAW, Marine Atlantic, NTL, Argentia Port Authority, Atlantic Pilotage Authority, the North Atlantic Refinery and the Placentia Bay Traffic Committee to determine high traffic periods and get a detailed vessel schedule for coordination of project activities. Project specific marine procedures will be reviewed with stakeholders to ensure awareness. All vessels contracted on Husky's behalf are vetted to ensure they meet Husky's requirements for reliability, redundancy, crew competency and vessel condition.

Closer to planned operations, a Notice of Shipping will be broadcast twice per day to ensure vessel traffic is aware of planned marine-related project activity. The speed for transit of project related vessels into and out of Argentia will be determined by the Port and Pilot authorities at time of navigation, given the current weather conditions.

*Nearshore work could involve the use of heavy lift vessels, supply vessels, tugs, as well as on-shore large construction equipment. The nearshore spill modeling considered fuel spills ranging from 100 to 350 $m^3$. Supply vessels can have a capacity of over 1100 $m^3$ of fuel and, in the event of collision, could lose more than 350 $m^3$. It may be useful to run nearshore scenarios with expanded fuel capacity reflecting what is carried in larger vessels.*

**Husky Response:**
350 $m^3$ is the estimated volume of fuel to be carried by supply vessels operating in the nearshore in support of the wellhead platform construction project.

*Again, for nearshore work, it may be useful to examine the potential for spills in the land-water interface (e.g., heavy equipment upset into a water body; puncturing of an onshore fuel tank that could spill into a water body). Planning could include placing in local inventory the material and equipment needed to deploy a boom from land to contain a water-borne slick, as well as having appropriately trained personnel.*

**Husky Response:**
Husky will ensure a local inventory of spill response equipment at Argentia to respond to on-land and nearshore spills. On site personnel will receive appropriate training in spill response.

**3.6 Hydrocarbon Spill Probabilities**
*In general, this section is difficult to follow. Some of the sources and information used are fairly dated (e.g., NAS 2000; Scandpower 2000). It might also be useful to change the format of the section so that calculations are done in an equation format with corresponding data tables reflecting the results of those calculations. In the discussion, it would also be useful to indicate which calculations were used to derive the spill probability for the White Rose Expansion Project.*

**Husky Response:**
NAS 2000 and Scandpower 2000 are mentioned in the report but are not used as primary sources for the spill frequency predictions. The primary references used for spill frequency predictions are Deloitte 2012, IAOGP 2010 and C-NLOPB 2012.

References;
C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2012. *Spill Statistics and Well Statistics*. Available at: www.cnlopb.nl.ca/ env_stat.shtml,/well_chrono.shtml.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2012. *Spill Information by Operator: Spills Greater than 1 Litre (1997-2012)*. Available at: http://www.cnlopb.nl.ca/env_stat.shtml

Deloitte Petroleum Services. 2012. *List of Offshore Petroleum Wells to December 31, 2011*. Report generated on request from Deloitte LLP. London, England.

IAOGP (International Association of Oil & Gas Producers). 2010. *Risk Assessment Data Directory: Blowout Frequencies*. International Association of Oil & Gas Producers. London, UK, Report No. 434-2. Available at: http://www.ogp.org.uk

**3.6.1.1 Blowouts During Drilling**

*Quote: "Up to 2011, four development-drilling blowouts have produced spills in the very large spill category (Table 3-48, including the recent incident in Australia, and including the spill in the extremely large category)."*

*Unclear. The description could be reworded to something like, "From Table 3-48, there are four large spills from development well blowouts, giving a spill frequency of (4/67,703) x 5.9 x $10^{-5}$ / well drilled = 1 spill / 17,000 wells drilled."*

**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive.*

**Husky Response:** The second paragraph in Section 3.6.1.1 is revised to read:

There has been one extremely large spill during offshore development drilling, so the frequency to the end of 2011 is (1/67,703) 1.5 x $10^{-5}$ spills per well drilled, or one such spill for every 68,000 wells drilled. A similar analysis can be done for very large spills. From Table 3-48, there are four large spills from development well blowouts, giving a spill frequency of (4/67,703) x 5.9 x $10^{-5}$ / well drilled = 1 spill / 17,000 wells drilled.

**3.6.1.2 Blowouts During Production and Workovers**

*Quote: "…it is estimated that the total oil produced offshore on a worldwide basis up to 2011 has been approximately 210 billion bbl, and that the total producing oil well-years has been 350,000 well-years… On this basis, the world-wide frequency of extremely large hydrocarbon spills from oil-well blowouts that occurred during production or workovers is 5.7 X $10^{-6}$ blowouts/well-year. For very large, the number is 1.4X$10^{-5}$ blowouts/well-year."*

*In recent decades, there has been an increasing move to explore and exploit hydrocarbon reserves that had been previously less accessible, or even inaccessible, given technologies available at the time. With the move to exploration in less hospitable frontiers, there would seem to be greater risk for spills from blowouts posed by environmental and geological conditions. These differences could be statistically smoothed by looking at the longer term drilling record. Perhaps the reference cited (Deloitte Petroleum Services. 2012. List of Offshore Petroleum Wells to December 31, 2011. Report generated on request from Deloitte LLP. London, England) discussed this aspect -- it would be informative if this was addressed in looking at exploration that has occurred in more challenging environments, which could have an impact on the calculated probabilities.*

**Husky Response:**
Unfortunately, Deloitte (2012) does not contain the detail necessary to separately identify those wells drilled in "challenging environments". If it is indeed true that recent decades have had more wells in challenging environments, it is not reflected in the spill record noted in Table 3-3 (Historical Large Spills from Offshore Oil Well Blowouts); until the Montara blowout (2009) and the Macondo blowout (2010), there had been no blowout spills of greater than 10,000 barrels since 1992.

It should be noted that deep-water exploration and production has occurred since the 1980s; production from wells in depths greater than 305 m (1,000 feet) in the Gulf of Mexico surpassed that of shallow-water production in the year 2001.

**3.6.1.3 Summary of Extremely Large and Very Large Oil Spills from Blowouts**
*Quote: "…the Ixtoc l oil-well blowout ... was caused by drilling procedures (used by PEMEX, …) that are not practised in US or Canadian waters and that are contrary to US or Canadian regulations and to the accepted practices within the international oil and gas industry. Therefore, extremely large spill frequencies in North America are expected to be even lower."*

*A few points to consider:*

- *Mexico is part of North America;*
- *the Macondo blow-out in the Gulf of Mexico occurred partly due to "… BP, Transocean, and Halliburton's conduct violated federal offshore safety regulations under BOEMRE's jurisdiction… " and poor risk management (Oil and Gas Journal, Sept. 14, 2011);*
- *there are different regulations in the US and Canada (e.g., 3.6.2.1 Shallow Gas versus Deep-well Blowout, Page 3-63 indicates that Canada requires two barriers in exploration and development, while only one is required in the US); and*
- *Quote: "…extremely large spill frequencies in North America are expected to be even lower" is a conclusion that could be modified based on the above.*

**Husky Response:**
Thank you for noting this: the text should be changed as follows:

> *"…the Ixtoc l oil-well blowout ... was caused by drilling procedures (used by PEMEX, …)* that are not practised in Canadian waters and that are contrary to Canadian regulations and to the accepted practices within the international oil and gas industry. Therefore, extremely large spill frequencies in Canada are expected to be even lower."

**3.6.2.1 Shallow Gas versus Deep-well Blowout**
*Blowout stats are derived from Scandpower (Scandpower A/S 2000. Blowout Frequencies 2000, BlowFAM Edition. Report No. 27.20.01/R3.). While very informative, it would be good to have stats up to 2013, given the significant blowouts that have occurred since 2000 (e.g., Deep Water Horizon in the Gulf of Mexico (2010) and the Montara spill off the west coast of Australia (2009)). These occurrences would not have been included in the other document cited (IAOGP 2010) since statistics quoted are up to 2005.*

*Quote: "Finally, it is worth noting (Table 3-52) that shallow gas blowout frequencies in the North Sea and in the US GOM have been on the decline in the most recent years of the record."*

*This is based on a period up to 1997 – 16 years ago. It would be good to determine if data are available to the present to indicate whether that trend has changed.*

**Husky Response:**
A search for other similarly detailed and more recent studies did not reveal any other studies. It should be noted that Scandpower (2000) data were not used for any predictive purposes, simply for illustrative purposes.

**3.6.3 Large Platform Spills**
*Quote (P. 3-65, para. 2): "BOEMRE statisticians … have decreased the estimate gradually over the past 15 years, mostly in recognition of a statistical trend towards a lower spill frequency."*

*What is the lower value? For what year?*

*Quote (P. 3-65, para. 4): "Note that the above statistic for spills >10,000 bbl (i.e. 5.5 x $10^{-6}$ spills/well-year) is almost four times smaller than the statistic derived earlier for production blowout spills >10,000 bbl (i.e. 2.0 x $10^{-5}$). This is impossible because the first category includes blowout spills. The reason for the anomaly is that the US record was used for the former and the world-wide record was used for the latter. The world-wide statistic is higher than the US-derived one because the former was developed on a very conservative basis, which considered an exposure of only oil wells and not gas wells."*

*This paragraph is unclear, please clarify which probability is going to be used and why.*

*Quote: "It is noted that there has been … Given the limited statistical database of Newfoundland and Labrador production operations, the US statistics are used in this frequency calculation."*

*Is it because of similar geologic and marine conditions? Are there greater similarities with North Sea operations?*

**Husky Response:**
The lower value is the stated, "*1.5 x $10^{-5}$ spills/well-year for spills equal or greater than 1,000 bbl and 5.5 x $10^{-6}$ spills/well-year for spills equal or greater than 10,000 bbl Anderson and LaBelle (2000)*". Again, although BOEMRE has updated the spill record (Table 3-9), they have not updated the predictor rates. Based on the fact there is only one recorded 10,000 barrel spill (Macondo) and two recorded 1,000 barrel spills (including Macondo) in the period 2000 to present, the T rates would be similar if the predictor rates were updated,

The fourth paragraph on page 3-65 is included to point out what is an anomaly (based on different exposure variable, total wells) between the number predicted from the raw data for production/workover blowouts and the reported platform rates by Anderson and Labelle.

If Newfoundland and Labrador statistics had been used, the frequency of spills would have been calculated based on zero spills greater than 1,000 barrels and one spill greater than 10,000 barrels; this did not seem to be a reasonable approach. No comparison is made between Newfoundland and Labrador and US waters based on geologic or marine conditions; US data were used simply because there is a reasonable and accessible data base.

**3.6.6 Summary of Blowout and Spill Frequencies**
*Quote (P. 3-68, last para.): "…0.5 and 0.2, respectively."*
*Are those values percentages?*

**Husky Response:**
Correct, those should be stated as percentages.

**3.7 Fate and Behavior of Hydrocarbon Spills in the Nearshore Study Area (Trajectory Modelling) and 3.8 Fate and Behavior of Hydrocarbon Spills from a Platform or Seafloor Blow-out in the Offshore Study Area (Trajectory Modelling)**

*Please see the attached report "Review of Husky Energy Proposal for The White Rose Extension Project Oil Spill Aspects" by Dr. Merv Fingas.*

*In general, Environment Canada is in agreement with the proponent's findings with some differences in direction due to differences in winds and currents utilized (the EC modelling was done in stochastic mode with winds from CMC and currents from DFO). The persistence of the oils differed somewhat, with the proponent overestimating dispersion. In the EC modelling, there were a few cases where oil impacted the shorelines in Placentia Bay and the movement was consistently to the south, driven by NE winds. In contrast, the proponent had the oil moving further into the bay.*

**Husky Response:**

Thank you very much for endorsement and the detailed review.

With regard to the comments on page 8 of the Fingas report regarding dispersed oil modelling: The oil shown to be lost from the surface in Table 3.6 is dispersed (as noted by Dr. Fingas) beneath the surface slick, mixed to a 10 m depth and diffused laterally. The characteristics of the dispersed oil cloud are provided in Table 3.6. All of these assumptions result in a conservative estimate of the possible dispersed oil cloud concentration and zone of influence. Figures 3.6 and 3.7 identify the locations along the spill trajectory where the dispersed oil concentration drops to 0.1 ppm.

Upon review of the Fingas report, Husky has determined that any differences, if they exist, would not significantly alter the outcome of the modelling exercise or the environmental assessment. The different winds and water currents used in the two assessments will result in differences in movement as Environment Canada has identified.

**3.7.1 Model Inputs and Scenarios**

*Quote (P. 3-69, para. 1): "The only potential sources of marine spills from the WREP nearshore operations are batch spills of fuel as a result of ship accidents or groundings during tow-out activities from the graving dock to the deep-water mating site and the support vessel activities during the topsides installation."*

*Could add dredging operations here.*

**Husky Response:**

Comment Noted. Thank you. The sentence could be reworded as follows:

The only potential sources of marine spills from the WREP nearshore operations are batch spills of fuel as a result of ship accidents or groundings during dredging, tow-out activities from the graving dock to the deep-water mating site and the support vessel activities during the topsides installation.

*P. 3-69, para. 2:*
*If supply vessels are in the nearshore, they can have fuel capacities of around 1150 $m^3$, so the batch spills could range from 100 to 1150 $m^3$ rather than the 350 $m^3$ suggested.*

**Husky Response:**

350 $m^3$ is the estimated volume of fuel to be carried by supply vessels operating in the nearshore in support of the WHP construction project.

*P. 3-69, para. 3:*
*Why not include current maps for the autumn (Oct – Dec) as well?*

**Husky Response:**
Spill trajectories were completed in the months of March, April, May, June and July as these are the months when marine-based activities are most likely to occur in the nearshore. For this reason, the summer water current mapping is most appropriate to show.

**3.8.22 Surface (Platform) Spill**
*Quote (last para.): "…the oil will be broken into small tar-balls spread over a large area, with the oil particles separated by large expanses of water."*

*Where would the tar-balls end up? Are there potential impacts for Greenland, Iceland and further east?*

**Husky Response:**
Oil spill fate prediction models do not use a mechanism for the final breakup of heavily weathered small oil particles. There is no literature or data available to our knowledge that would permit the development of such an algorithm. The present understanding of spilled oil behaviour does not permit the confident modelling of the behaviour of oil over such long durations and presentation of such trajectory results can be misleading. The time required to break down small particles of heavily weathered oil is currently unknown.

## 1.3 Chapter 4 Socio-economic, Terrestrial and Physical Environment Setting

**4.2.1.1 Climate Overview and 4.2.1.3 Wind Climatology**
*The stations used to describe the nearshore climate of Placentia Bay did not include St. Lawrence, located near the mouth of the bay on the west side, with a record of hourly and daily weather reports nearly as long as that of Argentia. It is more exposed to open water conditions than the other three land stations with hourly data.*

*EC recommends that hourly wind reports from St Lawrence be analyzed to improve the wind climatology near the mouth of the bay, and could be compared to the southernmost MSC50 grid point.*

**Husky Response:**
Thank you. We have updated the Placentia Bay nearshore winds with measurements from St. Lawrence (Environment Canada 2013). The key edits are:

- new columns in tables of monthly and annual mean and max wind (Tables 4-13, 4-14) and companion Figure 4-16 (see response to **Comment 4.2.1.3 Wind Climatology**).
- added St. Lawrence as a row in Table 4-2 (see Table 1) in Figure 4-3 (see Figure 1) for Site Location and Years of Record

Eleven Environment Canada weather stations (Environment Canada 2012) were used for determining air temperature, wind and precipitation statistics for the nearshore climatology of Placentia Bay. Hourly wind reports from St. Lawrence were also included (as a twelfth station) for wind characterization near the mouth of the bay.

**Table 1 Revised Table 4-2 List of Environment Canada Hourly Weather Observation Sites**

| Site Location | Years of Record |
|---|---|
| Argentia-Placentia | 1953-2011 (Staffed Visibility/Precipitation through 1986) |
| Marticot Island | 1994-2010 |
| St. Lawrence | 1994-1996; 1998-2013 |
| Winterland | 1999-2011 |
| Source: Environment Canada 2012a, 2013. | |

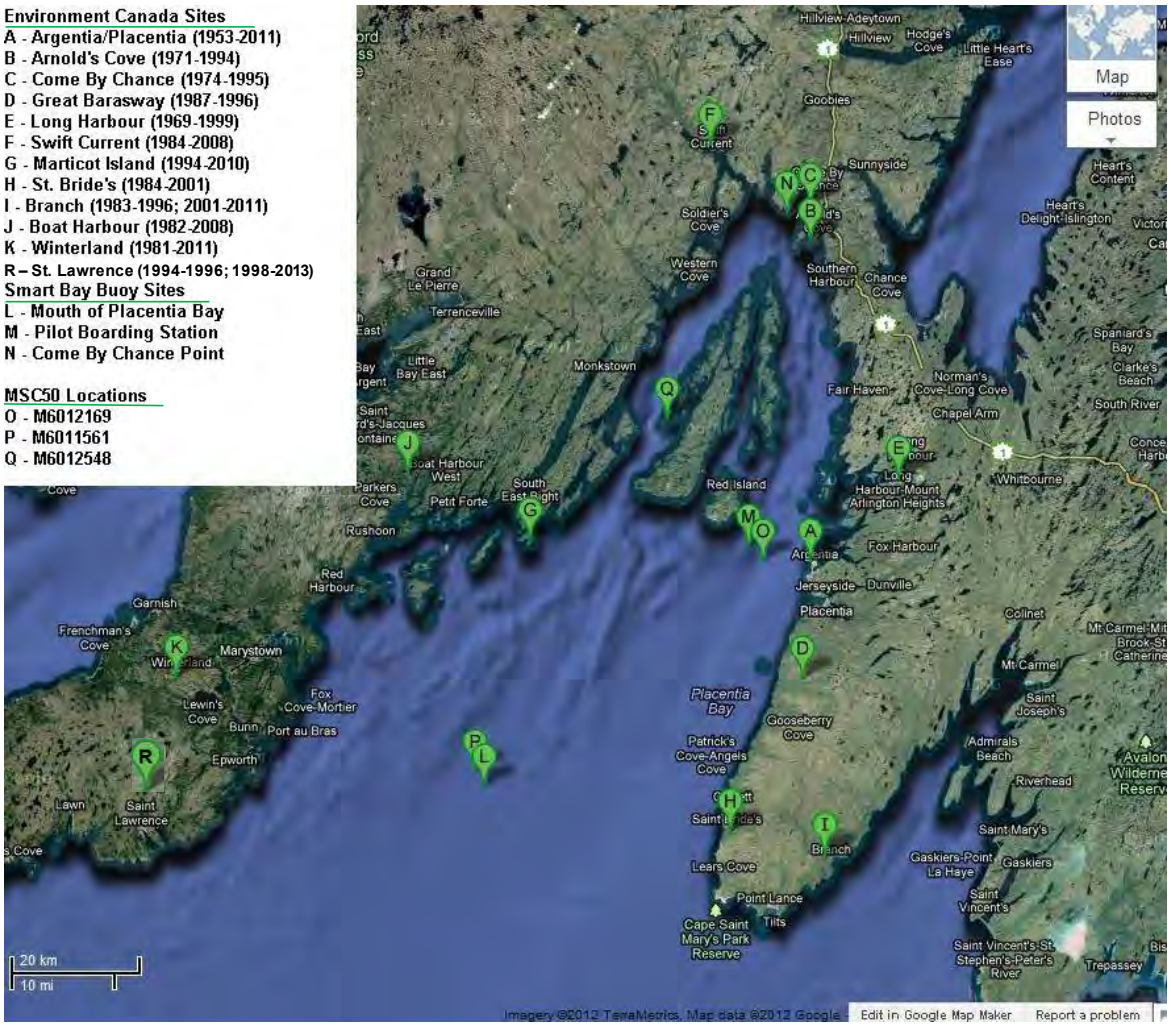



**Figure 1 Revised Figure 4-3 Location of Nearshore Weather Stations**

**4.2.1.3 Wind Climatology**

*Winds from the MSC50 grid point locations and the SmartBay buoys are compared in Tables 4-8 and 4-9. The differences in wind statistics are attributed to the much shorter record of the buoys, but the low buoy anemometer heights, compared to the 10 m MSC50 winds, would also contribute to an apparent low bias.*

*The wind climatology describes only the hourly-reported sustained (mean) wind speeds. Analysis of gust wind speeds, available from the hourly automatic stations, would be important for planning and design.*

**Husky Response:**
Wind gusts have been included.

Hourly observations from four Environment Canada weather stations (Marticot Island, Argentia-Placentia, Winterland and St. Lawrence) were used to assess the typical wind conditions nearshore Placentia Bay. These four sites provide a broad regional summary of winds surrounding the region as they encompass the west, east, and southwest sides of Placentia Bay. The lowest mean wind speeds are expected during the summer months (June-July), while the maximum occurs in the winter (January-February). The monthly and annual mean and maximum wind speeds for nearshore Placentia Bay are presented in Table 4-13 (Table 2) and Table 4-14 (Table 3) and plotted in Figure 4-16 (Figure 2).

Recognizing the relevance of wind gusts for planning, design, and operations activities, wind gust measurements measured at automatic climate stations for coastal sites Argentia-Placentia, Marticot Island and St. Lawrence were also analyzed. The maximum monthly wind gust speeds are also reported in Table 4-14 (Table 3), and plotted in Figure 4-16a (Figure 3).

**Table 2 Revised Table 4-13 Monthly and Annual Mean Wind Speed nearshore Placentia Bay**

| Month | Argentia-Placentia (m/s) | Marticot Island (m/s) | Winterland (m/s) | St. Lawrence (m/s) |
|---|---|---|---|---|
| Jan | 8.2 | 6.6 | 6.9 | 7.9 |
| Feb | 7.8 | 6.7 | 7.2 | 8.1 |
| Mar | 7.4 | 6.5 | 6.7 | 7.3 |
| Apr | 6.6 | 5.3 | 6.2 | 6.6 |
| May | 5.8 | 4.2 | 5.5 | 5.7 |
| Jun | 5.6 | 3.8 | 5.2 | 5.2 |
| Jul | 5.4 | 3.7 | 4.5 | 4.4 |
| Aug | 5.6 | 3.9 | 4.4 | 4.8 |
| Sep | 6.0 | 4.6 | 5.2 | 5.4 |
| Oct | 6.9 | 5.5 | 5.8 | 6.5 |
| Nov | 7.4 | 6.1 | 5.4 | 6.7 |
| Dec | 8.0 | 6.3 | 6.6 | 7.7 |
| Annual | 6.7 | 5.3 | 5.8 | 6.4 |
| Source: Environment Canada 2012a, 2013. | | | | |

**Table 3 Revised Table 4-14 Monthly and Annual Maximum Hourly Wind Speed and Wind Gust Nearshore Placentia Bay**

| Month | Argentia-Placentia | | Marticot Island | | Winterland | St. Lawrence | |
|---|---|---|---|---|---|---|---|
| | Maximum Wind Speed (m/s) | Maximum Gust Speed (m/s) | Maximum Wind Speed (m/s) | Maximum Gust Speed (m/s) | Maximum Wind Speed (m/s) | Maximum Wind Speed (m/s) | Maximum Gust Speed (m/s) |
| Jan | 30.3 | 36.7 | 26.4 | 30.3 | 25.3 | 29.7 | 42.2 |
| Feb | 30.8 | 39.2 | 28.3 | 33.9 | 27.2 | 35.0 | 44.2 |
| Mar | 24.2 | 36.7 | 31.9 | 38.6 | 22.2 | 27.2 | 39.7 |
| Apr | 25.8 | 29.4 | 27.2 | 35.0 | 22.2 | 26.7 | 36.7 |
| May | 23.3 | 27.8 | 25.8 | 31.9 | 23.6 | 25.8 | 35.5 |
| Jun | 20.6 | 25.3 | 18.6 | 22.8 | 18.1 | 20.6 | 29.4 |
| Jul | 21.7 | 26.7 | 20.6 | 22.2 | 19.4 | 19.2 | 25.8 |
| Aug | 22.2 | 24.2 | 22.2 | 30.8 | 20.6 | 20.6 | 26.7 |
| Sep | 26.4 | 36.7 | 29.7 | 35.0 | 25.3 | 24.7 | 38.6 |
| Oct | 28.6 | 29.7 | 27.8 | 33.9 | 22.8 | 29.4 | 38.0 |
| Nov | 28.1 | 30.8 | 25.8 | 29.7 | 20.6 | 24.7 | 36.9 |
| Dec | 30.0 | 35.5 | 27.2 | 33.9 | 25.8 | 29.4 | 42.2 |
| Annual | 30.8 | 39.2 | 31.9 | 38.6 | 27.2 | 35.0 | 44.2 |
| Source: Environment Canada 2012a, 2013 | | | | | | | |

Reference:

Environment Canada, 2013. *Wind Data, Placentia Bay, Newfoundland*. St. Lawrence, Argentia-Placentia. Marticot Island, hourly wind speed and wind gust speed data. Climate Services, Atlantic Climate Centre. MSC Atlantic Operations, Dartmouth, NS, 26 March 2013.

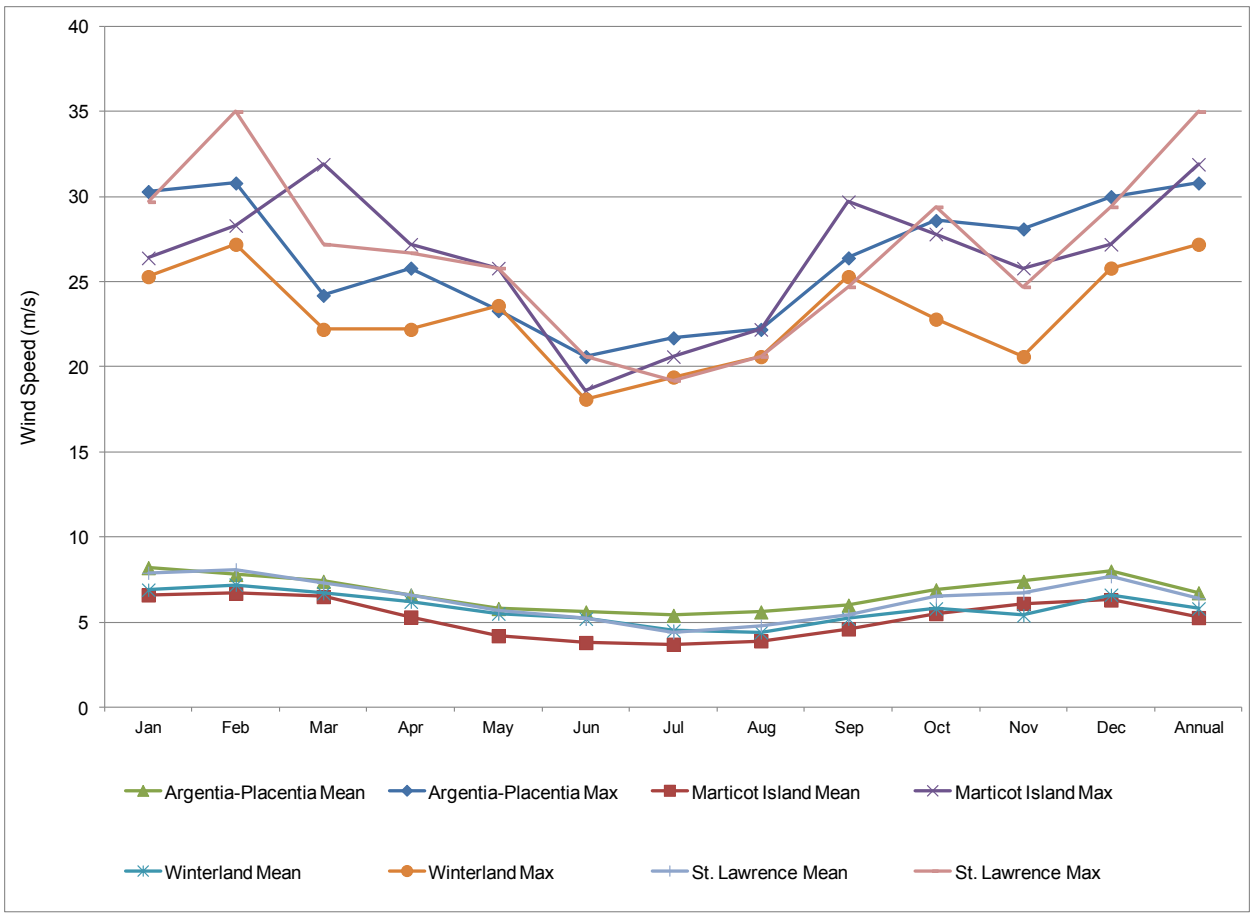



**Figure 2** **Revised Figure 4-16 Monthly Average and Maximum Wind Speed for Nearshore Placentia Bay**

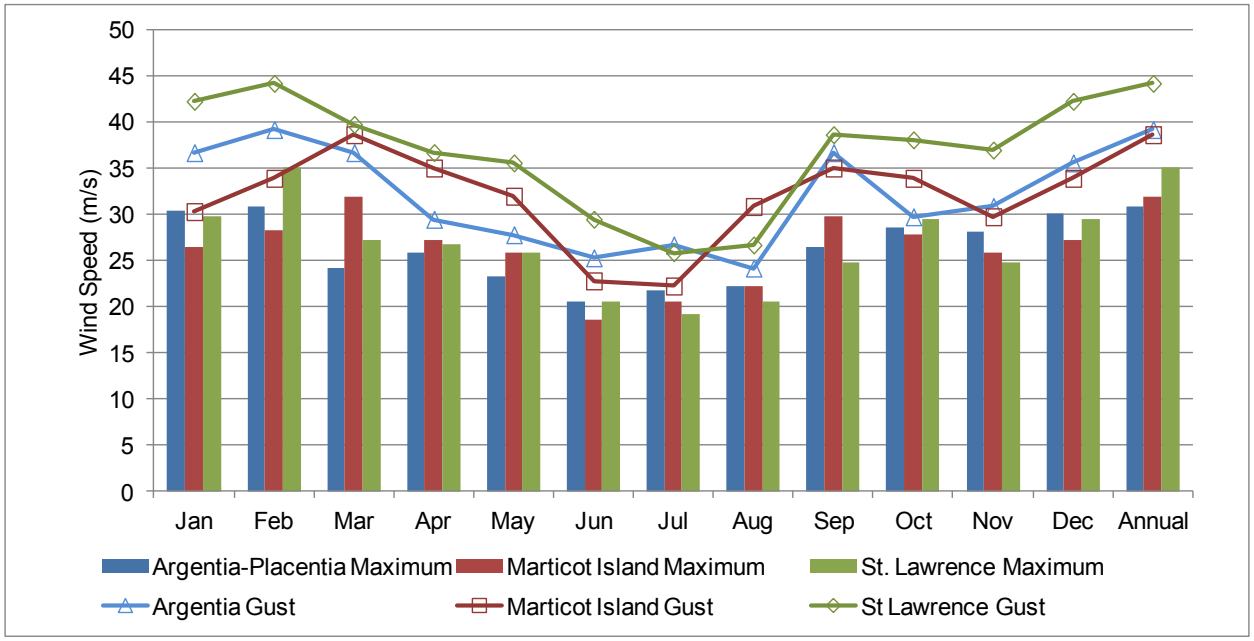



**Figure 3** **Figure 4 16a Monthly Maximum and Gust Wind Speed for Nearshore Placentia Bay**

**4.2.2.2 Waves**

*The MSC50 dataset was not intended for use very nearshore. The model resolution, representation of the coastline and islands, and the bathymetry, are not optimized for nearshore applications, such as well into the Placentia Bay. EC suggests that this limitation be acknowledged.*

**Husky Response:**

Husky acknowledges the limitation of the MSC50 data set in its use in the nearshore.

**4.2.2.5 Tides, Storm Surges**

*The text gives an estimate of 0.8 m for probable maximum storm surge from 40-year return period hindcast values (from Bernier and Thompson (2006), Figure 4-64), however the storm surge model used by Bernier and Thompson does not include wave set-up or wave run-up or seiche effects, which can contribute significantly to extreme water levels. EC recommends that the EIS include an extremal analysis of water levels based on long time series tide gauge data at Argentia.*

**Husky Response:**

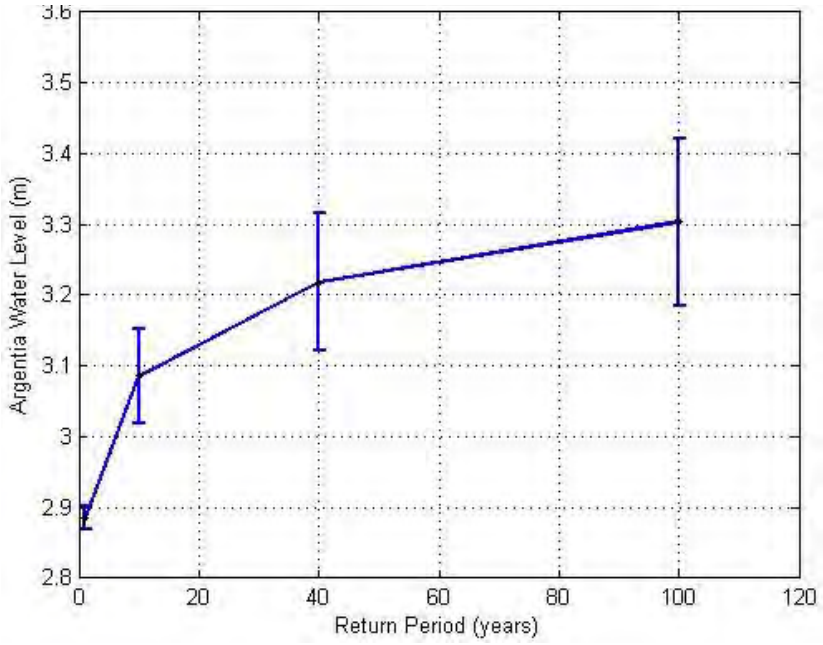
We have performed an extreme value analysis on the Argentia tide/water level historical data.

The following is added to the end of Section 4.2.2.5.

Extremal analysis was performed on the February 1971 to March 2011 historical 1-hourly water level measurements at Argentia (DFO 2012b) by fitting them to a Gumbel distribution using the maximum likelihood method. By analysing the water level measurements themselves, this approach includes any wave set-up or seiche effects which may occur. The results are shown in revised Table 4-34 (Table 4) and revised Figure 4-66 (Figure 4), which indicate a 100-year water level value of 3.3 m. This is again consistent with the HHW value of 3.4 m reported in Table 4-33.

**Table 4 Revised Table 4-34 Argentia Water Level Annual Extremes**

| | 1-yr Return (m) | 10-yr Return (m) | 40-yr Return (m) | 100-yr Return (m) |
|---|---|---|---|---|
| Argentia Water Level | 2.89 +/- 0.02 | 3.09 +/- 0.07 | 3.22 +/- 0.10 | 3.30 +/- 0.12 |




Source: DFO 2012b

**Figure 4 Revised Figure 4-66 Extreme Water Level Values, Argentia**

**4.2.4 Sea Ice and Icebergs**

*Page 4-112, Figure 4-75:*

*Typo – The x and y axes are labelled identically as "Annual Total Number of Icebergs Observed South of 48N". The label is correct for the x-axis, but the y-axis should simply be labelled "Year".*

**Husky Response:**

Comment noted. Thank you.

***EC Response**: Non-Responsive.*

**Husky Response:** Revised Figure 4-75 is provided as Figure 5.

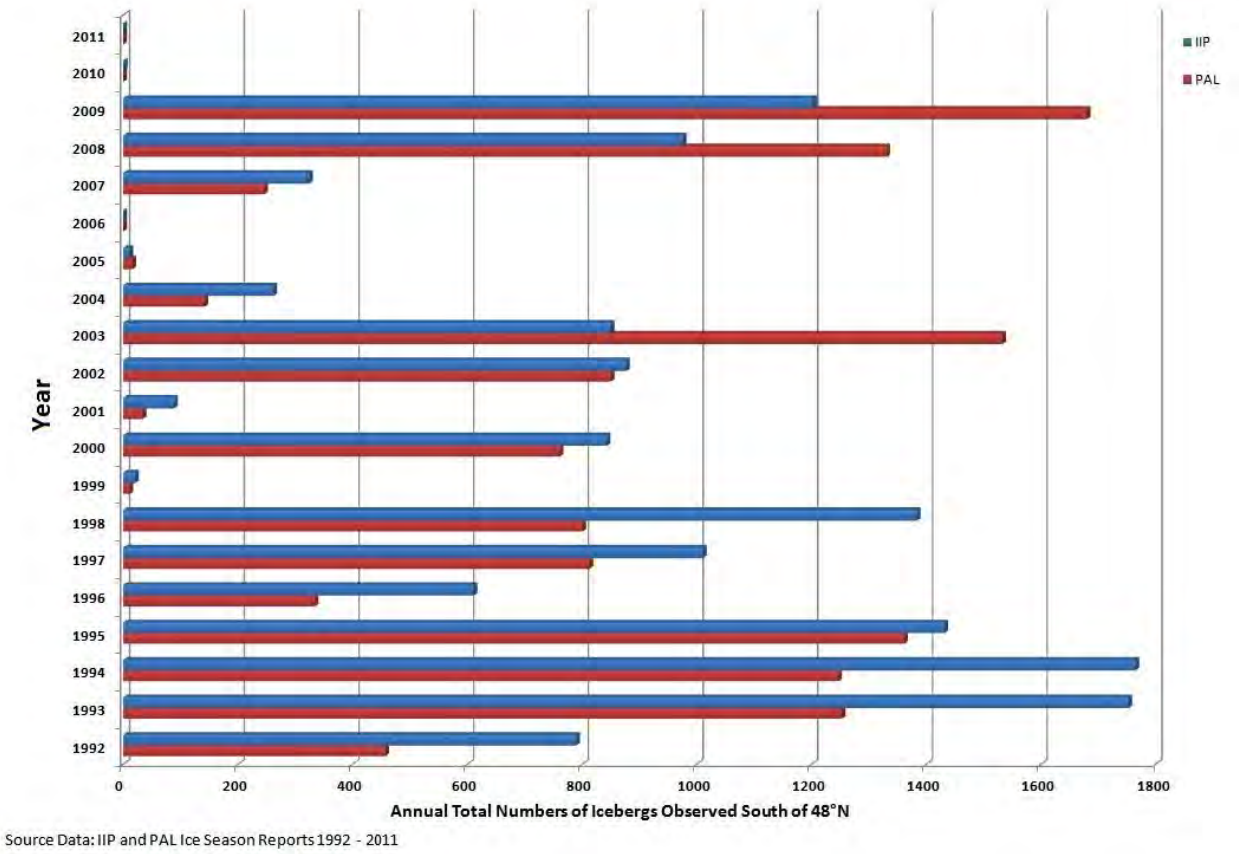



**Figure 5 Revised Figure 4-75 Comparison of International Ice Patrol and Provincial Airlines Limited Iceberg Databases 1992 to 2011**

**4.2.4.1 Sea Ice Conditions in Placentia Bay**

*Page 4-112, Sentence 3*:

*Two errors*

*The ice that enters the Bay in February is generally grey or grey-white ice (less than 30cm thick), and is not first-year ice (>30cm thick). First-year ice incursions into Placentia Bay only take place from March onwards.*

- *First-year ice is >30 cm thick. Contrary to indicated, it can be >120cm thick. First-year ice that is >120 cm is called "thick first-year" ice. Ice that is 30-70cm is thin first-year ice, and ice that is 70-120cm is medium first-year ice.*

*Page 4-114, Paragraph 2, Sentence 2* and *Page 4-115, Figure 4-78*:

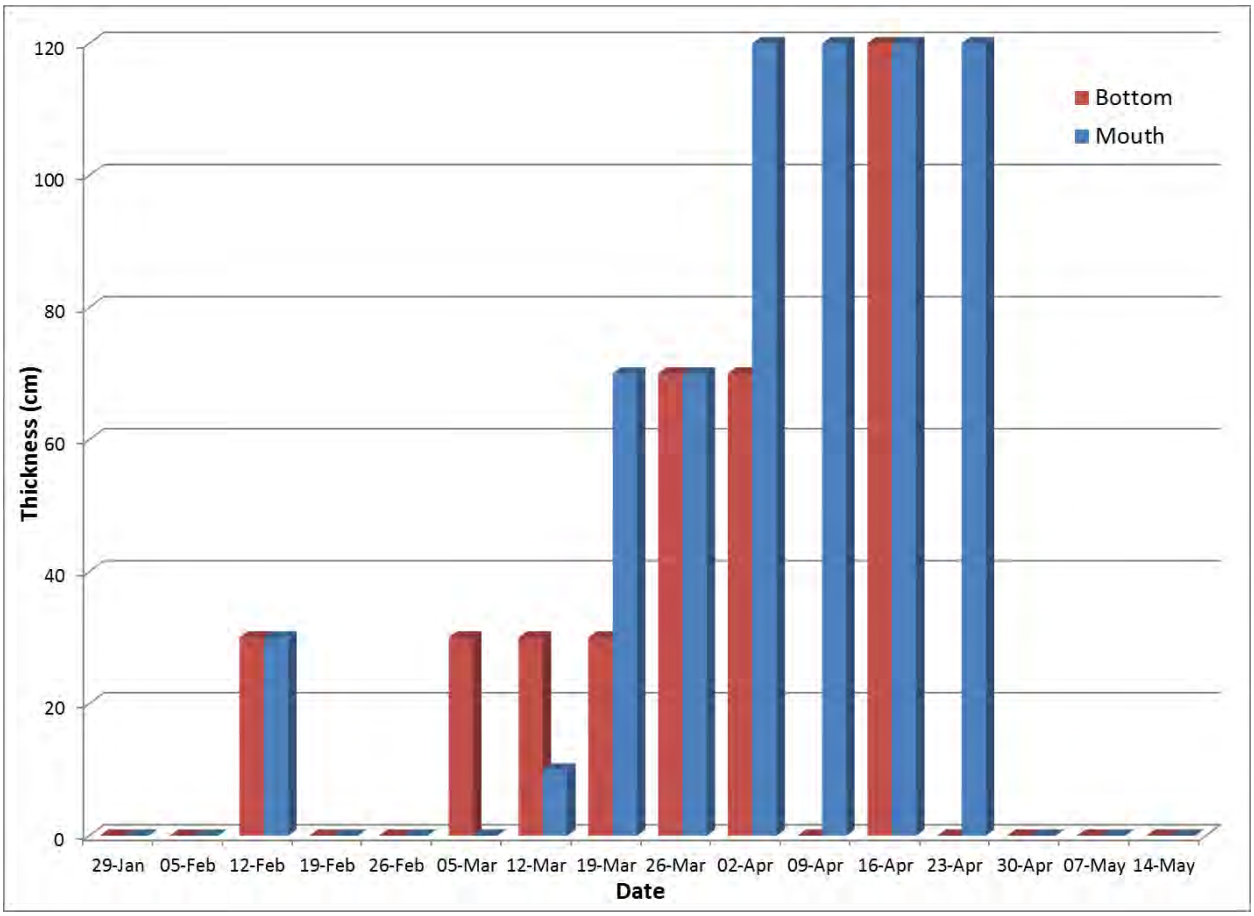
*Error with respect to the upper limit for the standard ice types – In Figure 4-78, the thickness of thin first-year ice (e.g., Mar 19, Mar 26, Apr 02) is given as 50 cm. This is the average thickness for this ice type, not the upper limit as indicated. The upper limit for this ice type is 70 cm.*

**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive.*

**Husky Response:** Section 4.2.4.1, Sea Ice Conditions in Placentia Bay, first paragraph is revised to read:
Pack ice presence in Placentia Bay from year to year may be variable, based on a review of the weekly CIS charts from 1981 to 2010, inclusive (Environment Canada CIS 2010). Most sea ice within the bay is formed off southern Labrador and drifts south to enter the bay around the mid-February timeframe. Pack ice begins to enter Placentia Bay in February, typically as grey or grey-white ice (<30 cm), followed by first-year ice incursion in March and April. Placentia Bay generally experiences thin or medium first-year ice (30 to 120 cm thick). The bay has been divided into two sections for analysis: the mouth and the bottom (Figure 4-76). The mouth of the Bay is more susceptible to incursions of the annual pack, while the bottom of the bay only fills with pack when there are sustained periods of onshore winds. The available data do not have the resolution to provide information on ice distribution in the various inlets and coves around the bay.

Revised Figure 4-78 is provided as Figure 6.




Source: CIS 2011

**Figure 6** **Revised Figure 4-78 Derived Sea Ice Thickness at the Mouth and Bottom of Placentia Bay (30 year average for period from 1981 to 2010)**

*Page 4-115, Sentence 1*:
*Typo – It appears that "(Figure 4-4)" should be "(Figure 4-78)".*

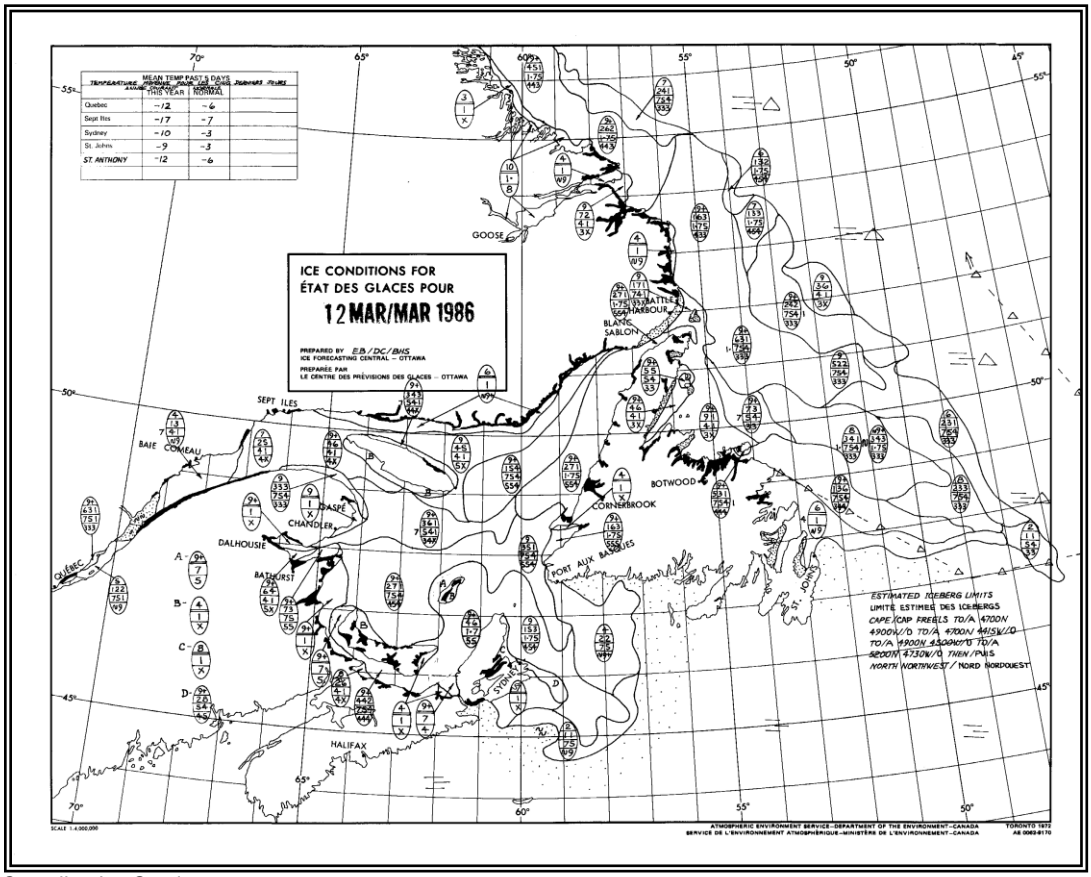
**Husky Response:**
The reviewer is correct. The in-text figure reference should be Figure 4-78.

**4.3 Offshore**
*Page 4-201*:
*Figure caption is missing – The sea ice chart on this page has no figure number (it should be Figure 4-121). There should also be a reference to the Canadian Ice Service in the caption, as the chart was obtained from its archives.*

**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive.*

**Husky Response:** Figure 4-121 is provided with appropriate caption as Figure 7.




Source: Canadian Ice Service

**Figure 7 Figure 4-121 Ice Coverage on March 12, 1986**

**4.3.1.2 Wind Climatology**
*The caption for Table 4-44 has the word "anemometer", which should be replaced by MSC50.*

***Husky Response:***
Comment noted. Thank you.

***EC Response**: Non-Responsive*

**Husky Response:** Revised Table 4-44 is provided as Table 5.

**Table 5 Revised Table 4-44 Monthly Maximum MSC50 Wind Speed (m/s) by Direction, 1954 to 2010**

| Month | Direction | | | | | | | | Monthly | |
|---|---|---|---|---|---|---|---|---|---|---|
| | NE | E | SE | S | SW | W | NW | N | Min | Max |
| January | 21 | 23 | 24 | 26 | 29 | 28 | 27 | 25 | 21 | 29 |
| February | 23 | 22 | 25 | 30 | 30 | 30 | 32 | 24 | 22 | 32 |
| March | 22 | 25 | 24 | 22 | 25 | 28 | 28 | 25 | 22 | 28 |
| April | 22 | 20 | 21 | 25 | 24 | 23 | 24 | 24 | 20 | 25 |
| May | 16 | 18 | 18 | 19 | 20 | 19 | 23 | 19 | 16 | 23 |
| June | 16 | 17 | 21 | 18 | 18 | 22 | 23 | 15 | 15 | 23 |
| July | 14 | 16 | 17 | 20 | 17 | 17 | 18 | 15 | 14 | 20 |
| August | 17 | 18 | 19 | 29 | 28 | 23 | 29 | 24 | 17 | 29 |
| September | 21 | 21 | 24 | 24 | 25 | 23 | 21 | 21 | 21 | 25 |
| October | 22 | 22 | 24 | 27 | 27 | 27 | 25 | 23 | 22 | 27 |
| November | 21 | 23 | 23 | 27 | 23 | 27 | 28 | 26 | 21 | 28 |
| December | 22 | 22 | 25 | 23 | 28 | 28 | 30 | 25 | 22 | 30 |
| Years Max | 23 | 25 | 25 | 30 | 30 | 30 | 32 | 26 | | |

**4.3.1.5 Icing**

*This section includes only potential sea spray icing. EC recommends that the EIS include analysis of observed freezing spray and icing accumulation measured on the platforms.*

**Husky Response:**

Ice accumulation on stationary offshore platforms is a rare event. Freezing spray is more common on ships transiting rough seas. Data on ice accumulation are not recorded in either case.

***EC Response**: Not Satisfactory. "EC had recommended that the EIS include analysis of observed freezing spray and icing accumulation measured on the platforms. This would augment the modeled potential icing results. Knowledge gained through direct experience and observations of ice accretion (whether formally reported or not) from years of winter operations in this area by station keeping production vessels, mobile drilling platforms, and supply vessels should be used to help characterize this significant environmental hazard."*

**Husky Response:** Husky has no record of ice accretion on the *SeaRose FPSO* or from drilling rigs while under contract to Husky. The WHP is being designed for ice loads according to the standards of NORSOK N-003 'Actions and Action Effects' and CAN/CSA ISO 19906 'Petroleum and natural gas industries – Arctic offshore structures'.

**4.3.4.1 Sea Ice**
**Spatial Distribution:**
*Page 4-204, Paragraph 3, last sentence*:
*Clarity – This sentence could easily be misunderstood as written. To make it clearer, it is suggested that it be rewritten as two sentences: "**Thin** first-year or white ice becomes the dominant ice form in areas off Newfoundland beginning in March, just before water temperatures rise above the freezing level. **In April and May, during years when ice lingers in the area, medium to thick first-year ice are the dominant ice forms.**"*

**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive*

**Husky Response:** Section 4.3.1.1 Spatial Distribution, third paragraph is revised to read:
In typical years, the ice edge reaches the northern tip of Newfoundland in early January and the Grand Banks in mid-February (National Climate Data Centre 1986). The pack ice off Newfoundland generally reaches annual peak coverage in March, but can remain at high levels through May. Thin first-year or white ice becomes the dominant ice form in areas off Newfoundland beginning in March, just before water temperatures rise above the freezing level. In April and May, during years when ice lingers in the area, medium to thick first-year ice are the dominant ice forms.

*Page 4-204, Paragraph 4, first sentence*:
*Clarity + Typo – For clarity, it is suggested that this sentence be rewritten as: "By the end of July, the ice pack **has retreated** northward, with substantial ice concentrations confined north of Labrador."*

**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive*

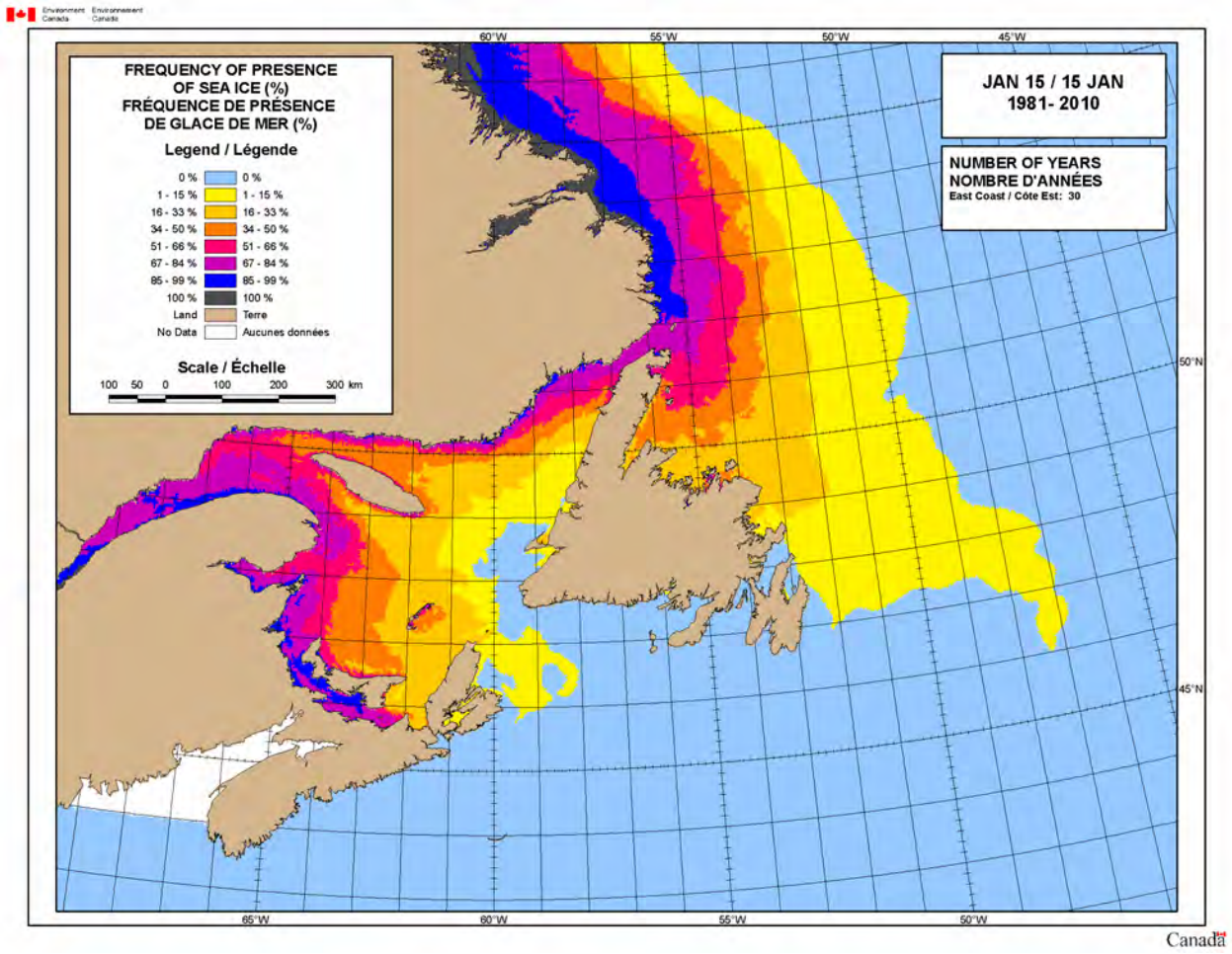
**Husky Response:** Section 4.3.1.1 Spatial Distribution, fourth paragraph is revised to read:
By the end of July, the ice pack has retreated rapidly northward, with substantial ice concentrations confined to north of Labrador. Occasionally, first-year ice remnants linger at the end of the summer season off the east coast of Baffin Island, near 70°N. These remnants, together with late discharges of first-year and older ice from Lancaster, Jones and Smith sounds, are the source of the old ice that can appear off Labrador the following ice season (Markham 1980).

*Page 4-205, Paragraph 1, Sentence 1 and Figure 4-122*:
*Slight error – In the first sentence, it says the mid-month Frequency of Presence of Sea Ice charts (taken from the CIS atlas) are shown January through May. All the charts shown are indeed for the middle of the months, except for the one for January. The chart shown for January is that of the week of January 08, when really, to be consistent with the statement and the other months, it should be that for January 15.*

**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive*

**Husky Response:** Revised Figure 4-122 is provided as Figure 8.




Source: Environment Canada CIS 2011

**Figure 8 Revised Figure 4-122 Frequency of Pack Ice Cover: Week of January 15 (1981 to 2010)**

*Page 4-209, Paragraph 1, Sentence 1*:
*Clarity – For greater clarity, it is suggested that the phrase "annual timing of all ice incursions" in the first sentence of this paragraph be replaced, since that is not exactly what the bar graph in Figure 4-127 shows. The sentence should rewritten as: "The* ***average ice coverage during the initial period of*** *ice incursions near the White Rose field,* ***between end of November and mid-February****, from 1980 to 2012, is shown in Figure 4-127."*

**Husky Response:**
Comment noted. Thank you.

***EC Response****: Non-Responsive*

**Husky Response:** Section 4.3.4.1, Spatial Distribution, Paragraph on Page 4-209 is revised to read:
The annual ice coverage during the initial period of ice incursions near the White Rose field, between end of November and mid-February, from 1980 to 2012, is shown in Figure 4-127. These data show the years of higher-than-average incursion (1983 to 1995, 2000 and 2008). The maximum recorded incursion of sea ice for east Newfoundland waters occurred in 1993 and is illustrated in Figure 4-128.

*Page 4-209, Paragraph 1, Sentence 2*:
*Clarity, as in Sentence 1 – Suggested revision of this sentence: "These data show the years of higher-than-average* ***ice coverage during the initial period of ice*** *incursions (1983 to 1995, 2000 and 2008)."*

**Husky Response:**
Comment noted. Thank you.

***EC Response****: Non-Responsive*

**Husky Response:** Section 4.3.4.1, Spatial Distribution, Paragraph on Page 4-209 is revised to read:
The annual ice coverage during the initial period of ice incursions near the White Rose field, between end of November and mid-February, from 1980 to 2012, is shown in Figure 4-127. These data show the years of higher-than-average ice coverage during the initial period of ice incursions (1983 to 1995, 2000 and 2008). The maximum recorded incursion of sea ice for east Newfoundland waters occurred in 1993 and is illustrated in Figure 4-128.

*Page 4-209, Paragraph 1, Sentence 3*:
*Clarity – as in Sentences 1 and 2*
*Inconsistency – The incursion period shown in Figure 4-127 spans Nov 26 – Feb 19. But the representative chart shown for 1993 is for March 01.*

*Suggested revision of sentence 3: "The maximum recorded* ***amount of ice during the initial period of*** *incursion of sea ice for east Newfoundland waters occurred in 1993* ***(Figure 4-127). The 1993 ice coverage chart for the second week following the incursion period*** *is illustrated in Figure 4-128."*

**Husky Response:**
Comment noted. Thank you.

***EC Response****: Non-Responsive*

**Husky Response:** Section 4.3.4.1, Spatial Distribution, Paragraph on Page 4-209 is revised to read:
The annual ice coverage during the initial period of ice incursions near the White Rose field, between end of November and mid-February, from 1980 to 2012, is shown in Figure 4-127. These data show the years of higher-than-average ice coverage during the initial period of ice incursions (1983 to 1995, 2000 and 2008). The maximum recorded amount of ice during the initial period of incursion of sea ice for east Newfoundland waters occurred in 1993 (Figure 4-127). The 1993 ice coverage chart for the second week following the incursion period is illustrated in Figure 4-128.

**Concentrations:**
*Page 4-212, Paragraph 2, Sentence 1*:
*Illustration or example required – When talking about the "seasonal ice tongue", it would be helpful if the reader were pointed to a visual example of this. A bracket could be added to the end of the first sentence, such as "(e.g. see Figure 4-124)".*

**Husky Response:**
Comment noted. Thank you.

**4.3.4.2 Icebergs**
**Origins and Controlling Factors:**
Page 4-217, Paragraph 1, Sentence 4:
Correction – Since the Humboldt Glacier and Jacobshavn Isbrae are two of the major sources of icebergs, the sentence should read, "…primarily from 20 major glaciers between **and including** the Jacobshavn and Humboldt glaciers". Also, note that there is no "e" in Jacobshaven.

**Husky Response:**

Comment noted. Thank you.

***EC Response**: Non-Responsive*

**Husky Response:** Section 4.3.4.2, Origins and Controlling Factors, first paragraph is revised to read:
Glacial ice is formed from the accumulation of snow, which gradually changes form as it is compressed into a solid mass of large granular ice. This process produces a structure quite different from pack ice. The principal origins of the icebergs that reach the White Rose field location are the tidewater glaciers of West Greenland. Between 10,000 and 15,000 icebergs are calved each year, primarily from 20 major glaciers between and including the Jacobshavn and Humboldt glaciers. These glaciers account for 85 percent of the icebergs that reach the Grand Banks. Of the remaining icebergs, 10 percent come from the East Greenland glaciers and 5 percent from the glaciers and ice shelves of Ellesmere Island.

*Page 4-217, Paragraph 4*:
*Additional explanation could be added here – It could be explained that the reason why there is a positive correlation between iceberg numbers and pack ice extent is that the pack ice protects the icebergs from melt and wave-induced deterioration during their trip southwards. Because of this, many more bergs survive the trip to Newfoundland during winters with extensive pack ice.*

**Husky Response:**

Comment noted. Thank you.

***EC Response:** Non-Responsive*

**Husky Response:** Section 4.3.4.2, Origins and Controlling Factors, fourth paragraph is revised to read:
Deterioration of icebergs during subsequent southward drift determines seasonal iceberg severities in offshore Newfoundland. The number of icebergs that survive to reach the Grand Banks each spring has been shown to have a direct relationship to the pack ice extent off Labrador in the winter and early spring (Marko et al. 1994b). In other words, when the pack ice covers the core of the Labrador Current, iceberg counts for the Grand Banks increase markedly per unit increase in pack ice cover. The positive correlation between iceberg numbers and pack ice extent is due to the fact that the pack ice protects the icebergs from melt and wave-induced deterioration during their trip southwards. Because of this, many more icebergs survive the trip to Newfoundland during winters with extensive pack ice.

*Page 4-217, Paragraph 5, Sentence 1:*
*Inconsistency – It is stated that according to the data (Figure 4-133)* ***iceberg counts of zero occurred in 1966****, 2006 and 2011,* ***however the bar chart in Figure 4-133 only goes back to 1981****. If a low of zero bergs did occur in 1966, a bracket after this year saying "(not shown)" should be added to the sentence.*

**Husky Response:**
Comment noted. Thank you.

***EC Response:*** *Non-Responsive*

**Husky Response:** Section 4.3.4.2, Origins and Controlling Factors, fifth paragraph is revised to read:
According to the IIP and PAL, the number of icebergs reaching the Grand Banks (48 degrees latitude) each year varied from a low of zero in 1966 (not shown), 2006 and 2011, to a high of 2,202 in 1984 (Figure 4-133). Of these, only a small portion will pass through the White Rose field.

**Variations in Local and Regional Iceberg Numbers:**
*Page 4-219, Paragraph 1, Sentence 2*:
*Inconsistency – Here it is stated that iceberg distributions between March and May of 2009 and 2010 are illustrated in Figures 4-134 and 4-135. However, the two charts shown for 2009 are for March and April, while those shown for 2010 are for March and May. While April does fall "between March and May", it would be better to compare the same months for the two years (i.e., either use a May chart for 2009 or an April chart for 2010).*

**Husky Response:**
It is stated in the first paragraph on Page 4-219, under the section "Variations in Local and Regional Numbers", as do accompanying captions for each iceberg distribution image, that these plots are meant to provide the extremes (maximum and minimum extent of iceberg distribution) during the 2009 and 2010 ice seasons. Those two seasons were chosen due to the significant difference in the number of icebergs observed off the East Coast of Canada. Only iceberg analysis charts between March 1 and May 31 of both years were analyzed to determine the minimum and maximum iceberg distribution during these three months, which is the typical iceberg season on the Grand Banks.

During the March 1 to May 31 timeframe of both the 2009 and 2010 ice seasons, the lowest number of icebergs analyzed off Eastern Canada occurred on March 1. The 2009 ice season was particularly heavy for icebergs and the highest number of analyzed icebergs during March, April and May occurred on April 17. The 2010 season was a light year for icebergs off Eastern Canada, particularly south of the 48° North latitude where no icebergs were observed. The majority of 2010 icebergs were observed off the coast of Labrador and the north coast of Newfoundland and the highest number of icebergs analyzed during March, April and May occurred on May 31.

*Page 4-223, Figure 4-137*:
*Chart does not make sense and needs more explanation – According to this chart, which is said to be based on the PAL database, zero bergs were sighted everywhere over the last decade except in the vicinity of the White Rose platform (smack in the middle of the highest observation densities) and along the Northern Peninsula of Newfoundland. Clearly this is not the case (see Figures 4-134 and 4-135). I suspect that what this chart is showing is a subset of the PAL sightings, based around or made from either the White Rose or Hibernia platforms. What exactly this chart is showing needs to be better explained here.*

**Husky Response:**
The reviewers' assumption is correct. Figure 4-137 used archived information from PAL's iceberg sighting database and concentrated the plot on the region around the White Rose oil field by filtering the records. The iceberg density around the Northern Peninsula, depicted in Figure 4-137, is not indicative of the actual concentration typically seen in that region, but these sparse densities were obtained from beacons that were placed on ice island fragments in the past couple of years. Since most iceberg observations are recorded by vessels servicing oil and gas operators on the Grand Banks and from surveillance flights, the majority of sighting data would be recorded near the offshore facilities and close to shorelines of Newfoundland and Labrador, therefore the true density of iceberg locations would not be completely known based on recorded data.

To correct the issue, PAL retrieved all known iceberg sightings from its expansive database, containing over 58,000 records, and produced an updated iceberg observation density plot, for a more condensed domain centred on the White Rose oil field and providing information for areas to the north and west of the Grand Banks. The iceberg density information for the period 1995 to 2012 with the annual mean and maximum (largest number of icebergs recorded in each block in one year) values for each square degree (1 degree latitude by 1 degree longitude) are provided as Figure 9.

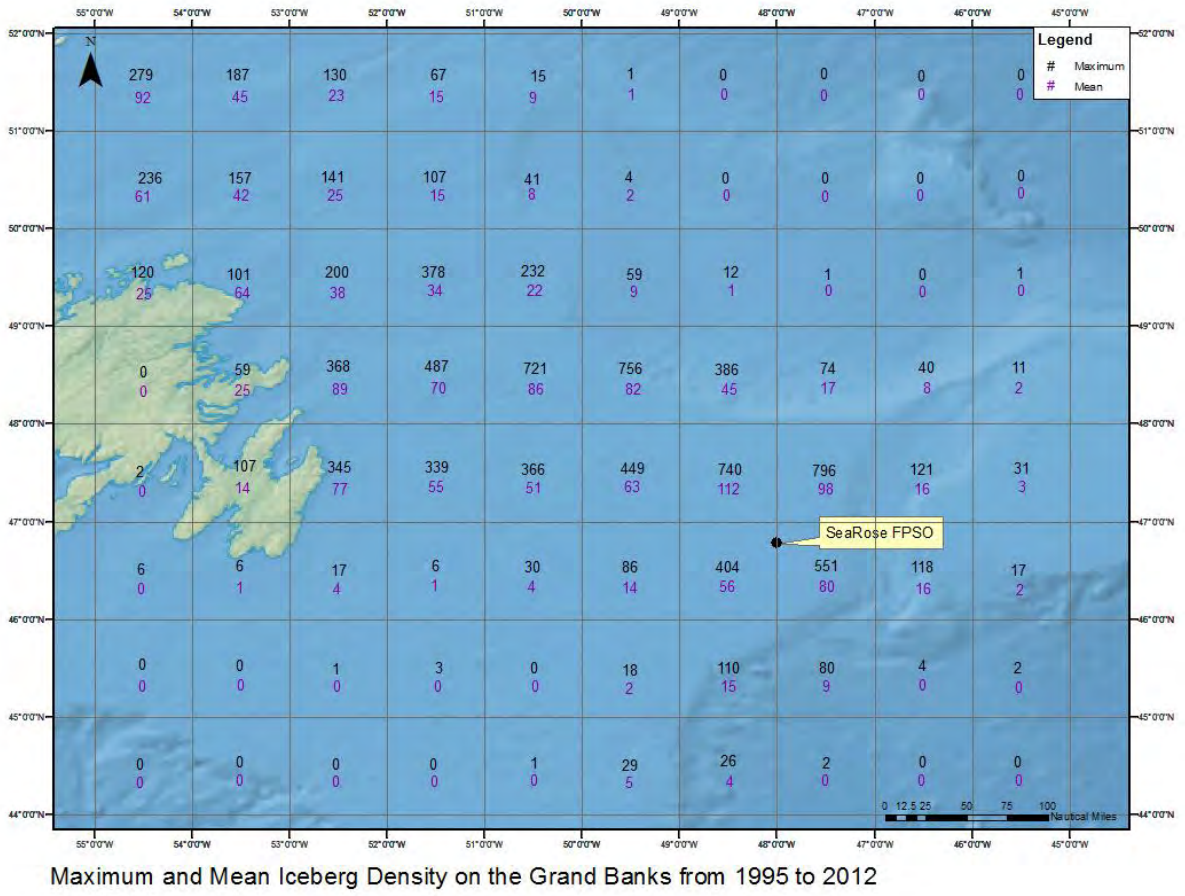



**Figure 9 Maximum and Mean Iceberg Density on the Grand Banks from 1995 to 2012**

**Size Distributions:**
*Page 4-226, Table 4-80*:
*Slight errors in quoted height and length values, and in quoted mass values*

- *Height / Length – The ranges of heights and lengths for each category should begin one increment higher than that of the previous category. So if a Bergy Bit has a length range of 5-15 m, then a Small Iceberg has a length range of 16-60 m (not 15-60 m). Ditto for height. This needs to be corrected for the small, medium and large iceberg categories in the table. See MANICE, Tables 2.3 and 4.8.*
- *Approximate Mass – Although ranges for the masses of medium and large icebergs are given in Table 4-80, the cited source of information does not give ranges for these categories. According to MANICE (Table 2.3), a Medium berg has an approximate mass of 2,000,000 tons and a Large berg has a mass of 10,000,000 tons.*

**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive*

**Husky Response:** Revised Table 4-80 is provided as Table 6.

**Table 6 Revised Table 4-80 Iceberg Size**

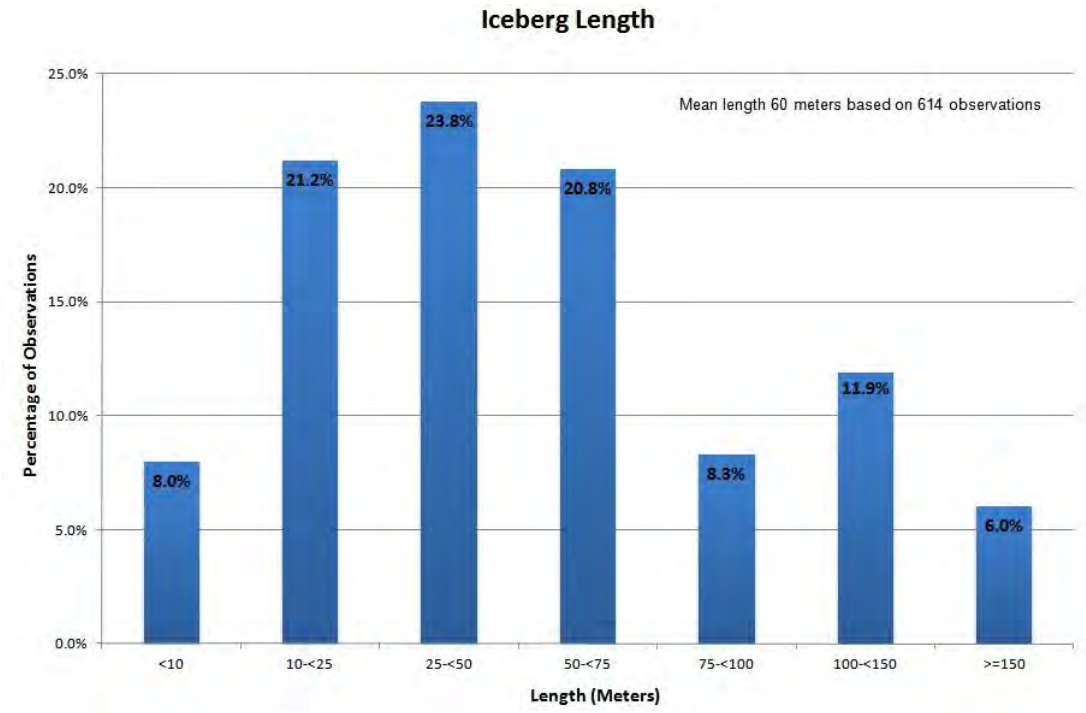
| Category | Height (m) | Length (m) | Approx. Mass (t) |
|---|---|---|---|
| Very Large | >75 | >200 | >10 Million |
| Large | 46 to 75 | 121 to 200 | 10 Million |
| Medium | 16 to 45 | 61 to 120 | 2 Million |
| Small | 5 to 15 | 15 to 60 | 100,000 |
| Bergy Bit | 1.0 to 4 | 5 to 14 | 10,000 |
| Growler | <1.0 | <5 | 1,000 |
| Source: Meteorological Service of Canada CIS MANICE (2002) | | | |

**Iceberg Length:**
*Pages 4-227 to 4-228, Figure 4-140*:
*Figure is split across 2 pages – This is a little confusing because the Figure has two panels. The panels should either be labelled "a)" and "b)" with descriptions of these in the Figure caption so that it is clear these panels both belong to "Figure 4-140", or the Figure should be published on a single page and not split across pages.*

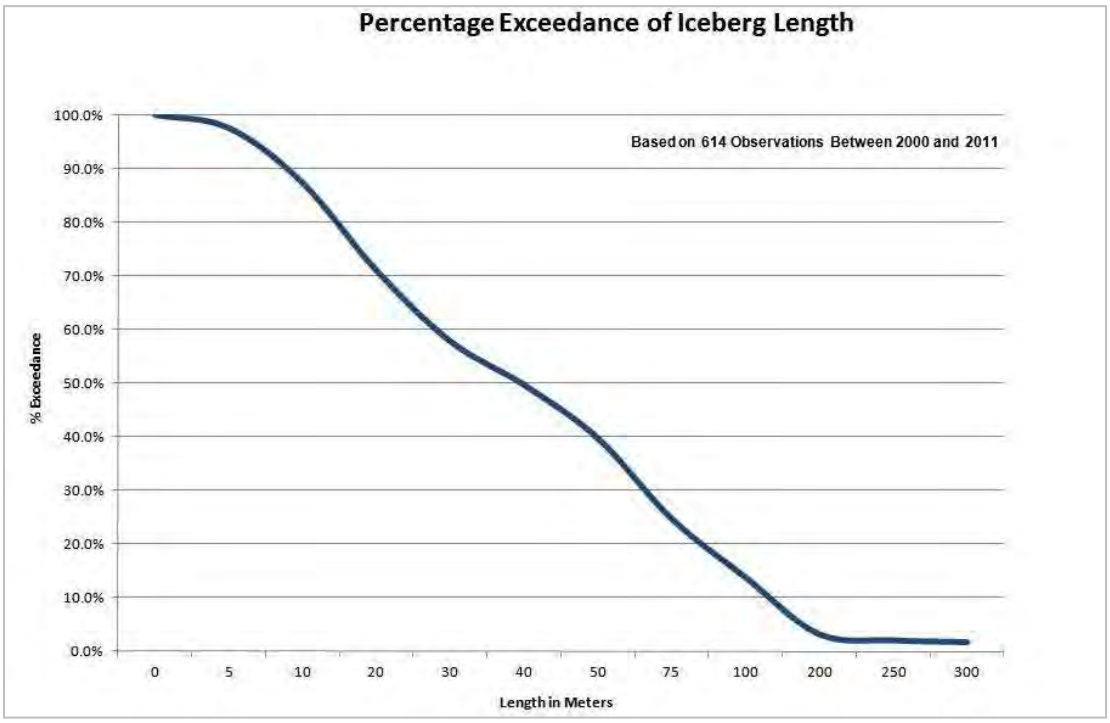
**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive*

**Husky Response:** Figure 4-140 is provided as Figure 10.




(A) Iceberg Length




(B) Percentage Exceedance of Iceberg Length

Source: PAL Iceberg Sighting Database 2000 to 2011

**Figure 10 Revised Figure 4-140 Iceberg (A) Length and (B) Percent Exceedance of Iceberg Length on the Grand Banks**

*Page 4-227, Paragraph 3, Last Sentence*:
*Clarification – It should be stated that the Petermann Glacier is in northwest Greenland, north of the 20 greatest sources of icebergs noted earlier, which lie between and include Jacobshavn Isbrae and the Humboldt Glacier. It could also be noted that the Petermann Glacier has a history of calving large tabular ice islands as opposed to hundreds of smaller bergs, the way the other glaciers do.*

**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive*

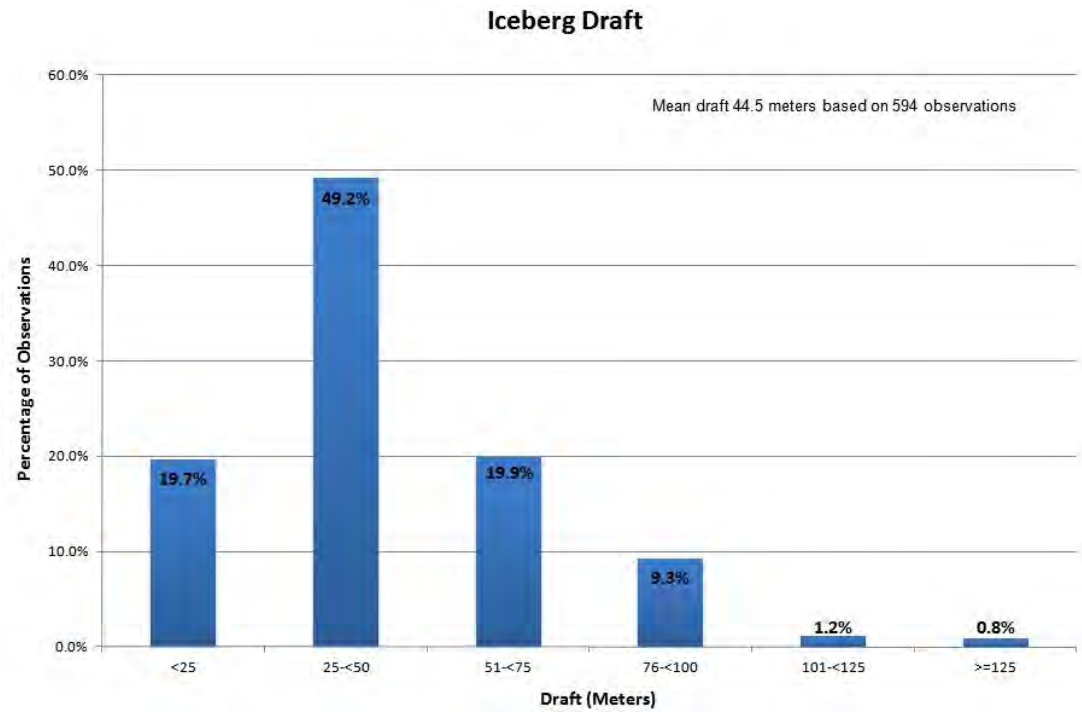
**Husky Response:** Section 4.3.4.2, Iceberg Length, third paragraph is revised to read;
Of note are several ice island fragments or very large icebergs sighted in the 2002, 2003, 2004 and 2011 ice seasons. Several of these fragments were detected from facilities on the Grand Banks, and were thus within 20 nautical miles of the locations. In 2011, however, the fragments deteriorated prior to making it south of 48°N. These icebergs, while having very large surface area, had drafts of 50 m or less. Based on several studies (Stoermer and Rudkin 2003; Rudkin et al. 2005; PERD 2004) these ice island fragments were the result of a significant calving event on the Petermann Glacier. The Petermann Glacier is in northwest Greenland, north of the 20 greatest sources of icebergs noted earlier (Section 4.3.4.2 Icebergs Origins and Controlling Factors: Page 4-217, Paragraph 1, Sentence 4,), which lie between and include Jacobshavn Isbrae and the Humboldt Glacier. The Petermann Glacier has a history of calving large tabular ice islands as opposed to hundreds of smaller icebergs, the way the other glaciers do.

**Iceberg Draft:**
*Pages 4-228 to 4-229, Figure 4-141:*
*Figure is split across 2 pages – This is a little confusing because the Figure has two panels. The panels should either be labelled "a)" and "b)" with descriptions of these in the Figure caption so that it is clear these panels both belong to "Figure 4-141", or the Figure should be published on a single page and not split across pages.*

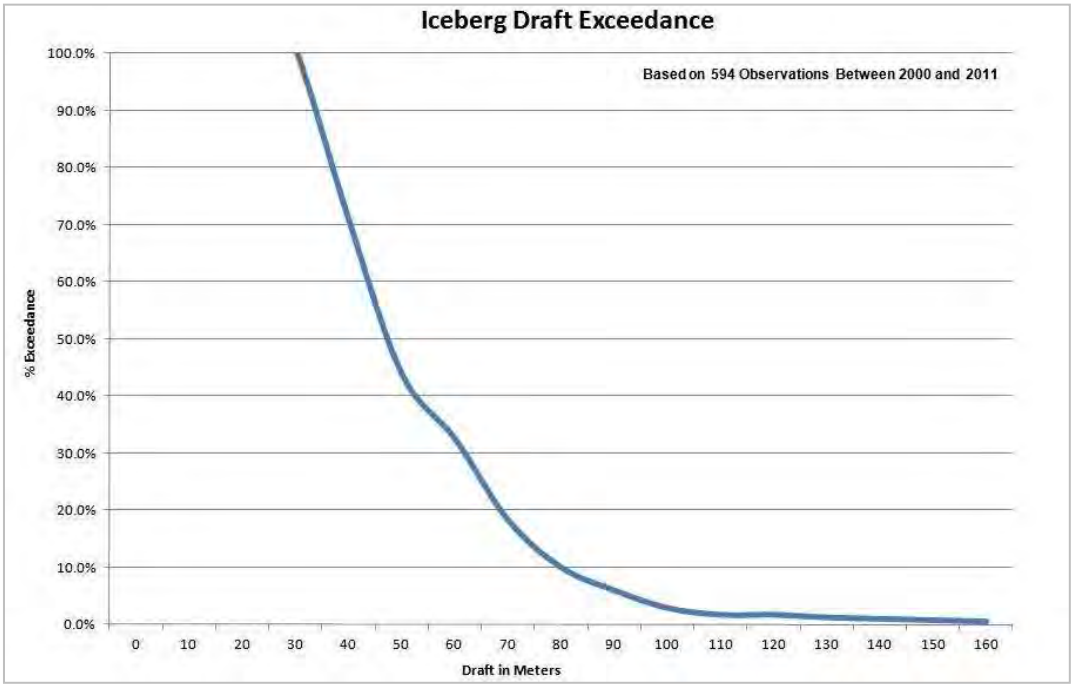
**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive*

**Husky Response:** Figure 4-141 is provided as Figure 11.




(A) Iceberg Draft




(B) Iceberg Draft Exceedance

Source: PAL Iceberg Sighting Database 2000 to 2011

**Figure 11 Revised Figure 4-141 Iceberg (A) Draft and (B) Exceedance of Iceberg Draft for Icebergs on the Grand Banks**

*Page 4-227, Paragraph 4, First Sentence*:
*Inconsistency – It is stated here that the data used in Figure 4-141 were derived from observations and measurements made from **2000 to 2012**, but the source under Figure 4-141 says the PAL data span **2000-2011**. According to our iceberg expert here at CIS, the 2012 data are not yet available.*

**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive.*

**Husky Response:** Section 4.3.4.2, Iceberg Draft, first paragraph is revised to read:
The draft of icebergs (the depth of the iceberg below the water) as derived from observations and measurements made from 2000 to 2011 on the Grand Banks is illustrated in Figure 4-141. The mean iceberg draft was 44.5 m. Almost half (49.2 percent) of draft observations fall into the 25 to 50 m category. Less than 1 percent (0.8 percent) of observed icebergs have drafts which exceed 125 m.

**Iceberg Height:**
*Page 4-229, Paragraph 2*:
*Reference to Figure 4-141 missing – The reader should be directed to Figure 4-142 somewhere in this paragraph.*

**Husky Response:**
Reference to Figure 4-141 is provided in the last paragraph on Page 4-227. Reference to Figure 4-142 is provided in the first paragraph on page 4-229.

**4.3.9 Climate Change,**
*The proponents discuss the impacts of NAO on climate and storminess of the region as well as on the path of hurricanes over the 20th century. Although confidence in projections is generally low (see IPCC SREX), they should provide some general discussion of projected future changes in these climate phenomena as well as extratropical storm tracks, frequency and intensity.*

**Husky Response:**
According to the IPCC AR4 (IPCC 2007), "*extratropical storm tracks are projected to move poleward, with consequent changes in wind, precipitation and temperature patterns…*" A number of studies have been done to project future changes in extratropical storm tracks, as well as extratropical storm frequency and intensity.

Ulbrich et al. (2008) computed winter storm-track activity from an ensemble of 23 runs from 16 coupled global climate models for the control period of 1960 to 1999 and for the period of 2081 to 2100. The Special Report on Emission Scenarios (SRES) A1B scenario was used for the climate forcing of the 2081 to 2100 period. The results of the 1960 to 1999 period were validated against the National Centres for Environmental Prediction (NCEP) – NCAR reanalysis (Kalnay et al. 1996) and found to perform well in reproducing the observed climatological pattern.

Ulbrich et al.'s findings show an increase in storm-track activity in the North Atlantic region extending from southern Newfoundland to Western Europe with the largest increase of 5 to 8 percent occurring over the Eastern North Atlantic.

In 2005, Yin (2005) analyzed storm tracks from an ensemble of 15 coupled climate models and found a consistent poleward and upward shift and intensification of the storm tracks in the Northern Hemisphere for the 21$^{st}$ century. This shift was

associated with enhanced warming in the tropics. Yin also found this poleward shift is accompanied by a poleward shift in surface wind stress and precipitation.

References

IPCC (Intergovernmental Panel on Climate Change). 2007. *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA.

Kalnay, E., M. Kanamitsu, R. Kistler, W. Collins, D. Deaven, L. Gandin, M. Iredell, S. Saha, G. White, J. Woollen, Y. Zhu, M. Chelliah, W. Ebisuzaki, W. Higgins, J. Janowiak, K.C. Mao, C. Ropelewski, J. Wang, A. Keetmaa, R. Reynolds, R. Jenne and D. Joseph. 1996. The NCEP/NCAR 40-Year Reanalysis Project. *Bulletin of the American Meteorological Society*, 77: 437-471.

Ulbrich, U., J.G. Pinto, H. Kupfer, G.C. Leckebusch, T. Spangehl and M. Reyers. 2008. Changing northern hemisphere storm tracks in an ensemble of IPCC climate change simulations. *Journal of Climate*, 21(8): 1669-1679.

Yin, J.H. 2005. A consistent poleward shift of the storm tracks in simulations of 21st century climate, Geophysical Research Letters, 32: L18701.

*Page 4-264:*
*MSC50 is mistakenly used in the sentence citing Swail et al 1999. It should be AES40, the earlier hindcast.*

**Husky Response:**
Comment noted. Thank you.

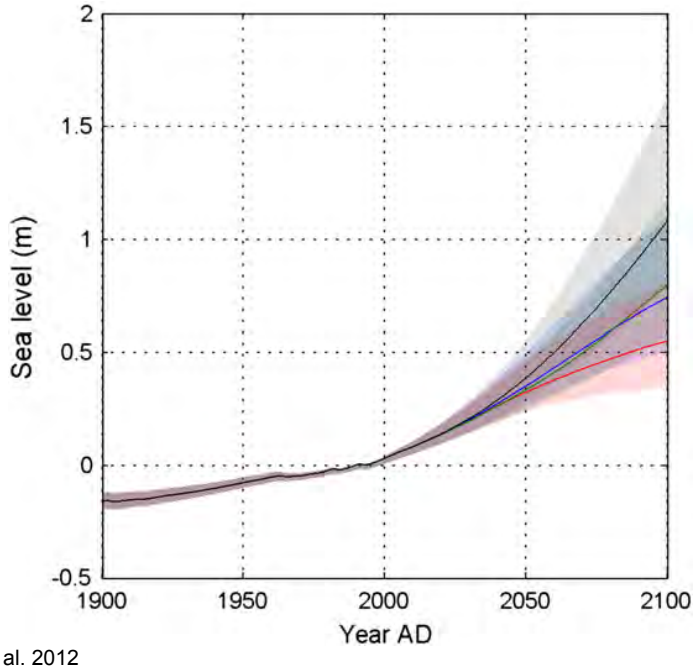
**4.3.9.1 Sea Level Rise**

*The proponents cite the IPCC AR4 which gives projections of global sea level rise of 18-59 cm by 2100 across the range of scenarios and models (the proponents cite an increase of 22-44 cm for the A1B scenario). These estimates are derived from process-based models and exclude possible effects of accelerated ice sheet dynamics. More recent studies based on process-based models give an estimated rise of 20-80 cm by 2100 (e.g. Church et al., 2011). Semi-empirical models yield estimates in excess of 100 cm. As such, the proponents may want to consider a wider range of possible change than they have presented here and discuss local (as opposed to global) sea level changes.*

**Husky Response:**
A study by Church et al. (2011) notes that the projected sea-level rise predicted by Solomon et al. (IPCC 2007) failed to take into consideration rapid dynamic ice sheet response since methods for quantifying it were unavailable at the time. Church et al. (2011) suggests an additional sea level rise of 10 to 20 cm or more, resulting in a range in global average projections of about 20 to 80 cm by 2100.

More recently, semi-empirical models have been used to model rapid dynamic ice sheet response. Since the IPCC Fourth Assessment Report new Representative Concentration Pathways (RCPs) scenarios have been developed. Jevrejeva et al. (2012) used a sea-level model forced with four new RCPs to project median global sea level rises of 0.57m for the lowest forcing and 1.10m for the highest forcing by 2100 (Figure 12). Unlike in the AR4, these projections include a contribution from changes in ice-sheet outflow.

Sea level changes are the result of local, hemispheric and global changes. Coastal areas respond differently and the change in sea level along different coasts is not identical, even along the coasts of Newfoundland. Little research has been done on the rate of sea-level change due to climate change on the Grand Banks and predictions of sea level changes along the coast of Newfoundland may not be representative of what will happen offshore. A study by Batterson (2010) shows projections of sea-level rise of 100+ mm by 2099 for the Avalon Peninsula of Newfoundland. This estimate was based on the IPCC A1F1 emissions scenario, which produces the greatest sea level rises of all the emissions scenarios. These estimates do not take into consideration rapid dynamic ice sheet response. A literature search for the Grand Banks and Newfoundland did not provide any estimates of sea-level rise using the Representative Concentration Pathways and therefore estimates based on the new emissions scenarios cannot be provided locally.




Source: Jevrejeva et al. 2012
Note: Shadows with similar colour around sea level projections represent the upper (95%) and lower (5%) confidence levels.

**Figure 12 Sea Level Projections by 2100 with RCP Scenarios**

References:

Batterson, M. and D. Liverman. 2010. Past and future sea-level change in Newfoundland and Labrador: Guidelines for policy and planning. Pp. 129-141. In: *Current Research. Newfoundland and Labrador Department of Natural Resources, Geological Survey*, Report 10-1.

Church, J.A., J.M. Gregory, N.J. White, S.M. Platten and J.X. Mitrovica. 2011. Understanding and projecting sea level change. *Oceanography*, 24(2): 130-143, doi:10.5670/oceanog.2011.33.

IPCC (Intergovernmental Panel on Climate Change). 2007. *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon,

S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA.

Jevrejeva, S., J.C. Moore and A. Grinstead. 2012. Sea level projections to AD2500 with a new generation of climate change scenarios. *Global and Planetary Change*, 80-81: 14-20. 10.1016/j.gloplacha.2011.09.006

***EC Response:*** *the climate change aspects are sufficient. The proponents may want to expand their discussion to include impacts of vertical land motion on local sea level.*

**Husky Response:**

There is abundant evidence that sea level has risen on the northeastern Grand Banks as a result of both eustatic and isostatic adjustment following the melting of glacial ice and subsequent unloading of the Earth's crust during and after the end of the last glaciation (e.g., Shaw 2006; Shaw et al. 2006). The component of isostatic adjustment contributing to contemporary local change in sea level on the northeastern Grand Banks is not known because of its distance from land.

New References:

Shaw, J. 2006. Palaeogeography of Atlantic Canadian continental shelves from the last glacial maximum to the present, with an emphasis on Flemish Cap. *Journal of Northwest Atlantic Fisheries Science*, 37: 119-126.

Shaw, J., D.J.W. Piper, G.B.J. Fader, E.L. King, B.J. Todd, T. Bell, M.J. Batterson and D.G.E. Liverman. 2006. A conceptual model of the deglaciation of Atlantic Canada. *Quaternary Science Reviews*, 25: 2059-2081.

**4.3.9.2 Waves**

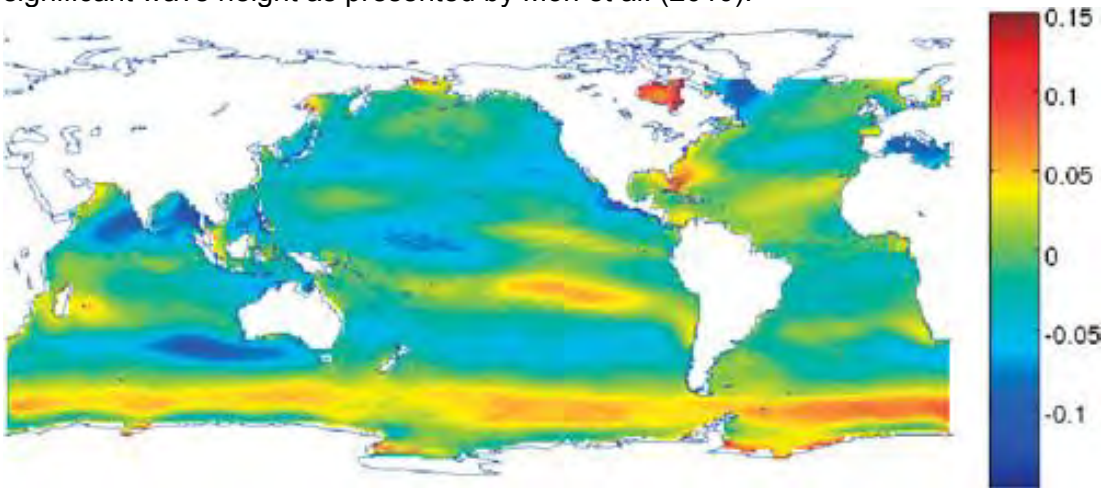
*Projections of wind-driven ocean wave heights are not available from current global climate models. As such, future projections of wave height have been based on either: (1) dynamical models that use wind speed projections to drive wave models, or (2) statistical downscaling based on relationships with variables related to wave height (e.g., sea level pressure projections). Wave height projections are considered uncertain (see IPCC SREX) in part because there are few studies but also because of limitations with GCM estimates of wind speed (used to drive wave models). The proponents rely on wind speed projections from a single scenario from a single climate model (CGCM2, B2) to make inferences about changes in wave height. This approach is inadequate to capture the range of uncertainty. They note increased wind speed is projected from this run. Recent studies project decreased wave height in this area (e.g., Hemer et al. 2012).*

**Husky Response:**

Projections of significant wave heights are not available from current global climate models. Therefore, two methods have primarily been used to project changes in mean significant wave height; dynamical models and statistical downscaling. Dynamical models use wind speed projections to drive wave models while statistical models develop statistical relationships between other variables (e.g., wind speed, mean sea level pressure) to generate empirical formulae. Both the dynamical model approach and the statistical model approach have their problems. Dynamical models show a bias with the corresponding current climate. Bias corrections are normally made to account for this however it is uncertain whether these corrections will be valid in future climates. Statistical models have the advantage of being less computationally intense than dynamical models however neglect factors such as

wave dispersion, fetch and swell and therefore, have difficulty in reproducing the observed wave fields in areas dominated by swell (Hemer et al. 2012)

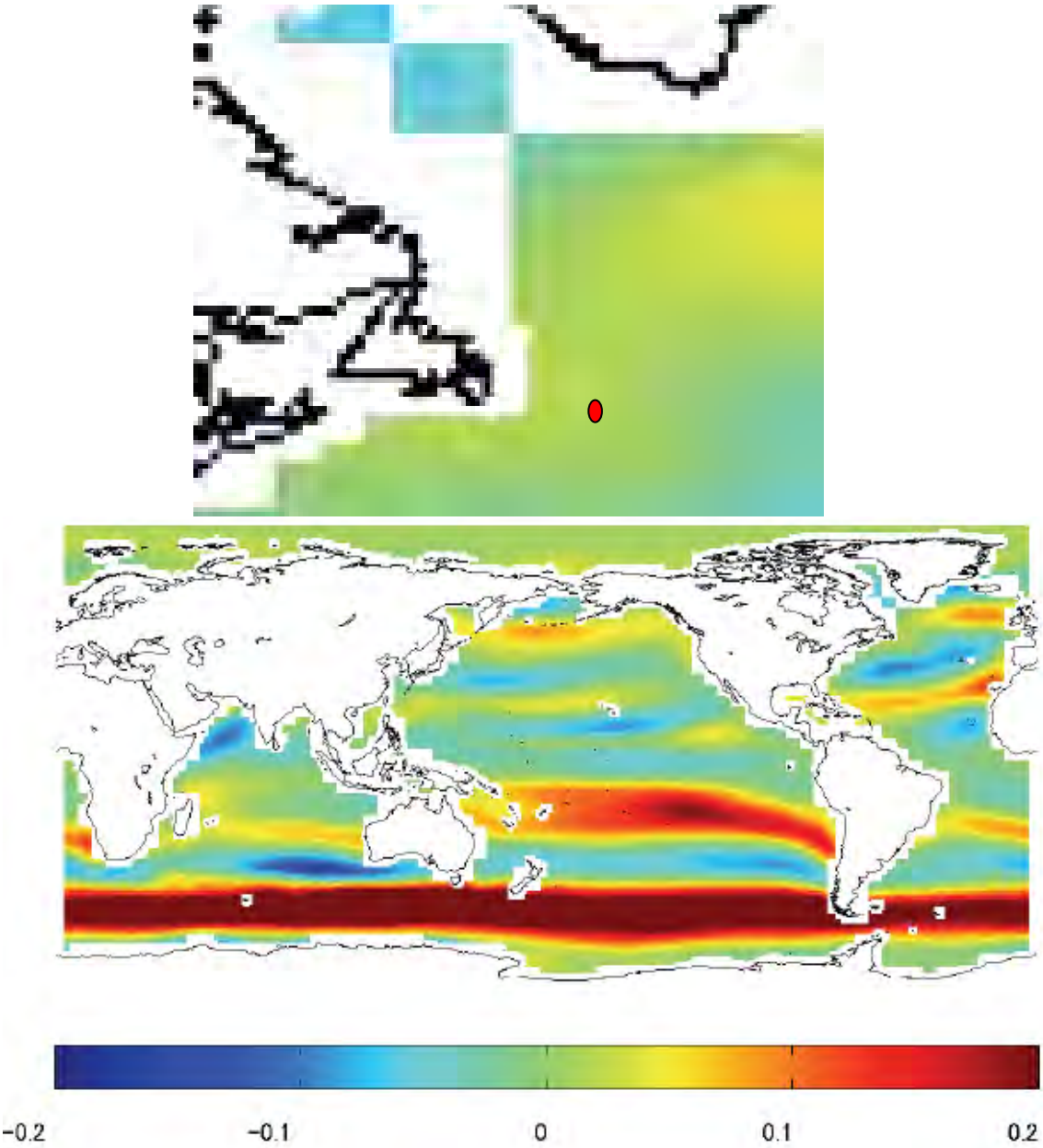
In a study by Mori et al. (2010), future climate predictions were produced using the MRI-JMA global climate model following the A1B scenario. The present climate is for the period of 1979 to 2005 and climate predictions were generated for the period of 2075 to 2100. The global wave climate was then simulated by the SWAN model using 10 m winds from the climate model. This study determined that in the North Atlantic Ocean between the latitude range of 30°N to 45°N there will be a decrease in mean significant wave height of approximately 7 percent, corresponding to a decrease of 0.15 m. An analysis of Figure 7 suggests a smaller decrease for the Grand Banks region of somewhere between 0.0 and 0.05 m. Figure 13 presents the global normalized difference between the future and present climate mean significant wave height as presented by Mori et al. (2010).




Source: Mori et al. 2010

**Figure 13 Difference of Mean Significant Wave Height between Future (2075 to 2100) Minus Present (1979 to 2005) Climate Normalized by Present Climate**

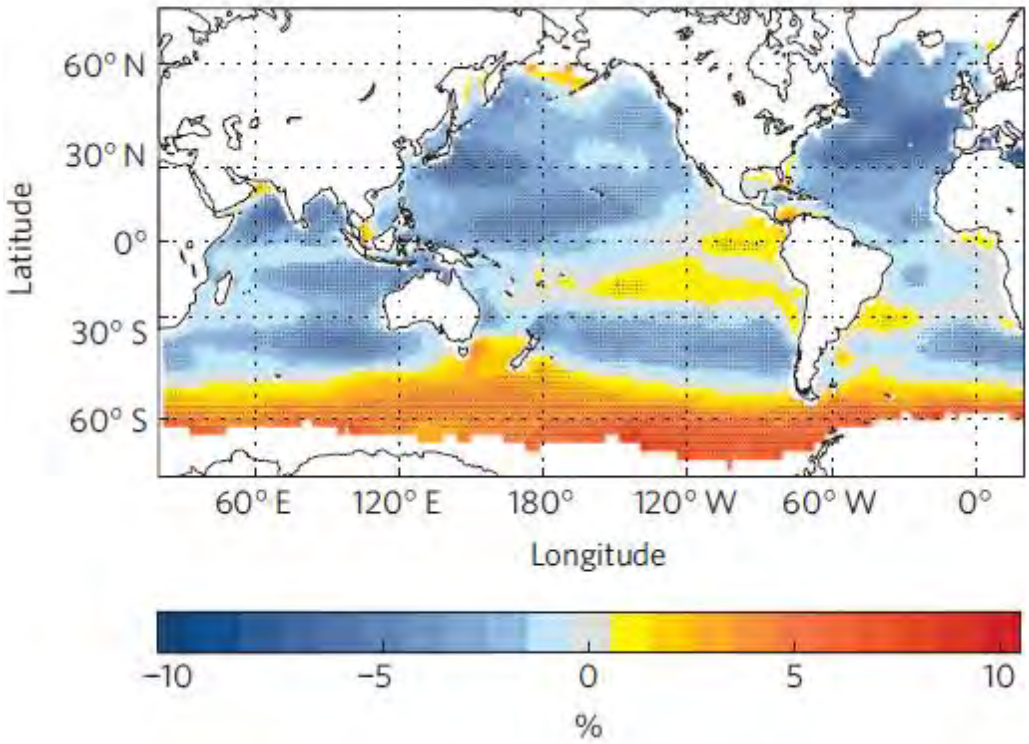
Additional work by Mori et al. (2012) using statistical analysis techniques projects a small increase in significant wave height for the 2070 to 2100 period (Figure 14 (top)). This study analyzed future change of ocean wave height using the CMIP3 ensemble with the SRES A1B forcing scenario. Wave heights were then statistically projected using an empirical formula based on wind speed and wave height from the ECMWF 40 Year Re-Analysis (Uppala et al. 2005) dataset.




Source: Mori et al, 2012
Note: Red dot in top graphic depicts the approximate location of the White Rose field.

**Figure 14 Future Change of Significant Wave Height at year 2100 using the SRES A1B scenario: top) Close-up of Offshore Newfoundland Region; and bottom) Global Projections**

In 2013, Hemer et al. (2013) compared the results of five independent studies to determine the level of agreement between available wave climate projections. In their analysis, they found a decrease in annual mean significant wave height over 25.8 percent of the global ocean area and an annual mean significant wave height increase over 7.1 percent of the global ocean area. In the North Atlantic, Hemer et al. (2013) found an agreed decrease in mean significant wave height across all models and all seasons. An analysis of Figure 15 shows a decrease in mean significant wave height of approximately 5 to 6 percent for the Northern Grand Banks.




Source: Hemer et al. 2013

**Figure 15 Projected Future Changes in Multi-model Averaged Annual Significant Wave Height for Future Climate (2070 to 2100) Relative to the Present Climate (1979 to 2009)**

References

Hemer, M.A., X.L. Wang, R. Weisse and V.R. Swail. 2012. Advancing wind-waves climate science. *Bulletin of the American Meteorological Society*, 93: 791-796.

Hemer, M.A., Y. Fan, N. Mori, A. Semedo and X.L. Wang. 2013. Projected changes in wave climate from a multi-model ensemble. Nature Climate Change, doi:10.1038/nclimate1791

Mori N, T. Yasuda, H. Mase, T. Tom and Y. Oku. 2010. Projection of extreme wave climate change under global warming. *Hydrological Research Letters*, 4: 15-19

Mori, N., T. Shimura, S. Nakajo, T. Yasuda and H. Mase. 2012. Multi-model ensemble projection of future coastal climate change. *Coastal Engineering Proceedings*, 1(33), management.25.

S.M. Uppala, P.W. KÅllberg, A.J. Simmons, U. Andrae, V. Da Costa Bechtold, M. Fiorino, J.K. Gibson, J. Haseler, A. Hernandez, G.A. Kelly, X. Li, K. Onogi, S. Saarinen, N. Sokka, R.P. Allan, E. Andersson, K. Arpe, M.A. Balmaseda, A.C.M. Beljaars, L. Van De Berg, J. Bidlot, N. Bormann, S. Caires, F. Chevallier, A. Dethof, M. Dragosavac, M. Fisher, M. Fuentes, S. Hagemann, E. Hólm, B.J. Hoskins, L. Isaksen, P.A.E. M. Janssen, R. Jenne, A.P. Mcnally, J.-F. Mahfouf, J.-J. Morcrette, N.A. Rayner, R.W. Saunders, P. Simon, A. Sterl, K.E. Trenberth, A. Untch, D. Vasiljevic, P. Viterbo, J. Woollen. 2005. The ERA-40 re-analysis. *Quarterly Journal of the Royal Meteorological Society*, 131(612): 2961-3012

**4.3.9.3 Sea Surface Temperatures**

*It is not clear exactly which gridpoints the SST anomalies plotted in Figures 4-163 and 4-165 are from.*

**Husky Response:**

SST anomalies were calculated from the ICOADS dataset as stated in Paragraph 1 of Section 4.3.9.3. The ICOADS region is defined in Section 4.3.1.1

*Why are trends in SSTs only discussed over the period 1981-2010? Much longer records are available and would be more appropriate for trend analysis*

**Husky Response:**

A 30 year period was chosen in part because of the number of errors in the data prior to this period.

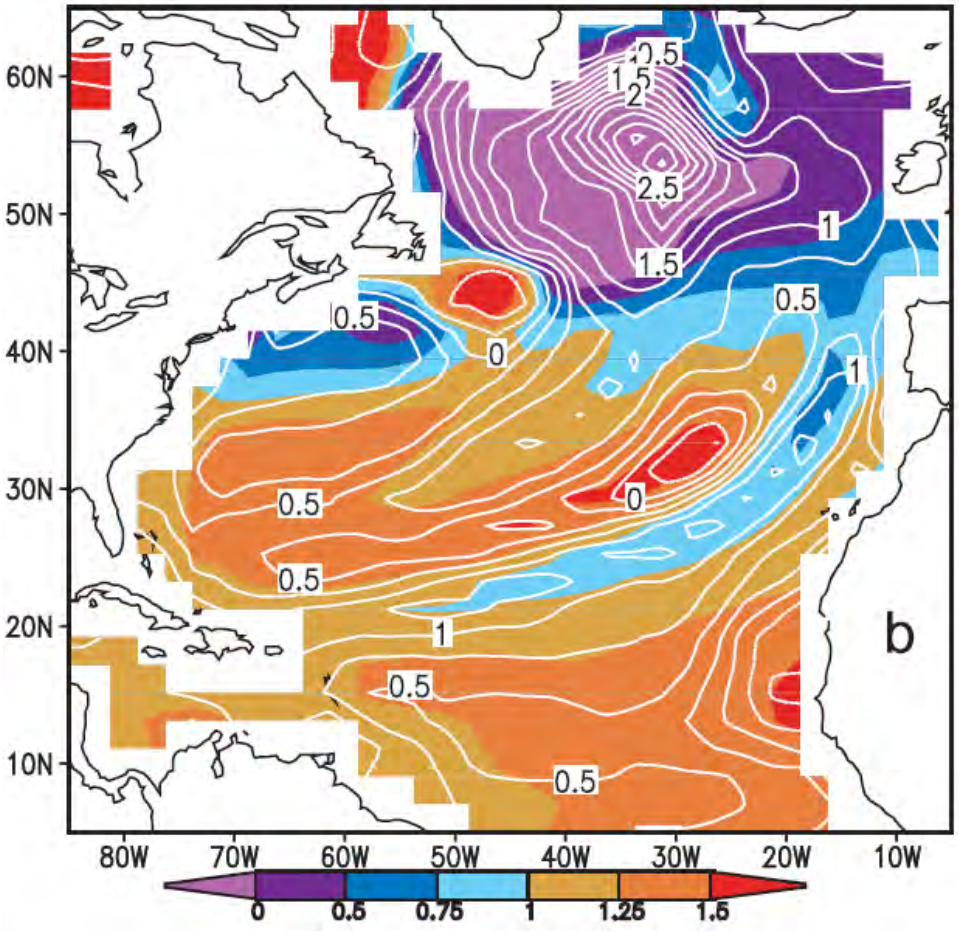
*What are future SST projections for the region?*

**Husky Response:**

Xie et al. (2009) investigated sea surface temperature changes based on ensemble simulations for the first half of the twenty-first century using the A1B emissions scenario with the Geophysical Fluid Dynamics Laboratory (GFDL) Climate Model, version 2.1 (CM2.1) and the National Center for Atmospheric Research (NCAR) Community Climate System Model, version 3 (CCSM3). As seen from Figure 16, the CM2.1 model predicts an annual mean sea surface temperature change of greater than 1.5°C for the White Rose area. The changes in the CM2.1 model were calculated by subtracting the 1996 to 2000 period from the 2046 to 2050 period.

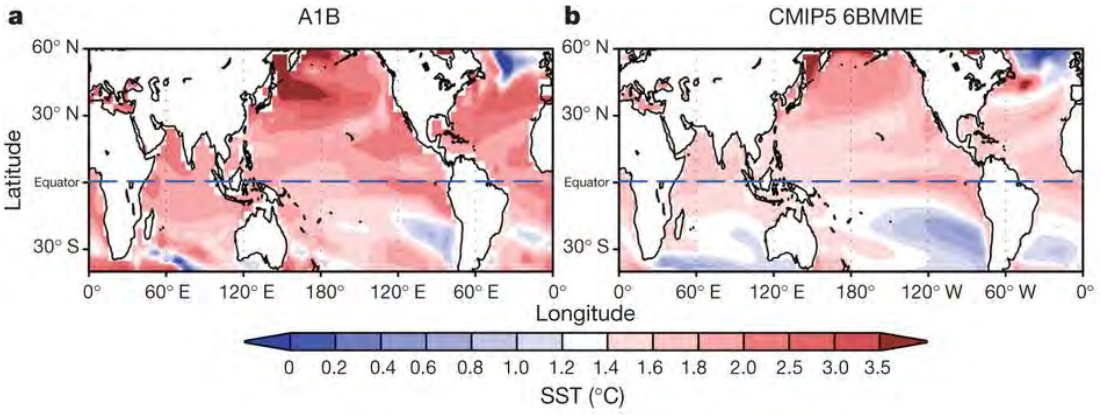
A similar warming increase of near 1.5°C was predicted by the CCSM3 for the White Rose area. The CCSM3 values were calculated by finding the difference between the 2001 to 2010 and 2051 to 2060 periods.

More recently Liu et al. (2013) used the ECHO-G climate model forced with the A1B scenario to produce global sea surface temperature estimates relative to the period of 1990 to 2019. These data were then compared with the Coupled Model Intercomparison Project Phase 5 (CMIP5) multi-model mean projection of the 6 best (6BMME) CMIP5 models forced according to the Representative Concentration Pathway 4.5. The CMIP5 model results are relative to the period of 1980 to 2005. Similar to the Xie et al. (2009) projections, the projections presented by Liu et al. (2013) indicate an increase in sea surface temperature for the White Rose area for the period of 2070 to 2099 (Figure 17).




Source: Xie et al. 2009

**Figure 16 Annual Mean Changes in CM2.1 A1B: SST (colored, °C) and Surface RH (white, CI 0.25%)**




Source: Liu et al. 2013

**Figure 17 Comparison of the Changes in Annual Mean Sea Surface Temperature**

References
Xie, S-P., C. Deser, G.A. Vecchi, J. Ma, H. Teng and A.T. Wittenberg. 2010. Global warming pattern formation: Sea surface temperature and rainfall. *Journal of Climate*, 23, 966-986. doi: http://dx.doi.org/10.1175/2009JCLI3329.1

Liu, Jian, B. Wang, M.A. Cane, S-Y. Yim and J-Y. Lee. 2013. Divergent global precipitation changes induced by natural versus anthropogenic forcing. *Nature*, 493.7434 (2013): 656-659. doi:10.1038/nature11784

## 1.4 Chapter 10 Marine Birds

**General:**
*The species "Greater Shearwater" should be changed to updated common name of "Great Shearwater" throughout the text.*

**Husky Response**: Comment noted. Thank you.

**EC Response:** Non-Responsive

**Husky Response:**
Revised Table 10-3 is provided as Table 7.

**Table 7 Revised Table 10-3 Offshore Study Area Marine Bird Observations 2004 to 2008**

| Project | Time Period | Location (Relative to Project Area and/or Study Area) | Approximate Water Depth (m) | Species with Highest Relative Abundances during Observations |
|---|---|---|---|---|
| CCGS *Hudson* Research Expedition | June 2004 | South Grand Banks (southwestern Study Area) | <100 | Great Shearwater |
| CCGS *Hudson* Research Expedition | June 2004 | Salar Basin (southwestern Study Area) | >1,000 | Great Shearwater Northern Fulmar |
| CCGS *Hudson* Research Expedition | June 2004 | Western Slope of Southern Flemish Pass (north-central Study Area) | ~ 500 | Northern Fulmar Great Shearwater Sooty Shearwater |
| CCGS *Hudson* Research Expedition | June 2004 | Sackville Spur (northeast of Study Area) | ~ 1,000 | Northern Fulmar Great Shearwater Great Black-backed Gull |
| CCGS *Hudson* Research Expedition | June-July 2004 | Orphan Basin (north of Study Area) | >2,000 | Northern Fulmar Great Shearwater Great Black-backed Gull Leach's Storm-Petrel |
| CCGS *Hudson* Research Expedition | July 2004 | North Grand Banks (northwestern Study Area) | 200 to 1,000 | Great Shearwater Manx Shearwater |
| Seismic Program for Chevron Canada Resources and ExxonMobil Canada Limited | June-September 2004 | Orphan Basin (north of Study Area) | 1,850 to 2,500 | Northern Fulmar Great Shearwater Leach's Storm-Petrel Sooty Shearwater Black-legged Kittiwake (Aug-Sept) |
| Seismic Program for Chevron Canada Resources and ExxonMobil Canada Limited | May-September 2005 | Orphan Basin (north of Study Area) | 1,108 to 2,747 | Northern Fulmar Leach's Storm-Petrel Great Shearwater Black-legged Kittiwake, Dovekie, and Thick-billed Murre (May-June) Great Black-backed Gull (Aug-Sept) |

| Project | Time Period | Location (Relative to Project Area and/or Study Area) | Approximate Water Depth (m) | Species with Highest Relative Abundances during Observations |
|---|---|---|---|---|
| Seismic Program for Husky | October-November 2005 | Approximately 75 km northwest of Terra Nova FPSO (northwestern Study Area) | 68 to 376 | Northern Fulmar Dovekie Black-legged Kittiwake Thick-billed Murre |
| Petro-Canada`s *Terra Nova* Hull Cleaning | May-June 2006 | 46 km radius around Terra Nova FPSO | 65 to 190 | Leach's Storm-Petrel |
| Seismic Program for Husky | July-August 2006 | 1) 95 km north and 2) 15 km east of Terra Nova FPSO | 86 to 387 | Great Shearwater Leach's Storm-Petrel |
| CSEM Program for ExxonMobil Canada Limited | August-September 2006 | Orphan Basin (north of Study Area) | 2,076 to 2,603 | Great Shearwater Leach's Storm-Petrel Black-legged Kittiwake Northern Fulmar |
| Seismic Program for Petro-Canada | June-July 2007 | Approximately 17 km northwest of Terra Nova FPSO (northwestern Study Area) | 61 to 171 | Great Shearwater Northern Fulmar Leach's Storm-Petrel |
| CSEM Program for ExxonMobil Canada Limited | July-September 2007 | Orphan Basin (north of Study Area) | 1,122 to 2,789 | Leach's Storm-Petrel Great Shearwater Northern Fulmar |
| Seismic Program for Petro-Canada, StatOil Hydro, and Husky | May-September 2008 | Jeanne d'Arc Basin | 66 to 119 | Great Shearwater Northern Fulmar Leach's Storm-Petrel |
| Source: Lang and Moulton 2004, 2008; Moulton et al. 2005, 2006a; Lang et al. 2006; Lang 2007; Abgrall et al. 2008a, 2008b, 2009. | | | | |

Section 10.3.6.2, Great Shearwater, Page 10-20. The second and third paragraphs are revised to read:

Concentrations of 100,000 shearwaters, mostly Greater with some Sooty Shearwaters, have been observed on the east side of Placentia Bay in June. Such observations serve as the basis for the IBA in eastern Placentia Bay (www.ibacanada.com). Large numbers of shearwaters are attracted to the southern Avalon Peninsula during the early summer season from mid-June to late July when capelin spawn. The numbers of Great and Sooty Shearwaters using Placentia Bay during the summer is not accurately known, but is probably in the hundreds of thousands.

Great Shearwater was among the top four most numerous species observed on the Orphan Basin during seismic monitoring 2004 to 2007 from June to September, with monthly density averages ranged from 2.4 to 35.4 birds/km$^2$ (Moulton et al. 2006a; Abgrall et al. 2008b). Seismic monitoring on the Jeanne d'Arc Basin showed Great Shearwater were common in summer with a mean weekly density of 5.1 birds/km$^2$ from 9 July to 16 August 2006 (Abgrall et al. 2008a) and 11.9 birds/km$^2$ from 21 May to 29 September 2008 (Abgrall et al. 2009). ECSAS survey data from 2006 to 2009 lumps all shearwater species within the Offshore Study Area shows densities per 1º survey blocks ranging from 0 to 14.1 birds/km$^2$ during the summer period May to August (Fifield et al. 2009).

Section 10.3.6.2, Sooty Shearwater, Page 10-20. The first paragraph is revised to read:
The Sooty Shearwater breeds in the Southern Hemisphere from November to March. A large percentage of the population migrates to the Northern Hemisphere and is present from May through October. It is a common bird during the summer months off Atlantic Canada north to Labrador, but it usually outnumbered by the Great Shearwater, with which it often associates.

**10.3.1 Nearshore Overview**
*Quote: "It contains the largest Northern Gannet nesting colony (14,696 pairs (2011) (CWS unpublished data)), the largest Thick-billed Murre colony and third largest Common Murre colony (14,789 pairs (2009) (CWS unpublished data)) in Newfoundland and Labrador (Table 10-2)."*

*The largest Thick-billed Murre colonies are located in Labrador. The colony mentioned above is the largest colony on the Island of Newfoundland, but is also the most southerly colony of the Thick-billed Murre's breeding range.*

**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive*

**Husky Response:** Section 10.3.1 first paragraph is revised to read:
Placentia Bay is one of the richest bays in coastal Newfoundland for marine birds. There are four Important Bird Areas (IBA) at the mouth of Placentia Bay (Figure 10-1), all of which are outside the Study Area, but are mentioned here for completeness (see also the Sensitive Areas Chapter; Section 13.3.1.5). An IBA is a site that provides essential habitat for one or more species of breeding or non-breeding birds. These sites may contain threatened species, endemic species, species representative of a biome, or highly exceptional concentrations of birds (www.ibacanada.com). Cape St. Mary's Ecological Reserve, designated pursuant to the provincial Wilderness and Ecological Reserves Act and situated at the southeast corner of Placentia Bay, is one of the most important seabird nesting colonies in Newfoundland and Labrador. It contains the largest Northern Gannet nesting colony (14,696 pairs (2011) (CWS unpublished data)), the largest Thick-billed Murre colony on the Island of Newfoundland (which is also the most southerly colony of the Thick-billed Murre's breeding range) and third largest Common Murre colony (14,789 pairs (2009) (CWS unpublished data)) in Newfoundland and Labrador (Table 10-2). The only sustained breeding site for Manx Shearwater in eastern North America is located at the Middle Lawn Islands, Burin Peninsula (Figure 10-1) (Roul 2011). Both Corbin Island and Green Island on the Burin Peninsula support more than 100,000 pairs of breeding Leach's Storm-Petrel (Figure 10-1; Table 10-2). Placentia Bay supports large numbers of non-breeding Great Shearwaters during the capelin spawning season. As a result, the southeastern quarter of the bay is designated an Important Bird Area (see the Sensitive Areas Chapter). There are over 365 islands in Placentia Bay, many of which support small colonies of terns, gulls and cormorants. In the winter months, several thousand Common Eider and other sea duck species winter along the coast of Placentia Bay. Cape St. Mary's is an important wintering area for the eastern Harlequin Duck, currently listed as a species of Special Concern on Schedule 1 of SARA and Vulnerable under the Endangered Species Act of Newfoundland and Labrador. Harlequin Duck are discussed in Section 12.3.3.1.

*Quote: "The only sustained breeding site for Manx Shearwater in eastern North America is located at the Middle Lawn Islands, Burin Peninsula (Figure 10-1) (Roul 2011)."*

*It should be noted here that Middle Lawn Island, along with two adjacent islands, which are collectively known as the Lawn Islands Archipelago, are now established as a Provisional Ecological Reserve by the Government of Newfoundland and Labrador, Parks and Natural Areas Division.*

**Husky Response:**
Comment noted. Thank you.

**Figure 10-1 Locations of Seabird Nesting Colonies at Important Bird Areas in Relation to the Study Areas**
*The Cape Freels Important Bird Area (IBA) should highlight Cabot Island as an important nesting area for migratory birds. Cabot Island supports approximately 10,000 pairs of nesting Common Murre (Canadian Wildlife Service, unpublished data). Gull Island should be removed from the list of important bird areas. This information should be updated in this section and in subsequent maps.*

**Husky Response:**
See Figure 18 (revised Figure 10-1).

**Table 10-2 Numbers of Pairs of Marine Birds Nesting at Marine Bird Colonies in Eastern Newfoundland**
*Cabot Island should be added to this table.*

**Husky Response:**
No revisions to Table 10-2 were necessary, as the table already included Cabot Island in the column: "Cape Freels and Cabot Island".

**10.3.5 Marine Bird Nesting Colonies Along Southeastern Newfoundland**
*Quote: "More than 4.6 million pairs nest at these three locations alone (Table 10-2; Figure 10-1). This number includes the largest Atlantic Canada colonies of Leach's Storm-Petrel (3,336,000 pairs on Baccalieu Island), Black-legged Kittiwake (23,606 pairs on Witless Bay Islands), Thick-billed Murre (1,000 pairs at Cape St. Mary's) and Atlantic Puffin (272,729 pairs on Witless Bay Islands) (Cairns et al. 1989; Rodway et al. 2003; Robertson et al. 2004)."*

*It should be noted here that two of the three Northern Gannet colonies in the province of Newfoundland and Labrador are on the Avalon Peninsula.*

**Husky Response:**
Comment noted. Thank you.

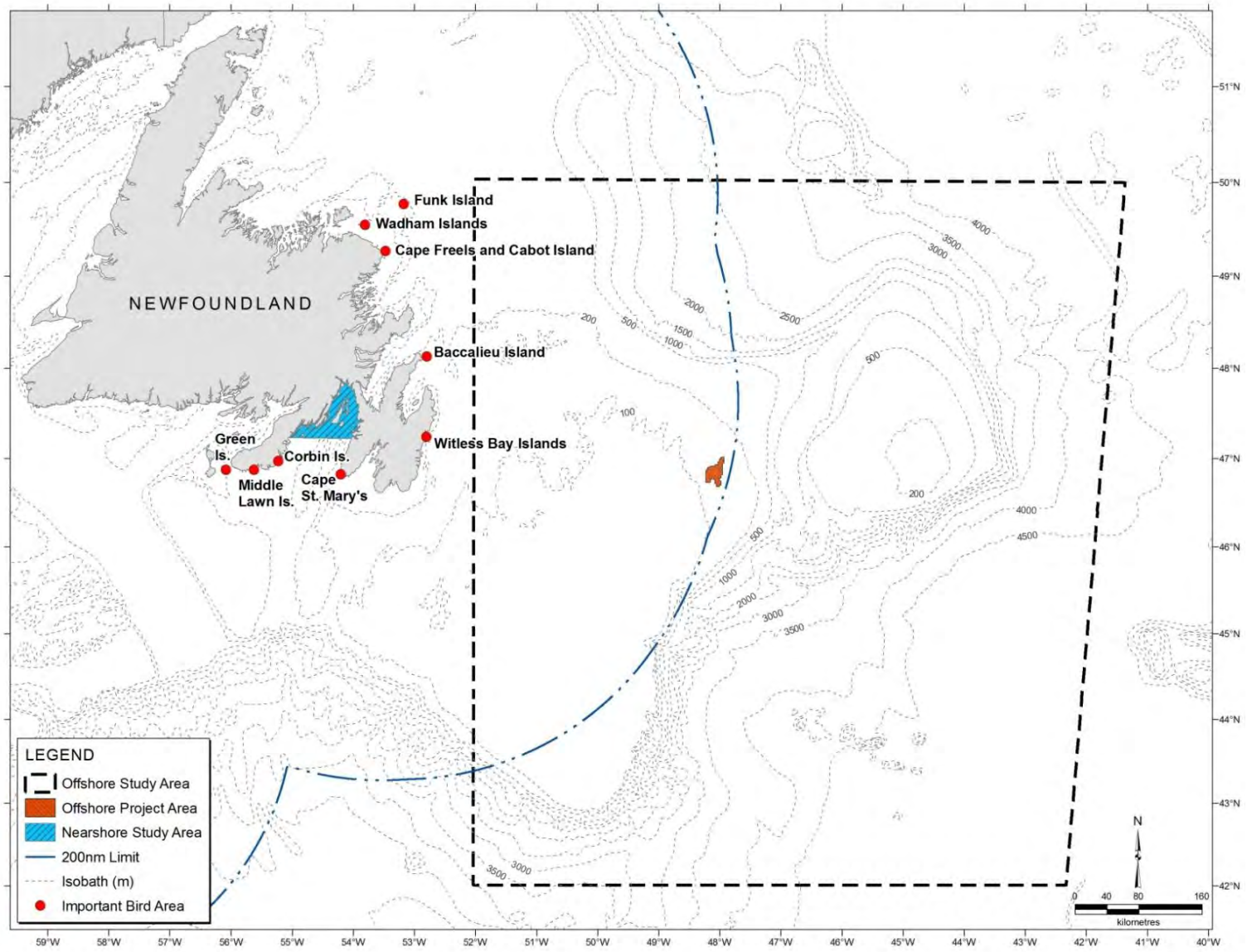



**Figure 18 Revised Figure 10-1 Locations of Seabird Nesting Colonies at Important Bird Areas in Relation to the Study Areas**

***EC Response**: Non-Responsive*

**Husky Response:** Section 10.3.5, first paragraph is revised to read:

Millions of marine birds nest on headlands, cliffs and islands along the coastline of the Avalon Peninsula. The marine bird nesting colonies on Baccalieu Island, the Witless Bay Islands and Cape St. Mary's are among the largest in Atlantic Canada. More than 4.6 million pairs nest at these three locations alone (Table 10-2; Figure 10-1). This number includes the largest Atlantic Canada colonies of Leach's Storm-Petrel (3,336,000 pairs on Baccalieu Island), Black-legged Kittiwake (23,606 pairs on Witless Bay Islands), Thick-billed Murre (1,000 pairs at Cape St. Mary's) and Atlantic Puffin (272,729 pairs on Witless Bay Islands) (Cairns et al. 1989; Rodway et al. 2003; Robertson et al. 2004). Two of the three Northern Gannet colonies in the province of Newfoundland and Labrador are on the Avalon Peninsula (Cape St. Mary's Ecological Reserve and Baccalieu Island Ecological Reserve). No major marine bird nesting colonies are located within either the Nearshore or Offshore Study Areas, so these sites are not discussed within the Sensitive or Special Areas VEC, with the exception of Cape St. Mary's. All of these colonies are included here as part of the profiles of the species within the Nearshore and Offshore Study Areas.

*Quote: "The Offshore Study Area is well beyond the foraging range of breeding birds during the breeding season (approximately May to August)."*

*Murres will feed close to their breeding colonies when spawning inshore capelin are available (late June/early July), but prior to the capelin spawning period will feed further from the colonies. Gannets and storm-petrels are known to feed considerable distances away from the colonies and may forage within the offshore study area (as noted on page 10-28 of the EIS).*

**Husky Response:**
Comment noted. Thank you.

**10.3.6.8 Alcidae (Atlantic Puffin)**
*Quote: "Grand Colombier in St. Pierre et Miquelon is the only breeding colony near Placentia Bay; approximately 400 pairs nest there."*

*The number of pairs breeding at the Grand Colombier colony should be updated to 9,543 pairs breeding pairs (Lormee et al. unpublished data).*

**Husky Response:**
Comment noted. Thank you.

***EC Response**: Non-Responsive*

**Husky Response:** Section 10.3.6.8, Atlantic Puffin, second paragraph is revised to read:
Atlantic Puffin occur in Placentia Bay during migration and in small numbers in summer and winter. Grand Colombier in St. Pierre et Miquelon is the only breeding colony near Placentia Bay; 9,543 breeding pairs nest there (Lormee et al. unpublished data). During the monthly pelagic bird survey program in Placentia Bay from August 2006 to April 2007, Atlantic Puffin were observed in low numbers in all months surveyed, suggesting that the species overwinters in that bay (Goudie et al. 2007).

## 1.5 Chapter 13 Sensitive Areas

**Figure 13-3 Ecological Reserves and Special Places Identified in Placentia Bay**
*The Lawn Islands Archipelago Provisional Ecological Reserve should be added to this section. The Lawn Islands Archipelago Provisional Ecological Reserve is also an Important Bird Area, and should be identified as such where Important Bird Areas are discussed.*

**Husky Response:**
Comment Noted. Thank you. The figure is from DFO 2008 and cannot be revised. Note that the Lawn Islands Archipelago Provincial Ecological Reserve/IBA is outside the Nearshore Study Area.

**Table 13-2 Number of Pairs of Marine Birds Characteristic of Placentia Bay Colonies**
*Columns should be added here regarding the Lawn Islands Archipelago IBA and the Corbin Island IBA.*

*Additionally, data for population numbers of Northern Gannet and Common Murre at the Cape St. Mary's IBA are incorrect. Numbers reported in Chapter 10 of this EIS should instead be used.*

**Husky Response:**
Please see Table 8 (revised Table 13-2) with new text underlined. Note that the Lawn Islands Archipelago IBA and the Corbin Island IBA are outside the Nearshore Study Area.

**Table 8 Revised Table 13-2 Number of Pairs of Marine Birds Characteristic of Placentia Bay Colonies**

| Common Name | Species Name | Cape St. Mary's | Middle Lawn Island (1985) | Corbin Island (1974) |
|---|---|---|---|---|
| Northern Fulmar | *Fulmarus glacialis* | 12 | -- | -- |
| Manx Shearwater | *Puffinus puffinus* | -- | 360 | 30 |
| Leach's Storm-petrel | *Oceanodroma leucorhoa* | -- | 26,313 | 100,000 |
| Northern Gannet | *Mora bassanus* | 14,.696 | -- | -- |
| Herring Gull | *Larus argentatus* | Present | -- | 5,000 |
| Great Black-backed Gull | *Larus marinus* | Present | -- | 25 |
| Black-legged Kittiwake | *Rissa tridactyla* | 10,000 | -- | 50 |
| Common Murre | *Uria aalge* | 14,789 | -- | -- |
| Thick-billed Murre | *Uria lomvia* | 1,000 | -- | -- |
| Razorbill | *Alca torda* | 100 | -- | -- |
| Black Guillemot | *Cepphus grylle* | Present | -- | -- |
| Colonial Waterbirds/ Seabirds | | -- | 26,327 | 105,107 |

Sources: Stenhouse and Montevecchi (1999), Cairns et al. (1989), and Chardine (2000) [adapted from VBNC 2008]; Middle Lawn Island IBA: http://www.bsc-eoc.org/iba/site.jsp?siteID=NF031; Corbin Island IBA: http://www.bsc-eoc.org/iba/site.jsp?siteID=NF030

**Figure 13-4 Areas Identified as Important for Birds and Whales in Placentia Bay**
*The Lawn Islands Archipelago IBA and the Corbin Island IBA should be identified on this map.*

**Husky Response:**
Comment Noted. Thank you. The figure is from DFO 2008 and cannot be revised. Note that the Lawn Islands Archipelago IBA and the Corbin Island IBA are outside the Nearshore Study Area.

**13.3.1.5 Bird Habitat**
*The Lawn Islands Archipelago IBA and the Corbin Island IBA should be added to this list.*

**Husky Response:**
Comment Noted. Thank you. Note that the Lawn Islands Archipelago IBA and the Corbin Island IBA are outside the Nearshore Study Area.

**13.5.1 Effects Analysis and Mitigation – Nearshore**
*It should be noted that eelgrass beds are wetlands.*

*The proponent should be aware that as part of its commitment to wetlands conservation, the Federal Government has adopted The Federal Policy on Wetland Conservation (FPWC) with its objective to "promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future." In support of this objective, the Federal Government strives for the goal of No Net Loss of wetland function on federal lands or when federal funding is provided. EC-CWS therefore recommends that the goals of the policy be considered in wetland areas, and EC-CWS recommends that that the hierarchical sequence of mitigation alternatives (avoidance, minimization, and as a last resort, compensation) recommended in FPWC is followed. Avoidance refers to elimination of adverse effects on wetland functions, by altering the siting or modifying the design of a project, and is the preferred option. In the event that avoidance is not possible, the reasons why elimination of adverse effects on wetland functions were not possible should be clearly demonstrated in environmental assessment documents, and EC-CWS should be contacted for advice on next steps to follow for compliance with the FPWC.*
*A copy of the FPWC can be found at: http://dsp-psd.communication.gc.ca/Collection/CW66-116-1991E.pdf*

**Husky Response:**
Husky is currently discussing the unavoidable loss of 692 $m^2$ of eelgrass habitat at water depths between 2.5 and 7.5 m with DFO to obtain a *Fisheries Act* Authorization for the harmful alteration, disruption or destruction of fish habitat (HADD). EC-CWS will be contacted for advice on next steps to follow for compliance with the FPWC.

**13.5.2.1 Nearshore (Important Bird Areas)**
*The Lawn Islands Archipelago IBA and the Corbin Island IBA should be added to this list.*

**Husky Response:**
Comment Noted. Thank you. Note that the Lawn Islands Archipelago IBA and the Corbin Island IBA are outside the Nearshore Study Area.

## 1.6 Chapter 14 Effects of the Environment on the White Rose Extension Project

**14.4 Nearshore Potential Marine Effects**
*The text gives an estimate of an extreme storm surge of 0.8 m occurring at the time of a large high tide, based on a model that does not include wave run up or set up, or seiche effects. As noted on the comments in 4.2.2.5, EC recommends an extremal analysis of water levels of long term tide gauge at Argentia would give better results for this location.*

**Husky Response:**
Please see 4.2.2.5 Tides, Storm Surges comment and response.

**14.4.6 Sea Ice and Iceberg**

*Sentence 2*:

*Same comments as in Section 4.2.4.1*

*Two errors*

- *The ice that enters the Bay in February is generally grey or greywhite ice (less than 30cm thick), and is not first-year ice (>30cm thick). First-year ice incursions into Placentia Bay only take place from March onwards.*
- *First-year ice is >30 cm thick. Contrary to indicated, it can be >120cm thick. First-year ice that is >120 cm is called "thick first-year" ice. Ice that is 30-70cm is thin first-year ice, and ice that is 70-120cm is medium first-year ice.*

**Husky Response:**
Comments noted. Thank you.

***EC Response**: Non-Responsive*

**Husky Response:** Section 14.4.6 first paragraph is revised to read:
Pack ice presence in Placentia Bay from year to year is variable, but the maximum frequency of occurrence over 30 years is 15 percent (Section 4.2.4.1). Pack ice begins to enter Placentia Bay in February, typically as grey or grey-white ice (< 30 cm), followed by first-year ice incursion in March and April. Placentia Bay generally experiences thin or medium first-year ice (30 to 120 cm thick). The mouth of the Bay is more susceptible to incursions of the annual pack, while the bottom of the bay only fills with pack when there are sustained periods of onshore winds. There are few data on the exact thickness of the sea ice in Placentia Bay. Ice thicker than 100 cm is uncommon at the bottom of Placentia Bay; average thicknesses between 30 and 50 cm are the most common. The International Ice Patrol has recorded icebergs in Placentia Bay. Icebergs were recorded in 7 of the 30 years between 1974 and 2003. A total of 30 icebergs were recorded in this period.

**Section 14.5.8 Climate Change** (New Comment) The proponents should also consider and/or provide more information about projected changes in precipitation (what is the source of the projections in section 14.5.8?) and extremes (e.g. heavy precipitation events). The "annual precipitation increases projected for Atlantic Canada between years 2020 and 2080 range from 18 to 21" (no units here but it is assumed to be %). This range is very high.

**Husky Response:** The following text is added as the final paragraph in Section 14.5.8:
The possibility of more severe storms, or severe storms occurring more frequently, pose additional risks to offshore development that cannot be evaluated by examining historical climate data. Relying on climate prediction models to understand future changes to precipitation therefore allows new developments to properly prepare and construct infrastructure to withstand predicted changes. Predictions of future precipitation due to global warming are subject to many uncertainties, and are dependent on the model employed to make the prediction as well as local geography (e.g., nearby topography and proximity to water bodies). Predicted future precipitation levels for Atlantic Canada vary widely. Specifically for the east coast of Island of Newfoundland, climate projection models such as CGCM2 generally predict increasing precipitation levels by 2050 (Lines et al. 2005). Climate prediction models have also indicated that the return period for intense storms could increase off the east coast of Newfoundland: put another way, storms currently considered severe could become more commonplace in the region. Enhanced snowfall or increasing levels of freezing rain in particular could potentially lead to increasing shutdowns of

the facility to protect staff from working in adverse weather conditions. However, the facility will be designed to withstand projected increases precipitation frequency or intensity off the coast of eastern Newfoundland. Therefore, the effect of higher levels of precipitation by 2050 on the WREP is not significant. While the number of suspensions of work due to extreme weather may increase slightly, the normal operation will not be affected.

New Reference:
Lines, G.S., M. Pancura and C. Lander. 2005. *Building Climate Change Scenarios of Temperature and Precipitation in Atlantic Canada Using the Statistical Downscaling Model (SDSM)*. The Meteorological Service of Canada, Atlantic Region, Science Report Series 2005-9.

## 1.7 Chapter 16 Environmental Management

**16.8 Emergency Response**

*As emergency response is covered in the Incident Coordination Plan (EC-M-99-X-PR-00003-001), which is a pre-existing plan for operations, EC is not providing comments. Likewise for the OSR Procedure – East Coast Oil Spill Response Plan (EC-M-99-X-PR-00125-001).*

**Husky Response:**
Comments noted. Thank you.

**16.11.2 Single vessel Side Sweep System**
*It would be beneficial to have a brief description on how equipment would be retrieved and cleaned, and how waste oil and sorbents would be handled*

**Husky Response:**
The SVSS equipment is deployed and retrieved through strict adherence to the above mentioned procedures and work instructions. SVSS equipment retrieval will be limited to specified areas of the vessel that have been protected by plastic sheeting and sorbents. Equipment that comes in contact with any spilled oil will be cleaned in the field with sorbent materials upon recovery.

The equipment cleaning process requires arrangements for collecting all oil and cleaning fluids after use and will likely involve steam cleaning and/or pressure washing after gross oil removal. All liquid and solid waste collected through the oil response spill recovery process will be handled through a contracted and approved waste management company. Husky will work with its waste management contractor to determine the most appropriate waste disposal option. All waste management activities will be undertaken in accordance with provincial and federal legislation, where applicable.

**16.13.3 Dispersants**
*It would be beneficial to indicate dispersant (Corexit 9500) availability, and whether quantities would meet the requirements at various levels of possible response.*

**Husky Response:**
Husky is a member of Oil Spill Response Limited (OSRL). This international oil spill response cooperative specializes in providing global oil spill response services from their bases in Southampton, England, and Singapore. Through its agreement with OSRL, Husky has access to inventory maintained at OSRL facilities which currently consists a stockpile of approximately 670 $m^3$ of dispersant. This stockpile consists of various types of dispersant including Corexit, Finasol and Slickgone products.

In addition to the dispersant volumes available through the standard OSRL member agreement, additional volumes may be available through;

- Members of the Global response Network
- Dispersant manufacturer inventory
- The Global Dispersant Stockpile being compiled through OSRL which will consist of a standing inventory of 5,000 $m^3$.

The actual volume of dispersant required for a response would depend on a number of factors including, but not limited to;

- Type of spill (batch vs. continuous)
- Application method
- Environmental conditions (wind, sea state, visibility etc.)
- Approved dispersant application program.

**16.14 Offshore Training – Spill Response Operations**
*It would be beneficial to indicate the types of exercises undertaken that would test crew and equipment under real conditions. Associated with these exercises could be the testing of communications and response management structures that combines the efforts of on-scene and on-shore emergency management. The communications hierarchy would also include communications to regulators and 24/7 pollution reporting (CCG-EC).*

**Husky Response:**
Husky's east coast oil spill response program has been structured to support any of Husky's operations offshore Newfoundland. The program is comprehensive and consists of two components – operational response and response management.

Husky has established an operational response capability to respond to offshore oil spills. Equipment has been staged to allow prompt response to small spills with resources at site and an efficient response to larger spills using equipment stored at ECRC's facility in Mount Pearl. The response management process is described in the Incident Coordination Plan and is an integrated and coordinated approach to a spill incident that includes:

- Immediate reaction to the incident controlled by the Person In Charge in the Emergency Command Centre or bridge of the offshore facility;
- Prompt and direct support for the offshore emergency response by Husky's onshore Incident Command Centre (ICC);
- Escalation of the onshore response to include long term management of post-emergency clean-up activities through Husky's onshore ERT response management team;
- Activation of ECRC in all spill events requiring mobilization of Husky's ICC, and;
- Activation of Oil Spill Response (OSR).

On an annual basis Husky completes a number of activities related to spill response operations this include;

- Annual training for contracted Supply Vessel with training completed one per year with each crew (28 day on / 28 day off rotation) The training program includes training on:
  - Sorbent side sweep system, tracker buoys, sampling equipment, oil observation, and bird recovery equipment
  - Annual training for SVSS equipped Supply Vessel with training completed one per year with each crew (28 day on / 28 day off rotation)
- Train 10 ECRC responders per year to maintain a pool of 20 responders

In addition to training noted above Husky completes frequent emergency response exercises and is a participant in the Annual Oil on Water exercise, known locally as synergy. Synergy 2012 was hosted by Husky with support from ECRC. It was designed to demonstrate selected elements of the combined oil spill response capabilities currently available to operators on the east coast of Canada. Objectives of the exercise were to:

- Demonstrate the ability of the Grand Banks Operators to work cooperatively with vessel crews, industry, and their response organization in responding to an oil spill incident.
- Demonstrate the safe and effective activation, deployment and operation of the I-Sphere™ Oil spill tracking buoy system.
- Demonstrate the safe and effective deployment, operation and recovery of a sorbent boom side sweep system.
- Demonstrate the safe and effective deployment, operation, and recovery of a single vessel side sweep system using an exercise vessel.
- Demonstrate the safe and effective deployment, operation (simulated spill containment) and recovery of the NorLense 1200-R containment system.
- Demonstrate the safe and effective deployment, operation, and recovery of the TransRec 150 skimmer system in concert with the NorLense 1200-R containment system. This demonstration is to include collection of simulated product into vessel internal tanks.
- Demonstrate the ability to offload simulated product from primary vessel tank to secondary storage.

In addition to the on water exercise activities noted above Husky holds emergency response exercises with the following objectives to;

- Provide an opportunity for Husky Emergency Response Team personnel to practice their Emergency response roles
- Raise the general level of awareness of Husky's Atlantic Region oil spill response program
- Provide the Husky onshore ERT and the crew of the *SeaRose FPSO* with hands-on experience in oil spill response operations and management
- Confirm the role of ECRC as Husky's principal oil spill response contractor in offshore spill response operations and onshore spill management activities
- Confirm the role of Oil Spill Response Limited (OSRL) as a contractor that can provide specialized services in a major oil spill incident

- Confirm communications links between offshore vessels, the SeaRose, a standby vessel, the Husky ERT and the ECRC Spill Management Team (SMT).

**16.17.3 Physical Management**

*Quote (Page 16-30): "The effectiveness of operational iceberg towing conducted during the 1980s has been studied (Bishop 1989). The conclusions were that, of 354 iceberg towing operations considered, 277 were successful with no difficulties, 74 were successful but required several attempts and 49 were unsuccessful. This translates into an effectiveness of 86 percent. Recently, much has been made of the criteria used in this study to define successful tows. However, since in most cases it is unknown what the free-drifting track would have been if the iceberg were not towed, tow success can only be evaluated on one simple criterion: did the offshore facility have to move? If not, the tow was successful".*

*Since the WHP is not mobile, how would this affect the required design of the CGS?*

**Husky Response:**

Whereas the Wellhead Platform (WHP) is not mobile, Husky will put sufficient measures into practice based on the predictability of iceberg encounters, forecasts for abnormal events to occur, and time required for implementation of a predefined emergency response plan. The emergency response plan will ensure life safety of personnel through evacuation and limit the risk to the environment by providing sufficient time to depressurize and shut in the production system.

WHP is being designed in compliance with the *Atlantic Accord Implementation Acts* and the Certificate of Fitness Regulations. Transport Canada Marine Safety's assistance will be sought as required for marine matters.

WHP must have a valid Certificate of Fitness issued by Det Norske Veritas (DNV), a recognized Certifying Authority, before it is used to conduct any activity in the offshore area. DNV will provide an independent third party assurance and verification that the installation, during the term of the Certificate of Fitness, is fit for purpose, functions as intended, and remains in compliance with the regulations.

## 1.8 Oil Spill Fate and Behaviour Modelling Supporting Document

*See Attached Document*
*Review of Husky Energy Proposal for The White Rose Extension Project Oil Spill Aspects, Merv Fingas Spill Science Edmonton, Alberta (For Environment Canada (February 2013)).*

**Husky Response.**

Thank you for this in-depth review and comments.

# 2.0 Department of National Defence

*The Department of National Defence is likely to be operating in the vicinity of the study area in a non-interference manner during the project timeframe. A search of the unexploded ordinates (UXO) records was conducte3d and those records indicate that there are two wrecks within the study area. There are two sunken U-Boats dating from 1942. The approximate locations of the U-Boats are 47.78N, 49.83E and 50.00N, 46.53E. Due to the limits of technology at the time of the sinking, the location information is considered inaccurate.*

*Given DND's understanding of the survey activities to be conducted, the associated UXO risk is assessed as negligible. Nonetheless, due to the inherent dangers associated with UXO and the fact that the Atlantic Ocean was exposed to many naval engagements during WWII, should any suspected UXO be encountered during the course of the proponent's operations it should not be disturbed/manipulated. The proponent should mark the location and immediately inform the Coast Guard. Additional information is available in the 2012 Annual Edition - Notices to Mariners. Section F, No.37. In the event of activities which may have contact with the seabed (such as drilling or mooring), it is strongly advised that operational aids, such as remote operated vehicles, be used to conduct seabed surveys in order to prevent unintentional contact with harmful UXO items that may have gone unreported or undetected. General information regarding UXO is available at our website at www.uxocanada.forces.gc.ca.*

**Husky Response:**
Comment noted. Thank you. Husky will conduct seabed surveys prior to activities that require contact with the seabed.

# 3.0 Natural Resources Canada

**Coastal and Marine Geology:**
*NRCan's Conclusions:*

*The proponent has properly referenced and described both nearshore and offshore Grand Bank geology (surface and shallow subsurface). The Final design criteria for the potential gravity-based structure will be based on a detailed geotechnical investigation and proper engineering design and installation details are not provided in the EA document. NRCan does not have expertise to advise on those aspects.*

*NRCan has not identified any issues or information gaps on aspects related to coastal and marine geology.*

**Husky Response:**
Comment noted. Thank you.

**Seismicity:**
*NRCan's Conclusion:*
*Based on NRCan's review of section 4.3.8, the seismicity and seismic hazard review analysis is reasonably comprehensive. The proposed 1/2500 year hazard values appear to be considerably higher than previous industry assessments and, if they are used in the design process, should be adequate.*

**Husky Response:**
Comment noted. Thank you.

*Using the average of the values from Model A and B is a little un-conservative relative to using a model that gives each a 50% weight. NRCan confirms that the estimated "GSC model" entries in Table 4-83 are approximately the same as when NRCan's Geological Survey of Canada (GSC) runs its NBCC2005 model for the White Rose site. The GSC values are median values, but it is uncertain whether the URS seismic hazard values in Table 4-83 of the EA document are mean or median values and should be clarified before they are used in design. The GSC is currently working on a revised model for NBCC2015 that gives lesser weight to "Model 2". Indications are that the mean hazard that the full model gives at the White Rose site will not exceed the "URS" values in Table 4-83. Note that the NBCC seismic source models are national in scope and of necessity very general for specific locations, so the values from the model are only suitable for screening purposes. Site-specific studies are recommended where safety or cost implications justify them.*

*NRCan Recommendation:*
*The proponent should clarify whether the URS seismic hazard values in Table 4-83 (chapter 4) are mean or median values before they are used in design.*

**Husky Response:**
The limitations of the NBCC seismic source models are appreciated and site-specific studies have been conducted for facility design.

# 4.0 Transport Canada

**Specific Comment / Request for Additional Information:**
*The Proponent is advised to assess all proposed works, including dredging operations, against the Minor Works and Waters Order.*

*The Proponent is advised to submit a completed 'Request for Work Approval' for all works and activities that do not meet the criteria outlined in the Minor Works and Waters Orders. Completed requests can be submitted to:*

*Navigable Waters Protection Program*
*Transport Canada – Marine Safety*
*PO Box 1013*
*Dartmouth, NS B2Y 4K2*
*P: (902) 426-2726*
*F: (902) 426-7585*
*E: nwpdar@tc.gc.ca*

*The Minor Works and Waters Order, 'Request for Work Approval' application, and other relevant information are available from the following website:*

*http://www.tc.gc.ca/eng/marinesafety/oep-nwpp-menu-1978.htm*

**Husky Response:**
Husky will assess all proposed works, including dredging operations, against the Minor Works and Waters Order and submit a completed 'Request for Work Approval' for all works and activities that do not meet the criteria outlined in the Minor Works and Waters Orders

**Specific Comment / Request for Additional Information:**
*In addition to the applicable regulations under the Canada Shipping Act, all international project vessels must apply for a Coasting Trade Permit issued under the Coasting Trade Act. This means that the vessel would comply with all applicable regulations under International Maritime Organization (IMO) Conventions, including but not limited to;*
*- International Convention for the Safety of Life at Sea (SOLAS)*
*- International Convention for the Prevention of Pollution from Ships (MARPOL)*
*- International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW)*
*- International Convention on Load Lines (LL)*
*- International Convention on Tonnage Measurement of Ships (TONNAGE)*
*- International Convention on the Control of Harmful Anti-Fouling Systems on Ships (AFS)*
*- International Convention on Civil Liability Damage for Oil Pollution Damage (CLC).*

**Husky Response:**
Comment noted. Thank you.

*The Coasting Trade Permit is actually issued by Canadian Customs in consultation with Canadian Transportation Agency and Transport Canada.*
*Page 17-15 of the EA Report states that project-related vessels will use designated routes during construction activities to help mitigate interactions with project vessels and other vessels. Transport Canada – Marine Safety would like an opportunity to review the proposed designated routes. Plans on the designated routes can be forwarded to:*

*Compliance and Enforcement*
*Transport Canada – Marine Safety*
*John Cabot Building, 10 Barter's Hill*
*PO Box 1300*
*St. John's, NL A1C 6H8*
*Tel: (709) 772-5167*

**Husky Response:**
With the exception of vessel traffic to and from the deep-water mating site, Husky will use existing navigation channels for regular traffic. Husky will communicate proposed traffic route for vessels to and from the deep-water mating site once selected.

***Section 15.2.1*** *- The Proponent is advised that Transport Canada may conduct compliance monitoring in relation to conditions listed on any Part 1, Section 5 Approval issued under the Navigable Waters Protection Act. The potential environmental effects associated with any NWPA approvals may also be evaluated by Transport Canada.*

**Husky Response:**
Comment noted. Thank you.

***Page 2-22 of the EA Report -*** *The Proponent is advised to communicate the final design of the graving dock to Transport Canada should the graving dock remain flooded and accessible to the navigating public once construction activities are complete.*

**Husky Response:**
Comment noted. Thank you.

EPP – White Rose Extension Project – Argentia Site, Section 6.4 Page 61 – Contingency Procedures No. 1 – states '…in accordance with CCG regulations.". TC suggests updating this statement to "…in accordance with CCG and TC regulations." because TC is responsible for the *Canada Shipping Act* and the *Navigable Waters Protection Act*.

**Husky Response:** The first procedure in the list of contingency procedures in Section 6.4 of the EPP – White Rose Extension Project – Argentia Site will be revised to read:

1. All stationary hazards, such as moored platforms or vessels, will be marked in accordance with CCG and Transport Canada regulations.

# 5.0 Canada-Newfoundland and Labrador Offshore Petroleum Board

## 5.1 Executive Summary

**Page v of xxix** - says "*Husky has an Environmental Protection and Compliance Monitoring Plan for its existing activities in the White Rose field. The Environmental Protection and Compliance Monitoring Plan will be modified to include the offshore activities associated with the WREP...*"

- *The WHP, if the option selected, will require an installation specific EPP.*

**Husky Response:**
Comment noted. Thank you.

**Page v of xxix** – says "*On June 19, 2012, the Newfoundland and Labrador Department of Environment and Conservation (NLDEC) advised Husky of its determination that the WREP is an undertaking requiring environmental review pursuant to the Environmental Protection Act and that registration was therefore required. Husky formally submitted the Registration to the Province of Newfoundland and Labrador on August 3, 2012.*"

- *[only] the construction site for the WHP is a provincial undertaking ?*

**Husky Response:**
Correct. Only the construction site (and deep-water mating site) for the WHP is a provincial undertaking

***Page vi of xxix*** *– the subsection* ***Assessment Scope and Approach***

- *needs more clarity around the geographic and temporal scope of the assessment*

**Husky Response:**
In accordance with the Scoping Document, the following spatial boundaries have been used in this environmental assessment for nearshore and offshore WREP activities:

- Project Area is defined as the area within which WREP activities will occur;
- Affected Area is defined as the area which could potentially be affected by WREP works or activities within or beyond the Project Area;
- Study Area has been defined by modelling WREP-environment interactions, such as accidental events, and considers all WREP-environment interactions. This is the area within which significance will be determined and it represents a compilation of the various Affected Areas for all WREP works, activities and accidental events.

The WREP schedule has been revised since the environmental assessment was prepared. The changes to the schedule do not affect the environmental assessment significance predictions nor the mitigations planned for the WREP. The following summary is the current schedule for nearshore and offshore activities:

- Nearshore (applies to Wellhead Platform option only) - In the case of the WHP development option, site preparation, graving dock construction, construction of CGS, dredging, topsides mating and tow out will occur over an estimated maximum 45 months from 2013 to 2017. Various activities will occur at all times of year until completion. In the case of the subsea drill centre development option, no nearshore activities will occur.

- Offshore - In the case of the WHP development option, site preparation, installation of the WHP and initial production/maintenance will occur in 2017. The WHP will be decommissioned and abandoned in accordance with standard practices at the end of its production life, which is anticipated to be 25 years. The subsea drill centre option is scheduled to begin construction in 2014, with first oil expected in 2016. Under this option, the wells will be plugged and abandoned at the end of its production life (anticipated to be 20 years), and the subsea infrastructure removed or abandoned in accordance with relevant regulations.

***Page vi of xxix*** *– says "This environmental assessment meets these requirements, as well as the requirements of the C-NLOPB Development Plan Guidelines (C-NLOPB 2006)."*

- *It would be more appropriate to preface the word "meets" with the words "is intended to"*

**Husky Response:**
Comment noted. Thank you.

***Page x of xxix*** *– says "The environmental effects of hydrocarbon spills could be significant if spills are large and persistent enough to affect more than one generation."*

- *Is this intended to mean that the on-water slick or shoreline fouling would persist for longer than one generation [which I read as one year but which could be longer], or that the population effect from a large and persistent spill will endure for longer than one generation. Some improvement in sentence construction would be appropriate here.*

**Husky Response:**
The sentence is revised to read:

The environmental effects of hydrocarbon spills could be significant if spills are large and persistent enough to cause population effects that endure for more than one generation (see Section 10.2 - Determination of Significance).

***Page xi of xxix*** *– the sections after the header* ***Species at Risk*** *should be designated as* ***SAR Marine Fish, SAR Marine Mammals and Sea Turtles, and SAR Birds*** *since there is no other way to distinguish between these headers and the same headings for non-SAR fauna on preceding pages.*

**Husky Response:**
Comment noted. Thank you.

**Page xiv of xxix** – says "*WREP design and planning will benefit from the years of physical data collection in the White Rose field. The WREP design and operations planning incorporates metocean criteria for specific nearshore and offshore conditions. Physical metocean data collection will continue during the WREP.*"

- *Check against development plan for inclusion of modern metocean data.*

**Husky Response:**
Both the WREP Environmental Assessment and the WREP Development Plan Amendment present metocean data provided by Oceans Ltd. in 2011. This is the most up to date metocean data available.

Reference:
Oceans Ltd. 2011. *Summary of White Rose Physical Environmental Data for Production System*. Prepared for Husky Energy, St. John's, NL.

## 5.2 Chapter 1 Introduction

**Page 1-9** - says "*This environmental assessment meets these requirements, as well as the requirements of the C-NLOPB Development Plan Guidelines (C-NLOPB 2006)*."

- *Replace "meets" with "is intended to meet".*

**Husky Response:**
Comment noted. Thank you.

**Page 1-10, Section 1.5.1**

- *Need temporal scope*

**Husky Response:**
The WREP schedule has been revised since the environmental assessment was prepared. The changes to the schedule do not affect the environmental assessment significance predictions nor the mitigations planned for the project. The current schedule for nearshore activities can be summarized as site preparation, graving dock construction, construction of CGS, dredging, topsides mating and tow out will occur over an estimated maximum 45 months from 2013 to 2017. Various activities will occur at all times of year until completion.

**Page 1-11, Section 1.5.2**

- *Need temporal scope*

**Husky Response:**
The WREP schedule has been revised since the environmental assessment was prepared. The changes to the schedule do not affect the environmental assessment significance predictions nor the mitigations planned for the project. In the case of the WHP development option, site preparation, installation of the WHP and initial production/maintenance will occur in 2017. The WHP will be decommissioned and abandoned in accordance with standard practices at the end of its production life, which is anticipated to be 25 years. The subsea drill centre option is scheduled to begin construction in 2014, with first oil expected in 2016. Under this option, the wells will be plugged and abandoned at the end of its production life (anticipated to be 20 years), and the subsea infrastructure removed or abandoned in accordance with relevant regulations.

***C-NLOPB Response**: While this response is generally acceptable, we note that the temporal scope for operations offshore exceeds the original White Rose temporal scope. The SeaRose FPSO and original subsea infrastructure have not been assessed for a life beyond 2020.*

**Husky Response:** Noted. Thank you.

## 5.3 Chapter 2 Project Description

**Page 2-7** says "*AMA would also have to take ownership of the material post-excavation, as material handling is not part of Husky's business*." But page 2-9 says "*In an effort to minimize the environmental footprint and disturbance to all stakeholders as much as possible, Husky has committed to ensuring proper disposal and use of the excavated and dredged material within the Argentia Peninsula. Husky has assumed environmental responsibility for the material from the AMA, and will test and treat the material as required, for the designated use.*"

- *Are these statements coherent? If not, make them coherent.*

**Husky Response:**
These statements are referring to different disposal options. If the material was to be stored on the Argentia Peninsula for a future use that was not associated with the WREP, a third party would have to assume ownership of the material. Husky has assumed environmental responsibility for the material within the Husky lease area that is intended to be disposed of in The Pond.

***Page 2-9, Table 2-4****: WHP Life of Field/Structure is up to 25 Years and Subsea Drill centre productive life is up to 20 years.*

- *Is this consistent with the original White Rose Environmental Assessment? Is it the proponent's intent to revise the project temporal scope?*

**Husky Response:**
The original White Rose Environmental Assessment (Husky Energy 2001) contemplated 3 to 4 subsea drill centres being constructed within the White Rose field. Three drill centres (Centre, Southern and Northern), were constructed prior to an assessment of five additional drill centres in the Husky White Rose Development Project: New Drill Centre Construction and Operations Program Environmental Assessment - EA Addendum (LGL 2007). To date, only the North Amethyst and South White Rose Extension drill centres have been constructed of the five assessed during the period from 2007 to 2015.

The current WREP Environmental Assessment re-assessed the effects of construction and operation of up to three drill centres during the life of the project. The productive life of the subsea infrastructure is estimated at 20 years, the productive life of the WHP is estimated at 25 years. The potential environmental effects of the operation of the *SeaRose FPSO* have not been assessed past 2020, the original projected life of the White Rose field.

Husky Energy will complete environmental assessments as required to review potential effects and mitigation opportunities prior to the expiry of current approvals.

***C-NLOPB Response****: This response is generally acceptable. We note that the current "Approvals" include the DPA, which doesn't expire per say, but which will be made inactive by expiry of the original project EA scope. The C-NLOPB won't be able to issue any "Authorizations" for production operations at the SeaRose FPSO beyond 2020 until the environmental assessment issue is resolved.*

**Husky Response:** Noted. Thank you.

***Page 2-10, Table 2-4****: Well Treatment fluids attribute is described as "≤ 30 mg/L…"*

- *Insert OIW before ≤ 30 mg/L*

**Husky Response:**
Comment noted. Thank you.

***Page 2-11, Section 2.4.2*** *lists "Seawater systems including cooling water and firewater" and Table 2-4 shows "No discharge limit" for "Fire Control Systems Test Water."*

- *The SeaRose FPSO has [in the past] required continuous discharge from the firewater ringmain to prevent freezing and that this water is expected to meet discharge limits for chlorine concentration. This potential discharge should be considered for the WHP as well.*

**Husky Response:**
Comment noted. Thank you.

***Page 2-11 and elsewhere*** *– references to OWTG*

- *References to the OWTG (National Energy Board et al. 2010) should include the phrase "as amended."*

**Husky Response:**
Comment noted. Thank you.

**Page 2-11 and 2-12 – Discussion of water based mud and cuttings**

- *This discussion of WBM and Table 2-5 should be moved to a separate section for discussion of mud and cuttings since it is not a discussion of wellhead platform systems and the associated systems are already listed in the preceding list.*

**Husky Response:**
Comment noted. Thank you.

**Page 2-12 – Discussion of Subsea Drill Centre**

- *The MODU and its subsystems have been omitted and should be included here*

**Husky Response:**
Comment noted. Thank you.

***C-NLOPB Response****: Not an acceptable response. Provide information on the MODU and its subsystems at a level comparable to the WHP.*

**Husky Response:** The following is added as new Section 2.4.4:

### 2.4.4 MODU Systems

A typical MODU has the following key equipment and systems:

- Storage capacities
- Propulsion/thrusters
- Mooring system
- Watertight integrity
- Ballast and bilge systems
- Power supply systems
- Drillstring equipment
- Well control/subsea equipment
  - marine riser system
  - subsea support system
  - bop control system
  - subsea control system
  - acoustic emergency bop control system
- High-pressure mud system
- Low-pressure mud system
- Bulk system
- Casing equipment
- Cement equipment
- Drilling instrumentation at driller's position

- Internal rig communication system
- Environmental instrumentation
- Production test equipment
- Sprinkler system
- Gas/fire/smoke detection
- Fire-fighting equipment
- Survival equipment
- Pollution prevention equipment
  - sanitary and food waste
  - garbage compaction
  - garbage disposal/grinder
  - machinery space waste oil drainage and storage
  - bilge, deck drain oily water treatment/storage
  - rig floor, cellar deck, piperack oily water treatment/storage

WBM and SBMs cuttings will be released from the MODU at estimated volumes as indicated in Table 2-6 (Section 2.4.3).

**Page 2-13 – Discussion of WBM and SBM cuttings**

- *This discussion of WBM and SBM cuttings and Table 2-6 should be moved to a separate section for discussion of mud and cuttings since it is not a discussion of subsea drill centre equipment.*

**Husky Response:**
Comment noted. Thank you.

**Page 2-13 Section 2.5**

- *The phrase "life of the White Rose field" should be clarified with respect to assessed temporal scope.*

**Husky Response:**
The original White Rose Environmental Assessment (Husky Energy 2001) contemplated three to four subsea drill centres being constructed within the White Rose field. Three drill centres (Centre, Southern and Northern), were constructed prior to an assessment of five additional drill centres in the Husky White Rose Development Project: New Drill Centre Construction and Operations Program Environmental Assessment - EA Addendum (LGL 2007). To date, only the North Amethyst and South White Rose Extension drill centres have been constructed of the five assessed during the period from 2007 to 2015.

The current WREP Environmental Assessment re-assessed the effects of construction and operation of up to three drill centres during the life of the project. The productive life of the subsea infrastructure is estimated at 20 years, the productive life of the WHP is estimated at 25 years. The potential environmental effects of the operation of the *SeaRose FPSO* have not been assessed past 2020, the original projected life of the White Rose field.

Husky Energy will complete environmental assessments as required to review potential effects and mitigation opportunities prior to the expiry of current approvals.

**Page 2-16**

- *What is meant by the term "industrial-sized road"?*

**Husky Response:**
The term 'industrial sized road' was stated in error. Route NL S 100 is a regional road that varies in provincial Highway Classification from RLU 100 to RLU 60 in areas where the road passes through communities along the way.

***Page 2-20 On-Land Construction Section 2.6.2*** *– does the emergency generator have a capacity of 750 kilowatts per hour as well? If not, then what is the hourly kilowatt number? Kilowatts per hour is the much more common and useful value.*

**Husky Response:**
Yes, when the generator is operated at its rated full real power capacity for 1 hour it will deliver 750 kilowatt hours of energy. When continuing to supply the same load for 10 hours it will have delivered 7,500 kilowatt hours of energy. Electrical generators designed for industrial applications will have the following three parameters on its nameplate and specification sheet.

- Watts
- Volt x Amperes
- Power Factor

***Page 2-23, Section 2.6.3.2*** *says "As part of PWGSC's site-wide environmental site assessments (ESAs) completed in 1993/1994 and 1995, 64 test pits, 62 monitor wells, and 15 boreholes with related soil and groundwater sampling were completed at the NFSA site, with the primary emphasis on petroleum hydrocarbon contamination in the area of petroleum hydrocarbon product tank storage, located immediately east of the current site (Figure 2-7)" and Page 2-24, Figure 2.7:*

- *Are the test pits, boreholes and wells referred to above shown on figure 2-7 since this drawing is titled "Casting Basin Geotechnical Borehole Location Plan" and the notes are somewhat cryptic. Are the existing boreholes locations completed as wells or filled and abandoned? Are the test pits in place or filled and abandoned? Are the proposed observation wells to be installed by Husky or were these proposed and installed some time ago by PWGSC. Please provide additional clarity in relation to figure 2-7.*

**Husky Response:**
The test pits, boreholes and wells referred to in Section 2.6.3.2 are not shown in Figure 2-7.

A summary of the historical environmental site assessment information acquired in close proximity to the Graving Dock site is illustrated in the 2011 NFSA (Northside Fuel Storage Area) Closure Report by Dillon Consulting Ltd.

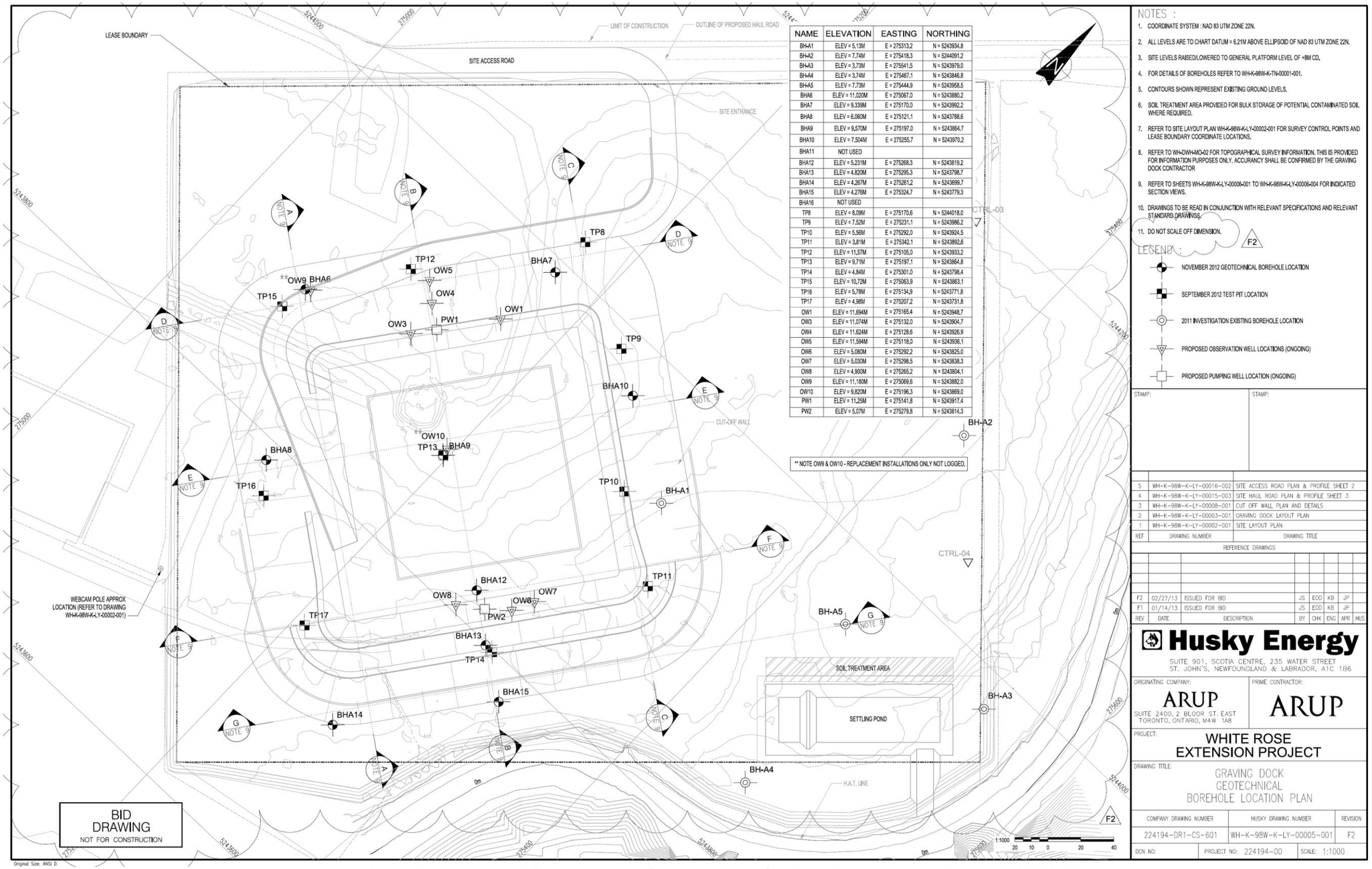
Existing boreholes have been abandoned. Existing boreholes located inside the area of construction will be removed during excavation of the graving dock.

Existing Test Pits have been filled and abandoned.

Proposed observation wells have been installed by Husky as a component of the planned hydrogeological site investigation. Observation wells will be removed during excavation of the graving dock.

- *If figure 2.7 is to be used for reference then the quality of the figure needs improvement*

**Husky Response:**
See Figure 19 (revised Figure 2-7 (Drawing # WH-K-98W-K-LY-00005-001).




| NAME | ELEVATION | EASTING | NORTHING |
|---|---|---|---|
| BH-A1 | ELEV = 5.13M | E = 275313.2 | N = 5243934.8 |
| BH-A2 | ELEV = 7.74M | E = 275418.3 | N = 5244091.2 |
| BH-A3 | ELEV = 3.73M | E = 275541.5 | N = 5243979.0 |
| BH-A4 | ELEV = 3.74M | E = 275467.1 | N = 5243846.8 |
| BH-A5 | ELEV = 7.73M | E = 275444.9 | N = 5243958.5 |
| BHA6 | ELEV = 11.020M | E = 275067.0 | N = 5243880.2 |
| BHA7 | ELEV = 9.339M | E = 275170.0 | N = 5243992.2 |
| BHA8 | ELEV = 6.060M | E = 275121.1 | N = 5243788.6 |
| BHA9 | ELEV = 9.570M | E = 275197.0 | N = 5243864.7 |
| BHA10 | ELEV = 7.504M | E = 275255.7 | N = 5243970.2 |
| BHA11 | NOT USED | | |
| BHA12 | ELEV = 5.231M | E = 275268.3 | N = 5243819.2 |
| BHA13 | ELEV = 4.820M | E = 275295.3 | N = 5243798.7 |
| BHA14 | ELEV = 4.267M | E = 275261.2 | N = 5243699.7 |
| BHA15 | ELEV = 4.276M | E = 275324.7 | N = 5243779.3 |
| BHA16 | NOT USED | | |
| TP8 | ELEV = 8.09M | E = 275170.6 | N = 5244018.0 |
| TP9 | ELEV = 7.52M | E = 275231.1 | N = 5243986.2 |
| TP10 | ELEV = 5.56M | E = 275292.0 | N = 5243924.5 |
| TP11 | ELEV = 3.81M | E = 275342.1 | N = 5243892.6 |
| TP12 | ELEV = 11.57M | E = 275105.0 | N = 5243933.2 |
| TP13 | ELEV = 9.71M | E = 275197.1 | N = 5243864.8 |
| TP14 | ELEV = 4.84M | E = 275301.0 | N = 5243798.4 |
| TP15 | ELEV = 10.72M | E = 275063.9 | N = 5243863.1 |
| TP16 | ELEV = 5.78M | E = 275134.9 | N = 5243771.8 |
| TP17 | ELEV = 4.98M | E = 275207.2 | N = 5243731.8 |
| OW1 | ELEV = 11.894M | E = 275165.4 | N = 5243948.7 |
| OW3 | ELEV = 11.074M | E = 275132.0 | N = 5243904.7 |
| OW4 | ELEV = 11.824M | E = 275128.6 | N = 5243926.9 |
| OW5 | ELEV = 11.594M | E = 275118.0 | N = 5243936.1 |
| OW6 | ELEV = 5.080M | E = 275292.2 | N = 5243825.0 |
| OW7 | ELEV = 5.030M | E = 275298.5 | N = 5243838.3 |
| OW8 | ELEV = 4.900M | E = 275265.2 | N = 5243804.1 |
| OW9 | ELEV = 11.180M | E = 275069.6 | N = 5243882.0 |
| OW10 | ELEV = 9.820M | E = 275196.3 | N = 5243869.0 |
| PW1 | ELEV = 11.25M | E = 275141.8 | N = 5243917.4 |
| PW2 | ELEV = 5.07M | E = 275279.8 | N = 5243814.3 |

NOTES :
1. COORDINATE SYSTEM : NAD 83 UTM ZONE 22N.
2. ALL LEVELS ARE TO CHART DATUM = 6.21M ABOVE ELLIPSOID OF NAD 83 UTM ZONE 22N.
3. SITE LEVELS RAISED/LOWERED TO GENERAL PLATFORM LEVEL OF +8M CD.
4. FOR DETAILS OF BOREHOLES REFER TO WH-K-98W-K-TN-00001-001.
5. CONTOURS SHOWN REPRESENT EXISTING GROUND LEVELS.
6. SOIL TREATMENT AREA PROVIDED FOR BULK STORAGE OF POTENTIAL CONTAMINATED SOIL WHERE REQUIRED.
7. REFER TO SITE LAYOUT PLAN WH-K-98W-K-LY-00002-001 FOR SURVEY CONTROL POINTS AND LEASE BOUNDARY COORDINATE LOCATIONS.
8. REFER TO WH-DWH-MO-42 FOR TOPOGRAPHICAL SURVEY INFORMATION. THIS IS PROVIDED FOR INFORMATION PURPOSES ONLY, ACCURANCY SHALL BE CONFIRMED BY THE GRAVING DOCK CONTRACTOR
9. REFER TO SHEETS WH-K-98W-K-LY-00006-001 TO WH-K-98W-K-LY-00006-004 FOR INDICATED SECTION VIEWS.
10. DRAWINGS TO BE READ IN CONJUNCTION WITH RELEVANT SPECIFICATIONS AND RELEVANT STANDARD DRAWINGS.
11. DO NOT SCALE OFF DIMENSION.

F2

LEGEND :
- NOVEMBER 2012 GEOTECHNICAL BOREHOLE LOCATION
- SEPTEMBER 2012 TEST PIT LOCATION
- 2011 INVESTIGATION EXISTING BOREHOLE LOCATION
- PROPOSED OBSERVATION WELL LOCATIONS (ONGOING)
- PROPOSED PUMPING WELL LOCATION (ONGOING)

STAMP: STAMP:

| REF | DRAWING NUMBER | DRAWING TITLE |
|---|---|---|
| 5 | WH-K-98W-K-LY-00016-002 | SITE ACCESS ROAD PLAN & PROFILE SHEET 2 |
| 4 | WH-K-98W-K-LY-00015-003 | SITE HAUL ROAD PLAN & PROFILE SHEET 3 |
| 3 | WH-K-98W-K-LY-00008-001 | CUT OFF WALL PLAN AND DETAILS |
| 2 | WH-K-98W-K-LY-00003-001 | GRAVING DOCK LAYOUT PLAN |
| 1 | WH-K-98W-K-LY-00002-001 | SITE LAYOUT PLAN |

REFERENCE DRAWINGS

| REV | DATE | DESCRIPTION | BY | CHK | ENG | APR | HUS |
|---|---|---|---|---|---|---|---|
| F2 | 02/27/13 | ISSUED FOR BID | JS | EOD | KB | JP | |
| F1 | 01/14/13 | ISSUED FOR BID | JS | EOD | KB | JP | |

**Husky Energy**
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ST. JOHN'S, NEWFOUNDLAND & LABRADOR, A1C 1B6

ORIGINATING COMPANY: ARUP, SUITE 2400, 2 BLOOR ST. EAST TORONTO, ONTARIO, M4W 1A8
PRIME CONTRACTOR: ARUP

PROJECT: WHITE ROSE EXTENSION PROJECT

DRAWING TITLE: GRAVING DOCK GEOTECHNICAL BOREHOLE LOCATION PLAN

| COMPANY DRAWING NUMBER | HUSKY DRAWING NUMBER | REVISION |
|---|---|---|
| 224194-DR1-CS-601 | WH-K-98W-K-LY-00005-001 | F2 |

DCN NO: PROJECT NO: 224194-00 SCALE: 1:1000

**Figure 19 Revised Figure 2-7 Environmental Site Assessment Site Plan (Drawing # WH-K-98W-K-LY-00005-001)**

***Page 2-45, Section Wellhead Platform –*** *Flowlines are discussed in Section 2.8.2 Subsea Drill Centre but not here. Are they proposed for the Wellhead Platform? If so, details with regard to installation (e.g. buried, rock covered) should be provided*

**Husky Response:**
Comment noted. The text from Section 2.8.2 regarding flowlines would also apply to the WHP option. Specifically, "*Flowlines will be laid directly on the seafloor, similar to installation methods used for flowlines currently in the White Rose field. The need for additional flowline tie-in modules and associated valves will be evaluated during engineering. Flowline tie-in modules will sit on the seafloor and range between an estimated 20 and 40 $m^2$. Dropped object protection on the flowline near the subsea drill centres is also being evaluated and maybe composed of rock berms, as for SCD and NADC, or concrete mats or sleeves.*"

***Page 2-46 Section 2.8.2 Subsea Drill Centre –*** *The particulars of the drill centres should be compared to the previously assessed drill centres, such as size, depth, amount of seabed sediment to be removed per drill centre, etc. If different then it must be addressed.*

**Husky Response:**
The size of subsea drill centres associated with the WREP are not anticipated to be different than the drill centres previously constructed in the White Rose field.

***Page 2-49 White Rose Extension Project Operation Section 2.9*** *– it is stated that if the WHP development option is selected, then SBM cuttings will be reinjected. How will the SBM cuttings be dealt with before the cuttings reinjection well is drilled?*

**Husky Response:**
The base plan is to drill two cuttings reinjection wells for cuttings disposal purposes. In addition, the WHP design currently envisions a secondary cuttings dryer system to lower synthetic based mud on cuttings (SOC) to a target level of 6.9 percent SOC. This is consistent with technology currently employed by MODUs operating in the area. This secondary dryer would be employed until the cuttings reinjection (CRI) system is functional. This secondary system would also be employed in the event of difficulties with the CRI system. Prior to having a CRI system in place, and in the event of CRI system failure, following processing with the secondary dryer, cuttings would be discharged overboard.

Current drilling authorizations allow for the discharge of cuttings while drilling with an SBM fluid, at discharge limits specified in the facilities Environmental Protection Plan. The discharge of mud and cuttings and their limits for the WREP will be described in the WREP Environmental Protection Compliance and Monitoring Plan and submitted as part of the authorization application. While using an SBM fluid system, the WHP intends to handle cuttings in a similar manner as a MODU until the CRI system is operable, as well as in the event the CRI system experiences a failure. Once the CRI system is operable, these cuttings will be reinjected downhole.

**C-NLOPB Response**: *The Proponent should model these discharges or explain why modeling is considered not necessary.*

**Husky Response:** Under the Subsea option (Section 3.2.1), the scenario of 16 wells drilled from a MODU at the West White Rose location (WWRX1) was modelled with the release of all treated SBM cuttings. The volume of cuttings released from the 16 MODU wells would be greater than the volume released from wells drilled prior to commissioning the CRI system and is therefore considered worst-case scenario for purposes of the environmental assessment.

***Page 2-51, Section 2.9.2*** *says "SBM cuttings will be treated and discharged from the MODU in accordance with the OWTG (NEB et al. 2010)."*

- *References to the OWTG (National Energy Board et al. 2010) should include the phrase "as amended."*

**Husky Response:**
Comment noted. Thank you

***Page 2-47 Subsea Drill Centre Section 2.8.2*** *– "Dropped object proection", assume it is supposed to be "protection."*

**Husky Response:**
The assumption is correct.

***Page 2-52 Shipping/Transportation Section 2.12*** *– "Oil will <u>be</u> stored on the ..."*

**Husky Response:**
Comment noted. Thank you

***Page 2-53 Offshore Section 2.14.2****– "... in accordance with standard oil field practices AND <u>approved by the C-NLOPB</u>, then..."*

**Husky Response:**
Comment noted. Thank you

**Page 2-53, Section 2.14.2** says" *Under the WHP development option, the WHP will be decommissioned and abandoned by first abandoning the wells in accordance with standard oil field practices, then decommissioning the topsides, followed by decommissioning and abandonment of the CGS. All infrastructure will be abandoned in accordance with the relevant regulations. The topsides will be removed from the CGS in a manner evaluated to be most effective at the time of decommissioning. The WHP will not be abandoned and disposed of offshore, nor converted to another use on site.*"

- *How does this compare to statements in the 2000 ES*
- *Should we require a surety for removal costs?*

**Husky Response:**
First bullet - please see response to review comment **Page 2-53, Section 2.14.2**.

Second bullet - Husky provides Proof of Financial Security as a condition for all operations authorizations issued by the CNLOPB. This documentation establishes that Husky has the financial ability to meet its obligations regarding the scope of activities as defined under the authorizations. Prior to start of production on the WHP, an operations authorization will be required, including Proof of Financial Security. The authorization will include the requirement for Husky to adhere to the commitments made in the WREP Development Plan Amendment and the environmental assessment, including commitments related to decommissioning.

**Page 2-53, Section 2.14.2**, says" *Under the WHP development option, the WHP will be decommissioned and abandoned by first abandoning the wells in accordance with standard oil field practices, then decommissioning the topsides, followed by decommissioning and abandonment of the CGS. All infrastructure will be abandoned in accordance with the relevant regulations. The topsides will be removed from the CGS in a manner evaluated to be most effective at the time of decommissioning. The WHP will not be abandoned and disposed of offshore, nor converted to another use on site*."

*Under the subsea drill centre development option, the wells will be plugged and abandoned and the subsea infrastructure will be removed or abandoned in accordance with the relevant regulations."*

- *The text regarding decommissioning should be consistent with the 2001 Comprehensive Study Report…*

  *[Husky 2001] Page 24, Section 2.5 says "At the end of the production life of the White Rose oilfield development, the operator will decommission and abandon the site according to C-NOPB requirements and Newfoundland Offshore Area Production and Conservation Regulations. The floating production facility will be removed from the oilfield. Subsea infrastructure will be removed and the wells will be plugged and abandoned."*

  *[Husky 2001] Page 38, Section 4.1.2.3 says "The White Rose site will be abandoned at the end of the production life and will be restored to minimize residual effects on the environment…conditions should revert to those before development and overall there will be no adverse effect. If some structures remain projecting above the seabed, there will be a positive, very localized effect on fish populations due to the reef effect, provided these structures are protected from trawlers."*

  *[Husky 2001] Page 47, Section 4.2.2.3 says "The White Rose site will be abandoned and restored to near pre-development conditions at the end of its production life to minimize potential residual effects on the environment…"*

  *[Husky 2001] Page 53, Section 4.3.2.3 says "The White Rose site will be abandoned and restored at the end of production to minimize permanent effects on the environment…"*

**Husky Response:**

The apparent inconsistency with the White Rose Comprehensive Study Report (Husky Energy 2001) may arise from the statement "*If some structures remain projecting above the seabed, there will be a positive, very localized effect on fish populations due to the reef effect, provided these structures are protected from trawlers.*"

As stated in the White Rose Decision Report (2001.01) s. 4.8.5.2 "…all subsea facilities, including flowlines, that are located on or above the undisturbed sea floor, will be removed during field abandonment."

Regarding the flowline rock berms, the White Rose Decommissioning and Abandonment Plan (Husky Energy 2012) states that "Flowline sections that have been rock-dumped will not be recovered, and will be cut by divers at the locations where rock dumping ceases."

Rock berms were approved by DFO as compensation for fish habitat loss and removal may constitute a harmful destruction of fish habitat and as such could require a *Fisheries Act* Authorization.

**Page 2-53, Section 2.15** says "*Regardless of the development drilling option selected, potential future activities include excavating and installing up to two additional drill centres within the White Rose field. Note that these drill centres have been previously assessed (LGL 2007a), but are included in this environmental assessment in order to extend the temporal scope of these activities.*"

- *Is this consistent with the original White Rose Environmental Assessment? The production project temporal scope extends only to 2020. Is it the proponent's intent to revise the project temporal scope?*

**Husky Response:**
The original White Rose Environmental Assessment (Husky Energy 2001) contemplated three to four subsea drill centres being constructed within the White Rose field. Three drill centres (Centre, Southern and Northern), were constructed prior to an assessment of five additional drill centres in the Husky White Rose Development Project: New Drill Centre Construction and Operations Program Environmental Assessment - EA Addendum (LGL 2007). To date, only the North Amethyst and South White Rose Extension drill centres have been constructed of the five assessed during the period from 2007 to 2015.

The current WREP Environmental Assessment re-assessed the effects of construction and operation of up to three drill centres during the life of the project. The productive life of the subsea infrastructure is estimated at 20 years, the productive life of the WHP is estimated at 25 years. The potential environmental effects of the operation of the *SeaRose FPSO* have not been assessed past 2020, the original projected life of the White Rose field.

Husky will complete environmental assessments as required to review potential effects and mitigation opportunities prior to the expiry of current approvals.

**C-NLOPB Response**: *Acceptable response. We note that only the drill centres identified in the WHP EA will be reviewed in this regard.*

**Husky Response:** Noted. Thank you.

## 5.4 Chapter 3 Summary of White Rose Extension Project-specific Models

**Page 3-2, Section 3.1.1** says "*…receptor height was set to sea level… the height of the platforms was set at 30 m above sea level to represent the first deck…*"

- *Since human exposure to air emissions is one of the primary concerns for air quality, is the meaning of the text noted above for the three discrete receptors [adjacent structures]? The air quality is modeled at the height of the [human] receptors.*

**Husky Response:**
The receptor height of all the receptors (discrete, sampling grids, nested grids) was set to sea level. This includes the three receptors that were included to represent each of the existing offshore oil operations (Hibernia, Terra Nova and *SeaRose FPSO*). The 30 m height refers to the physical height of the base of the source of platform emissions. The typical terminology is ground level; however, where the proposed Project is located offshore, the term "sea level" was also used. Tests using AERSCREEN show a difference for the contribution of the turbines at 1.5 m versus 30 m above sea level to be approximately 4 percent at 500 m distance decreasing to 2 percent at 10,000 m. Setting the receptor height to sea level (or ground level) is common practice to all dispersion modelling where conformance with standards must be tested, as this represents the "breathing zone", typically 1.5 m above the

surface. As shown in the subsequent test, there would be negligible vertical variation in concentration to persons exposed on fishing or supply boats at low speed and at low elevation, to those exposed briefly on the higher decks of transient large vessels; however, the duration of exposure at low elevation would favour the placement of the receptor grid at the lower level because these persons would likely be in the vicinity longer. At distances corresponding to the separation of offshore facilities, the exhaust plumes are virtually uniform in the vertical.

**Page 3-3, Section 3.1.1** says" *Ground level concentrations have been predicted for all these listed air contaminants*."

- *Do you mean sea level or deck level?*

**Husky Response:**
Ground level and sea level are used interchangeably.

***Page 3-3, Section 3.1.2.1*** *says" The maximum predicted 1-hour ground level concentrations at each of the three discrete installations for CO, $NO_2$, $SO_2$, total particulate matter (TPM), $PM_{10}$ and $PM_{2.5}$ during normal operation of the proposed WHP are listed in Table 3-1." The term "ground level is used repeatedly in this section.*

- *Do you mean deck level concentrations?*

**Husky Response:**
Maximum predicted ground level (or sea level) concentrations were predicted for each of the three discrete receptors. Setting the receptor height to ground level (or sea level) is common practice to all dispersion modelling and represents the "breathing zone", typically 1.5 m above the surface. As noted in the previous reply, the vertical variation in concentration was assessed for the maximum impact on receptors at 1.5 m and 30 m heights and found to be less than 4 percent at 500 m and 2 percent at 10,000 m.

**Page 3-5, Section3.1.2.2**
**Page 3-9, Section 3.1.2.3**
**Page 3-10, Section 3.1.2.4**
**Page 3.14, Section 3.1.2.5**

- *Do you mean deck level where the term "ground level" occurs?*

**Husky Response:**
Ground level is referring to sea level in all cases.

***Page 3-17, Table 3-26 and 3-27***

- *In the total column in Table 3-7 the WHP carries over the total burden of operations as described in Table 3-26 while the MODU carries over only the MODU specific emissions. Make these consistent.*
- *Can the proponent verify that the GHG emissions obtained from Environment Canada are calculated in the same manner as those presented for the WHP and MODU operations?*
- *Please provide details on what activities at the WHP account for the large difference between WHP Operations, specifically power generation, and MODU Operations.*

**Husky Response:**
Table 3-27 has been revised and is provided as Table 6.

**Table 9 Revised Table 3-27 2010 Greenhouse Gas Emissions data by Platform**

| Facility | GHG Emissions (tonnes $CO_{2eq}$/year) | | | |
|---|---|---|---|---|
| | $CO_2$ | $CH_4$ | $N_2O$ | Total |
| Terra Nova (A) | 569,634 | 22,976 | 11,616 | 604,227 |
| Hibernia (A) | 491,117 | 31,121 | 4,644 | 526,882 |
| *SeaRose FPSO*(A) | 394,690 | 27,691 | 9,405 | 431,786 |
| WHP Operation | 148,672 | 137 | 719 | 149,529 |
| MODU Operation | 62,688 | 17.6 | 326 | 63,033 |

Husky cannot verify that the GHG emissions obtained from Environment Canada have been calculated in the same manner as those calculations produced for the WREP, as they have been computed by other operators or a third party; however, we can confirm that our calculations are according to accepted principles for the major sources. There is no reason to expect that other sources were calculated differently.

The activities at the WHP that account for the difference between GHG emissions from the WHP operations and the MODU operations include that of power generation and flaring. In terms of power generation, the requirements for power will be lower on the MODU versus that of the WHP. As well, the GHG emissions data used for the MODU were based on data from operating a MODU in a typical year in the White Rose field (2011) during which no flaring occurred.

**Page 3-18, Section 3.2 and subsections**

- *Some reference to the sections where impacts of underwater noise are assessed would make this information relevant. It might be useful to include something very brief regarding the sound level magnitude where effects would be detected in identified receptors [or even to say where this information is in the report].*

**Husky Response:**

Effects of underwater noise are assessed in the following sections in the WREP environmental assessment:

- Page 8-46, Section 8.5.1.1 – Change in Habitat Quality – Noise
- Page 8-60, Section 8.5.2.1 – Change in Habitat Quality
- Page 11-31, Section 11.4
- Page 11-34, Section 11.4.1.1
- Page 11-35, Section 11.4.1.2 – Effects of Dredging and Effects of Vessel Traffic
- Page 11-66, Section 11.5.1.2 – Change in Habitat Quality - Dredging
- Pages 12-96 to 12-101, Section 12.5.1.1

***Page 3-33 Model Inputs Section 3.3.1-*** *"... that a 160 m-wide swath is required to..."*

**Husky Response:**

Comment noted. Thank you

**Page 3-39, Section 3.4 and subsections:**

- *Page 3-40 lists a number of assumptions about cuttings size distributions…Husky has been drilling in the Jeanne d'Arc basin for some time now and should be able to provide an average particle size distribution from SBM drilling operations.*

**Husky Response:**
Neither Husky nor its drilling contractor records particle size distribution from SBM drilling operations. AMEC used sieve analysis results from modeling of the Hibernia well K-18 (AGAT Laboratories 1993), which is the same information used for the Hibernia, Terra Nova and White Rose cuttings modeling (Hodgins 1993; Hodgins and Hodgins 1998, 2000). Hebron drill cutting models also used these grain size data as inputs (AMEC 2010). These estimates of percentage pebbles, coarse sand, medium sand and fines are the best available source of information.

**C-NLOPB Response**: *Husky could have collected the data but chose not to. Using data from the current White Rose drilling program would have been more representative of the grain size. Husky should remodel using more applicable data.*

**Husky Response:** Husky will design a drill cuttings particle size sampling plan to be executed at the next opportunity. The samples will be analyzed for particle size and those data will be compared to the data used for input into the WREP environmental assessment cutting dispersion model (AMEC 2012). If the particle size data sets are not comparable, the cutting dispersion model(s) will be re-run and the results used to re-assess and adjust the associated environmental assessment predictions, as necessary.

Drill cutting dispersion model predictions will be validated in situ by monitoring the thickness of cutting piles on the seafloor once the White Rose EEM program is revised to accommodate operation of the WREP. This additional EEM monitoring would serve to validate the associated environmental assessment predictions.

***Page 3-40 Drill Cuttings Deposition Section 3.4 & Table 3-36*** *– "These times do not include..."*

**Husky Response:**
Comment noted. Thank you

**Page 3-56, Section 3.6 refers to a "recent study"**

- *(NAS 2002) is not recent even if it is the last iteration from NAS and the most appropriate reference.*

**Husky response:**
Comment noted. Thank you, the word "recent" should be removed.

This is the most recent iteration from NAS. Note that it is not used in the analysis, only for illustrative purposes of the overall sources of petroleum in the environment.

***Page 3-57*** *says "Other sources used, notably Scandpower (2000), and NAS (2002), have not been updated."*

- *The proponent is directed to two studies referenced in the Hebron Comprehensive Study*
  - *Scandpower Risk Management AS. 2006. Blow-out and Well Release Frequencies – based on SINTEF Offshore Blow-out Database, 2006. Report No. 90.005.001/R2*
  - *IAOGP (International Association of Oil & Gas Producers). 2010. Blow-out Frequencies. Report No. 434-2.*

**Husky Response:**
IAOGP (2010) is referenced in this report, and is used as a primary source for data. Scandpower (2000) is not used as a primary source of data so the 2006 update was not included.

**C-NLOPB Response**: This is not an acceptable answer. Scandpower (2000) is used as a primary source of data, as the EA report says on page 3-62, "All three issues are covered thoroughly in Scandpower (2000), and this source is used in the following analysis" and by reference as primary source in Table 3-50, Table 3-52, Table 3-53.

The proponent is directed to Scandpower (2011), *Blowout and well release frequencies based on SINTEF offshore blowout database 2010 (revised). Scandpower report No. 19.101.001-3009/2011/R3*

**Husky Response:** A more recent analysis by Scandpower (2011) does not allow a comparison for each of the operations listed in Table 3-50, but confirms the overall blow-out frequency as $2.37 \times 10^{-5}$ for normal-pressure development wells and $1.47 \times 10^{-4}$ for high-pressure high-temperature (HPHT) wells. These values are consistent with the values used for predictive purposes in the WREP Environmental Assessment.

**Page 3-57** says "*Each drill centre will have 16 wells. Based on this, the total number of wells could range from 48 under the subsea drill centre option and 72 wells under the WHP option. For calculation purposes, the number of wells to be drilled will be assumed to be 60 (average of the range of 48 to 72) and the production well-years assumed to be 300 (60 wells, half of which assumed to be producers, each with a producing life of 10 years).*"

- *It would be more appropriate to calculate separate exposures for each scenario rather than to pool them.*

**Husky Response:**
The mean number of wells was considered a reasonable approach to calculate exposure because of the uncertainty in the number of wells for the WREP. There is a simple linear relationship between the number of wells and spill exposure. An increase in the number of wells from 60 to 72 would increase exposure proportionally, or by 20 percent in this example.

Unfortunately, an error was made in editing and 70 was used as the number of wells when it should have been 60, the average in the possible range. Corrected text is provided in the response to comment "**Page 3-60… the section is inserted below in its entirety**".

***Page 3-57 Hydrocarbon Spill Probabilities Section 3.6*** *– "... using an exposure variable based on the number..."*

**Husky Response:**
Comment noted. Thank you.

***Page 3.58, Table 3-48*** *- It is stated that the Australia spill is under investigation.*

- *This spill investigation has been completed. Spill volume estimate remains "best estimate".*

**Husky Response:**
Comment notes. Thank you

**Page 3-58 to 3-59, Section 3.6.1.1…**

- *If Deloitte (2012) says there are 85,796 development wells to end 2011, why is the frequency of an extremely large blowout calculated as [1/67,703] not [1/85,796]? Please explain or correct.*
- *The same calculation error is repeated for very large spills and should be corrected. In addition the statistic being calculated is actually frequency of "Spills >10,000 bbl Volume" which includes very large and extremely large spills.*

**Husky Response:**
The comment is correct: the number should be 1/85,796, or $1.2 \times 10^{-5}$, and 4/85,796, or $4.7 \times 10^{-5}$, respectively.

**Page 3-59 Blowouts During Production and Workovers Section 3.6.1.2**

- *The frequency of very large spills (including extremely large) should be [8/350,000] or 2.28 x$10^{-5}$ blowouts/well-year.*

**Husky Response:**

The comment seems to assume that the two extremely large spills were not included in the large category, but they were. The correct number for very large spills is 6/350,000, or 1.7 x $10^{-5}$ blowouts per well year.

**Page 3-60** says "*With respect to the WREP, there will be approximately 70 development wells drilled, and an estimated 300 well-years of production" but page 3-57 says "For calculation purposes, the number of wells to be drilled will be assumed to be 60*"

- Make these numbers agree

**Husky Response:**

As noted above, an error was made in editing and 70 was used as the number of wells when it should have been 60, the average in the possible range. Corrected text is provided in the response to the comment that immediately follows (**Page 3-60… the section is inserted below in its entirety**).

***Page 3-60****… the section is inserted below in its entirety:*

*With respect to the WREP, there will be approximately 70 development wells drilled, and an estimated 300 well-years of production. Using the above world-wide spill frequency statistics as a basis for prediction, the spill frequencies estimated for the WREP would be as follows:*

- *Predicted frequency of extremely large hydrocarbon spills from blowouts during a drilling operation, based on an exposure of wells drilled: 70 x 1.5 x $10^{-5}$ = 1.1 x $10^{-3}$, or a 0.11 percent chance over the life of the WREP.*
- *Predicted frequency of very large hydrocarbon spills from drilling blowouts based on an exposure of wells drilled: 70 x 5.9 x $10^{-5}$ = 4.1 x $10^{-3}$ or a 0.41 percent chance over the life of the WREP.*
- *Predicted frequency of extremely large hydrocarbon spills from production/ workover blowouts, based on an exposure of well-years = 300 x 5.7 x $10^{-6}$ = 1.7 x $10^{-3}$ or a 0.17 percent chance over the life of the WREP.*
- *Predicted frequency of very large hydrocarbon spills from production/workover blowouts, based on an exposure of well-years = 300 x 1.4 x $10^{-5}$ = 4.2 x $10^{-3}$ or a 0.42 percent chance over the life of the WREP.*

*The content above is wrong, the following corrections are provided*

*With respect to the WREP, there will be approximately 70 development wells drilled, and an estimated 300 well-years of production. Using the above world-wide spill frequency statistics as a basis for prediction, the spill frequencies estimated for the WREP would be as follows:*

- *The frequency of an extremely large hydrocarbon spill from a blowout during development drilling operations is 1/85,796 = 1.16 x $10^{-5}$ spills/well*
- *The predicted number of extremely large hydrocarbon spills from blowouts during a drilling operation, based on an exposure of wells drilled: 70 wells x1.16x $10^{-5}$ spills/well = 8.2 x $10^{-4}$ spills*
- *The frequency of very large hydrocarbon spills (including the extremely large category) from a blowout during development drilling operations is (4/85,796) = 4.66 x $10^{-5}$ spills/well*
- *The predicted number of very large hydrocarbon spills from blowouts during a drilling operation, based on exposure of wells drilled: 70 wells x 4.66 x $10^{-5}$ spills/well= 3.26 x $10^{-3}$ spills*
- *The frequency of extremely large hydrocarbon spills from production/workover blowouts is 2/350,000 = 5.71 x $10^{-6}$ spills/well-year*
- *The predicted number of extremely large hydrocarbon spills from the WREP based on well-years is calculated as 300 well-year x 5.71 x $10^{-6}$ spills/well-year=1.7 x $10^{-3}$ spills*

- *The frequency of very large hydrocarbon spills (including extremely large) from production/workover blowouts is 8/350,000 = 2.28 x $10^{-5}$ blowouts/well-year*
- *The predicted number of very large hydrocarbon spills (including extremely large) based on an exposure of well-years = 300 well-years x 2.28 x $10^{-5}$ blowouts/well-year = 6.8 x $10^{-3}$ spills*

*The following text is to provide background to comments*
*Of course you can't have 6.8 x $10^{-3}$ spills, which is what makes someone who didn't carry units through their equation think that they've calculated a probability. However, the problem is that the calculation of a probability for such an event is more complex.*

*Having a blow-out is a yes or no event (i.e. you either have one or you don't) and events of this type are typically viewed as being binomially distributed. If you model blow-outs as binomially distributed data using historical frequencies you find that you can use the Binomial Probability Formula to generate probabilities of x number of events occurring (where x has a value from 1 to n, and n is the total number of trials: 70 wells-drilled or 300 well-years as appropriate. If you do that and take the sum of probabilities for potential x (1,2,3,4,5...n) as the "probability of at least one event"; then for low probability events that sum is very close to ( i.e. the same as) the number calculated using the formula used by the proponent, but, as the likelihood of the event increases, the numbers become increasingly different.*

*For example, to model the likelihood of a very large blowout spill during development drilling where the frequency is 4.66x$10^{-5}$ spills/well. The binomial probability of any discrete number of spills* ***k*** *(1 to 70) in* ***n*** *trials (70) can be modeled using the binomial probability function*

$$P = \binom{n}{k} p^k q^{n-k}$$

*Where n = number of trials (wells)*
*k = number of successes (spills)*
*p =probability of success in one trial (spills per well)*
*q =1-p*

| ***k*** | ***P*** |
|---|---|
| *1* | *0.00325153* |
| *2* | 0.00000523 |
| *3* | 0.00000001 |
| *4* | 0.00000000 |
| *Sum* | 0.00325 |

*One can see that the value of P is vanishingly small with larger k (i.e. the probability of 4 [or more] very large spills in 70 wells is very small). The probability of at least one very large spill in 70 wells is the sum of the calculated values ≈ 0.00325.*

*Or you could use* $P_{k\geq 1} = 1 - (1-p)^n$ *to directly calculate a P value for probability that there will be at least one very large spill in n=70 wells. Which, for the example above, yields P =0.00325.*

*The formula used by the proponent to calculate "frequency over the life of the project" is both mathematically incorrect (as it does not preserve units) and will fail to produce a "statistically reasonable" answer for higher frequency events since the calculated probability will be greater than 100 percent.*

**Husky Response:**
The above bullet list provided by the reviewer is correct, however, the following edits are made to reflect 60 wells rather than 70:

With respect to the WREP, there will be approximately ~~70~~ 60 development wells drilled, and an estimated 300 well-years of production. Using the above world-wide spill frequency statistics as a basis for prediction, the spill frequencies estimated for the WREP would be as follows:

- The frequency of an extremely large hydrocarbon spill from a blowout during development drilling operations is 1/85,796 = $1.16 \times 10^{-5}$ spills/well
- The predicted number of extremely large hydrocarbon spills from blowouts during a drilling operation, based on an exposure of wells drilled: ~~70~~ 60 wells x$1.16 \times 10^{-5}$ spills/well = ~~8.2~~ $7.0 \times 10^{-4}$ spills
- The frequency of very large hydrocarbon spills (including the extremely large category) from a blowout during development drilling operations is (4/85,796) = $4.66 \times 10^{-5}$ spills/well
- The predicted number of very large hydrocarbon spills from blowouts during a drilling operation, based on exposure of wells drilled: ~~70~~ 60 wells x $4.66 \times 10^{-5}$ spills/well= ~~3.26~~ $2.8 \times 10^{-3}$ spills
- The frequency of extremely large hydrocarbon spills from production/workover blowouts is 2/350,000 = $5.71 \times 10^{-6}$ spills/well-year
- The predicted number of extremely large hydrocarbon spills from the WREP based on well-years is calculated as 300 well-year x $5.71 \times 10^{-6}$ spills/well-year=1.7 x $10^{-3}$ spills
- The frequency of very large hydrocarbon spills (including extremely large) from production/workover blowouts is 6~~8~~/350,000 = ~~2.28~~ $1.71 \times 10^{-5}$ blowouts/well-year
- The predicted number of very large hydrocarbon spills (including extremely large) based on an exposure of well-years = 300 well-years x ~~2.28~~ $1.71 \times 10^{-5}$ blowouts/well-year = ~~6.8~~ $5.1 \times 10^{-3}$ spills

Indeed, binomial probability could be used as an alternate method to make the calculations, but we believe that the calculation of spill frequency is an acceptable quantification of the risk of blowouts and spills, as required in the WREP Scoping Document (C-NLOPB 2012), and as previously deemed acceptable. We acknowledge there were inconsistencies in the well count used and that there is some confusion in the presentation of results. The probabilities in Table 3-60 have been corrected to reflect re-calculation using the binomial probability proposed by the reviewer. Revised Table 3-60 is provided as Table 10.

**Table 10 Revised Table 3-60 Predicted Probability of Blowouts and Spills for the White Rose Extension Project**

| Event | Historical Frequency | White Rose Exposure [(a)] | Probability over the Project Life |
|---|---|---|---|
| **Blowouts** | | | |
| 1. Deep blowout during development | $4.8 \times 10^{-5}$ / wells drilled | 60 wells drilled | 0.29% |
| 2. Blowout during production involving some hydrocarbon discharge >1 bbl | $2.8 \times 10^{-5}$ / well-years | 300 well-years | 0.83% |
| 3. Development drilling blowout with hydrocarbon spill >10,000 | $4.7 \times 10^{-5}$ / wells drilled | 60 wells drilled | 0.28% |
| 4. Development drilling blowout with hydrocarbon spill >150,000 bbl | $1.2 \times 10^{-5}$ / wells drilled | 60 wells drilled | 0.072% |
| 5. Production / workover blowout with hydrocarbon spill >10,000 | $1.7 \times 10^{-5}$ / well-year | 300 well-years | 0.51% |
| 6. Production / workover blowout with hydrocarbons pill >150,000 | $5.7 \times 10^{-6}$ / well-year | 300 well-years | 0.17% |
| **Platform Spills (b) (including blowouts)** | | | |
| 7. Hydrocarbon spill >10,000 bbl | $5.5 \times 10^{-6}$ / well-year | 300 well-years | 0.17% |
| 8. Hydrocarbon spill >1,000 bbl | $1.5 \times 10^{-5}$ / well-year | 300 well-years | 0.45% |
| 9. Hydrocarbon spill 50 to 999 bbl | $4.8 \times 10^{-4}$ / well-year | 300 well-years | 13% |
| 10. Hydrocarbon spill 1 to 49 bbl | $1.2 \times 10^{-2}$ / well-year | 300 well-years | 3.6 spills over the life of the Project |
| 11. Hydrocarbon spill 1 L to 1 bbl (159 L) | 0.23/well-year | 300 well-years | 69 spills over the life of the Project |
| 12. Hydrocarbon spill less than 1 L | 0.46/well-year | 300 well-years | 140 spills over the life of the Project |

(A) White Rose Exposure is the number of events over the life of the Project. This is either defined as number of well-years for production-related activities, or number of wells drilled for drilling-related activities.
(B) Platform spills greater than 150,000 bbl are not included on the table as it would simply duplicate the statistic for blowouts greater than 150,000 bbl.
(C) Probabilities estimated using binomial probability

**Page 3-62** says "*The probabilities of the various blowout categories are shown in Table 3-50, abstracted from Scandpower (2000).*"

- *This table actually contains the incident counts for various blowout categories and should be labeled as such.*

### Husky Response:
Comment noted. Thank you.

**Page 3-64, table 3-53**

- *Note that the blowout frequency has the units "Blowout per Well-year"*

### Husky Response:
Comment noted. Thank you.

**C-NLOPB Response**: *In the previous round of comments the binomial probability approach and the simpler use of the formula was posited to calculate the probabilities of spills, not as an alternative method but as the correct method. As previously stated, for low probability events the practice of multiplying historical frequency by exposure calculates the predicted number of occurrences, which approximates, numerically, the likelihood of occurrence over the project life but which is mathematically and statistically insupportable as a calculation of probability.*

*For additional clarity, the last column of table 3-60 as calculated in the original report did not contain the probability of occurrence of a spill but the most likely number of spills over the life of the project, as becomes evident in lines 10, 11 and 12 of that table. I have revisited the table again with appropriate edits and notes below.*

| *No.* | *Event* | *Historical Frequency* | *White Rose Exposure* | *Most Probable Number of Events (n) over project life (1)* | *Likelihood of Occurrence over project Life (2) (i.e., n≥1)* |
|---|---|---|---|---|---|
| ***Blowouts*** | | | | | |
| *1* | *Deep blowout during development* | *4.8 x $10^{-5}$ / wells drilled* | *60 wells drilled* | *0.0029* | *0.0029* |
| *2* | *Blowout during production involving some hydrocarbon discharge >1 bbl* | *2.8 X $10^{-5}$ / well-years* | *300 well-years* | *0.0084* | *0.0084* |
| *3* | *Development drilling blowout with hydrocarbon spill >10,000* | *4.7 x $10^{-5}$ / wells drilled* | *60 wells drilled* | *0.0028* | *0.0028* |
| *4* | *Development drilling blowout with hydrocarbon spill >150,000 bbl* | *1.2 x $10^{-5}$ / wells drilled* | *60 wells drilled* | *0.00072* | *0.00072* |
| *5* | *Production / workover blowout with hydrocarbon spill >10,000* | *1.7 x $10^{-5}$ / well-year* | *300 well-years* | *0.0051* | *0.0051* |
| *6* | *Production / workover blowout with hydrocarbons pill >150,000* | *5.7 x $10^{-6}$ / well-year* | *300 well-years* | *0.0017* | *0.0017* |
| ***Platform Spills (b) (including blowouts)*** | | | | | |
| *7* | *Hydrocarbon spill >10,000 bbl* | *5.5 x $10^{-6}$ / well-year* | *300 well-years* | *0.0017* | *0.0017* |
| *8* | *Hydrocarbon spill >1,000 bbl* | *1.5 x $10^{-5}$ / well-year* | *300 well-years* | *0.0045* | *0.0045* |
| *9* | *Hydrocarbon spill 50 to 999 bbl* | *4.8 x $10^{-4}$ / well-year* | *300 well-years* | *0.14* | *0.13* |
| *10* | *Hydrocarbon spill 1 to 49 bbl* | *1.2 x $10^{-2}$ / well-year* | *300 well-years* | *3.6* | *0.97* |
| *11* | *Hydrocarbon spill 1 L to 1 bbl (159 L)* | *0.23/well-year* | *300 well-years* | *69* | *1* |
| *12* | *Hydrocarbon spill less than 1 L* | *0.46/well-year* | *300 well-years* | *138* | *1* |

*Notes:*
*(1) Calculated as (Historical Frequency) x (Exposure) = Most Probable Number of Events.*
*(2) Calculated as $P_{k\geq 1} = 1 - (1 - p)^n$, the probability of at least one event.*
*(3) The reader should note that the frequency presented for platform spills >10,000 bbl (i.e., 5.5 x $10^{-6}$ spills/well-year) is almost four times smaller than the frequency for production blowout spills >10,000 bbl (i.e., 1.7 x $10^{-5}$). This is a practical impossibility because the platform spills include the blowout spills. However, the data for platform spills >10,000 bbl is from the US record, which includes only oil wells and not gas wells. The source of the production blowouts was the world-wide record, which includes events that would not be counted in the US record.*

*Additionally, the reader should note that for scenarios where the probability of an event is higher and the predicted most probable number of events is greater than 1, the calculated number of events represents the central position of a spill probability distribution. Based on an assessment of the cumulative distribution of probabilities, the 95% confidence interval around that central position for spills between 1 litre and 159 litres is between 54 and 83 events over the life of the WHP. For spills of 1 litre or less the 95% confidence interval is 121 to 154 spill events.*

**Husky Response:** Thank you for the clarification.

***Page 3-64 Section 3.6.2.3*** *says "There are an estimated 70 wells to be drilled for the WREP, so the calculated number of deep blowouts during development drilling becomes 70 [wells] x 4.8 x $10^{-5}$ [blowouts/well]= 3.4 x $10^{-3}$[blowouts]'*

- *Insert "using the deep-blowout frequency from OGP (2010)" and the units as indicated above*

*It then says "For gas blowouts occurring during production and workovers, the statistic for the WREP becomes 300 well-years x 1.17 x $10^{-4}$ blowouts/well-year, or approximately 3.5 percent probability over the 20-year life of the WREP.*

- *The quantity calculated is the number of events predicted. However, it is very close to the "probability of at least one spill" which may be calculated in the manner described in the note above as 0.0345*

*It also says "For gas blowouts that occur during production and workovers that involve some hydrocarbon discharge (>1 bbl), the statistic for White Rose becomes 300 well-years x 2.8 x $10^{-5}$ blowouts/well-year, or approximately 0.84 percent probability over the 20-year life of the WREP.*

- *The quantity calculated is the number of events predicted. However, it is very close to the "probability of at least one spill" which may be calculated in the manner described in the note above 0.0084.*

**Husky Response:**
Comment noted, thank you. This should be restated as "number of events predicted" rather than probability. As noted in the comments, for low frequency events, the results are identical to the two significant digits presented in the report. The probabilities in revised Table 3-60 (Table 10) have been corrected to reflect re-calculation using binomial probability proposed by the reviewer.

***Page 3-65 Section 3.6.3*** *says" The number of production well-years for WREP is 300; therefore, the probability over the WREP period would be 4.5 x $10^{-3}$ for a 1,000 bbl spill and 1.7 x $10^{-3}$ for a 10,000 bbl spill."*

- *These are the "probability of at least one spill" of the given size*

**Husky Response:**
Comment noted. Thank you

**Page 3-68, Table 3.6.6**

- *The proponent should review the contents of the table in relation to the notes above*
- *If "Platform Spills" includes blowouts the probability for platform spill >10,000 bbl should be larger than the probability of a production/workover blowout > 10,000 bbl. Please review the contents of the "Probability over the WREP Life" column.*

**Husky Response:**
Revised Table 3-60 is provided as Table 10. This anomaly was noted in the text.

***Page 3-68****, says "Over the 20-year life of the WREP, the probability of having a large or very large spill as a result of an accident on a platform is 0.5 and 0.2, respectively. This is calculated on the basis of US OCS experience."*

- *Is the word "percent" missing?*

**Husky Response:**
Comment noted. Thank you. The word "percent" is missing.

**Page 3-78 Subsea (seafloor) Blow-out Spill Section 3.8.2.1– Figure 3-47 and Figure 3-48** *– these figures need to be redrawn to fit the results of the oil spill trajectory model results. The author has erroneously placed the results of the oil spill model into a fixed diagram. This error is also present in the supporting oil spill trajectory model document. The author is advised to redraw any other figures that have the oil spill modelling results truncated by the fixed diagram.*

**Husky Response:**
The southern and eastern extents of the oil spill trajectory study area were defined by the extent of the water current data available from DFO, which are the best available water current data for the WREP. Since the water current data were not available to the east or south of this area, we could not model the movement of oil beyond these boundaries. The spill trajectories have been run for maximum duration of 120 days, which is the estimated time required to drill a relief well. As we demonstrate below, the 120 day trajectory predictions are conservative and if durations reflective of estimated spill surface slick persistence were presented, then all trajectories would terminate prior to the outer bounds of the figures provided.

From page 3-89 of the WREP environmental assessment:

> "It cannot be stressed enough that our confidence in accurately modelling the fate of crude oil on the open ocean past a few weeks is not high. Very little data has ever been collected on the long-term fate of different oil types in the offshore (past even one-week of exposure). A study completed for the US Minerals Management Service reviewed the worldwide data on the persistence of crude oil spills on open water (SL Ross et al. 2003). The study found that the persistence of large spills (>1,000 barrels) was predicted best with the following equation:
> PD= 0.0001S-1.32T+33.1
>
> Where: PD= spill persistence in days
> S= spill size in barrels
> T = Water temperature in degrees Celsius
>
> If the single day's release of oil is considered as a unique slick with a volume of 40,500 barrels then its long term persistence would be approximately 34 days in the winter and approximately 20 days in the summer. These estimated surface slick persistence values (based on the equation above) are somewhat shorter than those predicted in the detailed spill modelling prepared for this report and are presented only to provide additional insight into the possible survival time of surface slicks based on historical records."

## 5.5 Chapter 4 Socio-economic, Terrestrial and Physical Environment Setting

***Page 4-213 Sea Ice Floe Size Section 4.3.4.1*** *– the author has identified "melting" as a reason why floe sizes are smaller south of 49°N. What about warmer air? Also, why is it necessary to include "higher water temperatures" when you have stated "melting", which implies higher temperatures, overall? Please clarify.*

**Husky Response:**
Comment noted. The points explaining the reasons for floe sizes being smaller south of 49° North should read:

- Fracturing
- Warmer air
- Warmer water temperatures
- Sea states.

**Page 4-262, Figure 4-159**

- *The chart should include a note as to why (0) is set at the sea-level elevation corresponding to year 1990.*

**Husky Response:**
All series are set to have the same average value over 1960 to 1990 and the reconstructions are set to zero in 1990.

## 5.6 Chapter 5 Effects Assessment Method

**Page 5-2, Section 5.2**

- *Temporal scope is not discussed and needs to be included. The time of year for activities should be included.*

**Husky Response:**
Section 5.3.2.2 Temporal Boundaries, refers the reader to Chapter 2, which provides a description of the activities that will occur during each phase of the WREP. The text in Chapter 2 along with Figures 2-1 and 2-2 provide the time of year and duration for each activity.

**Page 5-12, Section 5.3.2.2 Temporal Boundaries, and**
**Page 7-6, Table 7-2**
**Page 8-2, Table 8-1**
**Page 9-5, Table 9-1**
**Page 10-2, Table 10-1**

- *The temporal boundaries of the WHP and subsea option are not consistent with the temporal boundaries for the original White Rose Project, including the operation of the SeaRose FPSO.*

**Husky Response:**
The original White Rose Environmental Assessment (Husky Energy 2001) contemplated three to four subsea drill centres being constructed within the White Rose field. Three drill centres (Centre, Southern and Northern), were constructed prior to an assessment of five additional drill centres in the Husky White Rose Development Project: New Drill Centre Construction and Operations Program Environmental Assessment - EA Addendum (LGL 2007). To date, only the North Amethyst and South White Rose Extension drill centres have been constructed of the five assessed during the period from 2007 to 2015.

The current WREP Environmental Assessment re-assessed the effects of construction and operation of up to three drill centres during the life of the project. The productive life of the subsea infrastructure is estimated at 20 years, the productive life of the WHP is estimated at 25 years. The potential environmental effects of the operation of the *SeaRose FPSO* have not been assessed past 2020, the original projected life of the White Rose field.

Husky Energy will complete environmental assessments as required to review potential effects and mitigation opportunities prior to the expiry of current approvals.

***C-NLOPB Response**: This response is generally acceptable. We note that the current "Approvals" include the DPA, which doesn't expire per say, but which will be made inactive by expiry of the original project EA temporal scope. The C-NLOPB won't be able to issue any "Authorizations" beyond 2020 until that issue is resolved.*

**Husky Response:** Noted. Thank you.

***Page 5-23 Step 7 – Cumulative Environmental Effects Section 5.3.7, Table 5-3*** *– The information presented in this table is out of date. Please revise.*

**Husky Response:**
See Table 11 (Revised Table 5-3) with new text in underline.

**Table 11 Revised Table 5-3 Past, Present and Likely Future Projects and Activities in the Nearshore Area Considered in the Environmental Assessment**

| Project / Activity Name | Project/Activity Description |
|---|---|
| Marine Transportation and Vessel Traffic | Marine transportation in Placentia Bay is predominantly comprised of fishing vessels and tanker/nickel plant traffic and other vessels both commercial and recreational. Tanker traffic associated with the oil and gas industry traverse Placentia Bay to the North Atlantic Refining Limited refinery and Newfoundland Transshipment Limited terminal. Ore carriers will also traverse Placentia Bay to the Vale nickel processing plant in Long Harbour. |
| Commercial Fisheries | Commercial fishing is an activity in Placentia Bay. Commercial fisheries include snow crab, cod, lobster and lumpfish roe. A more detailed description of commercial fisheries is outlined in Chapter 9 of this environmental assessment |

## 5.7 Chapter 8 Fish and Fish Habitat

**Page 8-42 Summary of Potential Environmental Effects Section 8.4.4 – Table 8-5** – if the *"x" is to indicate interaction, what does the "+" mean?*

**Husky Response:**
"+" means a positive interaction

**Page 8-48 Concrete Graving Structure Construction and Installation *Sedimentation* – Section 8.5.1.2** – "*...(Van Dalfsen et. al. 2000), while other species such..."*

**Husky Response:**
Comment noted. Thank you.

**Page 8-64 Production/Operation and Maintenance - Table 8-8 – Section 8.5.2.2** – *Explain how the potential mortality of fish in the Safety Zone is a positive effect?*

**Husky Response:**
A Safety Zone prohibits fishing, thus reducing the mortality of fish.

**Page 8-66 Production/Operation and Maintenance – O*perational Discharges* – Section 8.5.2.2** – *there is no such thing as OWTG Regulations. The OWTG are Guidelines, the Drilling and Production Regulations are Regulations*.

**Husky Response:**
Comment noted. Thank you.

**Page 8-68 Production/Operation and Maintenance – O*perational Discharges* – Section 8.5.2.2** – "*...and/or discharging SBM and WBMs..."*

**Husky Response:**
Comment noted. Thank you.

## 5.8 Chapter 9 Fisheries

**9 Page 9-44 Study Area Value of Harvest by Year, All Species, 2005 to 2010 Figure 9-25** – *Upon analysis of the Study Area and the affected NAFO zones, these two areas do not overlap in a symmetrical way so how can the author extrapolate anything, let alone dollar value of harvest, based on this approach? Explain your methodology of attaining dollar value for harvested species when the Study Area overlaps sections of NAFO zones.*

**Husky Response:**
As the sub-caption for this Figure notes, the source of the data used is "DFO Geo-referenced Catch and Effort Data 2005 to 2010", not NAFO data. The methodology for establishing the data used for the offshore is explained in detail in Section 9.3.1, pages 9-5 to 9.7. Catch and effort data were obtained from DFO and are geo-referenced records of the quantity and value of any species harvested at a particular longitude and latitude (by degree and minute) located within the Study Area (or Project Area). Thus, the dollar value (or the total weight in tonnes) of all species harvested within the Study Area is calculated (using a GIS) by summing the value of all the individual catch records that fall inside the boundaries of the Study Area. The data coordinates are those recorded in the vessel's fishing log and in the DFO database by degree and minute of latitude and longitude: thus the position is accurate within approximately 925 m (0.5 nm) of the reported coordinates.

**Figure 9-26 Project Area Quantity of Harvest by Year, All Species (Snow Crab), 2005 to 2010** – *is this all species, all species of crab or just Snow Crab?*

**Husky Response:**
Within the Offshore Project Area, the harvest has been exclusively for snow crab since 2005. In the title text for Figure 9-26, the bracketed words (Snow Crab) after "All Species" were included to alert the reader to this fact, but should have also been included in the text.

**Figure 9-27 Project Area Value of Harvest by Year, All Species (Snow Crab), 2005 to 2010** – *Again, is this all species, all species of crab or just Snow Crab? Also, was the value of the harvest for 2007, 2009 and 2010 below $100,000 each year? This seems low, clarify.*

**Husky Response:**
Again, in the title text for Figure 9-27 indicates Snow Crab after "All Species", but should have also been included in the text. With respect to the value of the harvest in the Project Area in recent years, and as noted on page 9-45, the DFO data show that "harvesting within the Offshore Project Area has been irregular, with no catch recorded there in three of the five years shown, and only relatively small quantities during 2009 and 2010." As Figure 9-55, page 9-75, illustrates, the Offshore Project Area is situated outside the main snow crab fishing grounds.

***General comment*** – *The Project and Study Areas are not symmetrical with NAFO Zones, therefore, how can the author determine the Quantity of Harvest or the Value of Harvests?*

**Husky Response:**
See response above regarding comment Page 9-44 Study Area Value of Harvest by Year, All Species, 2005 to 2010 Figure 9-25

***9.4.1.1 Graving Dock and Concrete Gravity Structure Construction*** *– the proponent appears to be assuming first rights to traditional and commercial fishing grounds. The proponent is reminded to work constructively with other users of the marine environment. Also, the author has written that "Fishing gear set to close to planned dredging operations..." This may be incorrect because if fishing gear is already in the water before dredging operations commence then the proponent will have to work constructively with fish harvesters to remove fishing gear with the use of an approved compensation plan.*

**Husky Response:**
As explained in Section 9.5.1.2 (page 9-94), prior to the start of marine activities, Husky will establish a Fisheries Liaison Committee (FLC) to ensure good working relations and cooperation between the WREP, fishers and fisheries harvesting activities during the life of the Project. The Proponent will also be an active member of the Placentia Bay Traffic Committee (PBTC) and, though its participation in this Committee, will work constructively with all users of the marine environment in the Bay.

**9.5.1.2 Concrete Gravity Structure Tow-out and mating at the Deep-water Site – Access to Fishing Grounds – page 9-92** – "*Dredging vessel(s) will need a 500 m safety zone,..."*

*..."there will also need to be a temporary..."*

**Husky Response:**
Comment Noted. Thank you

***General comment*** *– this type of presumptive language continues up to, and including page 9-98. Please revisit this and rewrite to remove presumptive language.*

**Husky Response:**
Presumptive language was not the intent of the Fisheries chapter, rather the need for safety zones will be assessed in consultation with stakeholders, authorities and Transport Canada.

## 5.9 Chapter 10 Marine Birds

**10.3.3 Data Sources and Survey Effort for Marine Birds in the Study Areas** – *the author has used the word "Tasker" in a number of places. The reviewer is assuming that the intention was to use the word "Tanker", clarify.*

**Husky Response:**
Tasker survey is the correct terminology. A Tasker survey is a standardized method for counting seabirds at sea developed by Tasker et al. (1984). For counting seabirds from a moving vessel, a transect 300 m in width is used so that their density can be calculated. All birds on the surface within this transect are identified to species and age and counted. Because flying birds pass through this transect more quickly than birds on the surface, counting all flying birds in the transect would result in an overestimation of their density. To avoid this bias, flying birds within the transect are identified and counted in a series of instantaneous counts ("snapshots") performed at 300 m intervals as the vessel moves along the transect. The Eastern Canadian Seabirds at Sea program and more recent industry programs used the Tasker method, modified by the incorporation of a technique called distance sampling (Fifield et al. 2009; Gjerdrum et al. 2012).

References:
Fifield, D.A., K.P. Lewis, C. Gjerdrum, G.J. Robertson and R. Wells. 2009. Offshore seabird monitoring program. *Environmental Studies Research Funds Report*, 183: 68 pp.

Gjerdrum, C., D.A. Fifield, and S.I. Wilhelm. 2012. Eastern Canada Seabirds at Sea (ECSAS) standardized protocol for pelagic seabird surveys from moving and stationary platforms. *Canadian Wildlife Service Atlantic Region Technical Report Series*, 515: vi + 36 pp.

Tasker, M. L., P. H. Jones, T. Dixon, and B. F. Blake. 1984. Counting seabirds at sea from ships: A review of methods employed and a suggestion for a standardized approach. *Auk*, 101:567-577.

**10.3.6.8 Alcidae (Murres, Razorbill, Puffins, Guillemots and Dovekie) page 10-27** Alcids either eat fish or feed on fish, they do not feed on eat fish.

**Husky Response:**
Comment noted. Thank you

**Page 10-38 Operation and Maintenance Section 10.4.2.2** - *says "Cooling water will be chlorinated and discharged overboard at an approximate temperature of 30°C, with a residual chlorine level <0.5 ppm."*

- *This is not consistent with current chlorine residual on the SeaRose FPSO and conflicts with Table 2-4 on page 2-9 of the Environmental Assessment.*

**Husky Response:**
Comment noted. Thank you. The discharge of cooling water associated with the WREP will be consistent with the *SeaRose FPSO* at chlorine residual concentration of 1.0 ppm, as stated in Table 2-4.

## 5.10 Chapter 11 Marine Mammals and Sea Turtles

**Table 11-1 Temporal Boundaries of Nearshore and Offshore Study Areas** - *... decommissioned and abandoned in accordance with standard practices, as approved by the C-NLOPB, at the end..."*

**Husky Response:**
Comment noted. Thank you

**11.3.1 Marine Mammal Monitoring in the Jeanne d'Arc and Orphan Basins in the Past Decade** – *There have been more recent surveys, see http://www.cnlopb.nl.ca/exp_stat.shtml for recent executed geophysical activity and incorporate the results of the respective marine mammal monitoring programs.*

**Husky Response:**
Reports for other more recent monitoring programs are not publically available and are not posted on the C-NLOPB website. Only monitoring reports that were publically available were used in the summary. The data that were presented provide an accurate summary of the types of marine mammals that could occur in the area.

**11.3.1.3 Fisheries and Oceans Canada Cetacean Sighting Database page 11-11** – *the personal communication with J. Lawson is somewhat dated. When wad the last time the author communicated with DFO on the cetacean sighting database?*

**Husky Response:**
LGL communicated with Jack Lawson at DFO in February 2013 regarding the cetacean sightings database. It is their understanding that there have been no updates to the sightings database since 2009, and records within the database for the study areas still cover 1945 to 2007.

**11.4.1.1 Graving Dock Construction – Effects of Pile Driving – page 11-35** – *this section/paragraph requires explanation or support from analysis of actual data or peer-reviewed research. The author simply cannot make statements that downplay the effects without scientific support or is this a non-qualitative assumption? Explain.*

**Husky Response:**
Few studies compare underwater received levels between on-land and in-water pile driving. In one study at the Stockton Regional Wastewater Control Facility in California, in-water received rms SPLs from on-land impact pile driving operations were 4 and 12 dB lower than from in-water pile driving at 10 and 12 m from the pile, respectively (Illingworth & Rodkin, Inc. 2006, 2007). The pile is assumed to have been less than 10 m inland from the shoreline; however, the exact distance is unknown.

In another study, Jenkerson et al. (2012) present measured underwater rms SPLs less than 135 dB re 1 µPa at 2 km from impact pile driving operation approximately 800 m from the shoreline, at the Odoptu-North construction site on Sakhalin Island, Russia.
The results of Illingworth & Rodkin, Inc. (2006, 2007) suggest that in-water rms SPLs from the WREP on-land pile driving operations may be 12 dB less or lower than from similar in-water operations. Results from Jenkerson et al. (2012) suggest that levels may be well below injury criteria (based on Southall et al. 2007) at short distance from the shoreline.

There is little risk for hearing impairment to marine mammals and sea turtles during pile driving activities, given that sound levels typically recorded during pile driving activities do not exceed 180 dB re 1 µPa (rms) beyond several hundred metres from the source. JASCO (2010) acoustic modelling for the Hebron Project estimated that 180 dB re 1 µPa (rms) levels would extend to 260 m and 150 m from two locations in Trinity Bay. Sound levels of 190 dB re 1 µPa (rms) occurred at 60 and 20 m from these locations. 180 and 190 dB re 1 µPa (rms) sound levels are commonly used to assess physiological effects on marine mammals. Thus, available information suggests that there is little risk for hearing impairment to marine mammals or sea turtles beyond 300 m from pile driving in water. There would be even less risk of hearing impairment during the WREP pre-construction and installation phase, as pile driving would occur onshore, if required (JASCO, pers. comm.).

References:
Illingworth & Rodkin, Inc. 2006. *Results of Underwater Sound Measurements for the Construction of Utility Crossing at Stockton Regional Wastewater Control Facility*. Report to CH2M Hill dated April 17.

Illingworth and Rodkin, Inc. 2007. *Compendium of Pile Driving Sound Data (Appendix I)*. Prepared for The California Department of Transportation. 129 pp. Available at: http://www.dot.ca.gov/hq/env/bio/files/pile_driving_snd_comp9_27_07.pdf

JASCO Applied Sciences. 2010. *Hebron Project: Modelling of underwater noise at the Bull Arm Construction Site*. Prepared for Stantec Consulting Ltd. 32 pp.

Jenkerson, M.R., S. Rutenko, J.M. Dupont, H.R. Melton and D.E. Egging. 2012. Sound levels associated with pile installation in waters offshore from Piltun Bay, Northeast Sakhalin Island. *International Whaling Commission Scientific Committee Document*, SC/63/BRG4: 16 pp. Available at: http://iwc.int/index.php?cID=499&cType=document&download=1

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R.G. Jr., D. Kastak and D.R. Ketten. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. *Aquatic Mammals*, 33:411-521.

**11.5.1.1 Graving Dock Construction – *Pile Driving* – page 11-64** – *provide evidence to support "it is very unlikely that on-land pile driving..." See comment **11.4.1.1 Graving Dock Construction – Effects of Pile Driving – page 11-35** above.*

**Husky Response:**
Please see response to comment 11.4.1.1 Graving Dock Construction – Effects of Pile Driving – page 11-35.

**11.5.1.2 Concrete Gravity Structure Construction and Installation – Change in Habitat Quality – page 11-65** *– the author's concluding statement that effects are negligible does not coincide with the "Medium" effects in Table 11-10. Rewrite this conclusion to better reflect the actual magnitude of effect.*

**Husky Response:**
It was concluded that increased turbidity associated with dredging would have negligible effects on marine mammals and sea turtles. However, increased noise from dredging activities could have medium-magnitude effects on habitat quality, which in turn may affect marine mammals and sea turtles if they avoid the area where dredging is proposed to occur. The "Medium" rating in Table 11-10 reflects the most conservative rating for this activity.

**11.5.1.2 Concrete Gravity Structure Construction and Installation – Change in Habitat Quality – Dredging - page 11-66** – *change the "negative effects language" to coincide with the medium magnitude effect in Table 11-10.*

**Husky Response:**
In nearshore shallow water regions, dredges can be strong sources of low frequency underwater noise; underwater sound produced by dredging may be detectable at ranges up to 25 km (Richardson et al. 1995; JASCO 2012). Thus, noise from dredging may have medium-magnitude effects on the habitat quality, which in turn may affect marine mammals and sea turtles if they avoid the area where dredging is proposed to occur. Sound levels of 160 dB re 1 µPa (rms) occur within 248 m (R95%) of the dredging site, depending on dredge type and season (JASCO 2012). Thus, marine mammals and sea turtles may show behavioural changes from dredging activities within at least 248 m of the dredging site.

References:
JASCO Applied Sciences. 2012. *Underwater Sound Propagation Assessment for the Environmental Assessment of the White Rose Extension Project*. Report P001162-001 by JASCO Applied Sciences, Dartmouth, NS, for Stantec Consulting Ltd., St. John's, NL.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme and D.H. Thomson. 1995. *Marine Mammals and Noise*. Academic Press, San Diego, CA. 576 pp.

**11.5.1.3 Accidental Effects in the Nearshore – Change in Habitat Quantity – page 11-71** *"... in habitat quality, because of an accidental hydrocarbon spill, may directly reduce..." An accidental spill does not have an indirect effect on habitat, it is a direct effect of an accidental event.*

**Husky Response:**
Comment noted. Thank you.

**11.5.2.2 Production/Operations and Maintenance – Change in Habitat Quality – *Other Activities* – page 11-80** *– it is not necessary to write out the reference to the OWTG (NEB et al. 2010) after it has been repeatedly abbreviated.*

**Husky Response:**
Comment noted. Thank you

## 5.11 Chapter 13 Sensitive Areas

**13.0 Sensitive Areas – page 13-1** – *"... stakeholder and regulatory requirements about the..."*

**Husky Response:**
Comment noted. Thank you.

**Figure 13-2 – Sensitive Areas Identified Within or Near to the Offshore Study Area** – *the Placentia Bay/Grand Banks LOMA does not have a land component, redraw the Figure with this correction.*

**Husky Response:**
Please see Figure 20 (revised Figure 13-2), indicating the boundary of the PBGB-LOMA.

**Page 13-10 Eelgrass Beds –** *remove the very first sentence in this section as it is not necessary. The third sentence is referenced and is better placed after the second sentence, which introduces the idea of eelgrass beds.*

**Husky Response:**
Comment noted. Thank you.

## 5.12 Chapter 16 Environmental Management

**Page 16-4, Section 16.4**

- *Should include a reference to the Environmental Protection Plan Guidelines (National Energy Board, et al. 2011) to be consistent with other similar sections.*

**Husky Response:**
Comment noted. Thank you.

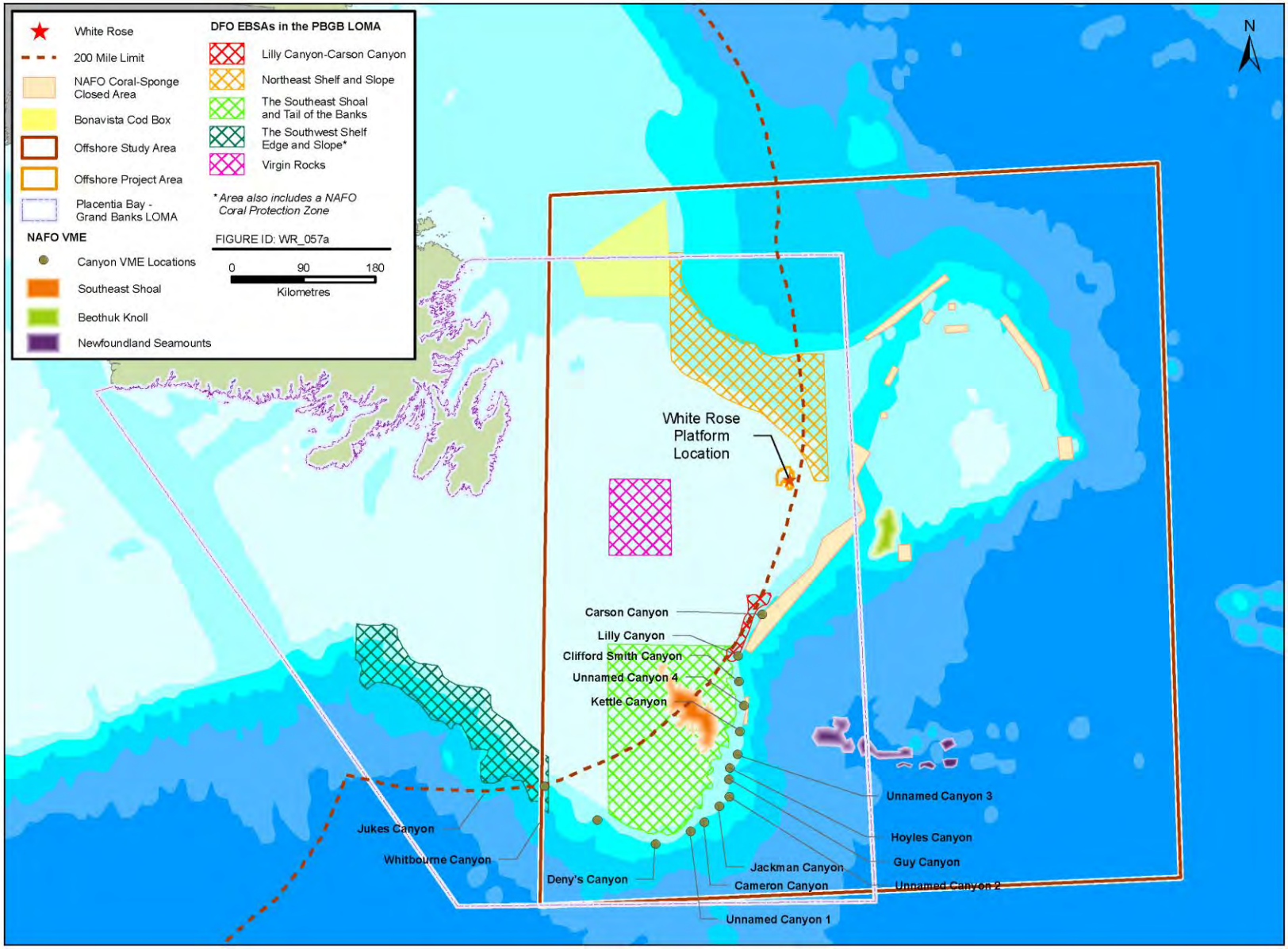



**Figure 20 Revised Figure 13-2 Offshore Sensitive Areas**

**Page 16-22, Section 16.13.2**

- *Husky has not indicated how they avail of the GRN.*

**Husky Response:**
The mission of the GRN is to maximize the knowledge, expertise, and preparedness that each spill response organization has individually, and share such information with other GRN members for the purposes of enabling each organization to provide a better response to their respective members or customers. The GRN does not, as a coalition, provide direct spill response resources such as equipment or personnel to a spilling entity.

Husky has agreements for personnel and equipment support with both ECRC and OSRL who are members of the GRN. In the event of a spill requiring Tier 3 support, beyond the combined capability of Husky, OSRL and ECRC, Husky would establish contracts with other agencies / response organizations that have equipment and personnel suitable for response in the operating area.

## 5.13 Chapter 17 Summary and Conclusions

**Page 17-1 Summary and Conclusions Section 17.0 –** "*All production from the potential future drill centres will be processed through the SeaRose FPSO currently operating at White Rose. The effects of production have been previously assessed (Husky Oil 2000; LGL 2007a), and are not addressed in this document*." *Again, the temporal scope for the previous EAs for operation of the SeaRose FPSO will have to be considered in relation to the temporal scope for the operation of this proposed project.*

**Husky Response:**
The original White Rose Environmental Assessment (Husky Energy 2001) contemplated three to four subsea drill centres being constructed within the White Rose field. Three drill centres (Centre, Southern and Northern), were constructed prior to an assessment of five additional drill centres in the Husky White Rose Development Project: New Drill Centre Construction and Operations Program Environmental Assessment - EA Addendum (LGL 2007). To date, only the North Amethyst and South White Rose Extension drill centres have been constructed of the five assessed during the period from 2007 to 2015.

The current WREP Environmental Assessment re-assessed the effects of construction and operation of up to three drill centres during the life of the project. The productive life of the subsea infrastructure is estimated at 20 years, the productive life of the WHP is estimated at 25 years. The potential environmental effects of the operation of the *SeaRose FPSO* have not been assessed past 2020, the original projected life of the White Rose field.

Husky will complete environmental assessments as required to review potential effects and mitigation opportunities prior to the expiry of current approvals.

**Page 17-2 Results of White Rose Extension Project Modelling Section 17.2.1 –** *See specific comments on Supporting Document below.*

**Husky Response:**
Responses to specific comments are provided in Sections 6 and 7.

**Page 17-4 Air Quality Section 17.2.2 –** *See specific comments on Supporting Document below.*

**Husky Response:**
Responses to specific comments are provided in Section 8.

## Canada-Newfoundland and Labrador Offshore Petroleum Board
## SUPPORTING DOCUMENT COMMENTS

# 6.0 Drill Cuttings and WBM Operational Release Modelling (AMEC June 2012)

## 6.1 General Comments

*G1 Throughout the document it is stated that the release of mud and cuttings will be in accordance with the Offshore Waste Treatment Guidelines (OWTG). The OWTG outline: " …the goals, objectives and requirements of the applicable acts and regulations, and to explain the expectations of the Boards regarding the management of waste material …". For an operator, the governing document with respect to management of discharges to the natural environment is the Environmental Protection Plan (EPP) submitted as part of the authorization application (OWTG page 2). The document should describe the discharge of cuttings and mud expected for the project (e.g. mud types, discharge locations, oil on cuttings).*

**Husky Response:**
A description of expected mud and cuttings volume and release locations are provided on the tables 2-2 and 2-3 of the Drill Cuttings and WBM Operational Release Modelling (AMEC 2012). The discharge of mud and cuttings and their limits for the WREP will be described in the WREP Environmental Protection Compliance and Monitoring Plan and submitted as part of the authorization application.

***C-NLOPB Response**: The tables do not show any release of SBM, leaving the assumption that there will be no release of SBM even if a MODU is used. If there is to be SBM released from a MODU then a response to this comment is still required.*

**Husky Response:** Tables 2-2 and 2-3 of the Drill Cuttings and WBM Operational Release Modelling report (AMEC 2012) estimate the volume of SBMs cuttings and mud released for both the WHP and subsea development option for the WREP, as highlighted below in Tables 12 and 13.

**Table 12 Revised Drill Cuttings Modelling Report Table 2-2 Drill Cuttings Volumes and Release Locations**

| Well Hole Section | WHP | | Subsea Drill Centre | |
|---|---|---|---|---|
| | Volume ($m^3$) | Release Location | Volume ($m^3$) | Release Location |
| Conductor | 107 | shale chute (A) | 79 | seafloor (B) |
| Surface | 188 | shale chute (A) | 188 | seafloor (B) |
| Intermediate | -- | treat and inject | 192 | sea surface (C) |
| Main | -- | treat and inject | 77 | sea surface (C) |

Notes:
(A) Elevation of chute exit from WHP estimated at 20 m above seafloor: to be confirmed during WHP design
(B) WBM cuttings for top two sections estimated release at 10 m above seafloor
(C) SBM cuttings treated prior to release. Estimated release at 20 m below sea surface
Source: J. Swain pers. comm.

**Table 13 Revised Drill Cuttings Modelling Report Table 2-3 Drill Mud Volumes and Release Locations**

| Well Hole Section | WHP | | Subsea Drill Centre | |
|---|---|---|---|---|
| | Volume ($m^3$) | Release Location | Volume ($m^3$) | Release Location |
| Conductor | 214 WBM | shale chute (A) | 158 WBM | seafloor |
| Surface | 470 WBM | shale chute (A) | 440 WBM | seafloor |
| Intermediate | -- | SBM returned to surface: treated and re-injected | 26 SBM on cuttings | sea surface (B) |
| Main | -- | SBM returned to surface: treated and re-injected | 14 SBM on cuttings | sea surface (B) |

Notes:
(A) Elevation of chute exit from WHP estimated at 20 m: to be confirmed during WHP design
(B) There is no discharge of SBM on its own. On release is residual SBM left on cuttings after treatment.
Source: J. Swain pers. comm.

*G2 There are a number of assumptions made, such as particle size and distribution, well depths and aggregation of cuttings. It is difficult to say if the assumption is valid. The basis on which all model assumptions are based should be provided.*

**Husky Response:**
Cuttings particle size, distribution and the aggregations used are presented in Section 3.2.2, including the basis for their selection and corresponding references. For well depths, please see comment "Section 2 Drilling Program, pg 3 – "Well lengths assumed …".

***C-NLOPB Response**: Current drilling discharges at White Rose would be more indicative of the White Rose Field than one Hibernia well. Husky should use information from actual drilling at White Rose or show that the difference between the Hibernia well and the well to be drilled for the White Rose Extension are similar.*

**Husky Response:** Husky will design a drill cuttings particle size sampling plan to be executed at the next opportunity. The samples will be analyzed for particle size and those data will be compared to the data used for input into the WREP environmental assessment cutting dispersion model (AMEC 2012). If the particle size data sets are not comparable, the cutting dispersion model(s) will be re-run and the results used to re-assess and adjust the associated environmental assessment predictions, as necessary.

Drill cutting dispersion model predictions will be validated in situ by monitoring the thickness of cutting piles on the seafloor once the White Rose EEM program is revised to accommodate operation of the WREP. This additional EEM monitoring would serve to validate the associated environmental assessment predictions.

*G3 It is not clear from the report that the modeling accounts for the effect the WHP and its orientation may have on local currents and the dispersion of cuttings. An explanation of how the WHP would affect currents and dispersion should be provided.*

**Husky Response:**
The modelling does not account for the presence of the WHP nor does it attempt to predict any potential effect on local currents and the dispersion of cuttings. The effect of turbulences generated by a GBS-type platform on sediment deposition would not be substantive, as indicated by discharge modeling conducted for Hibernia (Hodgins 1993).

Furthermore, in previous work AMEC carried out for the Hebron Project, a 1D model was established considering the symmetrical characteristics of the sediment deposition distribution. The model considered variation in current patterns in each of the 16 direction quadrants. The model adopted a radial modelling grid system, with the origin at the sediment discharge point. The model considered sedimentation by gravity in the vertical direction and movement with the current in the horizontal direction. Hydrodynamics and turbulences caused by the GBS were not considered. However, the Hibernia model was used to calibrate the Hebron model with respect to the effects of hydrodynamics and turbulences generated by the GBS, and they were found to be comparable.

It appears that the hydrodynamics and turbulences generated by the GBS have little effect on sediment deposition around a GBS. Several factors may have contributed to this observation. The current in the area generally has a low velocity, which causes the turbulences generated by the GBS to be low. The particles deposited around the GBS are typically coarse materials, which are less influenced by turbulences than fine particles. With distance from the GBS, where finer particles tend to settle, the turbulence generated by the GBS diminishes.

Settling and transport by the current of sediment particles is the primary mechanism in determining sediment deposition. The effect of turbulences generated by a GBS on sediment deposition was found to be not substantive.

Reference:
Hodgins, D.O. 1993. *Hibernia Effluent Fate and Effects Modelling*. Report prepared for Hibernia Management and Development Company Ltd., St. John's, NL.

*G4 Husky has completed a number of Environmental Effects Monitoring (EEM) Programs which give an indication of the extent of area affected by cuttings discharge from a MODU. There is no indication that the model has been calibrated or compared to the results of the EEM Programs. Such a comparison would demonstrate the accuracy of the model to predict the deposition of cuttings discharged.*

**Husky Response:**
A comparison of hydrocarbon concentrations measured in situ during the White Rose EEM program and those estimated by the SBM cuttings dispersion model (AMEC 2012) can be used to demonstrate the accuracy of the model. Although the EEM stations are not precisely at the distances from drill centres used in the model predictions, estimates of hydrocarbon concentrations may be compared at a scale of within 100 m.

Figure 5-7 from the 2010 White Rose EEM program displays the spatial distribution of hydrocarbon concentrations ($>C_{10}$-$C_{21}$) in sediment samples from around the four drill centers at White Rose (Figure 21). The figure illustrates that hydrocarbon concentration in sediment at EEM stations within 900 m of a drill centre as generally

greater than 5 mg/kg. EEM sediment stations further than 900 m from a drill centre generally have concentrations less than 5 mg/kg.

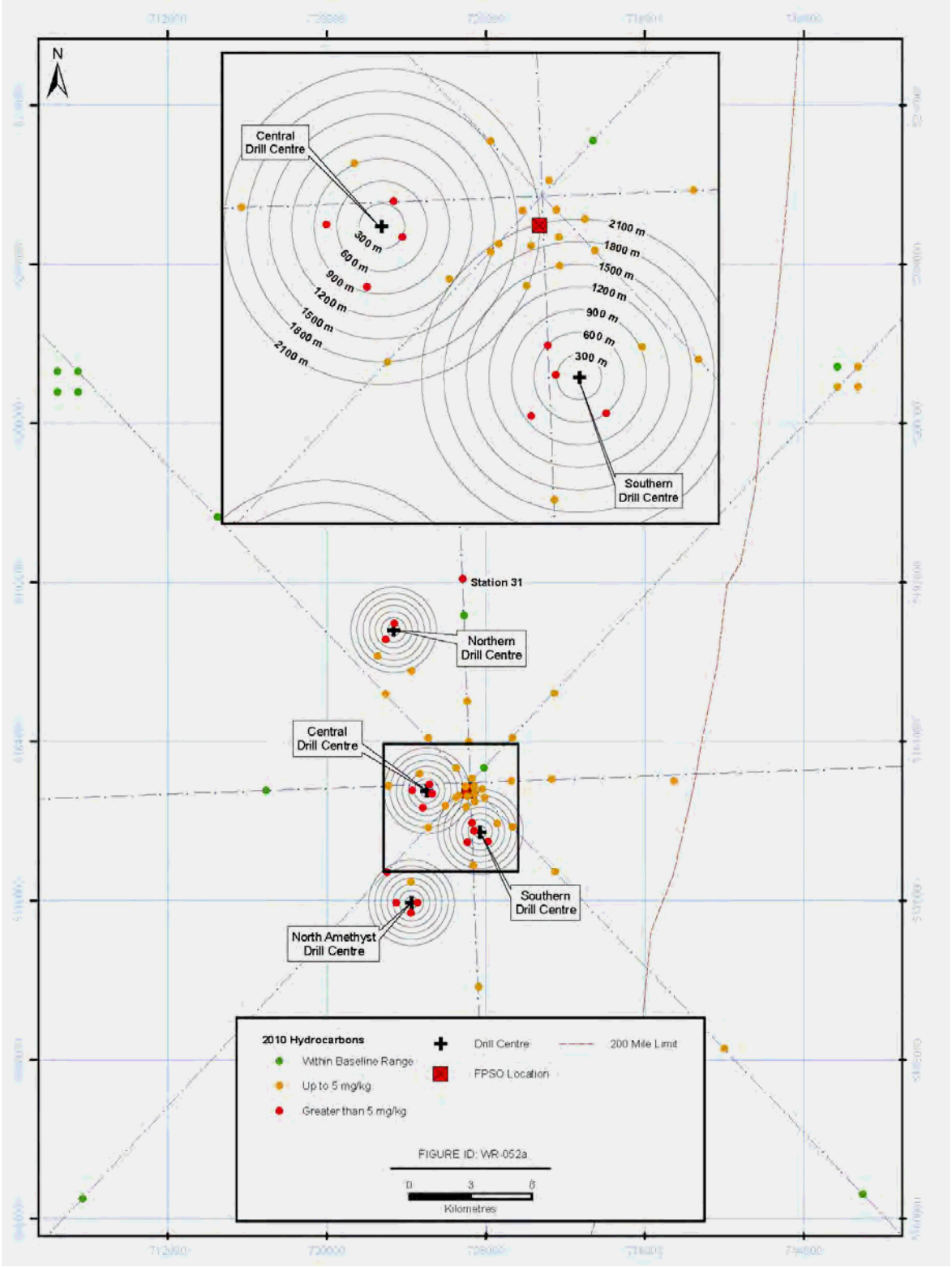



**Figure 21 2010 White Rose EEM Figure 5-7 White Rose 2010 EEM Stations with Hydrocarbon (>$C_{10}$-$C_{21}$) Concentrations up to 5 mg/kg and Greater than 5 mg/kg**

Table 3-12 in the Drill Cuttings and WBM Operational Release Model report (AMEC 2012) estimates hydrocarbon concentrations from SBM cutting discharge by distance from origin (see Table 14). Estimates from the SBM cutting dispersion model generally agree with the White Rose EEM results in that concentrations at distances less than 500 m from a drill centre are predicted to be greater than 5 mg/kg and concentrations at distances greater than 1,000 m from a drill centre are predicted to be less than 5 mg/kg. Hydrocarbon concentrations between 500 and 1,000 m from a drill centre are estimated to be slightly above and below 5 mg/kg.

**Table 14 AMEC 2012 Table 3-12 Mean Synthetic-based Mud Cuttings Oil Concentration (mg/kg)**

| Scenario | Distance from Origin (m) | | | | | |
|---|---|---|---|---|---|---|
| | **100 to 200** | **200 to 500** | **500 to 1,000** | **1,000 to 1,500** | **1,500 to 2,500** | **2,500 to 25,000** |
| WHP Development Option; 40 Wells at WWRX1 | no SBM cuttings released to sea | | | | | |
| Subsea Development Option; 16 Wells at WWRX1 | 1,122.9 | 7.7 | 3.2 | 2.6 | 2.6 | 1.9 |
| New Subsea Drill Centre; 16 Wells at SWRX | 1,350.7 | 22.2 | 1.9 | 2.2 | 3.7 | 1.7 |
| New Subsea Drill Centre; 16 Wells at WWRX2 | 1,092.1 | 22.6 | 7.1 | 4.9 | 4.4 | 1.5 |
| New Subsea Drill Centre; 16 Wells at NWRX | 1,394.0 | 17.8 | 4.0 | 1.9 | 2.7 | 1.9 |

## 6.2 Specific Comments

**Executive Summary, pgs i-ii – "***These will be almost exclusively the fast-settling pebbles and coarse sand (a very small percentage of the fines will drift for a time and ultimately settle near the WHP…". Please provide the reference for the grain sizing.*

### Husky Response:

Neither Husky nor its drilling contractor records particle size distribution from SBM drilling operations. AMEC used sieve analysis results from modeling of the Hibernia well K-18 (AGAT Laboratories 1993) . Which is the same information used for the Hibernia, Terra Nova and White Rose cuttings modeling (Hodgins 1993; Hodgins and Hodgins 1998, 2000). Hebron drill cutting models also used these grain size data as model inputs (AMEC 2010). These estimates of percentage pebbles, coarse sand, medium sand and fines is the best available source of information.

***C-NLOPB Response****: Husky could have collected the data but chose not to. Using data from the current White Rose drilling program would have been more representative of the grain size. Husky should remodel using more applicable data.*

**Husky Response:** Husky will design a drill cuttings particle size sampling plan to be executed at the next opportunity. The samples will be analyzed for particle size and those data will be compared to the data used for input into the WREP environmental assessment cutting dispersion model (AMEC 2012). If the particle size data sets are not comparable, the cutting dispersion model(s) will be re-run and the results used to re-assess and adjust the associated environmental assessment predictions, as necessary.

Drill cutting dispersion model predictions will be validated in situ by monitoring the thickness of cutting piles on the seafloor once the White Rose EEM program is revised to accommodate operation of the WREP. This additional EEM monitoring would serve to validate the associated environmental assessment predictions.

**Executive Summary, pg ii – "***Under the subsea scenario, the footprint of WBM cuttings is smaller than that for the WHP option, with a range generally restricted to within 2 km. The primary difference factor is the reduced number of wells drilled (16 as opposed to 40) and the reduced volume of cuttings material released (267 $m^3$ per well as opposed to 295 $m^3$) for the subsea option". This statement should be reviewed, as the settling rate would be the main determining factor for the area affected and to a much lesser extent the volume of material discharged.*

**Husky Response:**
The paragraph talks about WBM footprints resulting from WHP and subsea options. For both options, WBM cuttings are released near the sea floor (20 m above for WHP; 10 m above for subsea, see Table 2-2). The WBM drill cuttings characterizations including settling rates are the same under either option (Tables 3-3 and 3-4).

On review, yes, it's possible the slightly higher release location for the WHP option would result in a greater time (settling time) to reach the seabed and hence a greater horizontal distance travelled. This and the smaller cuttings volume are the primary differences.

**Executive Summary, pg ii – "***Under the subsea drill centre option, the majority of SBM cuttings are deposited quite close to the drill centre, due to the large percentage of large cuttings pieces having fast settling speeds*." *Please provide the reference for both the grain sizes expected for cutting and settling rates, and how they were determined.*

**Husky Response:**
Neither Husky nor its drilling contractor records particle size distribution from SBM drilling operations. AMEC used sieve analysis results from modeling of the Hibernia well K-18 (AGAT Laboratories 1993) . Which is the same information used for the Hibernia, Terra Nova and White Rose cuttings modeling (Hodgins 1993; Hodgins and Hodgins 1998, 2000). Hebron drill cutting models also used these grain size data as inputs (AMEC 2010). These estimates of percentage pebbles, coarse sand, medium sand and fines is the best available source of information.

Please see Section 3.2.2 of the AMEC for an explanation of settling rates used.

***C-NLOPB Response****: Husky could have collected the data but chose not to. Using data from the current White Rose drilling program would have been more representative of the grain size. Husky should remodel using more applicable data.*

**Husky Response:** Husky will design a drill cuttings particle size sampling plan to be executed at the next opportunity. The samples will be analyzed for particle size and those data will be compared to the data used for input into the WREP environmental assessment cutting dispersion model (AMEC 2012). If the particle size data sets are not comparable, the cutting dispersion model(s) will be re-run and the results used to re-assess and adjust the associated environmental assessment predictions, as necessary.

Drill cutting dispersion model predictions will be validated in situ by monitoring the thickness of cutting piles on the seafloor once the White Rose EEM program is revised to accommodate operation of the WREP. This additional EEM monitoring would serve to validate the associated environmental assessment predictions.

**Executive Summary, pg ii – "***The environmental effects of released WBMs are generally associated with the potential physical toxicity of fine particulate matter, either barite or bentonite, which are sometimes used to increase the density of the mud mixture, and these additives have greater potential to affect filter feeding organisms as they remain suspended in the bottom boundary layer." Barite and bentonite should sink to the ocean floor and not remain suspended in the bottom boundary layer. Explain what is meant by the bottom boundary layer and provide a reference for the assertion that WBM are generally associated.*

**Husky Response:**
The benthic boundary layer is the layer of water in the first few metres directly above the seabed. It is relevant for study of the oceanographic processes that affect the fate of drilling waste release. Drilling mud particles have settling velocities on the order of a few mm/s to a cm/s, which are high enough to allow them to settle to the bottom. Hodgins and Hodgins (2000) concludes sediment transport of parent sand and flocculated mud and cuttings ( fall velocity >1 mm/s) in the boundary layer is not expected at White Rose. In any case, Husky is not planning to use barite or bentonite as components of WBM, so suspension in the benthic boundary layer is not an issue.

Reference:
Hodgins, D.O. and S.L.M. Hodgins. 2000. *Modelled Predictions of Well Cuttings Deposition and Produced Water Dispersion for the Proposed White Rose Development*. Prepared for Husky Oil Operations Limited by Seaconsult Marine Research Ltd.

**Executive Summary, pg ii -** *"The most likely composition of the WBM planned for use during the WREP does not include these weighting agents". Either the WBM contains or does not contain weighting agents. The authors need to consult with the proponent regarding the types and general composition of muds to be used.*

**Husky Response:**
The WBM planned for use does not contain these weighting agents.

**Executive Summary, pg ii – "***No component of the WBM has been identified as potentially toxic; therefore…". Please define toxic and identify the generic composition of the mud and the toxicity of its components. Provide references for the toxicity of the mud components.*

**Husky Response:**
The WBM that Husky will use is comprised of primarily of brine, with the possible addition of sodium acid pyrophosphate (125 kg per hole section per well).

The WBM systems currently planned for use for the first two hole sections (i.e., conductor and surface) contain components as follows, with notional concentrations provided:

- Drilling Fluid: Seawater
- Mud Sweeps: Seawater + 6 to 10 kg/m³ Guar Gum
- SAPP Sweeps: Seawater + 3 to 7 kg/m³ SAPP
- Kill Mud: NaCl Brine (24%) + 4 kg/m³ Kelzan XCD + 5 kg/m³ Guar Gum + 35 kg/m³ Salt 805

Acute toxicity of sodium acid pyrophosphate to marine algae and animals is summarized in Neff (2010), who listed the range of LC50 for different species (in) (using the GESAMP (2002) toxicity classification, where >1,000 mg/L is non-toxic and >100 to ≤1,000 mg/L is practically non-toxic). Sodium acid pyrophosphate had a range of 870 mg/L (freshwater species used in test; salt water species expected to much more tolerant) to >100,000 mg/L. Testing the toxicity of WBMs to marine organisms from the Gulf of Mexico, Atlantic and Pacific Oceans and Beaufort Sea (NRC 1983, in Melton et al. 2000) indicated that WBM discharged to the marine environment will be low in toxicity (Melton et al. 2000).

**Section 2 Drilling Program, pg 2 – "***For drilling of the deeper intermediate and main hole sections - for both WHP and MODU drilling - SBM will be used. Under the WHP option the base case is to use two cuttings reinjection wells into which treated SBM and cuttings will be re-injected (i.e., no return of materials to the sea)". The discharge of SBM cuttings will not be permitted until the cutting reinjection system is operative. This would mean no drilling with SBM.*

**Husky Response:**

The base plan is to drill two cuttings reinjection wells for cuttings disposal purposes. In addition, the WHP design currently envisions a secondary cuttings dryer system to lower synthetic-based mud on cuttings (SOC) to a target level of 6.9 percent SOC. This is consistent with technology currently employed by MODUs operating in the area. This secondary dryer would be employed until the cuttings reinjection (CRI) system is functional. This secondary system would also be employed in the event of difficulties with the CRI system. Prior to having a CRI system in place, and in the event of CRI system failure, following processing with the secondary dryer, cuttings would be discharged overboard.

Current drilling authorizations allow for the discharge of cuttings while drilling with an SBM fluid, at discharge limits specified in the facilities Environmental Protection Plan. The discharge of mud and cuttings and their limits for the WREP will be described in the WREP Environmental Protection Compliance and Monitoring Plan and submitted as part of the authorization application. While utilizing an SBM fluid system, the WHP intends to handle cuttings in a similar manner as a MODU until the CRI system is operable, as well as in the event the CRI system experiences a failure. Once the CRI system is operable, these cuttings will be reinjected downhole.

***C-NLOPB Response****: The Proponent should model these discharges or explain why modeling is considered not necessary.*

**Husky Response:** Under the Subsea option (Section 3.2.1), the scenario of 16 wells drilled from a MODU at the West White Rose location (WWRX1) was modelled with the release of all treated SBM cuttings. The volume of cuttings released from the 16 MODU wells would be greater than the volume released from wells drilled prior to commissioning the CRI system and is therefore considered a worst-case scenario for modelling and environmental assessment.

**Section 2 Drilling Program, pg 3 – "***Well lengths assumed are for a typical producing well from a MODU, which is approximately 5,500 m (mKB)." Well length should be typical to what is being drilled and what the proponent expects to be drilling and not typical to a MODU.*

**Husky Response:**
At the time of environmental assessment submission, the mean average measured length of planned wellbores to be drilled from the WHP was 5,513 mMDbrt, consistent with the information provided. This is also consistent with what would be expected to be drilled from a MODU.

Subsequent to the environmental assessment submission, the most recent wellbore trajectory planning scope undertaken by Husky for the WHP project indicates a mean average wellbore length of 5,644 mMDbrt, which would not introduce significant deviation from what has been modelled for the environmental assessment.

**§3.1.1 Advection Dispersion Model Description, pg 6 -** *"For the purposes of predicting their physical deposition on the seabed, the cuttings are considered as a composition of particle types or sizes; typically larger cuttings pieces pebbles coarse sand, medium sand and fines. These particle sizes are assumed to be generally representative of the materials likely to be encountered in the area and generated using WBM or WBM." Please provide the percentage of each particle size and reference the source of the composition. It is inappropriate to make assumptions and where assumptions are made the rational for that assumption needs to be described.*

**Husky Response:**
Neither Husky nor its drilling contractor records particle size distribution from SBM drilling operations. AMEC used sieve analysis results from modeling of the Hibernia well K-18 (AGAT Laboratories 1993) . Which is the same information used for the Hibernia, Terra Nova and White Rose cuttings modeling (Hodgins 1993; Hodgins and Hodgins 1998, 2000). Hebron drill cutting models also used these grain size data as inputs (AMEC 2010). These estimates of percentage pebbles, coarse sand, medium sand and fines is the best available source of information.

***C-NLOPB Response****: Husky could have collected the data but chose not to. Using data from the current White Rose drilling program would have been more representative of the grain size. Husky should remodel using more applicable data.*

**Husky Response:** Husky will design a drill cuttings particle size sampling plan to be executed at the next opportunity. The samples will be analyzed for particle size and those data will be compared to the data used for input into the WREP environmental assessment cutting dispersion model (AMEC 2012). If the particle size data sets are not comparable, the cutting dispersion model(s) will be re-run and the results used to re-assess and adjust the associated environmental assessment predictions, as necessary.

Drill cutting dispersion model predictions will be validated in situ by monitoring the thickness of cutting piles on the seafloor once the White Rose EEM program is revised to accommodate operation of the WREP. This additional EEM monitoring would serve to validate the associated environmental assessment predictions.

*SBM are proposed to be discharged from the MODU for subsea development but according to the statement only WBM are modeled. SBM are to also be modeled.*

**Husky Response:**
The second WBM ("…using WBM or WBM") in the above paragraph is an error and should be SBM. SBM were also modelled as per the report.

**§3.1.1 Advection Dispersion Model Description, pg 6 -** *"After completion of a model run, when all particles have settled, or have reached the model grid boundaries (in which case, they are taken to have drifted outside the domain and are tabulated as 'lost')…". If particles reach the boundary then the boundary will need to be extended. Otherwise, no conclusion can be reached as to the extent of the affected area. State if the particles exceed the boundary.*

**Husky Response:**
This is a general description of the model. The model output listing reports the weight of cuttings settled and lost, and is routinely checked. Settled cuttings are those that reach the sea bottom within the horizontal extent of the model grid. Lost cuttings are those that do not reach the sea bottom while settling within the model grid and continue to drift horizontally outside the (model) domain. The grid sizes employed are noted at the bottom of page 13. There were no 'lost' cuttings for the scenarios modelled: no particles exceed (or drift outside of) the boundary.

**§3.1.1 Advection Dispersion Model Description, pg 7– "***All cuttings are assumed to be adequately treated to reclaim oil as required by present regulations. Oil content on cuttings produced during drilling with SBM, $OC_{initial}$ was set to 7.4 g / 100 g, equal to 6.9 g / 100 g oil on wet solids, as per the OWTG (NEB et al. 2010)." The use of oil on cuttings data from the proponent's current operation would be more appropriate for modeling purposes.*

**Husky Response:**
Actual mean SOC discharge for the past five Husky wells is 6.4 percent. So the use of 6.9 percent in the model is accurate and will not change model or impact assessment predictions.

**§3.2.1 Scenarios, Well Sequences, Well Types, Table 3-1, pg 8 –** *Please provide the information on the duration for drilling each well section. Duration should be based on actual time to drill a well in the White Rose field.*

**Husky Response:**
Average durations are as follows, based upon average duration for seven recent Husky subsea wells, and used as the basis for WHP time estimations. Durations are inclusive of skidding, drilling, casing, cementing, completions and associated ancillary operations:

- Conductor section (1,067 mm hole OD) = 5.0 days
- Surface section (406 mm hole OD) = 12.5 days
- Production section (311 mm hole OD) = 22.2 days
- Production liner section/completion (216 mm hole OD) = 43.5 days

Considering only durations in which cuttings are being generated, the following average times apply. Note that there are periods within these times provided that cuttings are not returned;

- Conductor section (1,067 mm hole OD) = 2.0 days
- Surface section (406 mm hole OD) = 8.9 days
- Production section (311 mm hole OD) = 17.3 days
- Production liner section/completion (216 mm hole OD) = 22.1 days

***C-NLOPB Response**: These durations are much longer than described in Table 3-1. The Proponent should consider if the durations described in Table 3-1 are representative of the times over which cuttings are discharged and adjust the model accordingly.*

**Husky Response:** As noted, the periods provided are durations for cutting generation, and there are periods within each estimate in which cuttings are not returned. The Table 3-1 durations have been revisited and reconsidered: they are judged from our experience to be representative approximations of the duration of discharge, so that no model adjustment is required.

**§3.2.2 Cuttings Particle Characterization, pg 9 -** *"Information for the Hibernia K-18 well is available from a sieve analysis performed by AGAT Laboratories (1993) and details depths of 900 to 5,010 m. This has been employed in the previous cuttings modelling for Hibernia, Terra Nova and White Rose (Hodgins 1993; Hodgins and Hodgins 1998, 2000), and Hebron (AMEC 2010), with estimates of percentage pebbles, coarse sand, medium sand and fines, and is the best available source of information." Information on particle size could be obtained through Husky's current drilling program and would be more representative of particles sizes while drilling with SBM.*

**Husky Response:**
Neither Husky nor its drilling contractor records particle size distribution from drilling operations. The quoted sources are currently the best available data for modelling inputs.

***C-NLOPB Response**: Husky could have collected the data but chose not to. Using data from the current White Rose drilling program would have been more representative of the grain size. Husky should remodel using more applicable data*

**Husky Response:** Husky will design a drill cuttings particle size sampling plan to be executed at the next opportunity. The samples will be analyzed for particle size and those data will be compared to the data used for input into the WREP environmental assessment cutting dispersion model (AMEC 2012). If the particle size data sets are not comparable, the cutting dispersion model(s) will be re-run and the results used to re-assess and adjust the associated environmental assessment predictions, as necessary.

Drill cutting dispersion model predictions will be validated in situ by monitoring the thickness of cutting piles on the seafloor once the White Rose EEM program is revised to accommodate operation of the WREP. This additional EEM monitoring would serve to validate the associated environmental assessment predictions.

**§3.2.2 Cuttings Particle Characterization, pg 9 – "***Experience with both SBM and WBM has shown that SBM systems are not dispersive; cuttings are large, and they remain intact until deposited on the seabed." Whose experience and what is the basis of that experience? For SBM cuttings, the more the cuttings are processed the more the particle size decreases and remain suspended in the water column. This increases the affected area. In addition, as cuttings get drier, the amount of oil decreases. Please see Brandsma, 1996 which states that* "*The explanation for this apparent conundrum is that while treatments other than centrifugation also reduce oil content (from an untreated level of 15.8% [w/w] to a range of 0.3% to 5.1%, these treatments also generate cuttings with finer particle sizes. Thus, according to the model, the untreated and centrifuged OBF-cuttings would not reach the 1000 m mark to the same extent that the treated OBF-cuttings would because the finer particles created by the treatment have lower settling velocities and are transported farther in the water column*."

*US EPA. 2000. Environmental Assessment Of Final Effluent Limitations Guidelines And Standards For Synthetic-Based Drilling Fluids And Other Non-Aqueous Drilling Fluids In The Oil And Gas Extraction Point Source Category, December 2000, report number EPA-821-00-014 Page 4-4.*

*Brandsma, M.G. 1996. Computer simulations of oil based mud cuttings discharge in the North Sea. In: The Physical and Biological Effects of Processed Oily Frill Cuttings. E&P Forum Report No.2.61/202. April 1996. Pages 25-40.*

**Husky Response:**

a) In response to the question "Whose experience and what is the basis of that experience?", as noted with the personal communication reference at end of that paragraph it is the experience of Chris Mazerolle, Drilling Engineer Advisor, Chevron Canada Resources, Calgary, AB.

b) In response to "Please see Brandsma, 1996 ..." Comment noted. Thank you.

***C-NLOPB Response****: The Proponent needs to revisit its assumptions on cuttings dispersion and adjust the model accordingly.*

**Husky Response:** Husky will design a drill cuttings particle size sampling plan to be executed at the next opportunity. The samples will be analyzed for particle size and those data will be compared to the data used for input into the WREP environmental assessment cutting dispersion model (AMEC 2012). If the particle size data sets are not comparable, the cutting dispersion model(s) will be re-run and the results used to re-assess and adjust the associated environmental assessment predictions, as necessary.

Drill cutting dispersion model predictions will be validated in situ by monitoring the thickness of cutting piles on the seafloor once the White Rose EEM program is revised to accommodate operation of the WREP. This additional EEM monitoring would serve to validate the associated environmental assessment predictions.

**§3.2.2 Cuttings Particle Characterization, pg 9 –** *"Cuttings drilled with SBM will be large, on the order of 2.5" in length, 1" wide, and 1/8" thick. To characterize these large cuttings as spherical particles for the model, their volume corresponds to a particle diameter of about 1 to 3 cm. This large cutting size type was added to the pebbles, coarse sand, medium sand and fines types used to characterize the WBM-cuttings noted above. It was assumed that most (approximately 70 percent) of the cuttings will be large, approximately 20 percent 0.5 to 1 cm, 5 percent 0.1 cm, with the remaining 5 percent being very fine particles, with diameters of 0.01 cm (Table 3-3)." Provide the reference for the data source.*

**Husky Response:**
Reference for cuttings drilled with SBM (first sentence, paragraph before Table 3-2) is (pers. comm. with Suncor drilling superintendent and MI Swaco personnel, January 2011).

***C-NLOPB Response****: The reference provided does not appear in the first sentence before Table 3-2. Husky should explain where the precise numbers provided in the paragraphs, as per the personal communications, came from.*

**Husky Response:** As noted. The personal communication (pers. comm.) reference should follow the end of the first sentence. The numbers were provided in the pers. comm. It is a pers. comm. from drilling personnel who know this subject matter/practice.

The other numbers in the paragraph follow by simply equating the volumes (rectangular to spherical particle). The final set of numbers (percent of different sizes) was confirmed as reasonable by Husky drilling personnel.

**§3.2.2 Cuttings Particle Characterization, pg 10 – "***It is assumed that the cuttings will enter the sea in a disaggregated form". There are a lot of assumptions made for this modeling however no basis for the assumptions is given. Provide the basis on which this assumption is made.*

**Husky Response:**
This is a reasonable assumption. Drill cuttings (solids) will be separated from the drilling fluid with shale shakers (solids separation) and during this process will, by nature, become disaggregated.

**§3.2.2 Cuttings Particle Characterization, pg 11 –** *Reference the source of the data provided in Table 3-4.*

**Husky Response:**
The source of the data in Table 3-4 is the equations presented in the report text immediately prior to Table 3-4.

**§3.2.3 Ocean Currents, pg 12 – "***It was assumed that drilling would commence in the fall, for either the WHP or subsea". Drilling can occur at any time of the year. Will the timing of drilling activities affect the outcome of the modeling? Please confirm the timing of drilling activities.*

**Husky Response:**
In order to select a time series of currents for the modelling, a drilling start date of fall (e.g., October 1 as a calendar date), was based on the proposed project schedule at the time of modelling (ref. WREP Project Description). See also Section 3.2.1 bottom of page 7.

Drilling activities are assumed to take place year round (e.g., for the 40 wells under a WHP option, 10 wells are drilled each season), over periods of approximately 15 (subsea option) to 21 years (WHP option), so the season in which they commence will not affect the outcome of the modelling

**§3.2.4 Model Geometry, pg 14 -** *"The subsea development option differed from the WHP option only in that West White Rose was drilled with a MODU rather than from the WHP; and 16 wells as opposed to 40 were drilled with the subsea option. For visualizations of combined scenario results (e.g., for the WHP option, 40 wells at the WHP, plus 16 wells at the SWRX, for a total of 56 wells".*

*It is stated in the Introduction that "Two development options are being considered for the West White Rose component of the WREP: a WHP, which essentially is a fixed drilling platform; or a subsea drill centre with wells drilled by a mobile offshore drilling unit (MODU). Also as part of the WREP are up to three additional drill centres in other areas of the White Rose field. If a WHP is used in the West, the total number of wells could be up to 88: 40 wells from the WHP, plus up to three additional subsea drill centres, each with up to16 wells (Husky 2012). For the subsea drill centre option, the total number of wells could be up to 64: 16 wells each for West White Rose plus up to three additional drill centres (Husky 2012). These wells will be a combination of producing, water injection, gas injection and (WHP option only) cuttings reinjection*."

*Modeling 56 wells when there is potentially 88 wells is not adequate to show the extent of the area that may be affected by cuttings. Modeling is to be done for the project scenarios described in the environmental assessment report. The proposal for the WHP and subsea development is 40 platform wells and 48 subsea wells, and the subsea option of 64 wells.*

**Husky Response:**

At the time of writing the modelling report, the WREP was to include up to 88 wells. Since then, the South White Rose Extension Drill Centre has proceeded under existing approvals, so was removed from the environmental assessment of the WREP. The number of wells for the WREP is now estimated between 48 (subsea) and 72 (WHP). Discharges from the maximum number of wells (40) at one location (WHP) were modelled and can be considered the worst case scenario for WBM cuttings deposition. As illustrated in Figure 3-9 and 3-10 of the report, SBM deposition was modelled for 64 wells, and the deposition is very similar between drill centres. The inclusion of another eight wells in the model will not affect the model results to a degree to change any impact predictions in the WREP environmental assessment.

The reference to 56 wells in the first paragraph on page 14 is simply mentioned in an example of how the results of two separate scenarios could be combined and visualized.

The modelling results of 64 wells for the subsea option are shown in Figure 3.10 (and three new zoomed-in views of the same figure as Figures 3-10a,b,c; see Figures 22 to 24).

A new set of four figures, Figure 3-10d,e,f,g (see Figures 25 to 28) have been prepared to illustrate deposition of the 88 well scenario, although not a potential scenario for the WREP. Figure 3-10d (Figure 25) shows the 28 km view following the WHP 88 well option, a similar extent as shown in Figure 3-10. Figure 3-10e (Figure 26) shows near NWRX after 88 wells; essentially the same as Figure 3-10a (Figure 22) view near NWRX after 64 wells for the subsea option. Figure 3-10g (Figure 28) shows near SWRX after 88 wells; essentially the same as Figure 3-10c view near SWRX after 64 wells for the subsea option.

Figure 3-10f (Figure 21) shows a WWRX1/WWRX2 view, which shows a similar cuttings thickness footprint to that in Figure 3-1 for the 40 WHP wells at WRX1 with two additional observations. With another 16 wells drilled (WWRX2) the amount of cuttings materials released is increased because of reinjection at the WHP. Near WWRX2, an increase of approximately 73 percent is predicted compared to the results from the 40 WHP wells and the areas of thickness between approximately 1 and 10 mm are larger by approximately 50 percent.

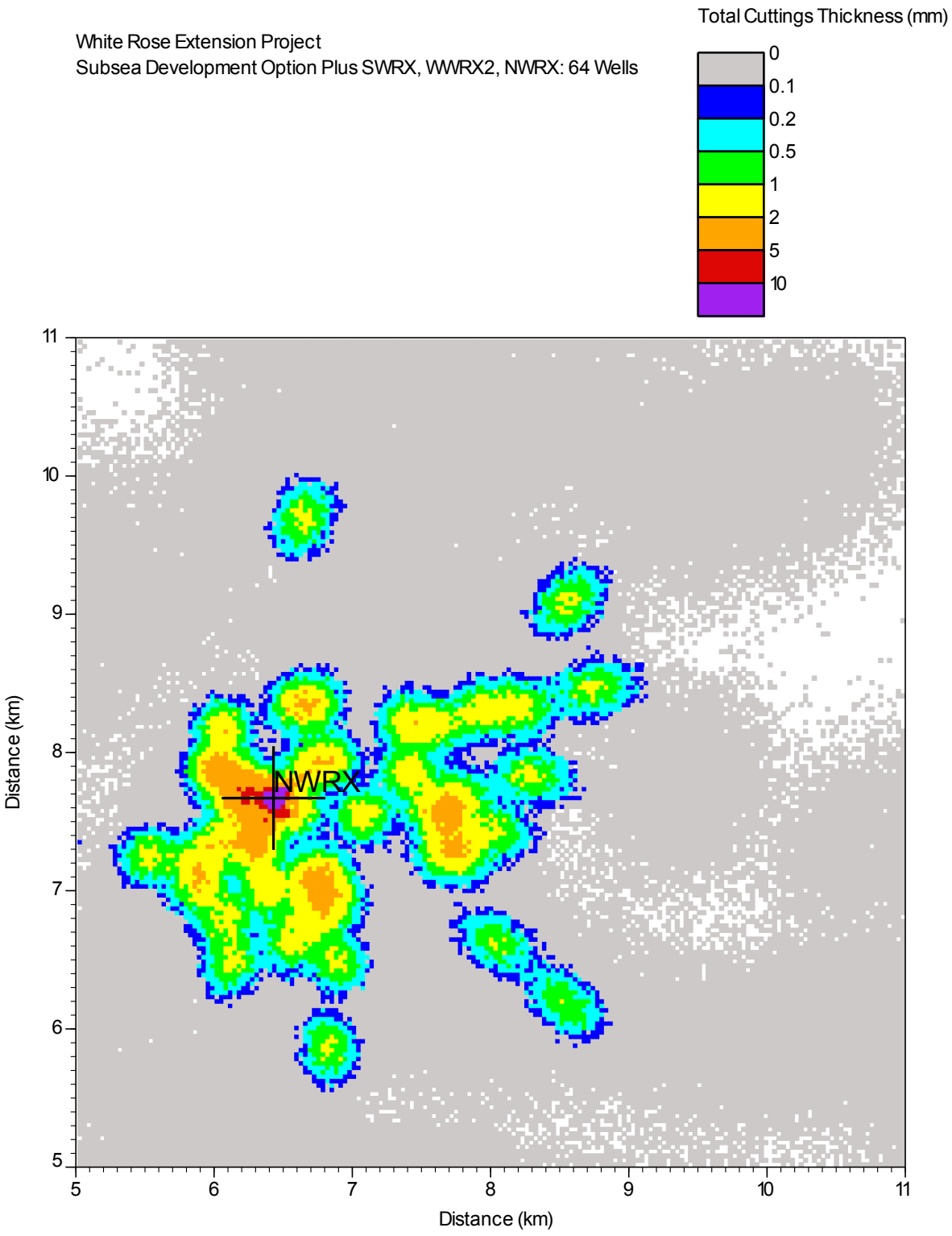



**Figure 22** **Figure 3-10a Total Water-based Mud and Synthetic-based Mud Cuttings Deposition for Subsea Option with 64 Wells, NWRX View**

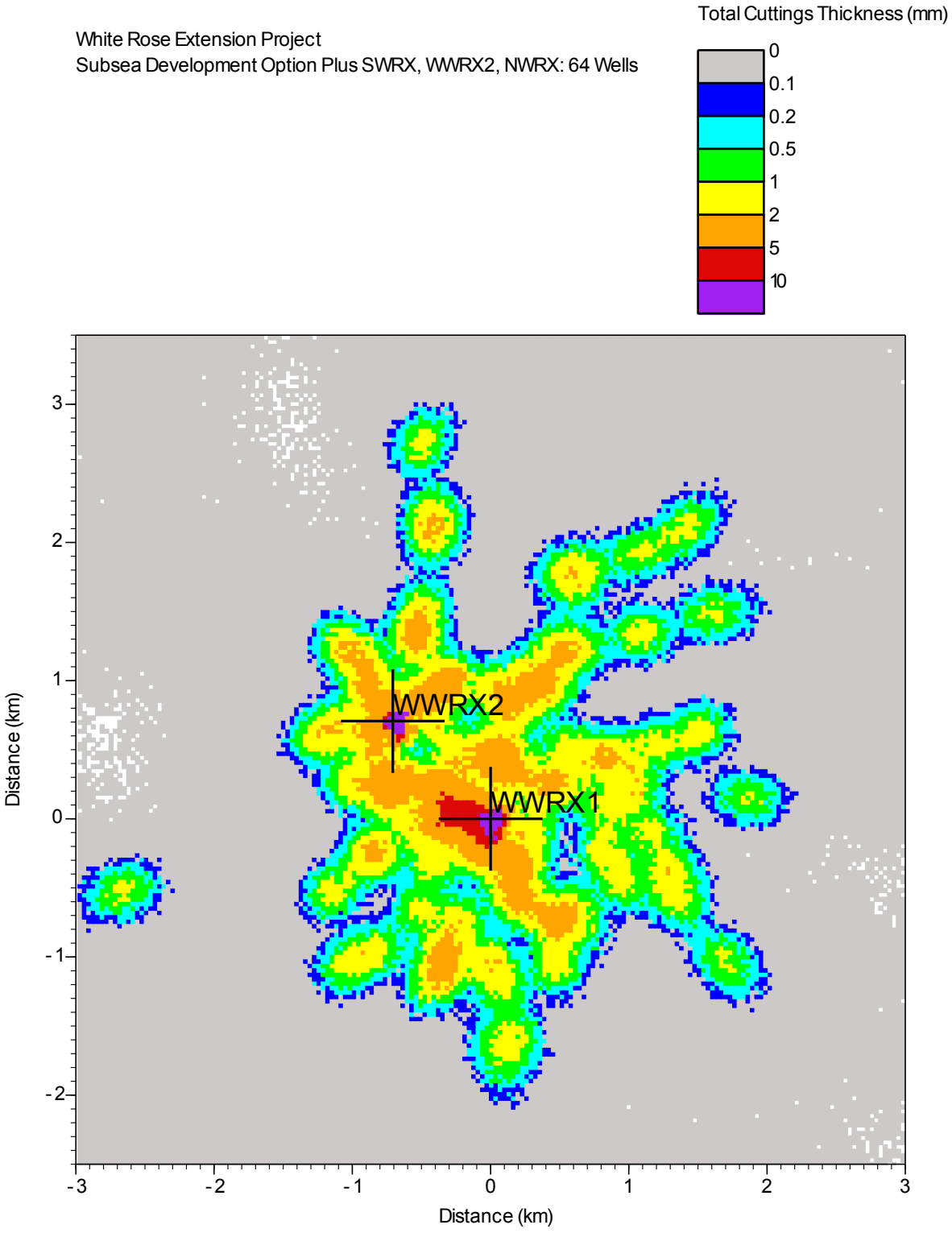



**Figure 23** **Figure 3-10b Total Water-based Mud and Synthetic-based Mud Cuttings Deposition for the Subsea Option with 64 Wells, WWRX View**

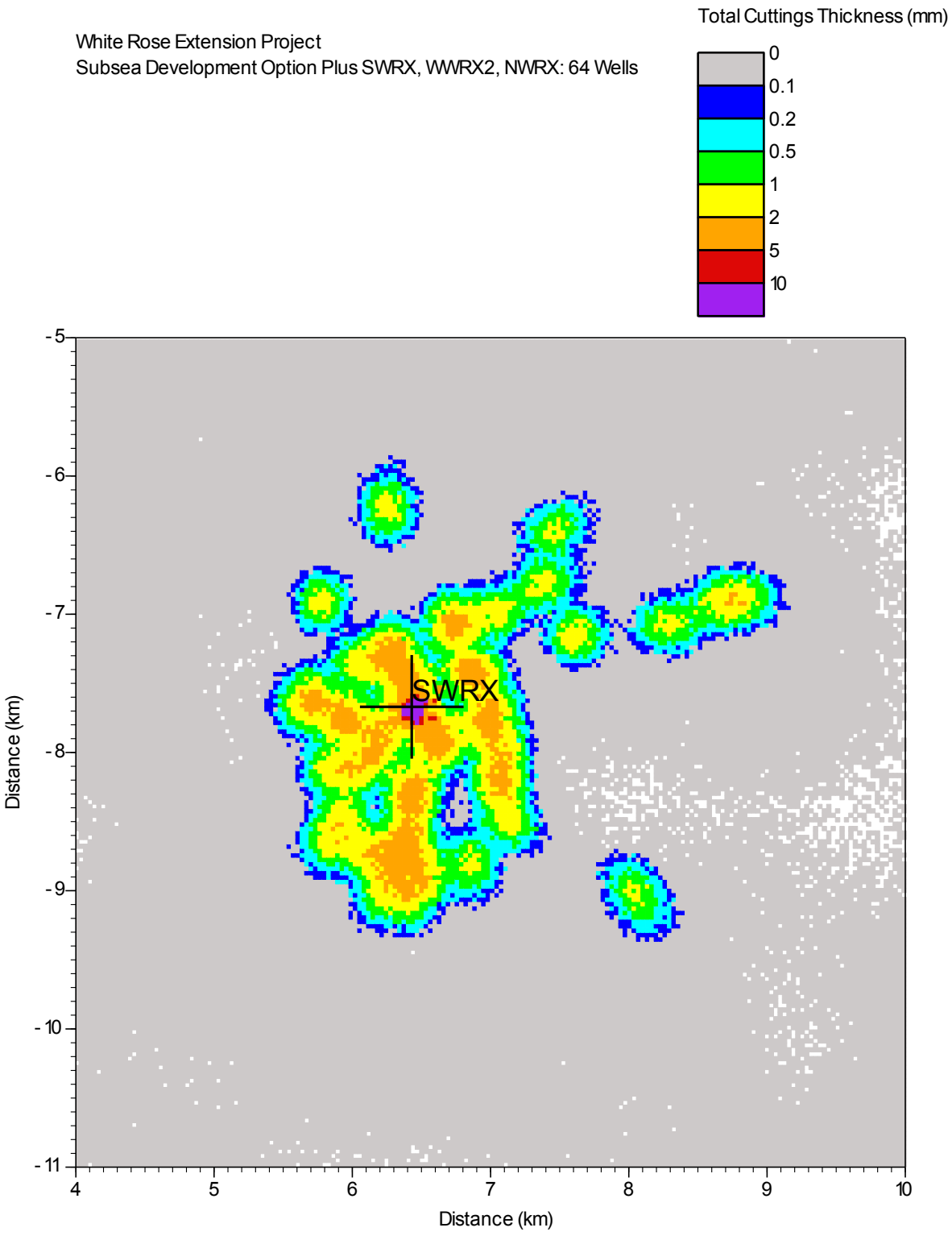



**Figure 24** **Figure 3-10c Total Water-based Mud and Synthetic-based Mud Cuttings Deposition for Subsea Option with 64 Wells, SWRX View**

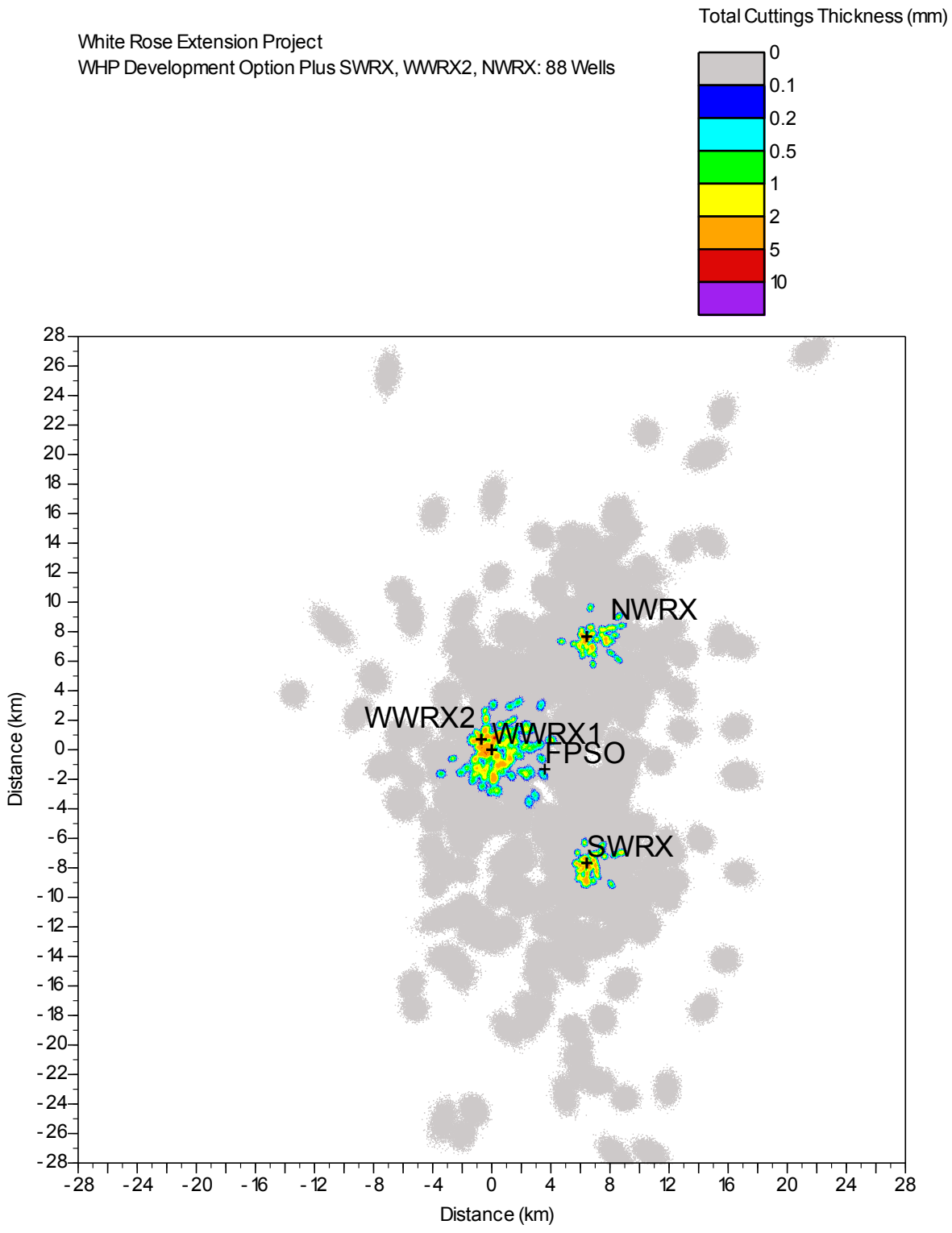



**Figure 25 Figure 3-10d Total Water-based Mud and Synthetic-based Mud Cuttings Deposition for WHP Option (40 Wells) plus 48 Drill Centre Wells**

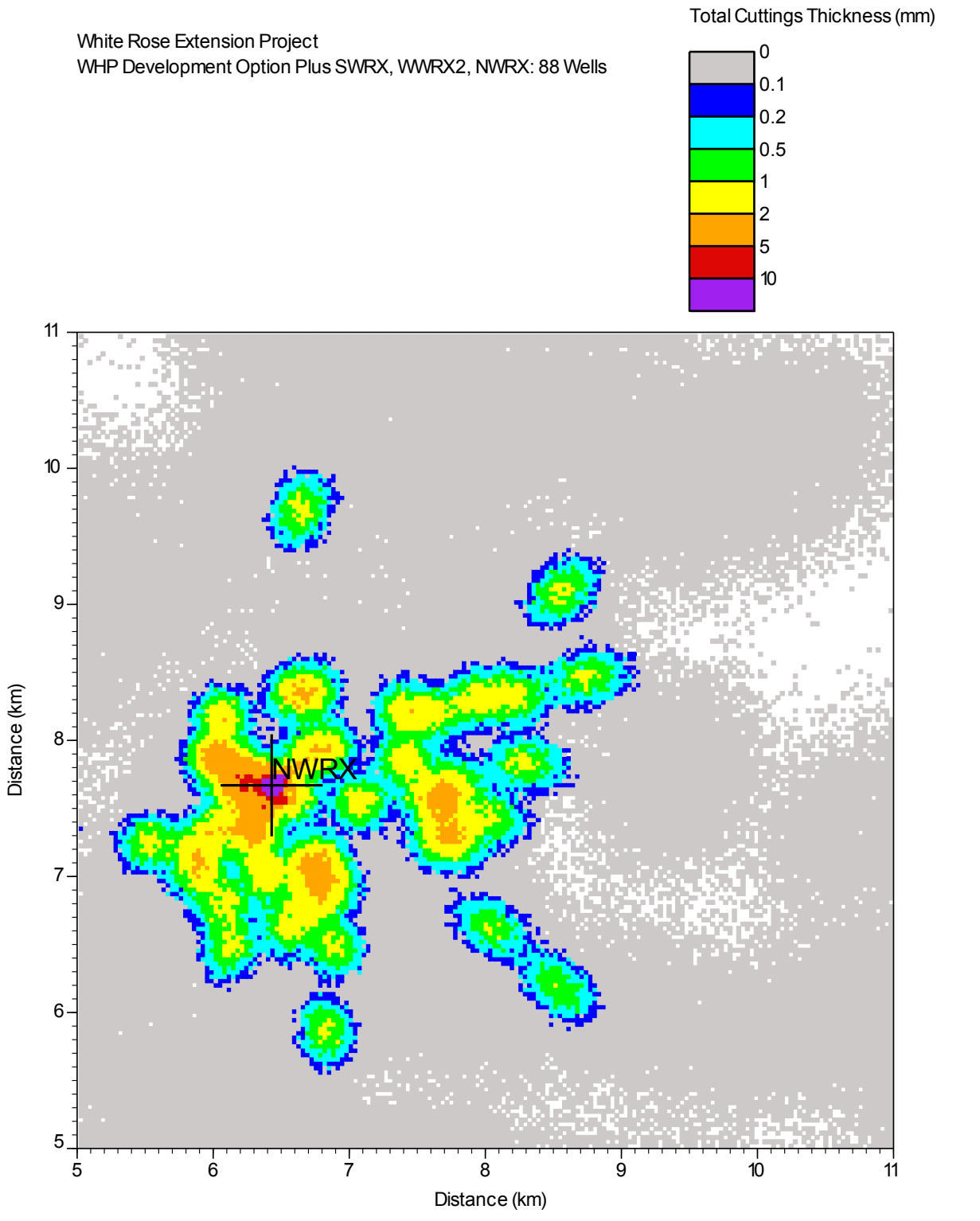



**Figure 26 Figure 3-10e Total Water-based Mud and Synthetic-based Mud Cuttings Deposition for WHP Option (40 Wells) plus 48 Drill Centre Wells, NWRX View**

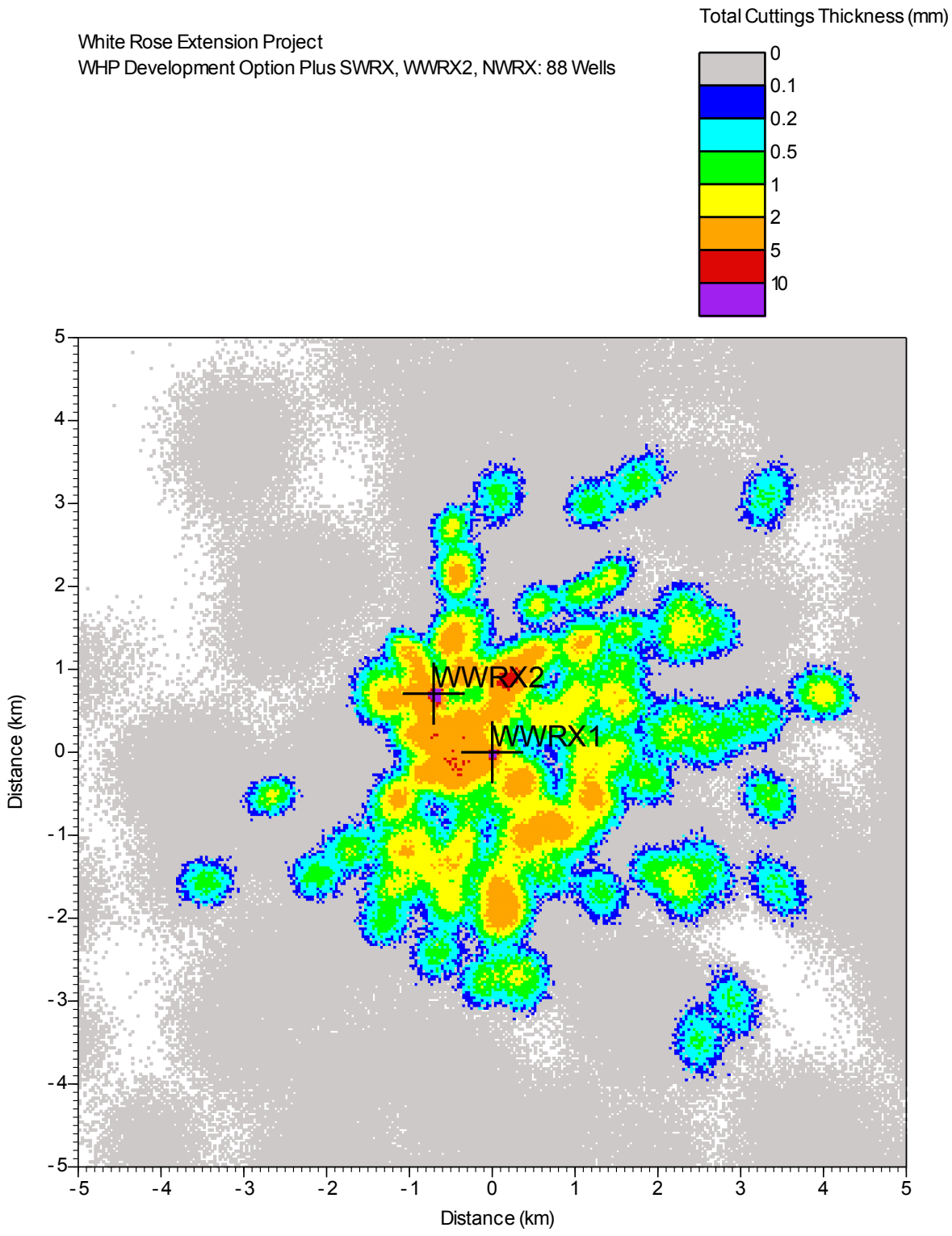



**Figure 27 Figure 3-10f Total Water-based Mud and Synthetic-based Mud Cuttings Deposition for WHP Option (40 Wells) plus 48 Drill Centre Wells, WWRX View**

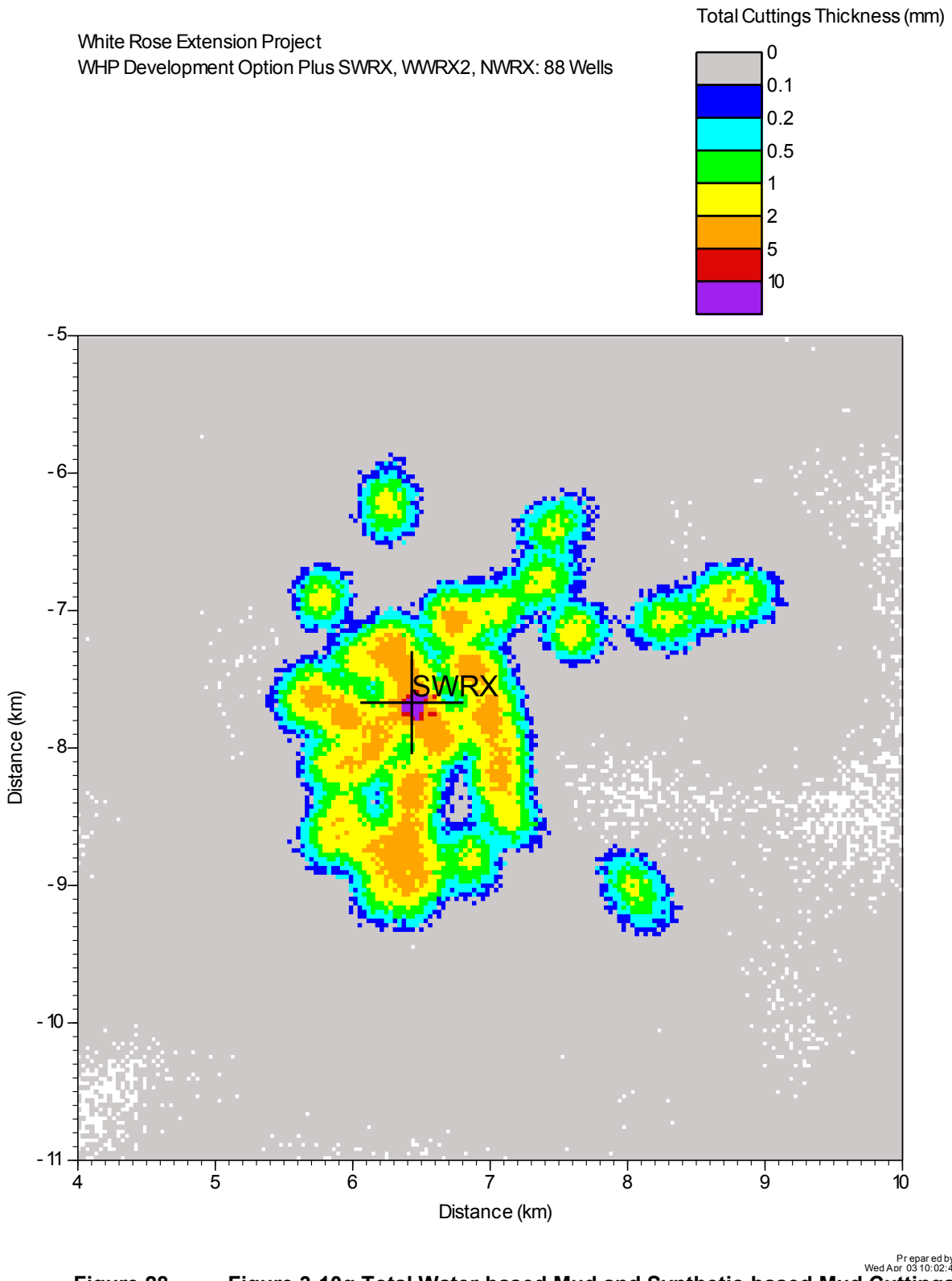



**Figure 28 Figure 3-10g Total Water-based Mud and Synthetic-based Mud Cuttings Deposition for WHP Option (40 Wells) plus 48 Drill Centre Wells, SWRX View**

**§3.3.1 Water-based Mud Cuttings, pg 15 – "***Cuttings from drilling the upper two well sections with WBM will all be released as per the OWTG (2012) close to the seafloor, under either the WHP option with chute release, or under the subsea option with MODU riserless drilling. Therefore, there is little time for the cuttings to be transported large distances by the ambient currents.". The Cuttings are not being released as per the OWTG, they are being released based on the design of the facilities and drilling practices. Also, the MODU discharges WBM at the sea floor while the wellhead platform will release discharges above the sea floor. The paragraph should be reworded to reflect that cuttings are being released based on facility design and practice and that the release of WBM from the platform and MODU are different but simplified for the purposes of the modeling.*

**Husky Response:**
Correct, the model is based on facility design and drilling practices. WBM cuttings are released near the sea floor (20 m above for WHP; 10 m above for subsea, see Table 2-2; the elevations of 20 m and 10 m are used in the model).

**§3.3.1 Water-based Mud Cuttings, pgs 16-17 -** *There is no figure showing the combined deposition of WBM and cuttings for either the WHP option or the Subsea option. There is also no figure showing the disposition of WBM cuttings discharged from all of the subsea wells. The only figure presented is for 16 wells and not the 88 wells for the wellhead platform or the 64 with the subsea option.*

**Husky Response:**
WBM cuttings deposition was modelled to assist in the environmental assessment of potential effects of the WREP. Potential physical smothering of fish and fish habitat from cutting deposition is considered more of an environmental risk than the discharge of water-based muds.

For the subsea option, the WBM+SBM (total) cuttings are shown in Figure 3-10 (plus the new three zoom-in views of the same figure for NWRX, WWRX1/2, SWRX) (see Figures 16 to 18).

Please see nearby comment "§3.2.4 Model Geometry, pg 14 - "The subsea..." for discussion and new figures for 88 wells with the WHP option.

**§3.3.2 Synthetic-based Jud Cuttings, pg 21 – "***For MODU drilling, SBM cuttings will be treated and released in accordance with the Offshore Waste Treatment Guidelines (OWTG) (National Energy Board (NEB) et al. 2010)*".

*See previous comments.*

**Husky Response:**
Comment noted. Thank you.

**§3.3.2 Synthetic-based Jud Cuttings, pg 28 -** *A smaller scale figure would be useful to distinguish the near field deposition.*

**Husky Response:**
Three finer scale versions of Figure 3-10 are provided as Figures 16 to 18, focusing on WWRX, NWRX and SWRX locations.

**§3.4 Sensitivity Discussion, pg 31 -** *"Sensitivity to the amount of cuttings material is straightforward; in general, the cuttings weights, densities and thicknesses seen over a given area are directly proportional to the volume of materials released*." *Provide the reference as to the source of the statement or more detail as to how the conclusion that densities and thicknesses are proportional to the volume of material released.*

**Husky Response:**

1. The volume of materials released, V, defines the weight (W=V * specific weight of the cuttings)
2. In turn, as shown in equation (1), p.7, the weight, W, and model grid cell area, A, define the cuttings density, C
3. In turn, as shown in equation (2), p.7, the thickness, T, is directly proportional to cuttings density, C, and in situ bulk density, γ

**§3.4 Sensitivity Discussion, pg 32 – "***For the present modelling, one settling velocity is employed for each particle type. For a faster fines settling velocity sensitivity, the value of 0.005 m/s from Tedford et al. (2003) was selected and applied for the scenario of drilling one of the potential future subsea drill centres." A more detailed explanation as to why this velocity was selected and the others excluded is required. Also, Tedford et al. only studied water based muds so an explanation as to the application of the settling velocities for WBM is comparable to SBM cuttings.*

**Husky Response:**

For the particle settling velocity sensitivity model run, to consider the effect of faster settling of the fines, AMEC selected a settling rate (w in equation 8) of 0.005 m/s used by Tedford; this is a larger value than the model 'base case' value of w=0.0012 m/s for the fines fall velocity (Table 3-4).

The w=0.005 m/s is a sensitivity to the base case particle settling velocity for fines. It applies to the fines particle whether they are associated with WBM or SBM cuttings (amounts of the different particles are given in Table 3-3). The objective of the sensitivity run is to consider possible change in range of the footprint. The outcome was that cutting thickness increased slightly as a result of faster settling velocities.

**Section 4 Drilling Mud Properties and Discharge characteristics, pg 38 – "***The use and disposal of water-based muds are subject to the Offshore Waste Treatment Guidelines (OWTG) (NEB et al. 2010)*".

*Previous comments*

**Husky Response:**

Comment noted. Thank you.

**Section 4 Drilling Mud Properties and Discharge characteristics, pg 38 – "***The most likely composition of the WBM planned for use during the WREP does not include these weighting agents, therefore no amount of particulate matter is expected to be introduced to the environment due to the release of WBM during any stage of the drilling process. The anticipated composition of WBM (Table 4-1) constitutes primarily of brine, with the possible addition of Sodium Acid Pyrophosphate (SAPP). SAPP is a white powder that is water soluble. It is used as a mud thinner and dispersant, and is especially effective for treating cement contamination (MiSwaco 2006)." Confirm with the proponent what the composition of WBM will be.*

**Husky Response:**
The WBM systems currently planned for use for the first two hole sections (i.e., conductor and surface) contain components as follows, with notional concentrations provided:

- Drilling Fluid: Seawater
- Mud Sweeps: Seawater + 6 to 10 kg/m³ Guar Gum
- SAPP Sweeps: Seawater + 3 to 7 kg/m³ SAPP
- Kill Mud: NaCl Brine (24%) + 4 kg/m³ Kelzan XCD + 5 kg/m³ Guar Gum + 35 kg/m³ Salt 805

Subsequent hole sections, once the BOP has been installed, will employ SBM fluid systems.

**Section 4 Drilling Mud Properties and Discharge characteristics, pg 38 – "***No component of the WBM has been identified as potentially toxic; therefore the dispersion of WBM following the discharges has not been treated in further detail." A reference of other information to support this conclusion is required otherwise it is an unfounded assumption.*

**Husky Response:**
The WBM that Husky will use is comprised of primarily of brine, with the possible addition of sodium acid pyrophosphate (125 kg per hole section per well).

Acute toxicity of sodium acid pyrophosphate to marine algae and animals is summarized in Neff (2010), who listed the range of LC50 for different species (in) (using the GESAMP (2002) toxicity classification, where >1,000 mg/L is non-toxic and >100 to ≤1,000 mg/L is practically non-toxic). Sodium acid pyrophosphate had a range of 870 mg/L (freshwater species used in test; salt water species expected to much more tolerant) to >100,000 mg/L. Testing the toxicity of WBMs to marine organisms from the Gulf of Mexico, Atlantic and Pacific Oceans and Beaufort Sea (NRC 1983, in Melton et al. 2000) indicated that WBM discharged to the marine environment will be low in toxicity (Melton et al. 2000).
Reference:

References:
GESAMP (IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). 2002. *The Revised GESAMP Hazard Evaluation Procedure for Chemical Substances Carried by Ships*. Reports and Studies No. 64, International Maritime Organization, London, UK. 120 pp.

Melton, H.R., J.P. Smith, C.R. Martin, T.J. Nedwed, H.L. Mairs and D.L. Raught. 2000. *Offshore Discharge of Drilling Fluids and Cuttings – A Scientific Perspective on Public Policy*. Brazilian Petroleum Institute – IBP. Paper prepared for presentation at the Rio Oil and Gas Conference held in Rio de Janeiro, Brazil, October 16-19, 2000.

Neff, J.M. 2010. *Fate and Effects of Water-based Drilling Muds and Cuttings in Cold-water Environment*. A scientific review prepared for Shell Exploration and Production Company, Houston, TX.

**Section 4 Drilling Mud Properties and Discharge characteristics, pg 39 – "***Drilling operations involving SBMs will be conducted in accordance with the OWTG (NEB et al. 2010), which dictate the following:*

> *Where there is technical justification (e.g., requirements for enhanced lubricity or for gas hydrate mitigation), operators may use synthetic based mud (SBM) or enhanced mineral oil based mud (EMOBM) in the drilling of wells and well sections. Other than the residual base fluid retained on cuttings as described in the operator's EPP, no whole SBM or EMOBM base fluid, or any whole mud containing these constituents as a base fluid, should be discharged to the sea."*

*See previous comments*

**Husky Response:**
Comment noted. Thank you.

# 7.0 SBM Accidental Release and Dispersion Modelling (AMEC June 2012)

## 7.1 General Comment

The proponent does not understand the current regulatory environment and should familiarize themselves with the difference between regulation and guidance. The OWTG is not regulation, it is guidance. The OWTG states "…*the goals, objectives and requirements of the applicable acts and regulations, and to explain the expectations of the Boards regarding the management of waste material…" For an operator, the governing document with respect to management of discharges to the natural environment is the Environmental Protection Plan (EPP) submitted as part of the authorization application*." *(OWTG page 2). The document should describe the discharge of cuttings and mud for the project which would include, mud types, discharge locations, and oil on cuttings as expected for the project.*

**Husky Response:**
The discharge of mud and cuttings and their limits for the WREP will be described in the WREP Environmental Protection Compliance and Monitoring Plan and submitted as part of the authorization application.

***C-NLOPB Response****: Husky could have collected the data but chose not to. Using data from the current White Rose drilling program would have been more representative of the grain size. Husky should remodel using more applicable data.*

**Husky Response:** Husky will design a drill cuttings particle size sampling plan to be executed at the next opportunity. The samples will be analyzed for particle size and those data will be compared to the data used for input into the WREP environmental assessment cutting dispersion model (AMEC 2012). If the particle size data sets are not comparable, the cutting dispersion model(s) will be re-run and the results used to re-assess and adjust the associated environmental assessment predictions, as necessary.

Drill cutting dispersion model predictions will be validated in situ by monitoring the thickness of cutting piles on the seafloor once the White Rose EEM program is revised to accommodate operation of the WREP. This additional EEM monitoring would serve to validate the associated environmental assessment predictions.

## 7.2 Specific Comments

**Executive Summary, pg I – "***The development of the White Rose Extension Project (WREP) will involve the use of synthetic-based muds (SBMs), due to their unique performance characteristics, as well as their low toxicity and relatively low environmental effects compared to oil-based muds (OBMs). "Low toxicity" and "relatively low environmental effects" need to be defined to put the intended meaning in perspective. Information to support the assertion that SBM have low toxicity and relatively low environmental effects compared to OBM is required.*

**Husky Response:**
Oil-based muds are characterized by much higher toxicity ($LC_{50}$ as low as 0.1 g/kg) in comparison to SBMs (Patin 1999).

Husky Energy's Chemical Management System will continue to adhere to the *Offshore Chemical Selection Guidelines* (OCSG) (NEB et al. 2009), in its assessment of toxicity and biodegradability of discharges for the WREP. The OCSG requires that discharges are initially evaluated against the OSPAR Pose Little or No Risk to the Environment (PLONOR) List. The PLONOR List contains a list of

substances that will pose little or no risk to the environment. If one or more of the constituents of a discharge are not on the PLONOR List, the PARCOM OCNS hazard rating system is used.

The Centre for Environment, Fisheries and Aquaculture Science (Cefas), on behalf of the UK government, assigns product ratings for the petroleum industry based on the OCNS. These ratings are based on the physical, chemical and ecotoxicological properties of products. Cefas publishes a list of ranked products and their hazard classifications. The assigned hazard groups vary from category A (most hazardous) through E (least hazardous), and hazard quotient colour bands from purple (most hazardous), through orange, blue, white, and silver, to gold (least hazardous).
As reported annually to the C-NLOPB, Husky only discharges substances on the PLONOR List or class chemicals rated C through E, or colour band silver or gold. Discharge of any substances not on these lists requires justification and pre-approval from the C-NLOPB. The OCNS rating for the constituents of the WBM (listed in the response to the comment Section 4 Drilling Mud Properties and Discharge characteristics, pg 38) are provided in Table 15.

**Table 15 Offshore Chemical Notification Scheme Rating for White Rose Extension Project Water-based Mud Constituents**

| Product Name | OCNS/Charm Rating Class |
|---|---|
| Sodium Chloride | E |
| Guar Gum | E |
| Ketzan XCD Polymer | E |
| Sifto 100 (sodium chloride) | E |
| SAPP | E |

Reference:
Patin, S. 1999. *Environmental Impact of the Offshore Oil and Gas Industry*. EcoMonitor Publishing, East Northport, NY.

**Executive Summary, pgs i – "***The interpretation of the predicted footprint areas and thicknesses should take into account that these are only preliminary dimensions of the projected landing area for the SBM droplets,…". What is meant by Preliminary Dimensions?*

**Husky Response:**
The current state of knowledge of SBM spill behaviour in the ocean allows for the calculation of the approximate landing area, or footprint, within which SBM droplets of a certain size would fall if they were released within a given period of time. It is not currently possible to predict the extent of spreading of SBM at the sea bottom following the initial landing. Therefore, the modelled footprint dimensions only reflect the spatial spreading of SBM droplets by ocean currents as they fall through the water column, up to the point where they reach the bottom.

**Executive Summary, pgs i-ii – "***The subsequent fate and the footprint are likely to evolve in a less predictable fashion, as the negatively buoyant SBM droplets are expected to coalesce into streams or pools, and flow under the influence of gravity and the local bathymetric features.". How does the unpredictability of the settling of SMB affect the model results and the extent of the area affected? This should be better explained in the report.*

**Husky Response:**
The spreading of SBM after it drops to the sea bottom will likely depend on the SBM droplet interaction with bottom sediments. These processes will likely be specific to the conditions at the landing site, including the site-specific sediment properties, bottom morphology, near-bottom currents and SBM weathering processes. SBM behaviour at the seafloor has not been characterized or quantified by basic research studies to date and is very site and scenario specific..

**Executive Summary, pg ii** – "*As there is a trade off between the area covered by the spill and the thickness of the spill,…". What is the trade off? Provide more explanation as to the relationship between the area covered and spill thickness, and how this affects the outcome of the model.*

**Husky Response:**
The SBM model grid consists of cells measuring 30 m by 30 m, and the thickness of SBM in each cell is computed from the total volume of SBM that falls in each cell if that volume was distributed uniformly within the cell. The total volume of spilled SBM is conserved in the model; therefore, the spill thickness and area covered are inversely proportional. In other words, if the spill is spread over a larger number of cells (over a larger area), the spill amount per cell (or spill thickness) would be smaller than if the same amount of SBM landed within a smaller area.

**Executive Summary, pg ii** – "**…***it is expected that the biodegradation of the SBM on the seafloor would take place over periods on the order of several weeks." A reference and information to support this conclusion is required. Not all of the components of the mud will degrade. The synthetic-based fluid is the component that will degrade faster than remaining components, some of which will not degrade. The assumption that the SBM will degrade is not entirely accurate. Revise the statement to reflect this.*

**Husky Response:**
SBM biodegradation itself is highly variable, as the various constituents. However, biodegradation of unused SBMs over several weeks is supported by Centre for Offshore Oil, Gas and Energy Research and Lee (2009).

Reference:
Centre for Offshore Oil, Gas and Energy Research and K. Lee. 2009. Environmental persistence of drilling muds and fluid discharges and potential impacts. *Environmental Studies Research Funds Report*, No. 176: 35 pp. http://www.esrfunds.org/pdf/176.pdf

**§1.1 Project Background, pg 1** – "*1 Under the wellhead platform (WHP) development option (the alternative to the subsea drill centre option), for both intermediate and main well sections, all SBM will be treated and reinjected or stored/ transferred to the next well." The proponent has neglected to consider that it is possible to spill SBM from the platform. For example on January 28, 2003 Hibernia spilled 23.7 $m^3$ of SBM when gates were not properly aligned to direct SBM to cuttings reinjection. There have also been instances where SBM was spilled due to breakages of bunkering hoses. The proponent should review the possibilities of SBM being lost from the WHP and, as appropriate, model those situations.*

**Husky Response:**
Please see nearby comment §2.2 Potential Synthetic-based Mud Accidental Release Scenarios for the White Rose Extension Project, pg 6 – "The most …"

The surface/platform release scenario (initially 60 $m^3$, now 175 $m^3$) is the most severe, but reasonable, hypothetical scenario that can be anticipated for the WREP (WHP). In the report we've classified the releases as surface/mid-depth/near bottom

based on the literature review (following SwRI 2007), and picked the most common mode of failure for each, and used the most severe spill amount for each of those modes in the modelling. The 175 $m^3$ is more severe than the 23.7 $m^3$ cited by the reviewer.

**§1.1 Project Background, pg 1** – "*The use of SBMs in offshore drilling operations is regulated in accordance with the Offshore Waste Treatment Guidelines (OWTG) (NEB et al. 2010), which dictate the following:…". The OWTG are not regulation they are guidance. Please refer to general comment above on the difference between guidance and regulation.*

**Husky Response:**
Comment Noted. Thank you.

**§1.1 Project Background, pg 1 – "…***as the synthetic fluids that comprise the continuous phase exhibit low toxicity to aquatic life and are more biodegradable in marine sediments than OBMs.". The statement "low toxicity and more biodegradable" needs to be put in context. Define what is meant by low toxicity and explain (and reference) how SBM is more biodegradable than OBM.*

**Husky Response:**
Unlike the base oils in OBMs (diesel and mineral oil), which are refined from crude oil, the base fluids in SBMs are synthesized organic compounds so are less toxic and biodegrade faster than OBMs (Patin 1999).

**§1.1 Project Background, pg 1 –***At the end of page 1 Burke and Veil (1995) is cited; however no such reference appears in the "Literature Cited" section. The reference can not be checked to verify that it supports the statements made in the paragraph.*

**Husky Response:**
Reference was indeed missing, thank you.

Burke, C.A., and Veil, J.A. 1995. Synthetic-based drilling fluids have many environmental pulses. *Oil and Gas Journal*, 93(48): 59-71.

**§1.2 Objectives, pg 2 – "***It is noted that these studies are preliminary and the information will be updated as design progresses through FEED and detailed engineering." MODU are not dependent on the FEED analysis. They are not a specific design for the Project. There should be sufficient information regarding accidental releases of SBM from these facilities. The design of the WHP should be at a stage where losses of SBM can be identified.*

**Husky Response:**
While MODU design is not associated with FEED analysis, there is variation amongst capacity and design of current MODUs in use and newer MODUs that may be operating in the area.

As WHP design progresses through FEED and detailed design, further optimizations will occur to validate and potentially improve the overall design with the goal of safe and efficient operations. This would include mitigations against spills. In this context, the information would be considered preliminary.

**§2.2 Potential Synthetic-based Mud Accidental Release Scenarios for the White Rose Extension Project, pg 6 – "***The most severe hypothetical scenario that can be anticipated for the WREP involves the inadvertent discharge of the entire volume of a mud tank, resulting in 60 m3 of SBM being discharged through a 25 cm (10 inch) (internal diameter) pipe a few metres below the sea surface.". An explanation as to how this hypothetical case was arrived at is needed considering that this is not the worst case in the C-NLOPB jurisdiction. The worst case was on October 24, 2004 when Husky spilled 96.7 $m^3$ from the GSF Grand Banks through the diverter line.*

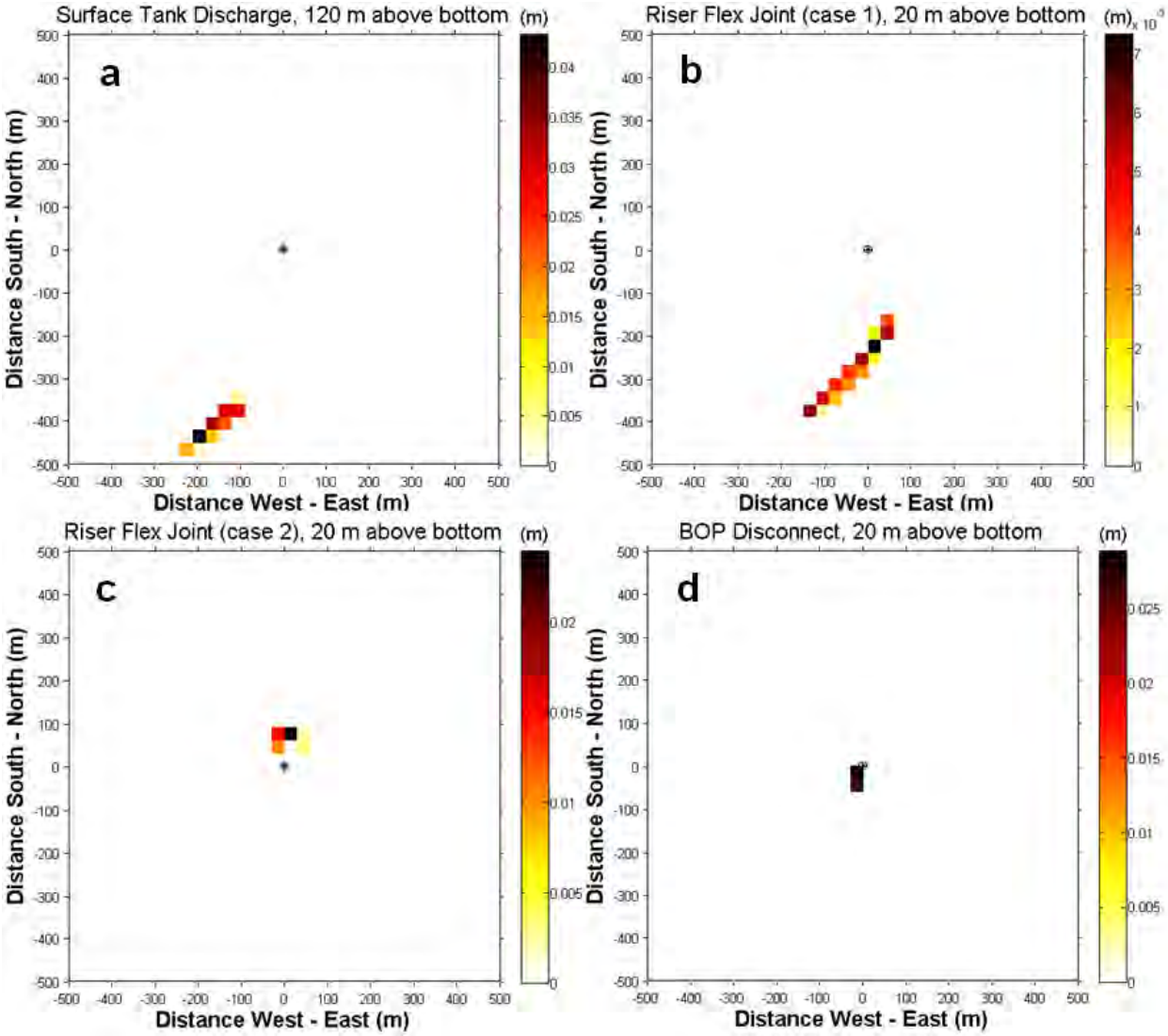
**Husky Response:**

The most severe, but reasonable hypothetical scenario that can be anticipated for the WREP (WHP) remains the inadvertent discharge of the entire volume of a reserve mud tank, resulting in 175 $m^3$ of SBM being discharged through a 25 cm (10 inch) (internal diameter) pipe a few metres below the sea surface. This volume has been updated since initial EA submission to reflect latest design.

An updated amount for the Surface Tank Discharge (STD) (mud tank) scenario is 175 $m^3$, almost three times the original volume of 60 $m^3$. The release time for this scenario has also been extended to 1.5 h (three times the original 0.5 h) to reflect the larger amount of SBM spilled. The updated results indicate that tripling the amount of SBM spilled from the surface would approximately triple the maximum footprint lengths and areas, but the median footprint length and areas would only double compared to the original results. The lengths and areas of the footprints from this scenario would still be smaller than those expected for the Riser Flex Joint (case 1), due to the fact that this mode of release is expected to produce SBM droplets with low fall velocities that can spread further over a shorter period of time.

See also Figure 29 (revised Figure 3-3) of results as response to comment §3.4 Synthetic-based Mud Dispersion Model Results, Figure 3-3. pg 17.

Another result of the updated surface release scenario is the increase in layer thickness. Thus, the STD scenario would result in the highest maximum layer thicknesses (19.4 cm in limited areas), and the highest average layer thicknesses (5.1 to 6.1 cm) that are most closely comparable to the average layer thicknesses of the BOP disconnect scenario (4.8 to 4.9 cm). It should be noted that the BOP disconnect scenario results in footprints that are approximately four to five times smaller in area than those from the STD scenario.




Note: a) surface low-speed jet release; b) subsea high-speed jet – low fall velocity; c) subsea high-speed jet – high fall velocity; d) subsea low-speed jet (BOP disconnect). The colour-contoured heights (z-value) is SBM layer thickness (m).

**Figure 29 Revised Figure 3-3 Example Realizations for the Four Modelled Release Scenarios in Winter**

**Section3.0 Synthetic-Based Mud Spill Dispersion Modelling, pg 9 – "***A literature review of the current state of scientific knowledge of the behaviour of SBM in the marine environment, as well as reports of observations of actual SBM spill events, revealed that SBMs exhibit a unique behaviour in the marine environment due to the fact that they are immiscible in water (i.e., cannot be mixed with), and are negatively buoyant.". A reference is required to support this conclusion.*

**Husky Response:**

We agree that the reference to the study describing the SBM behaviour should appear in the text sooner than it does.

The behaviour of spilled SBM in the ocean has been studied and quantified in laboratory conditions by the Southwest Research Institute, as discussed on page 10 of the report and thereafter (reference below). The same study included a review of spill incident reports as well as interviews with operators in the Gulf of Mexico, which

indicate that SBM is negatively buoyant and immiscible in water. This behaviour of SBM can be expected based on the composition of commonly used SBM.

Reference:
SwRI (Southwest Research Institute). 2007. *Fall Velocity of Synthetic-Based Drilling Fluids in Seawater*. Final Report, prepared for Minerals Management Service.

**Section3.0 Synthetic-Based Mud Spill Dispersion Modelling, pg 9 – "***Unlike water-based fluids, they tend to form distinct jets and droplets that fall relatively rapidly through the water column, and they are prone to form visible and clearly-defined streams and pools at the seafloor, where their dispersion is in large part driven by gravity in conjunction with the local seafloor features.". A reference is required to support this conclusion*

**Husky Response:**
Same as previous comment: We agree that the reference to the study describing the SBM behaviour should appear in the text sooner than it does (page 10).

**Section3.0 Synthetic-Based Mud Spill Dispersion Modelling, pg 9 – "***To date, there have been no systematic field observations of SBM dispersion in the marine environment that could be used to quantify their dispersion properties in a real world scenario.". The Proponent's EEM programs would provide an indication of the extent of SBM dispersion to verify the model.*

**Husky Response:**
The White Rose EEM program monitors the potential effects of field operations. An accidental SBM spill would require a site specific incident monitoring program to verify the model.

A comparison of the drill cuttings dispersion model and White Rose EEM results is provided above in response to comment G4 . Husky has completed a number of Environmental Effects Monitoring (EEM) Programs which give an indication of the extent of area affected by cuttings discharge from a MODU. There is no indication that the model has been calibrated or compared to the results of the EEM Programs. Such a comparison would demonstrate the accuracy of the model to predict the deposition of cuttings discharged.

**§3.1 Synthetic-based Mud Properties and Behaviour, pg 9 – "…***the continuous phase is comprised of Puredrill IA-35LV, a non-toxic and readily biodegradable synthetic fluid…". A reference is required to support this conclusion. The terms "low toxicity" and "readily biodegradable" need to be defined.*

**Husky Response:**
Exposure trials of PureDrill IA-35 on *Artemia* nauplii, capelin larvae, marine copepods, juvenile yellowtail flounder and ctenophores indicated that the potential for acute toxicity was very low (Payne et al. 2001). The MSDS for PureDrill IA-35 indicates that the product is readily biodegradable based on the results of the OECD Guideline for Testing of Chemicals (301b), which describes methods that permit the screening of chemicals for ready biodegradability in an aerobic aqueous medium. It was also found to be readily biodegradable in laboratory tests (Centre for Offshore Oil, Gas and Energy Research and Lee 2009).

References:
Centre for Offshore Oil, Gas and Energy Research and K. Lee. 2009. Environmental persistence of drilling muds and fluid discharges and potential impacts. *Environmental Studies Research Funds Report*, No. 176: 35 pp.

Payne, J., L. Fancey, C. Andrews, J. Meade, F. Power, K. Lee, G. Veinott and A. Cook. 2001. Laboratory exposures of invertebrate and vertebrate species to concentrations of IA-35 (Petro-Canada) drill mud fluid, production water and Hibernia drill mud cuttings. *Canadian Manuscript Report of Fisheries and Aquatic Sciences*, No. 2560: iv + 27 pp.

**§3.1 Synthetic-based Mud Properties and Behaviour, pg 9 – "***The overall density of the SBM will be 1,350 kg/m3.". Density of a drilling mud varies depending on the specific conditions of well section being drilled. For the purpose of this modeling, it is best to use a generic mud formulation which would produce a worst case result.*

**Husky Response:**
A drilling fluid density of 1,350 kg/m³ represents a generic fluid density for the WHP application, based on anticipated drilling fluid densities and offset well history.

**§3.4 Synthetic-based Mud Dispersion Model Results, Figure 3-3. pg 17 -** *The graphical presentation in Figure 3-3 is rather crude and small. It should be revised in finer resolution. Please indicate what each axis represents and where the release originated.*

**Husky Response:**
Please see Figure 23 (revised Figure 3-3). The axes are the distances in the south-north (y-axis) and west-east (x-axis) directions, about the origin, or point of release, at (x,y) = (0,0) shown as a small symbol.

**§3.5 Synthetic-based Mud Dispersion Model Sensitivity Tests, pg 19 – "***However, the tradeoff is that the larger footprint will result in a lower average SBM layer thickness at the seafloor, compared to the case where a smaller area receives a larger portion of the SBM.". Is this a trade off or an outcome of the model?*

**Husky Response:**
This is considered a trade-off because a larger footprint would result in thinner layer of SBM and vise-versa, but is also a result of the model.

The SBM model grid consists of cells measuring 30 m by 30 m, and the thickness of SBM in each cell is computed from the total volume of SBM that falls in each cell if that volume was distributed uniformly within the cell. The total volume of spilled SBM is conserved in the model; therefore, the spill thickness and area covered are inversely proportional. In other words, if the spill is spread over a larger number of cells (over a larger area), the spill amount per cell (or spill thickness) would be smaller than if the same amount of SBM landed within a smaller area.

**Section 4.0 Summary, pg 22 –** "*The interpretation of the predicted footprint areas and thicknesses should take into account that these are only preliminary dimensions of the projected landing area for the SBM droplets, and the estimated SBM layer thickness if the full spill volume landing in each model cell were to be equally distributed within that cell.". Saying that these are preliminary results implies that the information provided is not finalized and that there is more work to be done to calibrate the model or to collect additional data so the model's output represents the actual dispersion of mud. The Proponent needs to complete this work, submit a new report and revise the environmental assessment report, as appropriate.*

**Husky Response:**
The quoted statement by AMEC reflects the current state of scientific knowledge of SBM behaviour in the ocean environment, which is still in the early stages of development. AMEC acknowledges that further basic research is required to fully characterize SBM behaviour on the seafloor. The current SBM dispersion modelling study by AMEC represents a first effort (to the best knowledge of the authors) to model SBM spill behaviour on the Grand Banks based on the quantitative laboratory study by SwRI (2007), which treated SBM dispersion through the water column, but not the subsequent spreading on the sea bottom.

The current state of knowledge of SBM spill behaviour in the ocean allows for the calculation of the approximate landing area, or footprint, within which SBM droplets of a certain size would fall if they were released within a given period of time. It is not currently possible to predict the extent of spreading of SBM at the sea bottom following the initial landing.

# 8.0 Air Emissions Study – White Rose Extension Project (Stantec June 21, 2012) Revised Draft Report

## 8.1 General Comments

*G1 The "Air Emissions Study" report submitted is a revised draft report. Is it Husky Energy's intention to submit a final report?*

**Husky Response:**
Husky does not intend to submit another copy of this report. The submitted report was intended to be the final.

*G2 Section 5.3.6.2 of the Scoping Document directs the proponent to describe the potential means for reduction and reporting of air emissions. This report only deals with ambient air quality and does not examine the potential to reduce emissions from equipment or the facilities (i.e., WHP or MODU). The proponent should provide details with regard to plans to reduce and report air emissions. The proponent should also consider the future direction the federal government will take in achieving reductions of greenhouse gases in its evaluation.*

**Husky Response:**
Husky appreciates that energy efficiency is important to the WREP. That is why the detailed design and the tender documents will place value on the energy efficiency and emissions level of the selected units. It is Husky's intent to incorporate into their tender documents requests for emission reduction identification from the facility. Bidders will be directed to prepare bids reflecting these priorities. As well, any future policies or guidelines issued by the federal government during WREP design will be taken into consideration during final design.

*G3 The report has not mentioned gas dehydration for the WHP. If gas is to be dried for use on WHP it should be included in the report along with emissions estimates.*

**Husky Response:**
Gas dehydration will be conducted on the FPSO, not the WHP.

## 8.2 Specific Comments

**§3.2.2.1 Option 1 – Wellhead Platform, pg 12 – "***During normal operations of the WHP, a support vessel will be on stand-by for the Platform 365 days/year and at least one supply vessel will also be in operation 365 days/year, travelling between the east coast of…". The estimated number of vessels, two, appears to be low. The number of vessels to be used should be confirmed and compared to the number of vessels associated with other similar operations.*

**Husky Response:**
The estimated number of vessels used to calculate the emissions from the operation of the support vessels has been confirmed and remains at two, the number used within the Environmental Assessment and Air Emissions Study. If, once the WREP becomes operational, the number of support vessels differs, the additive emissions will be reported to the C-NLOPB and Federal Government through various reporting systems.

**§3.2.2.1 Option 1 – Wellhead Platform, pg 12 – "***Helicopters will also routinely travel between the east coast of Newfoundland and the offshore WREP site to transport employees to and from work, approximately three round trip flights per week*." *This estimate is for rotation of employees and does not account for other flights that may occur such as adhoc or medivacs. Such flights should also be included.*

**Husky Response:**
The estimate of approximately three round trip helicopter flights will occur per week, weather depending, has been confirmed and is valid. The additional number of flights, such as *ad hoc* or medevacs, is currently unknown, and will likely not add up to the number of routine flights cancelled due to incremental weather.

**§3.2.2.1 Option 1 – Wellhead Platform, pg 14 – "***The fuel gas composition analysis, as presented in Table 3-8, indicates that there is no hydrogen sulphide ($H_2S$) present in the gas;…". This is the composition of the gas now, however, as the field ages it is possible that the field may sour and $H_2S$ present in the gas. The proponent needs to examine this possibility and, if possible, account for souring in the modeling.*

**Husky Response:**
Husky is not expecting sour gas at a particular time but, consistent with the *SeaRose FPSO* topsides design, the WHP will be designed to handle 200 ppm $H_2S$ in topsides piping.

**§3.2.2.1 Option 1 – Wellhead Platform, pg 14 – "***Emissions related to the operation of the two 10 MW dual-fueled turbine generators were calculated using emission factors acquired from the US EPA AP-42 Chapter 3.1 Stationary Gas Turbines (US EPA 2000) and assuming a 34 percent efficiency (shaft plus electrical) for normal operations." Information on the efficiency of turbine generators is assumed but should be available and used in the modeling. The basis of the assumption used needs to be stated along with how the assumptions affect the outcome of the modeling.*

**Husky Response:**
As currently planned, the proposed WREP will use Siemens SGT-400 12.9 MW turbine generators for power generation on the WHP. The performance spec sheet for this unit states that the gross efficiency of the unit ranges from 33 to 36 percent, depending on the gross power. Therefore, the estimate of 34 percent used in the modelling conducted for the WREP environmental assessment is consistent with design specifications.

**§3.2.2.2 Option 2 – Subsea Drill Centre, pg 15 -** *Only total quantities of air emission are presented. This section should include a list of the emission sources and their contribution to the total emissions. If flaring is to occur with MODU, flare emission from the MODU will need to be included.*

**Husky Response:**
The emission estimates for the MODU were based on the operation of a MODU in the White Rose Field during a typical operating year. The emissions are representative of the combustion of diesel fuel in boilers and turbines. Flaring is an unpredictable and rare event and has not occurred from a MODU in the White Rose field since 2008.

Note that a transposition error was discovered following submission of the WREP Environmental Assessment and the Air Emissions Study. This error affects predicted concentrations of $SO_2$ from the operation of the MODU. The emission rate for $SO_2$ from the operation of the MODU is stated as being 0.008 g/s in the Environmental Assessment and Air Emissions Study; however, this value is 0.146 g/s. The

corrected concentration predictions for $SO_2$ is still far below the regulatory limit for all modelling scenarios considered and are provided in Tables 16 and 17.

**Table 16 Maximum Predicted Ground Level Concentrations of Sulphur Dioxide for Normal Operation of the Mobile Offshore Drilling Unit**

| Receptor | UTM | | 1-hour ($\mu g/m^3$) | 3-hour ($\mu g/m^3$) | 24-hour ($\mu g/m^3$) | Annual ($\mu g/m^3$) |
|---|---|---|---|---|---|---|
| | Easting (m) | Northing (m) | | | | |
| White Rose | 727708 | 5186021 | 22.7 | 17.6 | 7.56 | 0.522 |
| Hibernia | 669419 | 5179807 | 0.756 | 0.468 | 0.144 | 0.005 |
| Terra Nova | 693372 | 5149964 | 1.044 | 0.882 | 0.252 | 0.009 |
| NL Regulatory Limit | - | - | 900 | 600 | 300 | 60 |

**Table 17 Maximum Predicted Ground Level Concentrations of Sulphur Dioxide for Cumulative Mobile Offshore Drilling Unit Operation**

| Receptor | UTM | | 1-hour ($\mu g/m^3$) | 3-hour ($\mu g/m^3$) | 24-hour ($\mu g/m^3$) | Annual ($\mu g/m^3$) |
|---|---|---|---|---|---|---|
| | Easting (m) | Northing (m) | | | | |
| White Rose | 727708 | 5186021 | 28.6 | 21.6 | 9.72 | 0.666 |
| Hibernia | 669419 | 5179807 | 1.01 | 0.612 | 0.198 | 0.007 |
| Terra Nova | 693372 | 5149964 | 1.37 | 1.17 | 0.324 | 0.011 |
| NL Regulatory Limit | - | - | 900 | 600 | 300 | 60 |

**§4.5.3 Source Inputs, pg 23 – "***As discussed in Section 3.2.2, there is potential for approximately 12 blowdowns to occur per year. During a single blowdown event approximately 7,400 $m^3$ of gas is released from the flare. This type of flaring usually occurs over a short period of time and for calculation purposes a 10-minute release rate has been assumed for this study.". What are the source of the 12 blowdowns and 7,400 $m^3$ of gas? Why is an assumption made? The Proponent currently operates a FPSO and should be able to provide the duration of a blowdown. Please provide the basis of this assumption.*

**Husky Response:**

The duration of one blowdown event was an assumption used by Stantec to reflect an emergency reduction to half-pressure that must be complete within a 10 minute period, a condition that has been applied to other facilities. This information has since been updated based on further design of the WHP and therefore, modelling of a revised flare blowdown event was conducted and the results are provided in Table 18. A revised estimate of approximately 1,727 kg (or 2,409 $m^3$ (4.01 $m^3/s$)) of gas will be released during a blowdown event, based on the latest WHP design. The number of blowdown events per year is expected to be infrequent and not likely amounting to 12 in any given year.

**Table 18 Summary of Model Predictions - Maximum Predicted Ground-level Concentration for a Wellhead Platform Flare Blowdown Event**

| Contaminant | Averaging Period | Receptor | Location (UTM) | | Maximum Predicted GLC (µg/m$^3$) | NL *Air Pollution Control Regulations* (µg/m$^3$) |
|---|---|---|---|---|---|---|
| | | | Easting (m) | Northing (m) | | |
| $NO_2$ | 1-hour | Hibernia | 669419 | 5179807 | 6.96E-01 | 400 |
| | | Terra Nova | 693372 | 5149964 | 7.84E-01 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 7.48 | |
| | 24-hour | Hibernia | 669419 | 5179807 | 1.09E-01 | 200 |
| | | Terra Nova | 693372 | 5149964 | 1.69E-01 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 3.70 | |
| | Annual | Hibernia | 669419 | 5179807 | 3.82E-03 | 100 |
| | | Terra Nova | 693372 | 5149964 | 5.12E-03 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 2.02E-01 | |
| $SO_2$ | 1-hour | Hibernia | 669419 | 5179807 | 9.59E-03 | 900 |
| | | Terra Nova | 693372 | 5149964 | 1.10E-02 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 1.05E-01 | |
| | 3-hour | Hibernia | 669419 | 5179807 | 6.59E-03 | 600 |
| | | Terra Nova | 693372 | 5149964 | 5.25E-03 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 1.03E-01 | |
| | 24-hour | Hibernia | 669419 | 5179807 | 1.47E-03 | 300 |
| | | Terra Nova | 693372 | 5149964 | 2.31E-03 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 5.20E-02 | |
| | Annual | Hibernia | 669419 | 5179807 | 5.24E-05 | 60 |
| | | Terra Nova | 693372 | 5149964 | 6.99E-05 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 2.82E-03 | |
| CO | 1-hour | Hibernia | 669419 | 5179807 | 1.53E-01 | 35,000 |
| | | Terra Nova | 693372 | 5149964 | 1.76E-01 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 1.67 | |
| | 8-hour | Hibernia | 669419 | 5179807 | 7.03E-02 | 15,000 |
| | | Terra Nova | 693372 | 5149964 | 5.88E-02 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 1.46 | |

| Contaminant | Averaging Period | Receptor | Location (UTM) | | Maximum Predicted GLC (µg/m$^3$) | NL *Air Pollution Control Regulations* (µg/m$^3$) |
|---|---|---|---|---|---|---|
| | | | Easting (m) | Northing (m) | | |
| TPM | 1-hour | Hibernia | 669419 | 5179807 | 1.51E-02 | - |
| | | Terra Nova | 693372 | 5149964 | 1.55E-02 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 1.50E-01 | |
| | 24-hour | Hibernia | 669419 | 5179807 | 2.63E-03 | 120 |
| | | Terra Nova | 693372 | 5149964 | 3.79E-03 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 7.40E-02 | |
| | Annual | Hibernia | 669419 | 5179807 | 8.39E-05 | 60 |
| | | Terra Nova | 693372 | 5149964 | 1.15E-04 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 4.08E-03 | |
| $PM_{10}$ | 1-hour | Hibernia | 669419 | 5179807 | 1.45E-02 | - |
| | | Terra Nova | 693372 | 5149964 | 1.48E-02 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 1.43E-01 | |
| | 24-hour | Hibernia | 669419 | 5179807 | 2.53E-03 | 50 |
| | | Terra Nova | 693372 | 5149964 | 3.64E-03 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 7.06E-02 | |
| $PM_{2.5}$ | 1-hour | Hibernia | 669419 | 5179807 | 1.38E-02 | - |
| | | Terra Nova | 693372 | 5149964 | 1.39E-02 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 1.35E-01 | |
| | 24-hour | Hibernia | 669419 | 5179807 | 2.41E-03 | 25 |
| | | Terra Nova | 693372 | 5149964 | 3.46E-03 | |
| | | White Rose (*SeaRose FSPO*) | 727708 | 5186021 | 6.64E-02 | |

**§5.6 Greenhouse Gas Emissions (Wellhead Platform and Subsea Drill Centre), pg 36 -** *The summary only deals with air quality objectives. It does not deal with emissions from equipment and how their emissions can be minimized. The report also does not consider future emission reduction targets being considered by the federal government. The Proponent should address these issues as they are more relevant to the proposed operation than achieving air quality objectives. Air Quality objectives are not relevant as the proposed operation is in flat terrain with good dispersion and distant receptors.*

**Husky Response:**

As the proposed WREP has not undergone final design or tendering, plans pertaining to equipment and emission reductions are not currently available. The requirement for such consideration will be included in Husky's tender documents for final WREP design. During the final WREP design, consideration will also be given to any emission reduction targets identified by the federal government.

# 9.0 Government of Newfoundland and Labrador

## 9.1 Department of Advanced Education and Skills

*The Labour Market Development Division and the Skills Development Division of the Department of Advanced Education and Skills have reviewed the environmental assessment report provided for EA Registration #1665 by the proponent (Husky Energy). We are satisfied that the information provided in this report meets our requirements as outlined in the EA Guidelines for this project, and have no further comments on this report. In our opinion, the project may proceed.*

**Husky Response:**
Comment noted. Thank you. For the information of the Department of Advanced Skills and Education, an updated estimate of the person hours and corresponding full-time equivalents required for graving dock construction and concrete gravity structure construction at Argentia is provided as Table 14 (revised Table 4-2). The revised numbers are based on further project definition following completion of FEED.

*As the project moves closer to commencement, we are requesting copies of any HR, Benefits, Diversity and/or Women's Employment plans prepared for this project, as well as quarterly employment reports as outlined in the guidelines document.*

**Husky Response:**
Comment noted. Thank you. The *White Rose Extension Project Diversity Plan* is provided with this WREP EA Addendum as Attachment 1. No revisions have been made to this report since it was provided to DOEC on April 3, 2013.

## 9.2 Department of Environment and Conservation

### 9.2.1 Environmental Assessment Division

*Adequate justification provided on the need for a labour camp.*

**Husky Response:**
Comment noted. Thank you.

*Regarding site decommissioning see Water Resources Management Division comments below.*

### 9.2.2 Pollution Prevention Division

**Further Information Required during EA:**

1. *Information related to all potential discharges from the activity should be provided. This includes, but is not limited to details regarding the discharge locations, expected quality, duration, monitoring and receiving areas.*

**Table 19 Revised Table 4-2 Estimated Person-hours (Full-time Equivalents) to Design Graving Dock and Construct Graving Dock and Concrete Gravity Structure by Quarter**

| NOC Code | Role | Qtr 3, 2013 | Qtr 4, 2013 | Qtr 1, 2014 | Qtr2, 2014 | Qtr 3, 2014 | Qtr 4, 2014 | Qtr 1, 2015 | Qtr2, 2015 | Qtr 3, 2015 | Qtr 4, 2015 | Qtr 1, 2016 | Qtr2, 2016 | Qtr 3, 2016 | Qtr 4, 2016 | Qtr 1, 2017 | Qtr2, 2017 | Qtr 3, 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Graving Dock Construction** | | | | | | | | | | | | | | | | | | |
| NOC-0113 | Purchasing managers | 890(2) | 811(1) | 834(1) | 891(1) | 413(1) | | | | | | | | | | | | |
| NOC-0211 | Engineering managers | 3561(6) | 3246(4) | 3337(4) | 3566(5) | 1650(4) | | | | | | | | | | | | |
| NOC-1221 | Administrative officers | 890(2) | 811(1) | 834(1) | 891(1) | 413(1) | | | | | | | | | | | | |
| NOC-1241 | Administrative assistants | 2671(5) | 2434(3) | 2503(3) | 2674(3) | 1238(3) | | | | | | | | | | | | |
| NOC-2131 | Civil engineers | 13354(24) | 12171(15) | 12514(16) | 13371(17) | 6189(15) | | | | | | | | | | | | |
| NOC-2234 | Construction estimators | 2671(5) | 2434(3) | 2503(3) | 2674(3) | 1238(3) | | | | | | | | | | | | |
| NOC-7205 | Contractors and supervisors, other construction trades, installers, repairers and servicers | 2644(5) | 1983(3) | 1574(2) | 1077(1) | 410(1) | | | | | | | | | | | | |
| NOC-7302 | Contractors and supervisors, heavy equipment operator crews | 7046(13) | 5289(7) | 4199(5) | 2872(4) | 1095(3) | | | | | | | | | | | | |
| NOC-7521 | Heavy equipment operators (except crane) | 59023(107) | 44298(56) | 35164(46) | 24053(31) | 9177(22) | | | | | | | | | | | | |
| NOC-7611 | Construction trades helpers and labourers | 21161(38) | 16169(20) | 13215(17) | 9681(12) | 3839(9) | | | | | | | | | | | | |
| **CGS Construction** | | | | | | | | | | | | | | | | | | |
| NOC-0211 | Engineering managers | | | | | 3904(5) | 5530(7) | 5799(8) | 6136(8) | 6204(8) | 5462(7) | 5934(8) | 6136(8) | 6204(8) | 6204(8) | 6069(8) | 4997(6) | 0 (0) |
| NOC-1221 | Administrative officers | | | | | 1301(2) | 1843(2) | 1933(3) | 2045(3) | 2068(3) | 1821(2) | 1978(3) | 2045(3) | 2068(3) | 2068(3) | 2023(3) | 1666(2) | 0 (0) |
| NOC-1225 | Purchasing agents and officers | | | | | 1735(2) | 2458(3) | 2577(3) | 2727(3) | 2757(3) | 2428(3) | 2637(3) | 2727(3) | 2757(3) | 2757(3) | 2697(4) | 2221(3) | 0 (0) |
| NOC-1241 | Administrative assistants | | | | | 8676(11) | 12288(16) | 12887(17) | 13637(17) | 13786(17) | 12138(15) | 13187(17) | 13637(17) | 13786(17) | 13786(17) | 13487(18) | 11104(14) | 0 (0) |
| NOC-2131 | Civil engineers | | | | | 19625(25) | 27793(35) | 29149(38) | 30843(40) | 31182(39) | 27454(35) | 29827(38) | 30843(40) | 31182(39) | 31182(39) | 30504(40) | 25115(32) | 0 (0) |
| NOC-2132 | Mechanical engineers | | | | | 5496(7) | 7784(10) | 8164(11) | 8638(11) | 8733(11) | 7689(10) | 8354(11) | 8638(11) | 8733(11) | 8733(11) | 8543(11) | 7034(9) | 0 (0) |
| NOC-2231 | Civil engineering technologists and technicians | | | | | 8468(11) | 11993(15) | 12578(16) | 13309(17) | 13455(17) | 11847(15) | 12870(17) | 13309(17) | 13455(17) | 13455(17) | 13163(17) | 10837(14) | 0 (0) |
| NOC-2234 | Construction estimators | | | | | 2077(3) | 2941(4) | 3085(4) | 3264(4) | 3300(4) | 2905(4) | 3157(4) | 3264(4) | 3300(4) | 3300(4) | 3228(4) | 2658(3) | 0 (0) |
| NOC-7201 | Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations | | | | | 0 (0) | 0 (0) | 1076(1) | 7492(7) | 14257(13) | 10101(10) | 11552(11) | 15819(15) | 11549(11) | 2950(2) | 1268(1) | 1317(2) | 4(0) |
| NOC-7203 | Contractors and supervisors, pipefitting trades | | | | | 0 (0) | 0 (0) | 36(0) | 151(0) | 763(1) | 680(1) | 690(1) | 683(1) | 655(1) | 654(1) | 289(0) | 0 (0) | 0 (0) |
| NOC-7204 | Contractors and supervisors, carpentry trades | | | | | 0 (0) | 0 (0) | 21(0) | 2053(2) | 2785(3) | 1906(2) | 2250(2) | 2481(2) | 2122(2) | 698(1) | 189(0) | 0 (0) | 0 (0) |
| NOC-7205 | Contractors and supervisors, other construction trades, installers, repairers and servicers | | | | | 836(1) | 1772(2) | 2555(2) | 8490(8) | 13798(13) | 10415(10) | 13596(13) | 18473(17) | 11945(11) | 4644(4) | 1879(2) | 851(1) | 0 (0) |
| NOC-7236 | Ironworkers | | | | | 93(0) | 11959(19) | 48940(74) | 112236(134) | 153917(156) | 105105(105) | 119680(120) | 160178(158) | 122712(124) | 33836(36) | 16671(19) | 13833(23) | 38(0) |
| NOC-7252 | Steamfitters, pipefitters and sprinkler system installers | | | | | 0 (0) | 0 (0) | 341(0) | 1417(1) | 7153(11) | 6377(10) | 6469(10) | 6395(10) | 6133(10) | 6119(10) | 2701(5) | 0 (0) | 0 (0) |
| NOC-7271 | Carpenters | | | | | 0 (0) | 0 (0) | 242(0) | 23950(22) | 32490(29) | 22236(20) | 26254(24) | 28940(27) | 24757(22) | 8144(7) | 2197(2) | 0 (0) | 0 (0) |
| NOC-7302 | Contractors and supervisors, heavy equipment operator crews | | | | | 1649(2) | 2335(3) | 2449(3) | 2591(3) | 2619(3) | 2306(3) | 2506(3) | 2591(3) | 2619(3) | 2619(3) | 2562(3) | 2110(3) | 0 (0) |
| NOC-7521 | Heavy equipment operators (except crane) | | | | | 11790(15) | 16698(21) | 17512(23) | 18530(24) | 18734(24) | 16494(21) | 17919(23) | 18530(24) | 18734(24) | 18734(24) | 18327(24) | 15089(19) | 0 (0) |
| NOC-7611 | Construction trades helpers and labourers | | | | | 13550(17) | 22322(27) | 27130(32) | 59567(61) | 88032(87) | 68265(68) | 86324(86) | 112809(110) | 78150(78) | 39211(42) | 24132(29) | 16170(21) | 0 (0) |

**Husky Response:**
Information regarding all planned discharges related to construction of the CGS is provided in the EPP. The EPP is provided as Attachment 2.

2. *It is stated that water removed from the graving dock will be pumped into a lined 2,700 $m^2$ settling pond, where it will be aerated and tested against applicable regulations prior to ocean disposal. Details should be provided on how the water flow into the settling pond will be managed, and how this water will then be discharged into the ocean. Is it known that the proposed settling pond will be able to hold a large enough volume of water to avoid overflow and potential ground contamination?*

**Husky Response:**
The settling pond, weirs, ditches, and culverts within the construction site have been designed to avoid overflow, based on current knowledge of groundwater flow rates and 1/100 year storm event. Aeration has been considered further and determined to be counter-productive to the purpose of the settling pond in that aeration would prevent effective settlement of suspended particles. Aeration was considered to treat potential hydrocarbon contamination, but data from the soil and groundwater testing indicate little risk of water contamination. The primary purpose of the settling pond is to remove suspended particulate, which in turn will remove any contamination associated with particulate from being released to the marine environment. Additional information attained during detailed design process will be considered in the final design of the settling pond. Please refer to the Draft Settling Pond Plan and sections in Figure 30 for the most recent design detail.

The dewatering water will be pumped from the dewatering wells and treated by a silt fence at the pipe outfall (one silt fence per pump outfall) before being transported in the impermeable ditch (lined with 20 mm clean crushed stone) to the settling pond. The runoff water generated from the working platform will also be carried in an impermeable ditch lined with 20 mm clean crushed stone to the settling pond. After going through the settling pond, the water will be released through a 10 m wide weir at the outfall of the settling pond. The weir is protected by large-diameter crushed stones (100 to 200 mm) and a soakaway has been provided to facilitate water infiltration in the ground at the weir outfall.

3. *Section 2.3.2.2 indicates the material volume proposed to be disposed of in the pond would exceed the water volume but would not exceed the volume of the natural topography of the pond. If this is the case, would additional soil be brought to the site to completely level the area? Please provide further information.*

**Husky Response:**
All material being transported to The Pond during the graving dock construction will come from the Husky lease boundary. Additional material is not expected to be required to completely level the area. The area around the eastern edge of The Pond, adjacent to the Haul Road will be raised to +4m before tipping of material will commence but this will be done using material from the graving dock excavation. Some engineered rock fill may be placed and compacted along the Pond side of the berm between the Pond and the Ocean to reduce permeability of the berm.

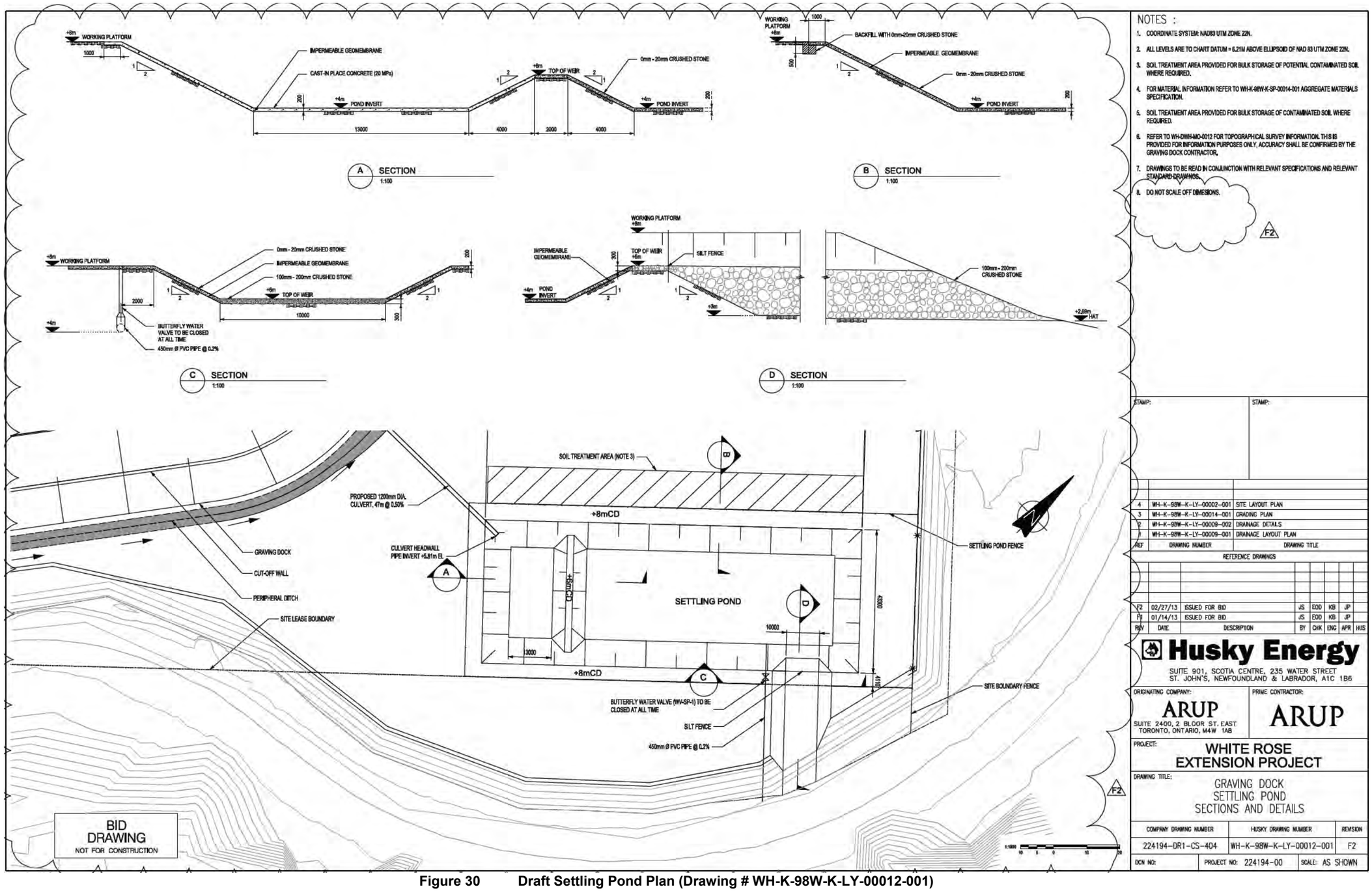



**Figure 30 Draft Settling Pond Plan (Drawing # WH-K-98W-K-LY-00012-001)**

4. *In order for material to be disposed in the Pond, it must be demonstrated that this is a beneficial use. This has not been demonstrated thus far. It is stated that "Sediments within the pond are contaminated and capping the contaminated sediments with cleaner sediments is a method of remediation that has previously been proposed" The ERA completed in 1998 indicated potential for unacceptable risks from PAHs in The Pond. However, in closure documentation provided to the Department by PWGSC, it is stated that a Risk Management Objectives (RMOs) were developed by Cantox in 2005 which concluded that further remediation was not required at the Pond. This same conclusion is referenced on page 2-33. It is therefore not evident that remediation/risk management is actually required at the Pond. In addition, based on the sediment samples collected during the recent sampling programs conducted by Husky, the pond sediment chemistry does not appear to be significantly different than that of the dredged materials and soil, with the exception of some slight PCB exceedances. The PCB results appear to be fairly consistent with those from 1997. Based on this, in order to determine if disposal in the pond is a beneficial use for excavated materials, an updated risk assessment would be required to demonstrate that risk management/capping is warranted.*

**Husky Response:**

Table 20 summaries the Risk Management Objectives (RMOs) applied previously to determine the need for remediation of The Pond. If we use the same criteria against the more recent data Husky has collected, these risks appear to have decreased, and remediation would not be warranted on this basis.

**Table 20 Risk Management Objectives Previously Applied to Determine the Need for Remediation of The Pond**

| Parameter (ppm) | RMO | The Pond Sediment | | Graving Dock Solis | |
|---|---|---|---|---|---|
| | | 1997 | 2012 | Test Pits | Boreholes |
| Lead | 187 | <1 to 71 | 17 to 55 | 14 to 60 | 15 to 29 |
| TPH | 1900 | <30.2 to 1600 | 170 to 500 | 20 to 64 | 27 to 38 |
| Total PAH | 11.4 | 0 to 18.9 | 1.18 to 8.33 | 0.01 to 0.18 | 0 |
| PCBs | 1.7 | <0.05 to 1.7 | <0.05 to 0.38 | 0.05 to 0.07 | 0 |

As Husky has pointed out in the WREP environmental assessment, The Pond is not a natural water body, it is man-made. DFO has concluded that The Pond is not productive fish habitat (DFO letter to Husky 01/10/12) and the sediments in The Pond are contaminated. However, by filling in The Pond, we are reducing contaminant exposure because soils from graving dock and sediments from the dredge areas pose less risk than sediments of The Pond.

As the excavation of the graving dock proceeds from the surface to deeper soils, there is less and less risk of contamination. Material from near the surface of the graving dock will be placed in the Pond initially and subsequently covered by deeper soils as the excavation proceeds, thereby reducing the risk of exposed contamination.

The process of material disposal in The Pond is to have bulldozers push material into The Pond that has been dumped alongside. This process will compact the material as the infill progresses from east to west within The Pond. Subsequent layers will be placed following a similar progression and compaction will result.

Husky will work with the AMA to reclaim The Pond for suitable future industrial/ commercial use.

5. *Should dredged material be permitted to be placed in the Pond, what measures will be in place to prevent fines in the material from becoming airborne?*

**Husky Response:**
Water content within the dredge materials will prevent fines from becoming airborne. Once the disposal of dredge material is complete, Husky will mitigate airborne particulate from the surface of the disposed material, as required.

6. *In the assessment of disposal alternatives for excavated materials, it is noted that out of area disposal is the environmentally preferred option. Clarification should be provided as to whether there is sufficient demand in the region for the excavated materials to be used as landfill cover. Section 2.3.2.3 refers to recent informal correspondence with Eastern Waste Management regarding the demand for cover material at nearby landfills. Husky should consult with the Department of Municipal Affairs to ascertain this demand, as that Department is the lead agency for the closure of landfills in this province.*

**Husky Response:**
In the third-party assessment of disposal options, out of area disposal was the environmentally preferred option, but just marginally better than disposal in The Pond. We must consider the socio-economic implications of trucking the material offsite at the rate of an estimated 764 truck-trips per day. Furthermore, the economic implication of offsite disposal to Husky is estimated at $150.5 million. This estimate has been calculated as the difference in cost between trucking materials to The Pond and trucking to a location 150 km offsite.

Nonetheless, Husky has investigated the demand for landfill cover though the Newfoundland and Labrador Department of Municipal Affairs, as requested. The information obtained reveals that most of the landfills on the Avalon Peninsula and Isthmus area have been decommissioned, so there is very little demand for landfill cover.

The disposal options analysis has demonstrated that disposal in The Pond is the only socially, economically and technically responsible option.

#### 9.2.2.1 Department Requirements

7. *It has been suggested that Husky would like to treat any petroleum hydrocarbon and metals impacted soil on site. Note that prior to this, approvals from Service NL and Department of Environment and Conservation would be required and there may be further sampling requirements.*

**Husky Response:**
Comment noted. Thank you.

8. *The operation of diesel generators at the site may require a Certificate of Approval from the Pollution Prevention Division, as per the Department's Guidance Document GD-PPD-061.1 (Approval of Diesel Generators).*

**Husky Response:**
Comment noted. Thank you.

9. *Pending a review of the additional information to be provided by the proponent, a Certificate of Approval may be required from the Pollution Prevention Division for this project.*

**Husky Response:**
Comment noted. Thank you.

10. *Any use of regulated substances, for example in cooling systems and fire suppression systems, associated with this proposed activity is subject to Halocarbon Regulations.*

**Husky Response:**
Comment noted. Thank you.

11. *Any discharge from the proposed site is subject to compliance with the Environmental Control Water and Sewage Regulations. Analyses completed for the purposes of compliance will be subject to the Accredited Laboratory Policy (PD:PP2001-01.2).*

**Husky Response:**
Comment noted. Thank you.

12. *White Rose has an Environmental Effects Monitoring (EEM) program in place for the offshore operations and this program will be re scoped to include the expansion. If there is a federal requirement for EEM at the Argentia site during construction, copies of the study designs and reports should be provided to the Department.*

**Husky Response:**
Comment noted. Thank you.

#### 9.2.2.2 Other Comments

13. *As a condition of release from Environmental Assessment, the Proponent should be required to prepare an acceptable Environmental Protection Plan that includes proposed effluent monitoring programs.*

**Husky Response:**
Comment noted. Thank you. Husky has provided a copy of the *Environmental Protection Plan - White Rose Extension Project - Argentia Site* as part of this environmental assessment Addendum as Attachment 2.

14. *During a site visit by Department officials in the fall of 2012, several coils of razor wire were noted just to the east of The Pond. These should be removed and disposed of safely.*

**Husky Response:**
Comment noted. Thank you. Husky will remove and dispose of the razor wire prior to construction, as a part of a site safety inspection.

15. *There is indication of groundwater monitoring at the site to determine site suitability. The groundwater monitoring should continue throughout the proposed activity to ensure that there are no impacts as a result of the activity.*

**Husky Response:**
Comment noted. Thank you. Groundwater monitoring will continue throughout the proposed activity. For details on the groundwater monitoring, the *Baseline Hydrogeological Characterization Concrete Gravity Structure Graving Dock Site Argentia, NL* (Stantec (2013)) is provided as part of this Environmental Assessment Addendum as Attachment 3.

### 9.2.3 Water Resources Management Division

#### 9.2.3.1 General Comments

*1. The requested information on groundwater flow and groundwater quality monitoring and treatment has not been provided in sufficient detail for WRMD to provide any recommendation. The proponent should provide the requested information.*

**Husky Response:**
Details on the groundwater flow and quality monitoring are contained in the attached Stantec (2013) report (Attachment 3). This information is supplemented by Section 5.2 of the EPP (Attachment 2), which addresses the plan for discharge monitoring. Should the groundwater require treatment for contamination, a mobile water treatment unit with the required specifications will be used to ensure compliance with applicable water discharge regulations.

*2. As per information provided, the Pond has been contaminated by previous users, does not have any fish, has no surface connections to other water bodies and is not accessible to the public because it is surrounded by private land. As such, the proponent must obtain a permit under Section 48 of the Water Resources Act prior to infilling the Pond and ensure that water discharged from the Pond meets all regulatory requirements.*

**Husky Response:**
Comment noted. Thank you.

*3. Pg2-2: the proponent indicates that the graving dock could be constructed as a permanent facility with gates or single-use facility that will be left flooded. The EA document does not confirm whether the proponent has chosen an option or not at this time.*

**Husky Response:**
No decision has been made at this time with regard to the construction of the graving dock gates.

#### 9.2.3.2 Permitting Requirements

*The proponent must apply for a non-domestic drilled well permit under Section 58 of the Water Resources Act for the proposed drilled well(s)*
***Contact: Manager, Groundwater Section, (709) 729-2539.***

**Husky Response:**
Comment noted. Thank you.

*The proponent must obtain a Water Use License from this Division for the use of any volume of water from any water source. As part of this licence the proponent will be required to provide a water use or diversion monitoring and reporting plan for all groundwater and surface water sources.*
***Contact: Manager, Water Rights Section (709) 729-4795***

**Husky Response:**
Comment noted. Thank you.

*The proponent will require approval from this Division under Section 48 of the Water Resources Act before starting construction activities within 15 metres of any water body (including wetlands). Construction activities include all stream crossings, dams, drainage works, fording and any other work such as landscaping, clearing or cutting of any natural vegetation within 15 metres of a body of water.*
***Contact: Manager, Water Investigations Section, (709) 729-5713***

**Husky Response:**
Comment noted. Thank you.

*Any effluent or runoff leaving the site will be required to conform to the requirements of the Environmental Control Water and Sewage Regulations, 2003.*

**Husky Response:**
Comment noted. Thank you.

## 9.3 Executive Council, Women's Policy Office

*The Women's Policy Office is in agreement with the assessment provided by Natural Resources.*

**Husky Response:**
Comment noted. Thank you.

*The Operator failed to include comments requested by WPO in the Guidelines and we reiterate the need for the Operator to include in the EPR document the following commitment:*

- *All benefit amendment components including Gender Equity and Diversity Plans (including Business Access Strategies) with the Province for the construction, operations and decommissioning phases of the project will be finalized and approved by the Minister of Natural Resources, and for Gender Equity and Diversity, the Minister responsible for the Status of Women prior to the start of construction.*

**Husky Response:**
Comment noted. Thank you. The *White Rose Extension Project Diversity Plan* is provided with this WREP Environmental Assessment Addendum as Attachment 1. No revisions have been made to this report since it was provided to DOEC on April 3, 2013.

## 9.4 Department of Natural Resources

*On behalf of Natural Resources (Mines and Energy), we have reviewed the EPR report for the Argentia Wellhead Platform Project and have found that the Operator failed to include comments requested in the Guideline.*

*Thus, we reiterate the need for the Operator to include in the EPR document the following commitments:*

- *All benefit amendment components including local benefit capture, and Gender Equity and Diversity Plans (including Business Access Strategies) with the Province for the construction, operations and decommissioning phases of the project will be finalized and approved by the Minister of Natural Resources, and for Gender Equity and Diversity, the Minister responsible for the Status of Women prior to the start of construction,*

**Husky Response:**
Comment noted. Thank you. The White Rose Extension Project Diversity Plan is provided with this EA Addendum (Attachment 1). No revisions have been made to this report since it was provided to DOEC on April 3, 2013.

- *The Operator must agree to address any additional benefit concerns identified by the province arising from the Wellhead project, and*

**Husky Response:**
Husky will submit a White Rose Canada-NL Benefits Plan Amendment to the C-NLOPB as part of its development application for the wellhead platform. This document will reflect the project benefits as agreed with the province.

- *Any Benefit Amendments will be submitted to the CNLOPB as an amendment to the Benefits Plan, and will also be amended in the overall White Rose Benefit Framework if deemed necessary by the Province.*

**Husky Response:**
Comment noted. Thank you.

# 10.0 Fish, Food and Allied Workers

*While the FFAW is generally supportive of the proposed project we have to balance that support with our responsibility to protect the interests of our fish harvester and plant worker membership and the health of our ocean for future generations.*

*Fundamentally, the overall project will impact fish harvesters both in Placentia Bay and the offshore. The near-shore component of the project will result in some loss of fishing grounds to harvesters in Placentia Bay. It needs to be noted that accessing alternate fishing grounds can be problematic when considering the traditional nature of the fishery in Newfoundland & Labrador. Fishing alternate grounds generally means that they are infringing on another harvester's "territory". As well, commercial species are not distributed equally in bays and coves. Therefore, the impacts of project-related activities in the next few years will have an impact on many harvesters in Placentia Bay, that is, not just those in the communities adjacent to the construction activities. All Placentia Bay harvesters will be subjected to increased risk of gear/vessel loss and damage, accidental spills, as well as reduced safety on the water, access to fishing grounds, and catch rates as a result of this project. As well, similar impacts will be faced by offshore harvesters with quotas to fish in NAFO Division 3L as offshore development begins.*

**Husky Response:**
Husky has included an extensive list of mitigations to minimize potential impact to fish harvesters in Section 9.5 of the WREP environmental assessment.

**Specific Comments**

*1. Establishing a Fisheries Liaison Committee with adequate fish harvester representation will be key in the coming months to enable appropriate consultation with the affected harvesters as the project proceeds (Section 6.2.1.3 and 9.5.1.2). Involving harvesters in the development of a near-shore Environmental Effects Monitoring program prior to the start of construction at the site will also provide opportunity for collaboration (Section 15.2.1). The FFAW and the harvesters whom it represents are looking forward to future consultations regarding the deepwater mating location as committed to by the Partners (Section 2.7.5)*

**Husky Response:**
Husky agrees that the Fisheries Liaison Committee (FLC) is key to successful cooperation between marine users. The FLC will be established prior to the start of marine construction activities. For clarification, Section 15.2.1 discusses an Environmental Protection Plan (EPP) to be implemented during construction activities at Argentia. The EPP will outline the testing requirements to ensure compliance with regulations and guidelines. The EPP will be prepared and submitted to the provincial Department of Environment and Conservation for review and approval. Husky is committed to holding further consultations with the FFAW once the deep-water site has been confirmed.

***FFAW Response**: The Fisheries Liaison Committee should not have to wait on the commencement of marine construction activities. Seeing that all activity will have some impact/involvement from/to the marine environment. Constituting the Fisheries Liaison Committee at the earliest convenience would largely be a beneficial venture, rather than holding off until activity happens. Early constitution will be conducive to enhance the positive approach to the mitigation efforts relating to the WREP. Looking at the response, the FFAW feels that there needs to be a definition of what prior to the start of marine construction activity is warranted.*

**Husky Response:** Husky also views a Fisheries Liaison Committee (FLC) as a beneficial venture with the purpose of mitigating WREP effects. We would anticipate establishing a FLC six months prior to the start of marine construction activity.

*2. In the discussion on planning for the development of the White Rose Expansion Project involving the western expansion in Section 2.4 there the acronym for the Wellhead Platform (WHP) is used on page 2-14, yet in Figure 2-1 said acronym is not involved in the depiction.*

**Husky Response:**
Comment noted. Thank you. The legend for Figure 2-1 should indicate that the WHP is comprised of the CGS and the topsides.

*3. Possible construction of the proposed Wellhead Platform structure in Placentia Bay will have an impact on the environment in the bay and more specifically fish habitat. Concerns from fish harvesters have been noted in the report with respect to dredging, debris, discharges, dumping, accidental spills, construction related noise and lighting. It needs to be reiterated however that construction activity will also impact catchability, and therefore profitability, for fish harvesters.*

**Husky Response:**
The WREP EA assesses the potential impact of all project activities on fish and fish habitat in Chapter 8. Potential impacts to Fisheries, including catchability, are assessed in Chapter 9. Husky has included an extensive list of mitigations to minimize potential impact to fish harvesters in Section 9.5.

***FFAW Response**: The FFAW feels that using only the interior of Placentia Bay excludes the headland communities. The WREP would have been better served using the whole of 3Psc as study area. This relates back to the fact that mitigation needs to include consideration of whole bay as a complex ecosystem and socio-economic environment. Activity in a single area can/will have economic and social implications for whole of bay.*

**Husky Response:** The Scoping Document for the WREP Environmental Assessment (C-NLOPB 2012) specifies that the Study Areas and associated boundaries should be described based on consideration of potential areas of effects as determined by modelling (e.g., spill trajectory, produced water and drill cuttings dispersion), the scientific literature and project-environment interactions. Husky defined the Nearshore Study Area by modelling WREP-environment interactions (underwater noise (JASCO 2012), dredge materials (AMEC 2012) and air quality (Stantec 2012)), including accidental events (oil spill trajectories (SL Ross 2012)). This is the area within which environmental effects were determined, including the effects on the fish, fish habitat and fisheries. Apart from an accidental event, the effects of the WREP were determined to be localized.

*4. The future fisheries were nominally encountered in this Environmental Assessment. With significant environmental changes it is anticipated that there will be a change in the biomass composition in Newfoundland & Labrador waters. With the environment readjusting to more stable/normal state there is an expectance of an increased presence of finfish (such as Cod). Therefore, although Figure 9-23 shows a drastic decrease around 1990 and since stability, there are indicators that this is about to change again. The likelihood is that harvesting patterns will change and there will be a significantly increased level of fishing activity throughout the Grand Banks. Potentially that activity could rival the time prior to the cod moratorium. The White Rose Partners should consult with the fishing industry on a regular basis to keep up to date with the fishing trends for the various species.*

**Husky Response:**
Husky intends to continue regular consultation with fishery representatives and the FFAW through One Ocean to remain current knowledge of trends and changes in both the nearshore and offshore fisheries environment. Husky provides annual updates to the FFAW and One Ocean on planned future activities. There is also ongoing liaison with the fishing industry through regular meetings of the One Ocean Technical Working Group. The C-NLOPB requires that all active environmental

assessments are updated annually with the most current fisheries data available. Consultation with One Ocean and the FFAW are conducted as part of those environmental assessment updates.

***FFAW Response**: The response provided by Husky Energy does not suffice in the context of the comment. As relating to Comment #6, 20 years is an inadequate timeframe in view of the FFAW. Historical data should/must include considerations of patterns pre-moratorium.*

**Husky Response:** Husky believes that consideration of pre-moratorium fishing patterns and catch levels are of limited value for the purpose of the WREP Environmental Assessment. As a case in point, an extensive analysis was undertaken for Mobil Oil in 1980 for the Hibernia environmental assessment, which concluded that Unit Area 3Lt was not a major or economically important cod fishing zone in the overall Grand Banks fishing industry and at that time, there were no crab being harvested from that zone. Since that time, the Unit Area 3Lt has become a highly valuable crab-fishing area, which Mobil's detailed analysis of the historical data and its extensive consultations with the fishing industry did not and could not have predicted in the 1980s. Even a 40-year catch data perspective cannot demonstrate the present or future economic importance and value of the commercial fisheries in a given area.

Husky intends to continue regular consultation with fishery representatives and the FFAW through One Ocean to maintain current knowledge of trends and changes in both the nearshore and offshore fisheries. As required by the C-NLOPB, potential future changes to the fishery will be assessed annually though environmental assessment updates. Consultation with One Ocean and the FFAW are conducted as part of those environmental assessment updates.

New Reference:
Mobil Oil 1980. Baseline analysis of commercial fisheries activities in eastern and southern Newfoundland. Hibernia Environmental Impact Statement, 1980-1981).

*5. Also with respect to future fisheries, information presented at RAP meetings in 2009 and 2010 indicated that there are increasing signs of cod in the offshore with scope for more recovery, with indication of a low natural mortality. The 2011 Assessment of Northern (2J3KL) Cod (Science Advisory Report) noted that the annual DFO trawl surveys indicated an eight-fold increase in the spawning stock biomass from 2004 to 2008. A commercial fishery for Atlantic cod on the Flemish Cap (an adjacent, NAFO-regulated stock) opened in 2010. For Southern Grand Banks cod (3NO) it is expected that the spawning stock biomass will surpass the conservation limit reference point set by DFO in 1999 at 60,OOOt.The resumption of offshore groundfish fisheries would significantly alter fishing patterns and activities within the Jean d'Arc Basin of the Grand Banks and have an impact on fishing enterprises. Again, the fishing industry should be regularly consulted to keep apprised of fishing trends.*

**Husky Response:**
Husky intends to continue regular consultation with fishery representatives and the FFAW through One Ocean to remain current knowledge of trends and changes in both the nearshore and offshore fisheries environment. Husky provides annual updates to the FFAW and One Ocean on planned future activities. There is also ongoing liaison with the fishing industry through regular meetings of the One Ocean Technical Working Group. The C-NLOPB requires that all active environmental assessments are updated annually with the most current fisheries data available. Consultation with One Ocean and the FFAW are conducted as part of those environmental assessment updates.

*6. The FFAW feels that the fisheries statistics contained in the Environmental Assessment are insufficient in that they do not give any reflection of the historical harvest for groundfish on the Grand Banks. With the changing environment it would be pertinent for the Environmental Assessment to contain indicators of where and how groundfish harvest was pursued on the Grand Banks, especially the formerly important codfish. Effectively, a five year horizon for past fisheries is not sufficient and does not provide a good enough perspective of the activities for the members of the FFAW.*

**Husky Response:**
WREP EA Section 9.3.2.1 - Historical Overview of Regional Fisheries (Placentia Bay) provides a broad overview of historical trends in the nearshore fisheries in Placentia Bay during the past 20 to 25 years. Section 9.3.3.1 - Historical Overview of Regional Fisheries (Eastern Grand Banks) provides a 20-year perspective of fisheries harvesting trends in NAFO 3LMN. As noted above, Husky will continue to consult on a regular basis with offshore fisher representatives, FFAW managers and One Ocean in order to keep apprised of future trends and changes in the offshore fisheries environment.

***FFAW Response**: The response aptly manages to quote and specify exactly what the FFAW comment identified as insufficient. The FFAW indicated that the data should go back past 1990, for a proper perspective of the potential harvesting patterns – particularly in the offshore.*

**Husky Response:** Please see response to Comment #4.

*7. Looking at the various discussions on habitat through out the Environmental Assessment there are some mishaps, such as a subheading in Section 8.5.2.1 being Change of Habitat Quality, the lead sentence then reads. "Habitat quantity may be reduced as a result of lighting, discharges, sedimentation and increased noise occurring due to the above activities." There obviously is a disconnect between what is written and what was intended written. It is further worth to note that the final paragraph of Section 8.5.1.3 suggests that in a worst case scenario of an accidental event the impact would be such to only affect abundance or distribution of one generation of fish, and to be re-established to previous levels within several generations. This is a significant statement as with the state of the Newfoundland & Labrador fisheries any impact on the biomass or resource availability is significant.*

**Husky Response:**
Comment noted. Thank you. The heading for Section 8.5.2.1 should read Change in Habitat Quantity. Section 8.5.1.3 assesses the effect of an accidental event on fish and fish habitat.

***FFAW Response**: It is clear that the reviewer is aware of what the sections contain. Therefore, merely re-citing the section number as it is in the comment is the same as not providing an answer or response to the comment.*

**Husky Response:** Our response was intended to acknowledge that Section 8.5.2.1 was mislabelled and to reiterate that Section 8.5.1.3 assesses the effects on fish and fish habitat, not fisheries. We further acknowledge the reviewer's comment that any effect on fish or fish habitat could translate into an effect on fisheries.

**8.** *In the responses prepared by Husky Energy, Comment #8 was collapsed in with Comment #7.*

*9. The establishment of a Safety Zone (Section 9.5.1.1 and 9.5.1.2) at the locations in Placentia Bay will result in a loss of fishing grounds to harvesters in Placentia Bay. This is significant for inshore harvesters in Placentia Bay as previously discussed.*

**Husky Response:**
While the establishment of a deep-water mating site safety zone will create a temporary loss of access to fishing grounds within these areas, it will serve as a key mitigation to avoid or prevent interaction and to help ensure the safety of workers, fishers and other marine users.

Husky has committed to several mitigation measures in Section 9.5.1.2 to mitigate the impact of the WREP on fish harvesters. Details of these mitigations will be further discussed during the Fisheries Liaison Committee meetings.

***FFAW Response**: It is prudent to recognize that any displacement of harvesting effort will have a broader impact than only the immediate area. Husky should not wait to engage harvesters – why not engage harvesters fully before the decision on the deep-water mating site. The mitigation efforts should not be confined to having consultations inside the project area, as stated elsewhere Placentia Bay is a whole. Further it is suggested in the Mitigations section that the Fisheries Compensation Program would already have been discussed at the Fisheries Liaison Committee – a committee not yet constituted (to the best of my knowledge).*

**Husky Response:** Husky and our environmental assessment consultants have met with the FFAW and area fishers for the purposes of assessing proposed activities at a deep-water site. The environmental assessment concludes that the potential effect of the WREP will be localized and of short duration.

*10. The Husky Energy Extension Project Environmental Assessment presents an untenable spin on an unfortunate situation in the Gulf of Mexico, making light of an environmental disaster (Section 9.5.3). There are now cases of species in the Gulf of Mexico that are experiencing changes in gender composition, directly affecting the species recruitment. The FFAW does not appreciate a suggestion of a potential better economic return per volume harvested, due to diminished resource availability on the market as a result of an environmental disaster. Section 9.5.3 leads with the indication that the "...effects from a spill or blowout will be not significant. However, economic impacts might still occur if a spill prevented or impeded a harvester's ability to access fishing grounds, caused damage to fishing gear or resulted in a negative effect on the marketability of fish products."*

**Husky Response:**
Husky in no way intended to make light of the Deepwater Horizon accident in the Gulf of Mexico. The context of the discussion was simply to state the potential effects of an accidental event. We agree that the effects of the incident are still being realized.

The context of quote regarding significant effects from Section 9.5.3 is:

> "Chapter 8 concludes that biophysical effects on fish from a spill or blowout will be not significant. However, economic impacts might still occur if a spill prevented or impeded a harvester's ability to access fishing grounds (because of areas temporarily excluded during the spill or spill clean-up), caused damage to fishing gear (through oiling) or resulted in a negative effect on the marketability of fish products (because of market perception resulting in lower prices)."

We thereby acknowledge that a non-significant effect on fish may still impact fish harvesters.

*11. With regards to socio-economic considerations there is a mention that "90 percent of the nickel processing plant's construction workforce live outside of the Argentia area and commute to the WREP site on a daily basis, and a similar situation is expected with the WREP." It is unfortunate that this was not caught before the document was sent out for review. In addition who is to say that the WREP will have access to the potential labour supply surplus resulting from the completion of the nickel processing plant, there are two other major industrial projects taking place in the province at the same time that the Wellhead Platform is expected to be constructed.*

**Husky Response:**
Husky will work with its contractors, who will work directly with the appropriate trade unions, to offer a competitive wage and benefits package to attract and retain the required workers for the Project. A competitive wage and benefits package, in addition to the location of the project site, will support recruitment of qualified persons from the local area, throughout Newfoundland and Labrador, as well as nationally and internationally as required.

***FFAW Response**: There is no question that the WREP will have to be competitive to attract the workforce. "90 percent of the nickel processing plant's construction workforce live outside the Argentia area and commute to the WREP (Sic) site on a daily basis." It remains doubtful that the construction crew at Long Harbour travels to Argentia daily; this is what was meant to be pointed out from the quoted text. .*

**Husky Response:** Correction acknowledged. The construction crew at Long Harbour would not be travelling to Argentia on a daily basis.

*12. In the consultation session with the Offshore Harvesters, one fisherman raised an issue with regards to the possibility of the petroleum activity within the White Rose Field expanding to the Northeast. If this were to take place it would have a direct impact on some of the most fruitful snow crab harvesting grounds. This was brought up as the diagrams showing the White Rose field with new drilling centres had one listed to the Northeast of the current North Drill Centre (Figure 2-15 and/or Figure 2-16). At a subsequent meeting on October 9th, 2012 between the Husky Energy and the FFAW (One Ocean was also present) Husky was indicating that any expansion towards the Northeast was not within the horizon, and there are currently no plans to pursue anything in this area. Nevertheless, when the Environmental Assessment was sent out for review this is still listed in the figures listed above. Further to this, it is mentioned that offshore harvesters were concerned that the extension into the west of the White Rose field would go into snow crab grounds (Section 6.2.2.2). This is factually inaccurate, the concern raised by the harvesters was about extending to the north, there is very limited harvest taking place to the west of the White Rose field as evident from the (limited) information presented in Figure 9-28.*

**Husky Response:**
Comment Noted. Thank you.

*13. With regards to the concerns that were raised in the context of the SWRX (Page 6-10), the issue at hand was that the Safety Zone depicted in the consultation slide differed from that which is in place out in the field. The map which was used included a zonal change, which Husky subsequently went on to apply to get implemented. At the September 20th, 2012 consultation meeting the submission to change the Safety Zone had not been made. However, at the follow-up meeting on October s". 2012 Husky indicated that the application for changing the Safety Zone had been submitted. The issue was not that the FFAW and One Ocean were not consulted on the SWRX, but rather that said consultation had not had any mention of a change to the White Rose Safety Zone. This approach was not conducive to the enhancement of mutual trust between the two industries. The FFAW does realize that at the time of submitting the original Environmental Assessment for the subsea drill centres Husky did not know the exact location where they would be drilling. But when the proponent knows where the drill centres will be, there needs to be further consultation if there is going to be an impact on the fishing vessels that use the area.*

**Husky Response:**
Husky makes every effort to inform stakeholders of planned activities once schedules have been confirmed. We continue to ensure that consultation meetings are held with the FFAW and One Ocean in a timely manner.

***FFAW Response**: The foundation of this comment is that Husky Energy used a map reflecting a Safety Zone which had not been submitted to Transport Canada at the time of the consultation with harvesters.*

**Husky Response:** Correct. Consultation on changes to the safety zone occurred prior to the application being filed with Transport Canada.

*14. The FFAW and its members are very concerned about the potential of aquatic invasive species, such as green crab, infesting our bays and coastal waters. The additional vessel traffic associated with the construction of the Wellhead Platform in Placentia Bay may potentially lead to the introduction or proliferation of unwanted aquatic invasive species. The green crab that has become resident in areas of Placentia Bay for example has destroyed eel grass beds and competes with native crab and lobster species for food. The potential for the introduction of aquatic invasive species in the area was merely mentioned in passing (Section 12.4.2.3) in the White Rose Extension Project Environmental Assessment document. The FFAW strongly encourages the Partners to consider and detail the mitigation strategies that the contracting marine vessel companies will need to follow to prevent the introduction and/or proliferation of aquatic invasive species in Placentia Bay. Furthermore, the FFAW calls upon the various regulatory bodies to be very stringent regarding any ballast water exchange plans proposed by the Partners and ensure vessels follow proper ballast water management practices. As well, aquatic invasive species should be incorporated into the near-shore Environmental Effects Monitoring program.*

**Husky Response:**
There is very little non-domestic marine traffic expected from the WREP. The *Ballast Water Control and Management Regulations*, *Canada Shipping Act* will be applied as necessary to WREP vessels to ensure vessels follow proper ballast water management practices to mitigate the risk of the introduction of aquatic invasive species.

# 11.0 Fisheries and Oceans Canada

## 11.1 White Rose Extension Project Environmental Assessment

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| **GENERAL COMMENTS** | | | | |
| *1* | *HPD* | *SL* | | *DFO has recently reviewed the post-construction survey for the South White Rose Extension. It has been determined that the authorized footprint for excavation of the South White Rose drill center and associated spoils disposal has been significantly exceeded.*<br>*Throughout the document, Husky states there is sufficient capacity within the existing authorization for all works and undertakings proposed for the offshore component. DFO would like to highlight the fact that although Husky Energy has a valid authorization (Authorization No. 07-01-002) until December 31, 2015 for the White Rose Extension Project, an amendment may be required if Husky Energy plans to carry out any further excavation activities at the West White Rose other than that required for installation of the CGS and/or develop the North White Rose drill center as originally authorized.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *2* | *HPD* | *SL* | | *Based on recent ROV surveys of a nearby oil development, it appears that accumulation of drill cuttings in proximity to offshore oil drilling sites may be greater than predicted during the environmental assessment (EA). As such, DFO will be requesting that all oil developments (existing and future) conduct additional monitoring to determine the magnitude and extent of deposition of drill cuttings closer to the drill centers where current monitoring has not been carried out (i.e., within 250-500 m). This will require further discussions with DFO.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *3* | *HPD* | *SL* | | *There is no mention in the EA of subsea cables occurring within the nearshore dredging/excavation areas. The proponent should contact Canadian Hydrographic Service, NL Region to ensure that there are no cables or other impediments within the proposed route prior to commencement of dredging activities and CGS tow-out.* |
| **Husky Response:** | | | | Comment noted. Thank you. |

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| *4* | *DFO (Sci.)* | | | *Species descriptions should include the most up-to-date, relevant information available. For example, many of the distribution maps, particularly those for marine fish and SAR, are based on data prior to 2001 and need to be updated accordingly. Significant changes have occurred over the past 10 to 20 years for many marine species, as well as the marine environment.* |
| **Husky Response:** | | | | To our knowledge the maps are the most recent available. The text is more current. |
| **SPECIFIC COMMENTS** | | | | |
| *1* | *HPD* | *SL* | *2.4.1 White Rose Extension Project Design Criteria Table 2-4, P. 2-10* | *Please provide the correct dimensions of the CGS as the table reports the diameter in $m^2$. The exact footprint of the CGS is not specifically reported, which is needed to confirm that the authorized area under the current Fisheries Act Authorization has not been exceeded.* |
| **Husky Response:** | | | | The current CGS footprint is 111 m x 111 m. |
| *2* | *HPD* | *SL* | *2.6.3.1 Excavation, P. 2-20* | *The proponent should ensure that the cut-off wall is constructed using appropriate mitigations, such as sedimentation and erosion control measures as outlined in DFO's Guidelines for Protection of Freshwater Fish Habitat in Newfoundland and Labrador. Please note that mitigation measures as described in this document are applicable in both the freshwater and marine environments. Also, please confirm that there will be no in-water works during construction of the cut-off wall.* |
| **Husky Response:** | | | | In-water works will not be required during construction of the cut-off wall. Sedimentation and erosion control measures as outlined in DFO's *Guidelines for Protection of Freshwater Fish Habitat in Newfoundland and Labrador* are included in the EPP, as appropriate. |
| *3* | *DFO (Sci.)* | | *Section 2.6.3.3, P. 2-25 to 2-29* | *Baseline data on the health of fish in Argentia Harbor would be useful. Data is presented on levels of contaminants in sediment, but information on contaminant levels alone is of very limited value in assessing any potential risks to aquatic organisms. It is also noted that levels of contaminants in some sediment samples are above Canadian Council of the Ministers of the Environment (CCME) guidelines.* |
| **Husky Response:** | | | | Sediment contaminant data were collected by Husky as part of the graving dock site selection and dredge materials disposal options analysis. Baseline fish health data were not considered necessary for the assessment of planned activities associated with construction of the CGS. |

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| ***4*** | *HPD* | *SL* | *2.6.4 The Pond, P. 2-30* | *During water withdrawal at The Pond, ensure adherence to DFO guidelines as described above, including the use of appropriately sized screens as described in DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines (1995).* |
| **Husky Response:** | | | | Comment Noted. Thank you. For clarification, water is not planned to be actively withdrawn from The Pond. |
| ***5*** | *HPD* | *SL* | *P. 2-32* | *Please confirm that activities within The Pond will not compromise the integrity of the bar sway/berm, which could result in a breach of the structure and a resultant release of sediment into the marine environment.* |
| **Husky Response:** | | | | The berm will be inspected for integrity/permeability prior to activities within the Pond. If necessary, engineered material will be placed and compacted along the Pond side of the berm. |
| ***6*** | *HPD* | *SL* | *2.7.2 Shoreline Dredging, P. 2-37* | *During shoreline dredging, please ensure appropriate mitigations are implemented, particularly erosion and sedimentation control measures. Dimensions of the graving dock entrance are unclear. Please clarify whether the excavated/dredged area will be 18-20 m deep across the entire 180 m channel.* |
| **Husky Response:** | | | | The current estimate of the graving dock entrance is approximately 151 m wide and 18 m deep, relative to chart datum. Husky will install rip-rap along the entrance of the graving dock to mitigate shoreline erosion, post construction. |
| *7* | *HPD* | *SL* | *2.7.3 Tow-out Channel Dredging, P. 2-38* | *The overall size of the dredging footprint appears to be different than that reported in the Marine Habitat Characterization Report, dated September 2012 (i.e., decreased from 223,800 to 215,000 $m^2$). Prior to the start of construction, a final estimate of the dredging footprint should be provided to DFO.* |
| **Husky Response:** | | | | A final estimate of the dredging footprint will be provided to DFO once finalized. |
| ***8*** | *HPD* | *SL* | *2.7.6 Topsides Mating and Commissioning, P. 2-42* | *Please provide more detailed information on the proposed mooring systems, including anchor dimensions, water depth and substrate type at anchoring points, timing and duration of deployment, etc.* |
| **Husky Response:** | | | | The topsides mating operation is scheduled to take place no earlier than the summer of 2016. Husky continues to evaluate the specifications required for the deep water mating site. Once a site has been selected, the associated detailed information on the proposed mooring system will be submitted to DFO. |

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| ***9*** | *HPD* | *SL* | *2.8.1 Wellhead Platform, Figures 2-15 and 2-16, P. 2-45 & 2-48, respectively* | *The drill center SWRX should be included in the figures as it has been excavated and will be developed in 2013 with completion of the site prior to the offshore component of this project.* |
| **Husky Response:** | | | | Figures 2-15 and 2-16 have been revised as suggested and are provided as Figures 31 and 32 at the end of the DFO comment tables. |
| ***10*** | *HPD* | *SL* | *2.8 White Rose Extension Project: Installation, Table 2-12, P. 2-46* | *The table indicates that rock berms could be installed offshore. It is DFO's understanding that there would not be extensive use of rock berms in the offshore. Please confirm in writing that concrete sleeves will be used instead of berms for flowline protection (phone conversation between S. Lewis and D. Pinsent, February 8, 2013), as this could have implications under s.35(2) of the Fisheries Act.* |
| **Husky Response:** | | | | For clarification, concrete sleeves will be used instead of berms for flowlines associated with the SWRX Drill Centre. As discussed in the WREP EA, "Flowlines will be laid directly on the seafloor, similar to installation methods used for flowlines currently in the White Rose field. The need for additional flowline tie-in modules and associated valves will be evaluated during engineering. Flowline tie-in modules will sit on the seafloor and range between an estimated 20 and 40 $m^2$. Dropped object protection on the flowline near the subsea drill centres is also being evaluated and maybe composed of rock berms, as for SCD and NADC, or concrete mats or sleeves." Husky will continue to consult with DFO on planned offshore activities associated with the WREP. |
| ***11*** | *HPD* | *SL* | *2.8.2 Subsea Drill Centre, Table 2-13, P. 2-49* | *Maintenance of drill centers and flowlines, including the removal of excess drilling muds should be included in the list of activities as there could be implications under s. 35(2) of the Fisheries Act depending on the scale of activities required.* |
| **Husky Response:** | | | | Husky will contact DFO prior to the undertaking of such activities. |
| ***12*** | *HPD* | *SL* | *2.9.1 Wellhead Platform Operation and Maintenance, P. 2-51* | *This section indicates that SBMs will be re-injected if a suitable formation can be found. Please provide a contingency plan if this is not possible.* |

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| **Husky Response:** | | | | The base plan is to drill two cuttings reinjection wells for cuttings disposal purposes. In addition, the WHP design currently envisions a secondary cuttings dryer system to lower synthetic based mud on cuttings (SOC) to a target level of 6.9% SOC. This is consistent with technology currently employed by MODUs operating in the area. This secondary dryer would be employed until the cuttings reinjection (CRI) system is functional. This secondary system would also be employed in the event of difficulties with the CRI system. Prior to having a CRI system in place, and in the event of CRI system failure, following processing with the secondary dryer, cuttings would be discharged overboard.<br>Current drilling authorizations allow for the discharge of cuttings while drilling with an SBM fluid, at discharge limits specified in the facilities Environmental Protection Plan. The discharge of mud and cuttings and their limits for the WREP will be described in the WREP Environmental Protection Compliance and Monitoring Plan and submitted as part of the authorization application. While using an SBM fluid system, the WHP intends to handle cuttings in a similar manner as a MODU until the CRI system is operable, as well as in the event the CRI system experiences a failure. Once the CRI system is operable, these cuttings will be reinjected downhole. |
| ***13*** | *HPD* | *SL* | *2.14 Decommissioning and Abandonment, P. 2-53* | *As part of the decommissioning plan for the graving dock, stabilization and erosion control measures should be implemented to ensure the conservation and protection of fish habitat. The long term plans of the graving dock should also be discussed with DFO to ensure whether there is any potential for fish habitat restoration measures. It is important to note that during offshore decommissioning, any structures currently considered as fish habitat (i.e. existing rock berms) should not be removed without prior consultation and approval with DFO.* |
| **Husky Response:** | | | | Husky will install rip-rap along the entrance of the graving dock to mitigate shoreline erosion, post construction.<br>Husky will contact DFO prior to the undertaking of offshore decommissioning. |
| ***14*** | *HPD* | *SL* | *2.15 Potential Future Activities, P. 2-53* | *See comment G-1.* |
| **Husky Response:** | | | | Comment noted. Thank you. |

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| ***15*** | *HPD* | *SL* | *3.4 Drill Cuttings Deposition, P. 3-39* | *Figures in this section should include finer scale images such as 0-1 km scale. As described in the general comment (G-2), based on recent ROV surveys at a nearby oil development, it appears that accumulation of drill cuttings in proximity to offshore oil drilling sites may be greater than predicted during the EA. As such, DFO may require Husky Energy, as well as operators of other existing and future oil developments, to provide additional monitoring adjacent to the drill centers in order to verify these predictions. It should be noted that in the past, DFO has recognized that drill cuttings deposition with thicknesses of greater than 10 cm are considered harmful to benthic organisms. Predictions provided in this section suggest that maximum thicknesses could reach approximately 8.6 cm within 100 m from the deposition area.* |
| **Husky Response:** | | | | The four cuttings plan view figures in this section consist of base case and fast settling of fines sensitivity runs for two views: a 28-km view, and a 5-km view. A new pair of "1.5 km" views have been prepared.<br>An additional figure shows the model run over a finer scale is presented in Figure 3-16a and is provided as Figure 33 at the end of the DFO comment tables. |
| *DFO Response:* | | | | *DFO would like to discuss monitoring of drill cutting dispersion for the EEM Program* |
| **Husky Response:** | | | | Husky would be pleased to meet with DFO to discuss monitoring of drill cuttings dispersion. |
| ***16*** | *HPD* | *SL* | *3.5 Synthetic-based Whole Mud Spill Trajectory Modelling, P. 3-52* | *The EA indicates that the SBM would biodegrade over several weeks; however, the properties are unknown. Please provide references or evidence to support this claim.* |
| **Husky Response:** | | | | SBM biodegradation is highly variable; however, biodegradation of unused SBMs over several weeks is supported by Centre for Offshore Oil, Gas and Energy Research and Lee (2009).<br>Reference:<br>Centre for Offshore Oil, Gas and Energy Research and K. Lee. 2009. Environmental persistence of drilling muds and fluid discharges and potential impacts. *Environmental Studies Research Funds Report*, No. 176: 35 pp. |
| ***17*** | *HPD* | *SL* | *Tables 3-50 to 3-52, P. 3-62 to 3-63* | *Oil spill information presented in these tables is based on data from 1987 to 1997. Although, previous EAs have also used the same data, it may be useful to incorporate more recent information as available.* |

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| **Husky Response:** | | | | Note that these were not primary data sources, more recent data were used for spill frequency calculations. |
| ***18*** | *HPD* | *SL* | *5.2 Scope of Environmental Assessment, P. 5-2* | *See comment G-1.* |
| **Husky Response:** | | | | Comment noted. Thank you |
| ***19*** | | *DFO (Sci.)* | *5.3.1 Step 1 - Scoping Issues and Selecting Valued Environmental Components, P. 5-7* | *The EA states "Populations of marine mammals and some sea turtle species migrate to the Offshore Study Area primarily to forage for food". It should be noted that some marine mammal species and the Leatherback Sea Turtle also migrate to the nearshore study area to feed in the summer and fall. The draft Critical Habitat for the Leatherback Sea Turtle may encompass part of the southern Placentia Bay area so this may require further mitigation and monitoring.* |
| **Husky Response:** | | | | Comment noted. Thank you |
| *DFO Response:* | | | | *Will Husky apply additional mitigations to reduce potential impacts on Leatherback Sea Turtles?* |
| **Husky Response:** | | | | The Nearshore Project and Study Areas do not overlap with southern Placentia Bay. However, if Critical Habitat is implemented for leatherback sea turtles in the southern Placentia Bay Area, Husky will consult with DFO to discuss regulations, including further mitigation measures, that pertain to the Critical Habitat designation. |
| ***21*** | | *DFO (Sci.)* | *8.3.1.5 Fish and Shellfish – Capelin, P. 8-22* | *The statement: "…migrate to deeper waters to spawn offshore at depths up to 125 m (likely when conditions for beach spawning are not ideal" is incorrect. Nakashima and Wheeler (2002) indicate that spawning occurs subtidally when water temperatures at the beach are too warm. Furthermore, this redirected spawning occurs in coastal waters generally at depths considerably less than 125m. Please adjust the statement appropriately.*<br>*The statement that eggs "…remain in the sediment for 14 to 52 days…" is not supported by Scott and Scott (1988) as indicated in the document. Scott and Scott (1988) indicate that eggs hatched in the beach from 9 to 24 days depending on where they were in the intertidal zone. If this statement is in reference to demersal spawning on the Southeast Shoal where water temperatures are much cooler, 52 days may be acceptable.* |
| **Husky Response:** | | | | Comments noted. Thank you. |
| *DFO Response:* | | | | *Are revisions to the text accepted?* |

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| **Husky Response:** | | | | The underlined text has been added to Section 8.3.1.5 Fish and Shellfish – Capelin, P. 8-22:<br>Typically, capelin winter offshore and will undergo extensive migrations to coastal areas during spring to spawn (Carscadden and Nakashima 1997). Timing of the inshore spawning of capelin in coastal Newfoundland can be highly variable, with temperature as one of the prime factors in explaining variability (Carscadden et al. 2001; Regular et al. 2009). During periods when colder than normal temperatures prevail, spawning is delayed. In late spring and summer, capelin move to shallower bays to spawn on beaches, or alternatively, <u>spawning occurs subtidally in coastal waters when water temperatures at the beach are too warm</u> (Nakashima and Wheeler 2002). Spawning may occur in a given location year after year, or only occur periodically in some locations (Nakashima and Wheeler 2002). Females may produce as many as 50,000 eggs at one time. Eggs attach to the substrate and <u>hatch in the beach from 9 to 24 days, depending on where they were in the intertidal zone</u>, with hatching time triggered by temperature (Scott and Scott 1988). A survey of local knowledge was used to document the location of capelin spawning beaches in Placentia Bay (Sjare et al. 2003), and this is discussed in further detail in the chapter on Sensitive Areas (Section 13.3.1.4). The beach on the northside of the Argentia peninsula is a known spawning beach for capelin, and demersal spawning by capelin and herring is also known to occur in this area. Though this beach has been used in the past for spawning, it has not been known to be used in recent years (J. O'Rourke, pers. comm.). There are no reports of capelin spawning on the beach adjacent to the graving dock construction site. The beach is not expected to be affected by activities associated with the WREP. |
| ***22*** | | *DFO (Sci.)* | *8.3.1.5 Fish and Shellfish – Capelin, P. 8-23* | *The statement that juvenile Capelin in the nearshore prefer eelgrass habitat should be supported with a reference. Most juvenile Capelin are found offshore where eelgrass does not occur. The following statement "….except in autumn, when they have a reverse vertical migration (migrate to the surface during the day)" that is attributed to Mowbray (2002) is incorrect.* |

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| **Husky Response:** | | | | In support of the first statement regarding juvenile capelin and eelgrass the following reference is provided:<br>Grant, S.M. and C.G. Grant. 2013. Habitat requirements and life history characteristics of selected marine finfish species occurring in the Newfoundland and Labrador Region. *Canadian Manuscript Report of Fisheries and Aquatic Sciences*. (in progress).<br>Second Comment noted. Thank you. |
| *23* | | *DFO (Sci.)* | *8.3.1.5 Fish and Shellfish – Herring, P. 8-23* | *The description for Herring should be updated using DFO (2012).* |
| **Husky Response:** | | | | The paragraphs on herring have been revised with the insertion of underlined text as provided below.<br>"Herring in Placentia Bay are part of the St. Mary's Bay-Placentia Bay stock and are commercially fished during spring and fall (DFO 2005a; Wheeler 2010). Herring move into the bays during spring to spawn and feed, and generally migrate to deeper water to over-winter. Herring are demersal spawners, depositing their eggs on stable substrates in shallow, coastal waters (Stevenson and Scott 2005), although some spawning can occur on offshore banks at depths of 40 to 80 m. Masses of herring eggs attach to the hard bottom substrate nearshore or to kelp fronds. Eelgrass has been associated with spawning in some areas (DFO 2005a). Herring have been known to spawn north of the Argentia peninsula in previous years (John O'Rourke, pers. comm.).<br>Hatching of larvae occurs after approximately 10 to 30 days and is temperature dependent (Scott and Scott 1988). Spring recruits will remain in the water column during spring and summer, but fall recruits may be pelagic until the following spring. Tides may cause retention of eggs and larvae near the spawning ground, or eggs and larvae may passively drift with dominant currents (DFO 1984, in EMCP 2011). Herring primarily feed on euphausiids (DFO 2005a) and this species is an important prey item for other fish, seabirds and marine mammals. |

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| | | | | Herring in Newfoundland are at the northernmost part of their range. As a result, ideal conditions rarely occur, resulting in rare years of strong recruitment (DFO 2012). Survival of young-of-the-year is influenced by environmental conditions, with ideal conditions consisting of warm overwintering water temperatures and high salinities prior to spawning. Large year classes of herring produced in 1968 and 1969 supported stocks throughout the 1970s (DFO 2012).<br>The moderate to large stock of 1982 allowed stocks to rebuild in the 1980s, with moderate stock sizes occurring in 1987 and 1996.<br>Assessments of the St. Mary's Bay-Placentia Bay stock suggest a decline occurred from 2001 to 2004, remained stable from 2005 to 2010, and increased slightly in 2011 (DFO 2012). The 2003 and 2006 year classes account for 20 percent each of the catch. Autumn spawners comprised 43 percent of the catch from 2010-2011, which is an increase of 8 percent from 2009. Short-term prospects for herring stocks in St. Mary's Bay-Placentia Bay remain uncertain, with the 2006 stock above average. All year classes since 1982 are weak when compared to historical levels (DFO 2012). A survey of local knowledge identified three known herring aggregation sites in Placentia Bay: coastal waters between Lamaline and St. Lawrence (southern Burin Peninsula); near Boat Harbour/Brookside/Little Harbour (west side of Placentia Bay); and on northeast and northwest Merasheen Island and southwest Long Island (refer to Section 13.3.1.4; Figure 13-5)." |
| ***24*** | *HPD* | *SL* | *8.4.1.2 Concrete Gravity Structure Construction and Installation, P. 8-41* | *The EA states that a gated structure could be installed at the entrance of the graving dock post-flooding. Installation of the gate should be included in the assessment as an activity resulting in potential impacts to fish and fish habitat.* |
| **Husky Response:** | | | | *The following underlined insertions have been made to Section 8.4 to include the addition of a potential gated structure installed at the entrance of the graving dock post-flooding.*<br>**Summary of Potential Environmental Effects**<br>The potential environmental effects that could result from WREP-VEC interactions for fish and fish habitat are provided in revised Table 8-5, |

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| | | | | including planned future activities and potential accidental events, which is provided as Table 21 at the end of the DFO comment tables.<br>**8.4.1 Nearshore**<br>The activities assessed in the Nearshore Project Area include graving dock construction and CGS construction and installation. There are no nearshore activities associated with the subsea drill centre option. Project-related accidental events could also occur in the Nearshore Study Area.<br>**8.4.1.1 Graving Dock Construction**<br>During construction of the graving dock (see Section 2.6.3), the nearshore activities that have the potential to interact with marine fish and fish habitat include discharge of water from The Pond, dewatering of the graving dock, noise from construction activities (i.e., sheet pile driving and potential grouting) and lighting.<br>**8.4.1.2 Concrete Gravity Structure Construction and Installation**<br>During CGS construction and installation, the nearshore activities that have the potential to interact with marine fish and fish habitat includes lighting, operation of vessels, nearshore surveys (i.e., multibeam, sonar, environmental), dredging and dredge spoils disposal, ballasting/deballasting of the CGS; towing to the deep-water mating site; noise from topsides mating; and the establishment of a no-fishing safety zone.<br>**8.4.1.3 Operation and Maintenance of Permanent Graving Dock**<br>Under the WHP development option, consideration will be given during the design phase to developing the CGS construction facility as a permanent graving dock, which could be used for the construction of future CGSs or for other industrial applications. Design of the graving dock for future use could include provision for a gated system, allowing the graving dock to be flooded and drained as required. During operation and maintenance of the permanent graving dock, nearshore activities that have the potential to interact with marine fish and fish habitat include dewatering and flooding of the graving dock. |

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| | | | | *The following underlined insertions have been made to Section 8.5 to include the addition of a potential gated structure installed at the entrance of the graving dock post-flooding.*<br>**8.5.1 Nearshore**<br>In the Nearshore Study Area, the WREP activities that could affect marine fish and fish habitat include those associated with graving dock excavation, CGS construction, CGS tow-out, topsides mating and permanent graving dock operations and maintenance. The potential environmental effects from these activities include change in habitat quality, change in habitat quantity and potential mortality.<br>**8.5.1.1 Graving Dock Construction**<br>**Change in Habitat Quality**<br>The potential change in marine fish and fish habitat quality in the Nearshore Study Area during graving dock construction include lighting, discharges from The Pond, dewatering of the graving dock and noise from pile driving and graving dock gate installation. The potential environmental effects include increased light, sedimentation and underwater noise.<br>**8.5.1.3 Operation and Maintenance of Permanent Graving Dock**<br>**Change in Habitat Quality**<br>The potential change in marine fish and fish habitat quality in the Nearshore Study Area during the operation and maintenance of a permanent graving dock include discharges during dewatering of the graving dock and flooding of the graving dock. The potential environmental effects to the marine environment are primarily associated with the discharge during the dewatering of the graving dock. These environmental effects may include changes in the water quality of the ambient environment with respect to salinity, dissolved oxygen, and sedimentation. Flooding of the graving dock will have minimal environmental effects, except for the potential introduction of fish in the graving dock, but they will be able to move freely back to the marine environment. |

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| | | | | ***Salinity***<br>The operation of the permanent graving dock with a gated system could lead to the intrusion of hypersaline or hyposaline water from discharges during dewatering of the graving dock into the marine environment. Saline water trapped inside the gated graving dock system could be subject to evaporation (intense during the summer months), resulting in increased salinity of graving dock water. Water trapped inside the gated graving dock system could be subject to freshwater input from precipitation or groundwater intrusions resulting in hypo-saline water. If this hypersaline or hyposaline water is discharged to the marine environment, it could lead to stress on marine species present in the immediate area, especially benthic sessile species that do not have the ability to avoid contact with this water.<br>Osmoregulation in marine species depends on the relationship between solute and solvent concentrations of internal body fluids and the outside medium that surrounds the animal (Hammerschlag 2006). Unless the species' internal body fluids are equal to those of the water surrounding it, water will enter the body when fluids in the body contain higher concentrations of ions, and will leave the body when the surrounding environment contains higher concentrations of ions. Electrolytes (ions) will also diffuse across concentration gradients in a similar fashion (Hammerschlag 2006; Genz et al. 2011). Marine teleosts are slightly hypo-osmotic compared to the surrounding seawater and experience water loss and an influx of salts (Sardella et al. 2004; Gonzalez et al. 2005; Genz et al. 2011). Exposure to hypersaline water poses increased challenges for osmoregulators and stresses physiological and biochemical systems. In hypersaline situations, marine species experience a greater osmotic gradient and greater water loss than normal. To maintain a constant cellular volume, species must actively ingest ambient water and excrete salts. Most marine species are unable to maintain long-term osmotic balance in salinity greater than concentrations found in seawater (Sardella et al. 2004; Gonzalez et al. 2005; Genz et al. 2011). |

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| | | | | Hyposaline environments can also put stress on marine organisms. When salinity decreases marine organisms will have an influx of water due to passive diffusion. To maintain a constant volume they will have to actively pump water out via the kidney in the form of dilute urine (Hammerschlag 2006). Low salinity can also put stress on marine algae. Marine algae in low saline environments will have a lower photosynthetic rate and growth rate (Kim and Garbary 2006).<br>***Dissolved Oxygen***<br>Water kept in the graving dock for extended periods of time could result in lower dissolved oxygen levels than circulated marine water. Lower dissolved oxygen water could be introduced to the marine environment upon dewatering of the graving dock. If a large amount of water with low dissolved oxygen enters the marine environment, mortality of some organisms could occur and stress induced to surviving organisms (Vanquer-Sunyer and Duarte 2008).<br>Benthic organisms are more vulnerable to coastal hypoxia due to the fact that they are far from the atmospheric oxygen supply and sediments are often depleted in oxygen (Vanquer-Sunyer and Duarte 2008). Differences in oxygen thresholds for hypoxia across different species reflect the broad range of adaptations to low oxygen conditions. Mobile organisms have the ability to migrate and avoid oxygen-deficient water and have relatively high sub-lethal and lethal thresholds for oxygen concentrations. Organisms which are sessile or slow-moving have higher thresholds for sub-lethal and lethal oxygen concentrations due to the fact they cannot quickly escape oxygen-deficient water. Median lethal dissolved oxygen concentrations range from 8.6 mg $O_2$/L for the larval crab, *Cancer irroratus,* to 0 mg $O_2$/L for the oyster, *Crassostrea virginica*. Median sub-lethal dissolved oxygen concentrations range from 10.2 mg $O_2$/L for cod, *Gadus morhua*, to 0.085 mg $O_2$/L for the burrowing shrimp, *Calocaris macandreae* (Vanquer-Sunyer and Duarte 2008). |

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| | | | | ***Sedimentation***<br>Water discharges from the graving dock during dewatering may result in a change in marine habitat quality due to sedimentation or the increase in suspended sediment concentrations in the ambient environment. Potential environmental effects of sedimentation on organisms include direct effects such as smothering (decreased gas exchange), toxicity (exposure to anaerobic sediment layers or contaminated sediment), reduced light intensity, and physical abrasion, as well as indirect effects such as changes in substrate characteristics (Wilber et al. 2005). The WREP will comply with the total suspended solids discharge limit of 30 mg/L (Newfoundland and Labrador *Environmental Control Water and Sewage Regulations, 2003*) and, therefore, water discharges are not expected to result in any smothering effects. The discharge of water at these levels is also not expected to create a suspended solids level that would exceed the *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (CCME 2002). The CCME guidelines specify that during clear flow periods, anthropogenic activities should not increase suspended sediment concentrations by more than 25 mg/L over background levels during any short-term exposure period (24 hours). Since these levels are not expected to be exceeded during dredging operations (see Section 8.5.1.2), then CCME suspended solids levels would not be exceeded while discharging water within regulated limits.<br>Increased levels of suspended sediment can reduce the availability of light in the photic zone and may reduce local primary production, particularly if sediment loading occurs just prior to, or during, a phytoplankton bloom. This could have effects on higher trophic levels including fish and shellfish if the sediment is suspended over large areas for extended duration. Benthic primary production can also be reduced due to decreased light attenuation caused by sediment loading over extended periods (Aumack et al. 2007).<br>Plankton and sessile invertebrates are unable to actively avoid areas with high sediment loads. Mechanical damage has been observed in herring larvae at TSS levels of 1,000 mg/L (Boehlert and Yoklavich |

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| | | | | 1984). Further harm to fish and invertebrates may result from respiratory and feeding problems associated with high sediment levels. The severity of environmental effects of the suspended sediment increases as the volume and duration of exposure increase. Mobile fish and invertebrates may avoid an area completely during the period of physical activity (Robinson and Cuthbert 1996). Shellfish are typically more likely to experience adverse effects of increased sediment load than fish because they are often sessile and filter feeders, and may reduce or stop feeding until sediment loading decreases to suitable levels (Peddicord 1980). Eventually, suspended sediment will settle on the seafloor, and the rate at which this occurs is dependent on sediment grain size and the water currents in the area. Fine sediment such as silt and mud will drift over longer distances in the water column than coarser sediments.<br><br>Water discharges from the graving dock during dewatering will be treated, if necessary, to comply with applicable federal and provincial water quality standards. The discharge will be tested routinely for TSS and to be in compliance with the Newfoundland and Labrador *Environmental Control Water and Sewage Regulations, 2003*. If there is indication that the water is close to the discharge limit of 30 mg/L, the water will be diverted to a settling pond or through a filter to ensure compliance before discharge. Contact of graving dock water by marine organisms, however, would be temporary and localized and which would be further reduced in severity as a result of mixing with the surrounding waters and attributed to physical factors such as the tides, waves and current flows in Argentia Harbour. Therefore, these discharges are likely to result in a short-term change in marine habitat quality due to the potential input of hypersaline or hyposaline water, of lower dissolved oxygen water, or high suspended solids in the water. Large volumes of water will be discharged over the course of several tidal cycles to ensure adequate mixing. The environmental effects on the marine environment from the potential discharge of hypersaline or hyposaline water, low dissolved oxygen, or high suspended solids during the dewatering of the graving dock is therefore expected to be |

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| | | | | short in duration, low in magnitude, of limited geographic extent and reversible. Further, with the proposed mitigation measures noted above, adverse residual environmental effects on fish and fish habitat from the dewatering and flooding of the graving dock are predicted to be not significant.<br>**New References:**<br>Genz, J., M.D. McDonald and M. Grosell. 2011. Concentration of $MgSO_4$ in the intestinal lumen of *Ospanus beta* limits osmoregulation in response to acute hypersalinity stress. *American Journal of Physiology - Regulatory, Integrative and Comparative Physiology,* 300: R895-909.<br>Gonzalez, R.J., J. Cooper and D. Head. 2005. Physiological responses to hyper-saline waters in sailfin mollies (*Poecilia latipinal*). *Comparative Biochemistry and Physiology, Part A*, 142: 397-403.<br>Hammerschlag, N. 2006. Osmoregulation in elasmobranchs: a review for fish biologists, behaviorists and ecologists. *Marine and Freshwater Behaviour and Physiology*, 39 (3): 209-228.<br>Kim, Y.K. and D.J. Garbary. 2006. Photosynthesis in *Codium fragile* (Chlorophyta) from a Nova Scotia estuary: responses to desiccation and hyposalinity. *Marine Biology*, 151: 99-107.<br>Sardella, B.A., V. Matey, J. Cooper, R.J. Gonzalez and C.J. Brauner. 2004. Physiological, biochemical, and morphological indicators of osmoregulaotry stress in 'California' Mozambique tilapia (*Oreochromis mossambicus X O. urolepis hornorum*) exposed to hypersaline water. *The Journal of Experimental Biology*, 207: 1399-1413.<br>Vaquer-Sunyer, R., and C.M. Duarte, 2008. Thresholds of hypoxia for marine biodiversity. *Proceedings of the National Academy of Sciences*, 105 (40):15452-15457. |

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| ***25*** | *EAMP* | *LN* | *8.4.4 Summary of Potential Environmental Effects, Table 8-5, P. 8-43* | *i. Under Subsea Drill Center Installation, installation of subsea equipment: "x/+" should be depicted under Change in Habitat Quantity, as habitat is being lost as a result of the placement of equipment on the seafloor.*<br>*ii. Under Potential Future Activities, excavation of drill centers: "-" should be depicted under Potential Mortality, as there will likely be loss of benthic organisms as a result of the excavation and disposal of dredge spoils.*<br>*iii. Under Wellhead Platform Installation/Commissioning, Dredging and disposal of dredge material should have "X" for Potential Mortality*<br>*iv. Under Potential Future Activities, Installation of Pipeline(s) and Testing from Drill Centres to FPSO, including Flowline Protection should have an "X" for Potential Mortality.* |
| **Husky Response:** | | | | All comments are noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes to Table 8-5? Will the table be revised?* |
| **Husky Response:** | | | | See Table 21 (revised Table 8-5) at the end of these responses. Please Note:<br>*iii Under Wellhead Platform Installation/Commissioning, Dredging and disposal of dredge material should have "X" for Potential Mortality*<br>There is no dredging and disposal of dredged material with the WHP installation (not listed in table). An "X" for Potential Mortality has been added under Subsea Drill Centre Installation/Commissioning, dredging and disposal of dredged material. |
| ***26*** | *HPD* | *SL* | *8.5.1.1 Graving Dock Construction, P. 8-46* | *As discussed in the EA, The Pond will be drained prior to disposal of the graving dock and dredge spoils. However, given the permeable nature of the berm/barasway, please provide justification/evidence to illustrate that there will be no contamination or sedimentation from The Pond into the marine environment.*<br>*Also, it should be noted that appropriately sized screens should be employed during the draining of The Pond as noted above (S-4).* |
| **Husky Response:** | | | | Please note that the water in The Pond will be displaced as soil from the graving dock is deposited. Water from The Pond will be tested for compliance according to the Newfoundland and Labrador *Environmental Control Water and Sewage Regulations, 2003*, prior to discharge to the marine environment. |

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| *27* | *HPD* | *SL* | *8.5.1.2 Concrete Graving Structure Construction and Installation, P. 8-50* | *The proposed Dredging Area nearshore was originally proposed to be 24,150 $m^2$ (as stated in the Marine Habitat Characterization Report, 2012), whereas the EA indicates that a significantly smaller area will be dredged/excavated (55 m x 200 m). Please confirm the actual amount of habitat that will be potentially affected. Also, depending on the final design of the graving dock entrance (i.e. gated or left open), additional habitat protection measures may be required. Measures to offset the impacts to fish habitat as a result of dredging/excavation of eelgrass beds and other productive nearshore habitats should be included. The EA should demonstrate that there are sufficient mitigation measures in place to ensure there are no significant adverse environmental effects.*<br>*As discussed above (S-8), please confirm there will be no change in the quantity of fish habitat at the deep-water mooring points.* |
| **Husky Response:** | | | | Husky submitted a habitat quantification report to DFO on March13th, 2013 which clarifies nearshore dredging area to be affected.<br>The topsides mating operation is scheduled to take place no earlier than the summer of 2016. Husky continues to evaluate the specifications required for the deep water mating site. Once a site has been selected, the associated detailed information on the proposed mooring system will be submitted to DFO. |
| *28* | *EAMP* | *LN* | *8.5.1.2 Concrete Graving Structure Construction and Installation Table 8-6 /P 8-52* | *The Ecological/Social/Cultural/Economic Significance should be rated "2 (Evidence of existing adverse activity)".* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *29* | *HPD* | *SL* | *8.5.1.3 Accidental Events in the Nearshore, P. 8-54* | *The potential collapse of the settling pond at The Pond and a breach at the berm/barasway resulting in a sedimentation event in the marine environment are potential accidental events that should be included in this section.* |
| **Husky Response:** | | | | The following underlined insertions have been made to Section 8.5.1.3 to include the accidental event for the potential collapse of the settling pond at The Pond and a breach at the berm/barasway, resulting in a sedimentation event in the marine environment.<br>**8.5.1.3 Accidental Events in the Nearshore**<br>There is the possibility of an accidental event occurring in the Nearshore Study Area during graving dock construction or CGS construction and installation phases. The scenarios with the greatest |

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| | | | | potential environmental risk considered in this section are a breach in the graving dock, collapse of the settling pond at The Pond and breach at the berm/barasway, or an accidental release of marine diesel fuel from a vessel as a result of a collision or other incident.<br>The collapse of the bund wall could result in a sudden increase in sedimentation in the immediate vicinity of the breach. A breach in the bund wall surrounding the graving dock would result in an influx of water into the dry graving dock. Water could become contaminated with cement, lube oils and other chemicals contained within the graving dock.<br>The collapse of the settling pond at The Pond or a breach at the berm/barasway could also result in a sudden increase in sedimentation in the immediate vicinity of the collapse. Water containing fines could exit The Pond and enter the marine environment, potentially causing adverse environmental effects to habitat quality and mortality within the immediate vicinity. The berm dividing The Pond from the marine environment is reinforced with armour stone on the sea side and is unlikely to give way. In the event of a breach, wind, wave, and current action will disperse these fines into a dilute layer that is not expected to result in significant adverse environmental effects. A breach would quickly be repaired by the earth works equipment on site. In an extreme failure event, there may be a small, localized area of smothering within the immediate area of the breach, which could potentially increase direct mortality of sessile benthic organisms. The potential environmental effects of sedimentation are discussed above in Sections 8.5.1.1 and 8.5.1.2. Potential direct mortality in this case is expected to be very low and not significant.<br>In the unlikely event there is a spill of marine diesel fuel in the nearshore, oil spill response plans will be initiated to contain and clean-up the spill to mitigate potential environmental effects. Nearshore oil spill modelling (Section 3.7) suggests that in the unlikely worst-case scenario, the maximum possible volume of a batch fuel spill (350 $m^3$) would be released. The tug boats, accommodation |

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| | | | | vessel and supply vessels that will be used in the Nearshore Study Area will use marine gas oil, which is similar in composition and spill behaviour to diesel fuel. Modelling of an unmitigated nearshore oil spill scenarios found that a high proportion (55 to 94 percent) of the modelled slicks reach the shoreline due to the close proximity of the spill sites modelled to shore (near Argentia and the two possible deep-water mating sites) and due to the prevailing westerly and southwesterly winds in Placentia Bay. The minimum time to shore ranged from two to five hours if there was no spill response (SL Ross 2012). During the months of March and July, over 55 percent of the modelled spills (diesel slick) reached the shore within less than 24 hours, and more than 75 percent of the modelled spills reached the shoreline within 48 hours. Survival time of the diesel fuel that did not reach the shoreline ranged from a minimum of 0.5 days to 8 days (SL Ross 2012). The average summer and winter conditions were modelled based on wind speed and water temperature. There are few differences in the fate of the spills between the two seasons. The nearshore oil spill model is discussed in detail in Section 3.7 and SL Ross (2012). The potential effects of diesel fuel reaching the identified Sensitive Areas in the Nearshore Study Area (e.g., coastal habitats) are discussed in Section 13.5.2.1. Marine fish species at risk and the potential effects of the accidental release of diesel fuel are discussed in Section 12.4.2.1. The majority of information summarized below is from studies on crude oil spills, but may be relevant to marine diesel spills in the nearshore, and is also applicable to the Offshore Study Area.<br><br>**Summary of Nearshore Environmental Effects Assessment from Accidental Events**<br><br>The environmental effects resulting from an accidental event in the Nearshore Study Area and the mitigations to be implemented are summarized in revised Table 8-7, which is provided as Table 22 at the end of the DFO comment tables.). |

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| ***30*** | *EAMP* | *LN* | *8.5.1.3 Accidental Events in the Nearshore P 8-59* | *In the nearshore, another accidental event that could potentially have an adverse effect on fish and fish habitat is a oil spill near a capelin spawning beach during a sensitive time of the year.* |
| **Husky Response:** | | | | Please refer to Section 13.5.2.1, which discussed the environmental effects of an oil spill in the vicinity of a capelin spawning beach |
| ***31*** | *EAMP* | *LN* | *8.5.2.2 Production/Operation and Maintenance Table 8-8 / P. 8-64* | *i) The Ecological/Socio/Cultural/Economic Significance should be given a lower rating of 2 = evidence of existing adverse activity. In fact, this would apply for any of the potential effects assessment summary tables.*<br>*ii) The change in habitat quantity for flowline rock berms is Negative as well as Positive.* |
| **Husky Response:** | | | | Both comments are noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes to Table 8-8? Will the table be revised?* |
| **Husky Response:** | | | | Revised Table 8-8 is provided as Table 23 at the end of these responses.<br>It is also acknowledged that the Ecological/Socio/Cultural/Economic Significance rating of 2 (evidence of existing adverse activity) would apply for any of the potential effects assessment summary tables. |
| ***32*** | *HPD* | *SL* | *8.5.2.2 Production/Operation and Maintenance, P. 8-67* | *It is important to note that even though Husky Energy has already been previously authorized for the footprint of the CGS, this will cause a change in fish habitat quantity and therefore should be included. Although a "reef effect" may occur at the installation site, it is temporary in nature as the CGS will be removed during decommissioning.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| ***33*** | *HPD* | *SL* | *8.5.2.3 Offshore Decommissioning and Abandonment, P. 8-69, 8-72* | *As stated above (S-10), the removal of rock berms and flowlines which were approved as compensation for fish habitat loss may constitute a harmful destruction of fish habitat and as such could require a Fisheries Act Authorization.* |
| **Husky Response:** | | | | Husky will contact DFO prior to the undertaking of such activities. |
| ***34*** | *HPD* | *SL* | *8.5.2.4 Potential Future Activities, P. 8-72* | *Future maintenance of drill centers could result in further harmful alteration and/or destruction of fish habitat depending on the magnitude and extent of operations. For large-scale maintenance projects and extensive installations of new equipment, Husky is advised to consult DFO to determine whether there are any Fisheries Act implications.* |
| **Husky Response:** | | | | Husky will contact DFO prior to the undertaking of such activities. |

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| ***35*** | *EAMP* | *LN* | *8.5.2.4 Potential Future Activities*<br>*Table 8-11 / P 8-74* | *i) The intentions surrounding the potential future activities should be clarified as the potential effects associated with activities or components outside of the current project description would be subject to regulatory view and may require additional EA.*<br>*ii) The Ecological/Socio/Cultural/Economic Significance should be given a lower rating of 2 = evidence of existing adverse activity.*<br>*iii) Please provide clarification on the mitigation measure referring to s.32 Fisheries Act Authorization. The issuance of a s.35(2) Fisheries Act Authorization is more accurate.* |
| **Husky Response:** | | | | All comments noted. Thank you |
| ***36*** | *HPD* | *SL* | *8.5.3.1 Nearshore, P. 8-80* | *As described in the general comments (S-4), submarine cables and other obstacles may be present in the coastal environment which could pose a risk during dredging activities.* |
| **Husky Response:** | | | | Comment noted. Thank you |
| ***37*** | *HPD* | *SL* | *8.5.5 Follow-up and Monitoring, P. 8-83* | *Fish habitat compensation monitoring will be required as a condition of the s. 35(2) Fisheries Act Authorization to be issued for the harmful alteration or destruction of fish habitat associated with the dredging/excavation activities within the immediate vicinity of the graving dock.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| ***38*** | *EAMP* | *LN* | *11.4.4 Summary*<br>*Table 11-9 / Pg 11-57*<br><br>*12.4.1.5 Summary*<br>*Table 12-4 / Pg 12-61* | *i) Avoidance should be considered a Change in Habitat Quantity associated with seismic activities.*<br>*ii) Collisions should be considered as Potential Mortality associated with Cumulative Effects.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes to the tables? Will the tables be revised?* |
| **Husky Response:** | | | | Revised Table 11-9 is provided as Table 24 at the end of these responses.<br>Re. Table 12-4 (Potential White Rose Extension Project-Related Interactions – Marine Fish Species at Risk) Collisions are considered under accidental events (Marine Vessel Incident Including Collisions) not cumulative effects. |

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| ***39*** | *EAMP* | *LN* | *11.5.1.1 Graving Dock Construction, Table 11-10, P. 11-61* | *Avoiding mammal concentrations, maintaining a steady course and safe speed (identify limit, i.e., less than 26 km/hr) should be mandatory rather than "when possible", otherwise, conditions not likely to implement a safe speed should be identified.* |
| **Husky Response:** | | | | A safe speed for transit into and out of Argentia will be determined by the Port and Pilot authorities at time of navigation, with consideration for weather and visibility. |
| ***40*** | *EAMP* | *LN* | *11.5.2.5 Accidental Events, P. 11-87* | *Please provide additional rationale why the Killer Whale population-level effects conclude "no population-level effects."* |
| **Husky Response**: | | | | Because killer whales are uncommon in the study areas and are widely distributed throughout their range in the Northwest Atlantic and eastern Arctic, population-level effects would appear to be unlikely. However, it is noted that if the population size is small (although population size is currently unknown), loss of one or two individuals could represent a population-level effect. |
| ***41*** | *EAMP* | *LN* | *12.2 Definition of Significance, P. 12-2* | *The qualifying statement, "…if a population is vulnerable to extinction" should be removed from the definition.*<br>*This also applies to inclusion of "vulnerable to extinction" in the summary on page 12-71.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| ***42*** | *DFO (Sci.)* | | *12.3 Existing Environment, Table 12-3, P. 12-5* | *For Smooth Skate, Table 12-3 should also state "Southern NF population has moderate potential for occurrence in Nearshore Study Area". This addition also applies to* ***Page 12-25 (para. 4)****.*<br>*The second most common skate species caught in the inshore NF/Subdiv. 3Ps skate fishery is Smooth Skate (Malacoraja senta), all discarded at sea; albeit not SAR population of the Funk Island Deep DU.* |
| **Husky Response:** | | | | Both comments noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes to Table 12-3? Will the table be revised?* |

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| **Husky Response:** | | | | Revised Table 12-3 is provided as Table 25 at the end of the DFO comment tables. The underlined text has been added to the third and fourth paragraphs on Page 12-24:<br>Smooth skate (Funk Island Deep population) was assessed by COSEWIC as Endangered in May 2012 (COSEWIC 2011a) due to steep declines in the abundance of juveniles and adults since the early 1980s. Mean catch rates for the Funk Island Deep Designatable Unit peaked in 1978/1979 and then declined for both juveniles and adults until 1994. Catch rates remained consistently low but stable through to 2005. Slight increases have been observed since 2005 (Simpson et al. 2011). Although the abundance of adults appears to have increased in recent years, the overall abundance remains very low. These trends in abundance are matched by strong reductions in area of occupancy. Smooth skate will be considered for listing under SARA but, to date, do not have status. Although there is no directed fishery in Canadian waters, smooth skate is taken as bycatch. <u>The second most common skate species caught in the inshore NF/Subdivision 3Ps skate fishery is smooth skate, all discarded at sea; albeit not the species at risk population of the Funk Island Deep Designatable Unit (DFO, pers. comm.).</u> It is vulnerable to increased mortality as it is long-lived, slow-growing and late maturing (Frisk et al. 2001; Simpson et al. 2011). The period of decline in the Funk Island Deep Designatable Unit corresponds with the coldest water temperatures reported (Colbourne et al. 2006) and may also relate to high bycatch rates; however, other factors may be at play (Simpson et al. 2011).<br>Survey data suggest smooth skate concentrate north and south of the Nearshore and Offshore Project Areas. There is low potential for smooth skate to occur in the Offshore Study Area <u>and moderate potential for smooth skate to occur in the Nearshore Study Area</u>. |
| ***43*** | *DFO (Sci.)* | | *12.3 Existing Environment, Table 12-3, P. 12-6* | *For Blue Shark, Table 12-3 should read "<u>Prio**n**ace</u> glauca"; not "Prio<u>m</u>ace glauca". Also should read "Cape <u>Hatt**e**ras</u>"; not "Cape Hatt<u>a</u>ras" for Spiny Dogfish (Squalus acanthias) and elsewhere.*<br>*The EA statement, "Most abundant along the coast of Nova Scotia and offshore Scotian Shelf" is irrelevant to this Newfoundland EA study; however, Blue Sharks (Prionace glauca) are an abundant regular seasonal visitor to Newfoundland waters.* |

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| **Husky Response:** | | | | Both comments noted. Thank you. |
| ***44*** | *DFO (Sci.)* | | *12.3 Existing Environment, Table 12-3, P. 12-7* | *For Basking Shark, Table 12-3 should read "Low to moderate potential for occurrence in Nearshore Study Area during summer"; not "Low". Also, the table should read "Usually present in surface waters of Newfoundland bays feeding on plankton from May to September." This correction also applies to* ***Page 12-40 (para. 2)****.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes to Table 12-3? Will the table be revised?* |
| **Husky Response:** | | | | Revised Table 12-3 is provided as Table 25 at the end of the DFO comment tables. The underlined text has also been added to the second paragraph on Page 12-40:<br>This species is considered to have low potential for occurrence near the Offshore Study Area during May to September, and is unlikely to occur at other times of the year and is considered to have low to moderate potential for occurrence in the Nearshore Study Area, usually present in surface waters of Newfoundland bays feeding on plankton from May to September. |
| ***45*** | *DFO (Sci.)* | | *12.3 Existing Environment, Table 12-3, P. 12-7* | *For Thorny Skate, Table 12-3 should read "Moderate to high potential for occurrence in Nearshore Study Area; not "Moderate" as suggested. This correction also applies to* ***Page 12-44 (para. 2)****.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes to Table 12-3? Will the table be revised?* |
| **Husky Response:** | | | | Revised Table 12-3 is provided as Table 25 at the end of the DFO comment tables. The underlined text has been added to the second paragraph on Page 12-44:<br>On the Grand Bank (NAFO Division 3LNO), catch data suggests concentrations were more widespread during 1970s and 1980s, but abundance declined in late 1990s, and since then has been more concentrated on the southwest Grand Bank (Kulka et al. 2004). There is moderate to high potential for occurrence of thorny skate in the Nearshore Study Area, and moderate potential for occurrence in the Offshore Study Area. Skate is fished in Placentia Bay, and the species primarily caught is thought to be thorny skate. |

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| ***46*** | *DFO (Sci.)* | | *12.3.1.2 Wolffish, P. 12-9* | *Regarding the following statement, "No wolffish were observed during the nearshore ROV habitat survey of Argentia and area", any conclusions are dependent upon the date(s), time of day, survey depth(s), and remotely operated vehicle (ROV) proximity to bottom topographic features. The ROV survey was conducted "outside" of the Atlantic Wolffish (Anarhichas lupus) spawning/nesting season; therefore, it is not unexpected to find low/no observations of adults "near shore". If this ROV survey was conducted "within" the wolffish spawning/nesting season, this conclusion may change. Therefore, the specifics of the ROV survey are crucial for the validation of conclusions in regard to wolffish in the proposed Argentia Peninsula (i.e., Nearshore) development.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *DFO Response:* | | | | *What were the specifics of the ROV survey?* |
| **Husky Response:** | | | | It should be noted that the ROV survey was not intended to confirm species presence/absence, but to characterize the affected habitat.<br>The following text is from the report on Marine Habitat Characterization, Argentia, Newfoundland (Husky 2012), submitted to DFO on September 27, 2012:<br>For the purpose of the ROV survey, the placement of underwater transects in the Project Area was divided into three survey sites (refer to Figure 8-1 in the WREP environmental assessment), according to the proposed dredging areas:<br>1. Site A - the area adjacent to the proposed graving dock site;<br>2. Site 1A Tow-Route - the smaller of the two proposed tow-route sites that require dredging, also referred to as Corridor 1; and<br>3. Site 1B Tow-Route - the larger of the two proposed tow-route sites, also referred to as Corridor 2.<br>Two ROV surveys were undertaken for Site A, the first in November 2011 and the second survey in March 2012. Sites 1A and 1B tow-routes were surveyed between February and April 2012.<br>Weighted rope transects marked in 5 m increments were placed on the seabed for the ROV to follow. The ROV video images of the seabed covered an approximate area of 16 m2 for each 10 m section of transect line; habitat classifications were conducted in 10 m increments. The transect lines were positioned using a global positioning system uploaded with a digital marine chart to track |

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| | | | | between the pre-determined transect start and end points. The distribution and arrangement of the transects and survey points were selected to maximize video coverage of the area currently being considered for dredging.<br>The ROV camera, which was situated approximately 1.0 m above the seabed, recorded continuous video footage as the ROV travelled along and above each transect. Water depth was measured using a depth gauge attached to the ROV, which was present in the video frame and recorded. The ROV followed parallel transects in a grid pattern as described in Part III of Kelly et al. (2009) for video surveys.<br>Field observations were recorded on standardized data sheets, with additional notes/comments recorded in field notebooks. The marine benthic habitat was described according to substrate type, water depth, vegetation cover and species present as per Kelly et al. (2009). |
| ***47*** | *DFO (Sci.)* | | *12.3.1.2 Wolffish, P. 12-11* | *The following statement, "Females guard the nests", is incorrect and the cited references do not support those statements. For all three wolffish species, the adult male of each mated pair guards and aerates the resultant egg mass (i.e., "nest") until hatching.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes?* |
| **Husky Response:** | | | | The underlined text has been added to the second paragraph on Page 12-11:<br>Spawning in the northwest Atlantic is thought to occur between April and October. Females are highly fecund, laying up to 30,000 large eggs in a nest on the seafloor (Simpson and Kulka 2002). The <u>adult male of each mated pair guards and aerates the resultant egg mass (i.e., "nest") until hatching</u> and after hatching larvae are pelagic (Simpson and Kulka 2002; Kulka et al. 2007). Little is known about the reproduction of northern wolffish, but spawning is thought to occur late in the year (DFO 2004c). |
| ***48*** | *DFO (Sci.)* | | *12.3.1 Marine Fish Species at Risk, Figures 12-1 to 12-7, 12-9 to12-12, 12-14 to 12-16, and 12-18* | *Please update the figures as more recent data is available.* |

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| **Husky Response:** | | | | Figures 12-1, 12-2, 12-3, 12-6, 12-7, 12-12, 12-14, 12-15 and 12-18 have been updated and are provided as Figures 34 to 42 at the end of the DFO comment tables. Figures 12-5, 12-9, 12-10, 12-11 and 12-16 are up to date. |
| *DFO Response:* | | | | *Recent data is available for Roughhead Grenadier (Figure 36). It was last assessed for NAFO 2+3 in 2010 by NAFO and interim reports have been issued for 2011 and 2012.* |
| **Husky Response:** | | | | The original figure (12-18) in the WREP environmental assessment was from Kulka et al. 2003. The replacement figure (42) in the Addendum is from COSEWIC 2007. These figures were not generated by Husky and can therefore not be updated. We have reviewed the NAFO scientific council documents on roughhead grenadier as suggested by the reviewer. These documents provide information at the NAFO Division level related to weight and lengths of fish caught at different depth strata. They do not contain any geographic distributional information. |
| ***49*** | *DFO (Sci.)* | | *12.3.1.3 Atlantic Cod, P. 12-15* | *The distribution plots for Atlantic Cod (and other species using Kulka et al. 2003) are based on data from 2000 and should be updated, particularly in relation to baseline information for the project.* |
| **Husky Response:** | | | | Figure 12-4 has been updated and is provided as Figure 43 at the end of the DFO comment tables. |
| ***50*** | *DFO (Sci.)* | | *12.3.1.5 Porbeagle Shark, P. 12-22* | *The statement, "Porbeagle are also caught as bycatch in other fisheries…of the 57 mt of discards annually" (based on Campana et al. 2011), underestimates fishing bycatch mortality for this species. A more realistic estimate/fisheries overview can be obtained from Benjamins et al. (2010). This paper also considers several other SAR shark species including Shortfin Mako, Spiny Dogfish, Blue Shark, and Basking Shark.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes? Will the text be updated?* |

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| **Husky Response:** | | | | The underlined text has been added to the third paragraph on Page 12-22:<br>Porbeagle is the only directly targeted shark species in Canada, though currently participation in the fishery has dropped to five to eight active vessels due to a small TAC (DFO 2006d). Like other elasmobranchs, the porbeagle is long-lived (estimated 25 to 46 years) (O'Boyle et al. 1998; Campana et al. 2001), has low natural mortality, late sexual maturity, low fecundity and a long gestation period. These characteristics make the porbeagle vulnerable to increased mortality (Jensen et al. 2002). Fisheries data and population models suggest the abundance of this species has declined by 89 percent between 1961 (prior to porbeagle fishing in Canada) and 2001 (Campana et al. 2001). There have also been size changes and declines in the proportion of mature porbeagle sharks on the mating grounds (Campana et al. 2002; COSEWIC 2004). It is uncertain if reductions in fishing will allow for recovery. Porbeagle are also caught as bycatch in other fisheries (Campana et al. 2011), <u>such as cod, lumpfish, monkfish/skate, white hake, Greenland halibut and turbot (Benjamins et al. 2010). From 2011 to 2003, Benjamins et al. (2010) estimated a total of 566 porbeagle shark (weighing a total of 744 kg) were taken as incidental catch in the nearshore and a total of 161 (weighing a total of 2,361 kg) were taken in the offshore. An estimated 115 porbeagle shark were taken as bycatch in the Newfoundland nearshore gillnet fishery (Benjamins et al. 2010).</u><br>In 2004, COSEWIC assessed the species as Endangered in Canada. However, to date, the species has not gained federal protection under SARA. |
| ***51*** | *DFO (Sci.)* | | *12.3.1.8 Redfish, Figure 12-9, P. 12-27* | *The distribution plots for redfish indicate very low relative abundance except for an occasional hot spot. This was not expected and should be reviewed for accuracy. In addition, the low abundance of the distribution plots for redfish appear to contradict the results of the DFO RV survey in Div. 3L for 2010 and 2011 where Deepwater Redfish (Sebastes mentella) is the dominant species by weight both years (**Page 8-34**).* |
| **Husky Response:** | | | | The figure is from Kulka et al. (2003). Comment noted. Thank you. |
| *DFO Response:* | | | | *Will this section be reviewed in light of the reference to DFO RV survey in Div. 3L for 2010 and 2011?* |

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| **Husky Response:** | | | | The underlined text has been added to the second paragraph on Page 12-26:<br>In the Offshore Study Area, both the Acadian and deepwater redfish occur at depths of 100 to 700 m, but their occurrence is patchy and varies spatially and temporally <u>according to Kulka et al. 2003</u> (Figure 12-9). However, <u>DFO RV surveys in Division 3L in 2010 and 2011 concluded that deepwater redfish was the dominant species by weight in both years (see Table 8-3, page -8-34).</u> They are more common in NAFO Division 3L in spring surveys than in fall surveys (Kulka et al. 2003). Spawning occurs on the northeastern edge of the Grand Banks during June at more than 200 m depth. Larvae have been abundant during summer pelagic surveys of the Grand Banks (Anderson et al. 1999). The Southwest Shelf Edge and Slope EBSA has been identified as an important area for redfish spawning (DFO 2007b), and this area occurs within the Offshore Study Area (refer to Section 13.3.2.1). |
| ***52*** | *DFO (Sci.)* | | *12.3.1.12 Atlantic Salmon, P. 12.32* | *For the south coast of Newfoundland, Atlantic salmon (Salmo salar) remain in the river until <u>age three or four</u>, not "age two". The species is no longer valued as "commercial fisheries" (also delete sentence 2 of **para. 6**). The third sentence of para. 2 should be revised because salmon breed in other areas besides the southeast tip. In **para. 5,** the last sentence should state "20 percent for <u>small salmon</u> and by 11 percent for <u>large salmon</u>." Note that the small salmon are adults. In Figure 12-13, "post-smelt" should be <u>post-smolt</u>.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes? Will the text be updated?* |
| **Husky Response:** | | | | The underlined text has been added to the first paragraph on Page 12-32:<br>Atlantic salmon are an anadromous species that inhabit freshwater rivers until age <u>three or four</u> and then migrate seaward. Atlantic salmon are ecologically important in both freshwater and marine systems, and are also valued by Aboriginal peoples and recreational fisheries in Canada (DFO and MRNF 2009). Atlantic salmon require rivers that are clear, cool and well-oxygenated, and prefer bottom substrates with gravel, cobble and boulder (COSEWIC 2010c). Older juvenile and adult Atlantic salmon generally return to their natal river or |

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| | | | | tributary each year for spawning, although some do stray from their natal river, and not all adults are anadromous (Hendry and Beall 2004). While at sea, adult salmon are known to occur mainly in the upper portion of the water column and to undertake long migrations that include the Nearshore and Offshore Study Area (Figure 12-13) (Reddin 2006). Tagging studies of post-smolts also indicated they spend most of their time near the surface, but also undergo deep dives, likely in search of prey (Reddin et al. 2004).<br>The second paragraph is revised to read:<br>The South Newfoundland population has a moderate to high potential to occur in the Nearshore and Offshore Study Areas year-round. This population has been assessed as Threatened by COSEWIC (2010c); however, it is not currently listed under SARA. This population is found from Cape Ray and along the south coast of Newfoundland. The numbers of both small and large salmon in this population have declined over the last three generations (COSEWIC 2010c).<br>The underlined text has been added to the fifth paragraph:<br>To counter declines, restrictions on commercial Atlantic salmon harvests were first initiated in the 1970s, and additional measures were implemented in the 1980s. Commercial fisheries were closed in 1984 in the Maritimes and portions of Quebec, and a moratorium on commercial fishing for insular Newfoundland occurred in 1992, followed by Labrador fisheries in 1998, and finally, all commercial fisheries for Atlantic salmon were closed in eastern Canada in 2000 (COSEWIC 2010c). From 1992 to 1996, salmon stocks on the south coast of Newfoundland declined by 20 percent for <u>small salmon</u> and by 11 percent for <u>large salmon</u> (DFO 1997).<br>The sixth paragraph is revised to read:<br>There are five identified salmon rivers at the head of Placentia Bay: Come By Chance River; Watson River; North Harbour River; Black River; and Pipers Hole River. Measures have also been put in place for recreational fisheries, including daily and season bag limits, mandatory catch and release of large (in some cases all) individuals, and direct closures in parts of Maritimes. Within Newfoundland and |

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| | | | | Labrador, there are 15 Atlantic salmon management areas, known as Salmon Fishing Areas 1 to 14B, and the salmon in Placentia Bay are part of Salmon Fishing Areas 10. Surveys of abundance of salmon in insular Newfoundland from 2005 to 2010 indicate considerable variation from year to year, with 2010 being a stronger year than the previous five-year mean, including in Salmon Fishing Areas 10 (Robertson et al. 2011).<br>Revised Figure 12-13 is provided as Figure 44 at the end of the DFO comment tables |
| ***53*** | *DFO (Sci.)* | | *12.3.1.18 Thorny Skate, P. 12-44* | *The statement, "Simon and Frank (2000) found that in the skate fishery on the eastern Scotian Shelf…majority was Winter Skate", is irrelevant to this EA study. Instead, scientific papers reporting on the annual Newfoundland skate fishery - in which 95% of the skate catch is Thorny Skate (Amblyraja radiata) - should have been used.*<br>*This fact, "95% of the skate catch is Thorny Skate", also applies to the skate fishery in Placentia Bay; rather than the ambiguous EA statement, "is thought to be Thorny Skate". (Simpson and Miri, 2012).* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes? Will the text be updated?* |
| **Husky Response:** | | | | The third paragraph is revised to read:<br>Like other elasmobranch species, thorny skate have a low reproductive output as they have slow growth, are long lived, low fecundity, and long reproductive cycles (Templeman 1987), which make them vulnerable to increased levels of mortality. Survey data suggest thorny skate have experienced severe population declines over the southern part of their Canadian distribution and that their range has shrunk (Simpson et al. 2011). Bycatch of thorny skate is not well known because skate bycatch is typically reported without specifying species. A study by Gavaris et al. (2010) estimated bycatch from total discard rates of skate. Declines in thorny skate have continued in their southern range despite reductions in fishing mortality in recent decades. In contrast, abundance of thorny skate has been increasing in their northern range to population levels observed in the 1970s (Simpson et al. 2011). Due to the observed declines in its southern range, thorny skate was assessed as Special Concern in the |

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| | | | | Northwest Atlantic by COSEWIC in May 2012 (COSEWIC website), but does not have SARA status at this time.<br>The underlined text has been added to the fourth paragraph:<br>On the Grand Bank (NAFO Division 3LNO), catch data suggest concentrations were more widespread during 1970s and 1980s, but abundance declined in late 1990s, and since then has been more concentrated on the southwest Grand Bank (Kulka et al. 2004). There is moderate potential for occurrence of thorny skate in the Nearshore Study Area, and moderate potential for occurrence in the Offshore Study Area. Thorny skate dominates the composition of commercial catches of skates (which consist of several skate species). In Canadian commercial catches, thorny skate comprise approximately 95 percent of the Canadian commercial skate catch (Simpson and Miri 2012). Skate is fished in Placentia Bay, and 95 percent of the skate catch is thorny skate. |
| ***54*** | *DFO (Sci.)* | | *12.5.1.1 Nearshore, P. 12-97 and 12-98* | *Previous published studies of the possible effects of pile driving are discussed, but not in relation to the pile driving activities proposed in the EA. In addition, there is no mention of sound output into the marine environment from pile driving in* ***Section 17.2.1****.* |
| **Husky Response:** | | | | Effects of pile driving activities as they relate to the proposed project are addressed in the Effects Analysis Section 12.5.2.1 of the environmental assessment. They were also addressed in Section 11.5.1.1.<br>Few studies compare underwater received levels between on-land and in-water pile driving. In one study at the Stockton Regional Wastewater Control Facility in California, in-water received rms SPLs from on-land impact pile driving operations were 4 and 12 dB lower than from in-water pile driving at 10 and 12 m from the pile, respectively (Illingworth & Rodkin, Inc. 2006, 2007). The pile is assumed to have been less than 10 m inland from the shoreline; however, the exact distance is unknown.<br>In another study, Jenkerson et al. (2012) present measured underwater rms SPLs less than 135 dB re 1 µPa at 2 km from impact pile driving operation approximately 800 m from the shoreline, at the |

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| | | | | Odoptu-North construction site on Sakhalin Island, Russia.<br>The results of Illingworth & Rodkin, Inc. (2006, 2007) suggest that in-water rms SPLs from the WREP on-land pile driving operations may be 12 dB less or lower than from similar in-water operations. Results from Jenkerson et al. (2012) suggest that levels may be well below injury criteria (based on Southall et al. 2007) at short distance from the shoreline.<br>There is little risk for hearing impairment to marine mammals and sea turtles during pile driving activities, given that sound levels typically recorded during pile driving activities do not exceed 180 dB re 1 µPa (rms) beyond several hundred metres from the source. JASCO (2010) acoustic modelling for the Hebron Project estimated that 180 dB re 1 µPa (rms) levels would extend to 260 m and 150 m from two locations in Trinity Bay. Sound levels of 190 dB re 1 µPa (rms) occurred at 60 and 20 m from these locations. 180 and 190 dB re 1 µPa (rms) sound levels are commonly used to assess physiological effects on marine mammals. Thus, available information suggests that there is little risk for hearing impairment to marine mammals or sea turtles beyond 300 m from pile driving in water. There would be even less risk of hearing impairment during the WREP pre-construction and installation phase, as pile driving would occur onshore, if required (JASCO, pers. comm.). |
| ***55*** | *DFO (Sci.)* | | *12.5.1.1 Nearshore, P. 12-120* | *The EA states that "Although effects of the Exxon Valdez oil spill were substantial on killer whales, killer whales are uncommon in Placentia Bay, and no population-level effects would be expected." This conclusion may be incorrect based on the apparent small size of the Northwest (NW) Atlantic Killer Whale population. Even if the number of known individuals reaches 100, loss of one or two animals would represent a "population-level effect".* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes? Will the text be updated?* |

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| **Husky Response:** | | | | The underlined text has been added to the fourth paragraph on Page 12-120:<br>At-risk marine mammals are not considered to be at high risk from the effects of oil exposure. However, sea turtle carcasses are often found after a spill, but leatherback sea turtles are uncommon in the Nearshore Study Area, especially outside of summer and fall. At-risk baleen whales appear to be less susceptible to spills than delphinids, as dolphins are often found stranded after an oil spill. Thus, delphinids that occur in the Nearshore Study Area at the time of the spill are most susceptible to fouling. Although effects of the *Exxon Valdez* oil spill were substantial on killer whales, killer whales are uncommon in Placentia Bay, and no population-level effects would be expected. <u>It should be noted that given the apparent small size of the Northwest Atlantic killer whale population, the loss of one or two animals could represent a "population-level effect" even if the number of known individuals reaches 100 (DFO, pers. comm.).</u> |
| ***56*** | | | *12.5.2.2 Offshore, P. 12-126* | *Please specify a "safe speed" for project vessels. To ensure no mortality to listed marine mammals or sea turtles the safe speed would be (an unrealistic) zero knots. And it is unlikely that vessels transiting in night, fog, or high wave height conditions will be able to detect, much less, avoid a sea turtle or beaked whale.* |
| **Husky Response:** | | | | A safe speed for transit into and out of Argentia will be determined by the Port and Pilot authorities at time of navigation, with consideration for weather and visibility. |
| ***57*** | *DFO Oceans* | | *13.0 Sensitive Areas, P. 13-1* | *The definition for sensitive areas quoted from the Scoping Document differs from the sensitive areas definition that has been used for other recent strategic and project based EAs (ex. Western Newfoundland SEA Update). In addition, in some assessments, sensitive areas are grouped with "special areas" (Western Newfoundland SEA), referred to as "potentially sensitive areas" (Southern Newfoundland SEA) or simply referred to as "special areas" (Laurentian Sub-Basin SEA). In the interest of clarity and consistency, it is suggested that the C-NLOPB identify a common, comprehensive definition and use common terminology for all SEAs and project based EAs when referring to special and sensitive areas.* |
| **Husky Response:** | | | | Comment noted. Thank you. |

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| ***58*** | *DFO Oceans* | | *13.3 Existing Environment, P. 13-5* | *Please provide consistency in reference to the CPAWS Special Marine Areas. There are three areas not two areas, as specified in the EA. These three Special Marine Areas should be depicted on a map as they are currently not shown in the document.* |
| **Husky Response:** | | | | Revised Figure 13-1, with the three CPAWS special Marine Areas identified is provided in Attachment 2. |
| *DFO Response:* | | | | *Figure 13-1 is not included in the Attachment* |
| **Husky Response:** | | | | Revised Figure 13-1 is provided as Figure 45 at the end of the DFO comment tables |
| ***59*** | *DFO Oceans* | | *13.3.1 Nearshore, P. 13-6* | *The EA states: "…The Placentia Bay Extension EBSA (which includes all of Placentia Bay) is ranked second by DFO (2007b) in priority among the 11 identified EBSAs within the PBGB LOMA as candidate sites for designation as an MPA…". The Placentia Bay Extension EBSA was not ranked second in relation to priority for Marine Protected Area designation. The area scored second out of the 11 EBSAs in relation to the criteria evaluated to determine the ecological or biological significance of the areas examined by DFO Science. The EA document refers to these criteria on p.13-16 in Section 13.3.2.1. The identification of EBSAs is not restricted to considerations for MPA designation. While portions of EBSAs may be potentially considered for MPA designation, there are a suite of potential management measures that may be established for EBSAs, not just strict protection. It is suggested that the proponent refer to Appendix 1 of the Southern Newfoundland Strategic Environmental Assessment http://www.cnlopb.nl.ca/pdfs/snsea/snseaapp1.pdf where DFO submitted a clarification of the purpose for identifying EBSAs.*<br>*References framing EBSAs solely in the context of MPA designation should be corrected (ex. P. 13-6 and third paragraph P. 13-16).* |
| **Husky Response:** | | | | Both comments are noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes? Will the text be updated?* |

| No. | Sector | Reviewer Initial | Section / Page No. | Comment / Information Request |
|---|---|---|---|---|
| **Husky Response:** | | | | The underlined text has been added to the second paragraph on Page 13-6:<br>The Placentia Bay Extension EBSA (which includes all of Placentia Bay) is ranked second by DFO (2007b) in priority among the 11 identified EBSAs within the PBGB-LOMA. <u>The area scored second out of the 11 EBSAs in relation to the criteria evaluated to determine the ecological or biological significance of the areas examined by DFO Science (see Section 13.3.2.1).</u> The geophysical and biological characteristics of Placentia Bay has been characterized by Catto et al. (1997, 1999), which provides a framework for describing the area. Catto et al. (1999) classified Placentia Bay based, in part, on the distribution of important indicator species and habitat features, including: eelgrass; salt marsh; barachois estuaries; capelin spawning beaches; rockweed; and seabird-dominated shores. Placentia Bay is highly industrialized, but is well flushed and levels of contamination are generally low; although moderate levels of persistent organic pollutants have been detected in marine birds, harbour seals, and fish (Sjare et al. 2005).<br>The third paragraph on page 13-16 is revised to read:<br>As part of the Integrated Management Plan for PBGB-LOMA, DFO has identified EBSAs in the area that may require specific management measures. EBSAs are identified according to pre-established criteria, including uniqueness, aggregation, fitness consequences, resilience and naturalness (DFO 2004e). In total, 11 EBSAs have been identified within the PBGB-LOMA. Five of these 11 EBSAs are located within the Offshore Study Area (Figure 13-2): Lily Canyon-Carson Canyon; Northeast Shelf and Slope; Southeast Shoal and Tail of the Banks; Virgin Rocks; and Southwest Shelf Edge and Slope. In the ranking scheme for DFO priorities, the Southeast Shoal and Tail of the Banks EBSA was given the highest ranking, and the Southwest Shelf Edge and Slope EBSA ranked third. The other three EBSAs being considered within this section were ranked in the bottom 4 of the 11. The five EBSAs being considered are described in greater detail in the follow sections. |

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|---|---|---|---|---|
| ***60*** | *DFO Oceans* | | *13.3.1.2 Eelgrass Beds, P. 13-10* | *The location of eelgrass beds should be depicted in a map as per the statement "…Extensive eelgrass beds have been identified in Placentia Bay (Catto et al. 1999; CPAWS 2009)…".* |
| **Husky Response:** | | | | Neither CPAWS (2009) nor Catto et al. (1999) provide mapping of eelgrass bed locations in Placentia Bay.<br>Eelgrass beds are known to occur within most shallow, sandy, sheltered areas of Placentia Bay with freshwater input (CPAWS 2009; Catto et al. 1999), forming in areas with energy levels low enough to allow for the accumulation and maintenance of sand, but with sufficient water circulation to limit accumulation of mud. Catto et al. (1999) conducted a preliminary biological and geomorphological classification of Placentia Bay and found that eelgrass beds in Placentia Bay are associated with "*estuarine areas (shore class 23), and are also found in association with ponds and inlets present along the landward sides of narrow sand flats (shore class20), gravel and sand flats (shore classes 16 and 17), on the lower energy, low shore zones of gravel flats (shore classes 13 and 14), and in the Come-by-Chance area (shore class 24)*".<br>Within the Cape Shore region, defined by Catto et al. (1999) as the region extending from Cape St. Mary's to the northern tip of the Argentia Peninsula, and within Northeast Placentia Bay, defined as Argentia Harbour to North Harbour, eelgrass shores were identified as one of the most commonly encountered subregions.<br>Within the Swift Current Estuarine Region or northwest portion of Placentia Bay, defined as the area between North Harbour Point and Prowsetown, including Soundy Island, Woody Island, and Bar Haven Island, eelgrass beds were identified as the most characteristic feature. At Swift Current, eelgrass beds start just above the low tide level and extend almost to the upper reaches of the Swift Current estuary, associated with the presence of suitable sheltered sandy substrate (Catto et al. 199).<br>Within the northwest Placentia Bay region, which is defined by Catto et al. (1999) to include Merasheen Island, Long Island, the Ragged Islands archipelago, Isle Valen, Presque Harbour, Paradise Sound, |

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|---|---|---|---|---|
| | | | | and the adjacent mainland shores of Newfoundland, eelgrass communities were not identified as a common subregion.<br>Within the Burin Peninsula region, from Marystown to Point May, eelgrass communities are also less common, although present in some areas. This is due to the lack of deep embayments in this region (Catto et al. 1999). |
| ***61*** | *HPD* | *SL* | *13.5.1 Nearshore Pre-construction and Construction, Table 13-4, P. 13-24* | *The reversibility eelgrass bed destruction is not accurate as presented in the table. The cut-off wall will be excavated to 18-20 m depth making it too deep for eelgrass re-colonization. Therefore, the effects would be irreversible. Please clarify.* |
| **Husky Response:** | | | | Comment noted. It is acknowledged that some eelgrass located within the proposed dredge area will be permanently lost (refer to Figure 8-2 in the WREP environmental assessment). As this loss of habitat will be compensated for (under HADD compensation) and it is a small percentage of the eelgrass present in Placentia Bay, the residual adverse effects are still predicted to be not significant. |
| ***62*** | *HPD* | *SL* | *15.1 Existing White Rose Offshore Environmental Effects Monitoring Program, P. 15.1* | *While it is acknowledged that the WHP requires inclusion into the existing EEM, DFO has not reviewed any plans for the insertion of the SWRX into the EEM design. Prior to the commencement of the next iteration of the EEM program (2014), it is advised that the proposed design be submitted to DFO for review.* |
| **Husky Response:** | | | | Husky will update the design of the EEM to include SWRX prior to the next scheduled sampling program in 2014. DFO will be consulted during the EEM re-design. |
| ***63*** | *HPD* | *SL* | *15.1.2 Environment Effects Monitoring Sampling Design, P. 15-3* | *Additional sampling will likely be required to verify predictions made during the EA regarding dispersion and subsequent accumulation of drill cuttings and therefore should be included in the monitoring program.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *DFO Response:* | | | | *Response adequate – However, DFO would like to discuss monitoring of drill cutting dispersion for the EEM Program* |
| **Husky Response:** | | | | Husky would be pleased to meet with DFO to discuss monitoring of drill cuttings dispersion. |
| ***64*** | *HPD* | *SL* | *15.2.1 Nearshore Environmental Compliance Monitoring, P. 15-4* | *The proponent should also specify that a Section 35(2) Fisheries Act Authorization will likely be required for the nearshore dredging component.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes? Will the text be updated?* |

| No. | Sector | Reviewer Initial | Section / Page No. | Comment / Information Request |
|---|---|---|---|---|
| **Husky Response:** | | | | The underlined text has been added to the bullet list on Page 15-4:<br>Husky will develop a site-specific environmental protection plan (EPP) for the activities associated with graving dock excavation and CSG construction at Argentia under the WHP development option, including those activities requiring compliance monitoring pursuant to legislation and guidelines. Such legislation and guidelines include, but are not limited to:<br>• *Fisheries Act* Section 36<br>• *Fisheries Act* Section 32<br>• *Migratory Birds Convention Act*, 1994, Section 35<br>• *Canada Shipping Act*, 2001, *Vessel Pollution* and *Dangerous Chemicals Regulations*<br>• <u>Section 35(2)</u> *Fisheries Act* Authorization for Works or Undertakings Affecting Fish Habitat (issued by Fisheries and Oceans Canada) <u>(likely be required for the nearshore dredging component)</u><br>• Newfoundland and Labrador Water Resources Act Permit to Alter a Body of Water<br>• Newfoundland and Labrador *Environmental Control Water and Sewer Regulations* for waste water discharge<br>• NLDEC Guidance Documents on Dredge Spoils Disposal (GD-PPD-028.1) and Leachable Toxic Waste, Testing and Disposal (GD-PPD-026.1). |
| ***65*** | *HPD* | *SL* | *15.2.2 Offshore Environmental Compliance Monitoring, P. 15-5* | *See comment G-1.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| ***66*** | *HPD* | *SL* | *15.3 Other Required Programs, P. 15-5* | *It is important to note that although there will be upcoming changes to the Fisheries Act, the current requirements of the Fisheries Act and DFO's Policy for the Management of Fish Habitat (1986) are still in effect for on-going projects.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| ***67*** | *DFO (Sci.)* | | *15.3* | *Dynamic positioned rigs and vessels will produce significant and long-duration underwater noise through propeller cavitation and thruster operations displacing marine mammals, or in the case of Northern Bottlenose Whales (Hyperoodon ampullatus), may attract them to such operations. Regular monitoring before, during, and after the onset of such activities would help to determine if there were distributional or behaviour responses to such noise sources.* |

| No. | Sector | Reviewer Initial | Section / Page No. | Comment / Information Request |
|---|---|---|---|---|
| **Husky Response:** | | | | Comment noted. Thank you. |
| ***68*** | *HPD* | *SL* | *17.4 Summary of Monitoring and Follow-up, P. 17-11* | *There is an indication that the EEM will be updated to incorporate the West White Rose development; however, the SWRX also needs to be included into the existing EEM program as described above (S-62).* |
| **Husky Response:** | | | | Baseline information was collected around SWRX during White Rose 2012 EEM, prior to excavation. Husky will update the design of the EEM to include SWRX prior to the next scheduled sampling program in 2014. |
| ***69*** | *Oceans* | | *17.5 Conclusions, Table 17-2, P. 17-12* | *Please be consistent in referring to "Special Areas" or "Sensitive Areas" throughout the EA.* |
| **Husky Response:** | | | | Comment noted. Thank you. |

## 11.2 Drill Cuttings and WBM Operational Release Modelling

| No. | Sector | Reviewer Initial | Section / Page No. | Comment / Information Request |
|---|---|---|---|---|
| **GENERAL COMMENTS** | | | | |
| *1* | *HPD* | *SL* | *Executive Summary, P. ii* | *The statement "Nor is account made of the possibility of cuttings near the cuttings deposits directly about the excavated drill centre(s) being cleared by a seafloor cutting transportation system and moved to another seafloor location" is concerning to DFO. The transportation of drill cuttings outside the authorized area could have Fisheries Act implications and therefore DFO should be contacted prior to the relocation of drill cuttings.* |
| **Husky Response:** | | | | Husky will contact DFO prior to the undertaking of such activities. |
| *2* | *HPD* | *SL* | *2.0 Drilling Program, P. 2* | *The document suggests there could be three additional subsea drill centers at the White Rose field as well as the WHP. This is inconsistent with the EA and other documentation. Regardless, as stated in DFO's comment G-1 of the EA, the post-construction survey results from the SWRX have indicated Husky Energy may require amendments to existing authorizations to enable the excavation of anymore drill centers beyond the installation of the WHP.* |
| **Husky Response:** | | | | For clarification, the WHP option includes two additional subsea drill centres, since SWRX was excavated in 2012. Husky will consult DFO regarding requirements for amendments to existing authorizations prior to the excavation of any additional subsea drill centres. |
| *3* | *HPD* | *SL* | *Figure 2-1, P. 3* | *The drill center SWRX is not depicted on the figure. Similar to S-9, please include it in the figure.* |
| **Husky Response:** | | | | Please see response to comment S-9. |
| *4* | *HPD* | *SL* | *3.3.2 Synthetic Based Muds, P. 31* | *As discussed above, relocation of drill cuttings could have implications to fish and fish habitat, therefore contact DFO prior to the undertaking such activities.* |
| **Husky Response:** | | | | Husky will contact DFO prior to the undertaking of such activities. |
| *5* | *HPD* | *SL* | *4.0 Drilling Mud Properties and Discharge Characteristics, P. 38* | *It should be noted that another environmental effect of released WBMs is the smothering of benthic organisms that should be included.* |
| **Husky Response:** | | | | Comment noted. Thank you. |

| No. | Sector | Reviewer Initial | Section / Page No. | Comment / Information Request |
|---|---|---|---|---|
| *DFO Response:* | | | | *Does Husky Energy accept the proposed changes? Will the text be updated?* |
| **Husky Response:** | | | | The underlined text has been added to the fifth paragraph on Page 38 of the drill cuttings modelling report:<br>The environmental effects of released WBMs are generally associated with the potential physical toxicity of fine particulate matter, either barite or bentonite, which are sometimes used to increase the density of the mud mixture: as noted by Cranford (2005) these additives have greater potential to affect filter feeding organisms as they remain suspended in the bottom boundary layer. <u>Smothering of benthic organisms may also result from the release of WBMs.</u> |

## 11.3 Underwater Sound Propagation

| No. | Sector | Reviewer Initial | Section / Page No. | Comment / Information Request |
|---|---|---|---|---|
| **GENERAL COMMENTS** | | | | |
| *1* | *DFO (Sci.)* | | *Table 1-2, P. 4* | *While the injury criteria in Southall et al. (2007) are accepted by many reviewers, the behavioural criteria are not generally accepted. For some cetaceans, reactions to sound appear to be highly dependent on context and their behavioural state. Based on the modelled sound propagation the area ensonified to a level that would result in behavioural reactions by cetaceans could be quite large.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *2* | *DFO (Sci.)* | | *Table 2-2, Section 2.2.2 and elsewhere* | *Given that sounds from propeller cavitation and dynamic positioning using thrusters can be substantial – it would have been useful to review these models separately as they might be significant.* |
| **Husky Response:** | | | | Comment noted. Thank you. |
| *3* | *DFO (Sci.)* | | *Section 3.0* | *Provide a rationale for the exclusion of 5% of the furthest distance values to a given sound level; it does not seem useful to present this reduced dataset.* |
| **Husky Response:** | | | | Using R95% to define an omnidirectional safety region (i.e., affected area, as defined in Section 5.3.2.1 of the environmental assessment) avoids inflating its size to encompass a large area that is mostly below the threshold. This radius is especially relevant where the source directivity or the environment lead to acoustic footprints that are highly irregular and include perimeter features that extend far beyond the circumference of the main ensonified area. Where the shape of a modelled isopleth is compact and has a featureless boundary, on the other hand, it may be advisable to use Rmax in determining the boundaries of the affected area, which will result in the inclusion of more than 100% of the ensonified area. The choice of which radius to use may ultimately depend on considerations of the shape of the region and the specific circumstances of each exposure scenario. |

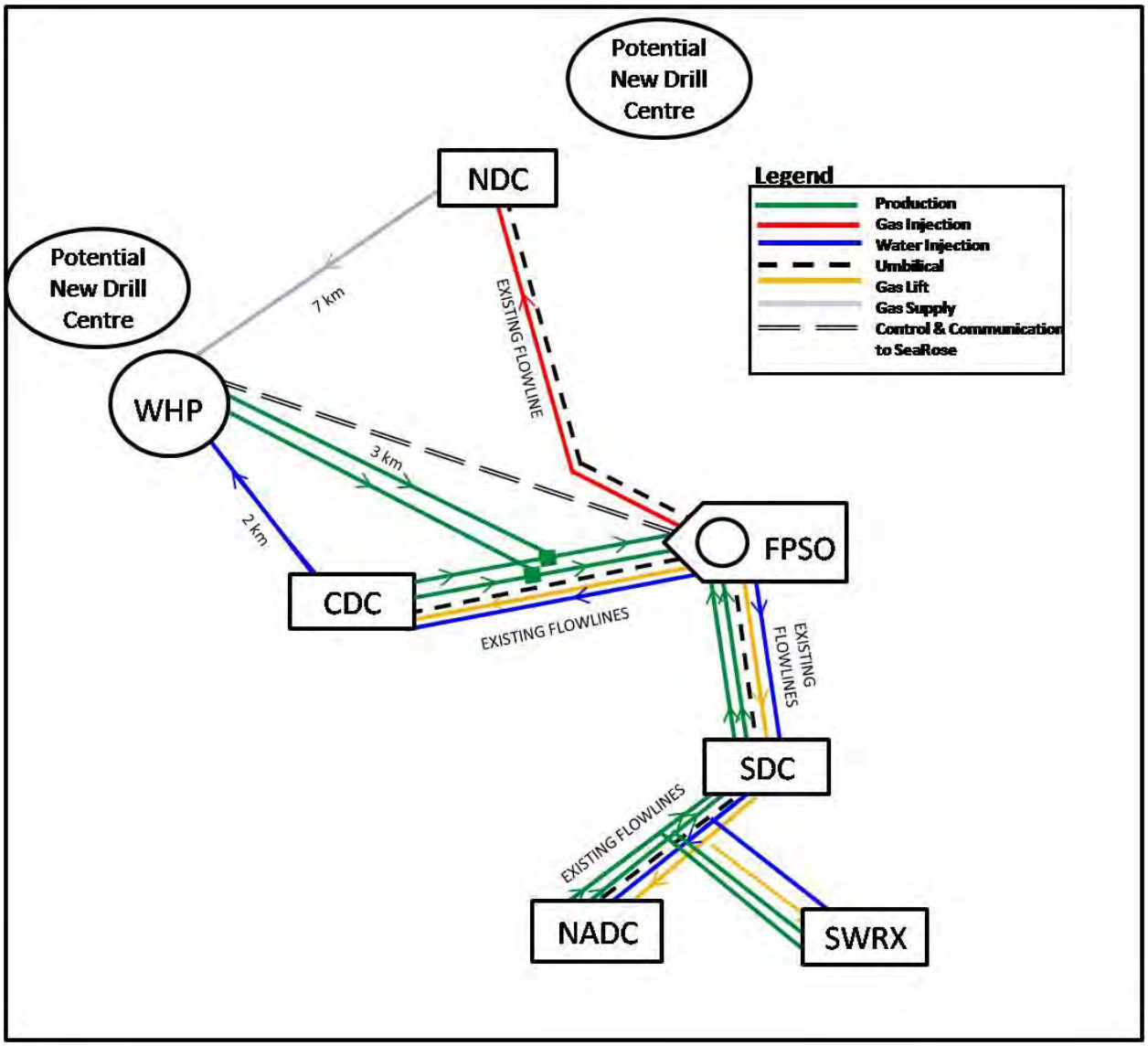



**Figure 31 Revised Figure 2-15 Potential Wellhead Platform Concept Integration into Existing White Rose Facilities**

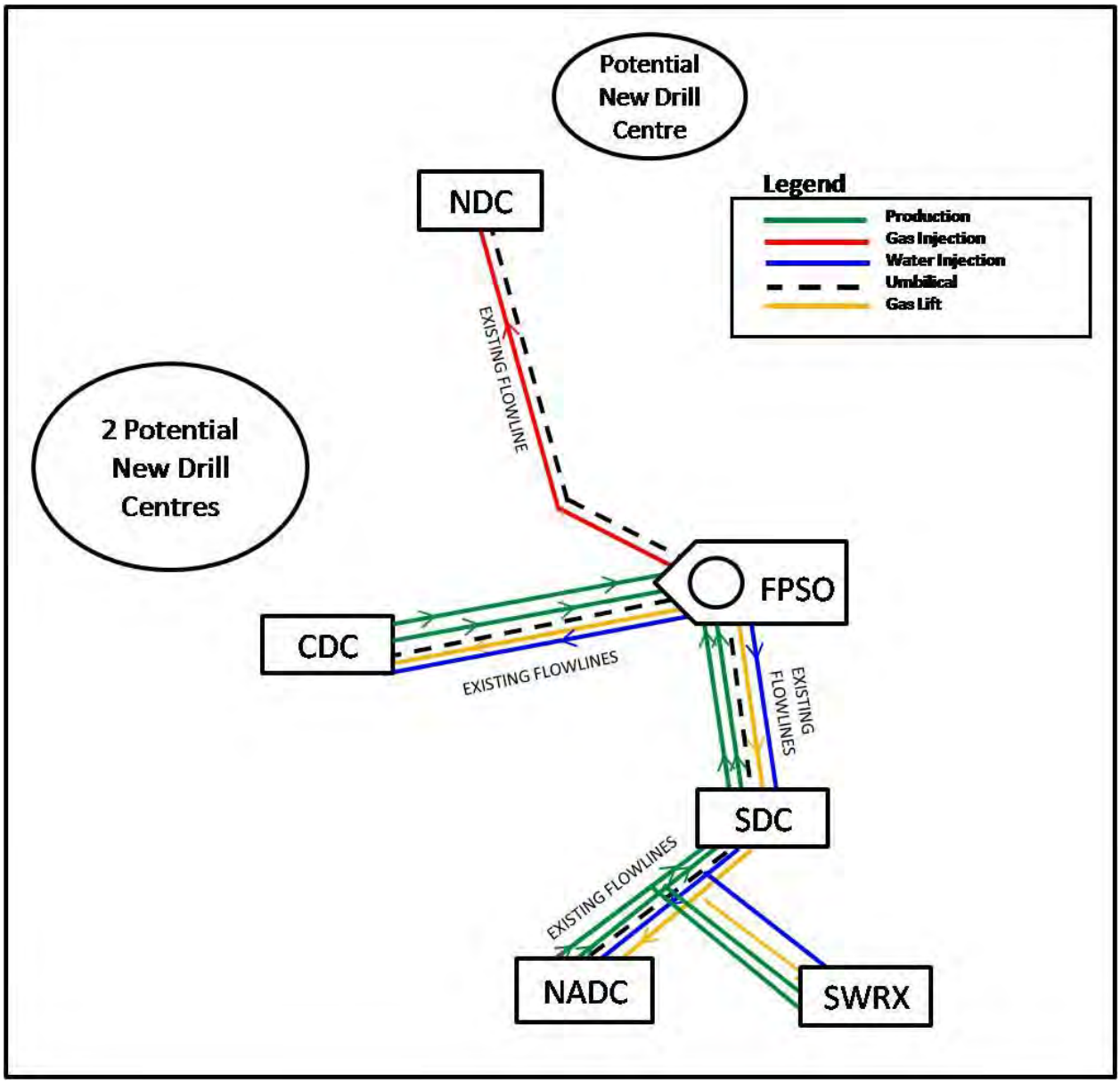



**Figure 32 Revised Figure 2-16 Potential New Subsea Drill Centres Location in Relation to the Existing White Rose Facilities**

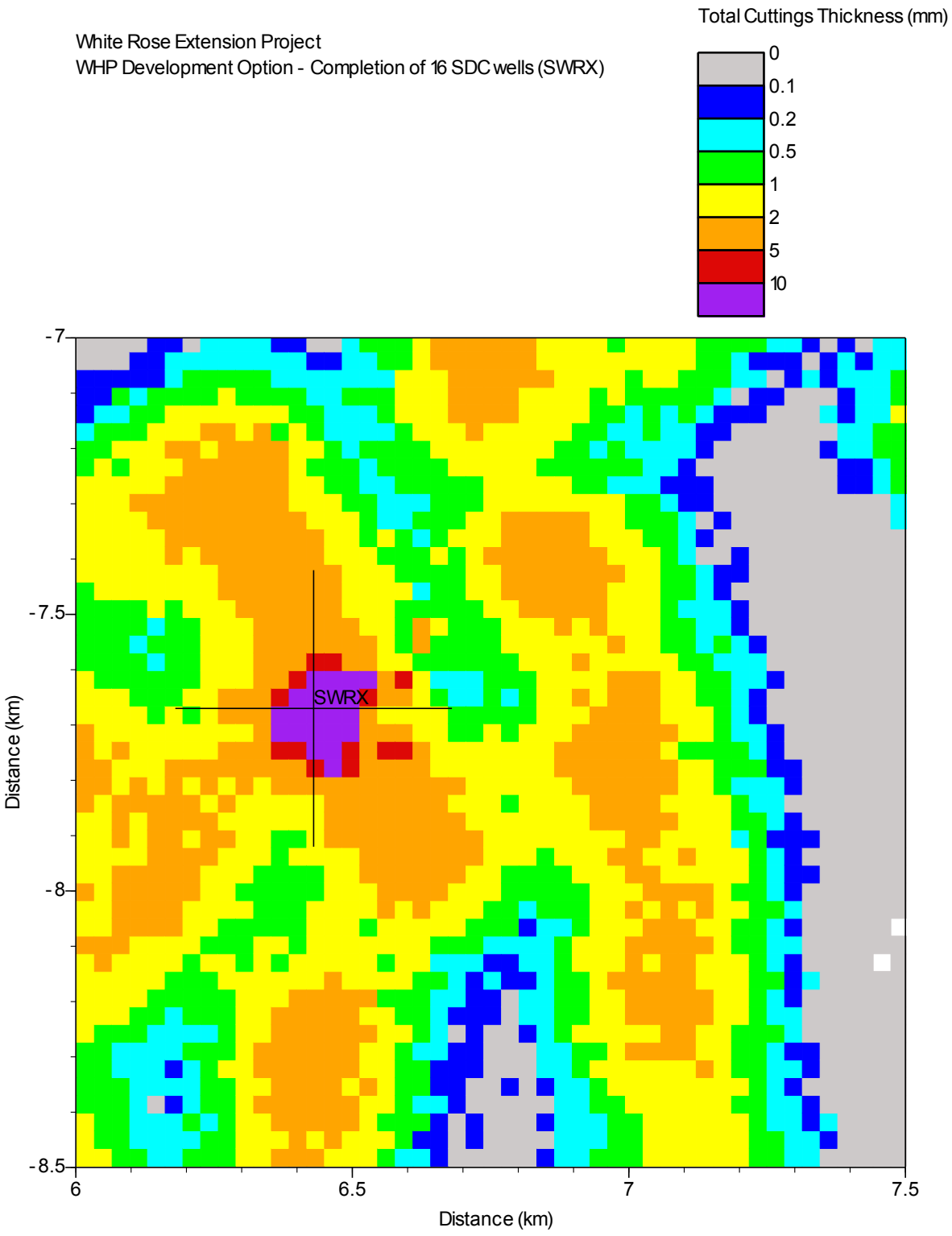



**Figure 33 Figure 3-16a Total Water-based Mud and Synthetic-based Mud Cuttings Deposition for South White Rose Extension Drilling of 16 Wells, 'Base Case', 1.5-km View**

**Table 21 Revised Table 8-5 Potential White Rose Extension Project-related Interactions – Fish and Fish Habitat**

| Potential WREP Activities, Physical Works, Discharges and Emissions | Change in Habitat Quality | Change in Habitat Quantity | Potential Mortality |
|---|---|---|---|
| **Nearshore (WHP only)** | | | |
| **Graving Dock Construction** | | | |
| Lighting | x | | |
| Water discharge from The Pond | x | | |
| Construction of graving dock (include sheet pile driving, potential grouting, potential gate) | x | | |
| Dewater graving dock | x | | |
| ***CGS Construction and Installation*** | | | |
| *Onshore (Argentia Construction Site)* | | | |
| Lighting | x | | |
| *Marine (Argentia and Deep-water Mating Site)* | | | |
| Operation of vessels | x | | |
| Additional nearshore surveys (e.g., multibeam, sonar, environmental) | x | | |
| Dredging | x | x | x |
| CGS solid ballasting (which may include disposal of water containing fine material) | x | | |
| CGS water ballasting and de-ballasting | x | | |
| CGS towing to deep-water mating site | x | | |
| Noise from topsides mating | x | | |
| Lighting | x | | |
| Safety zone | | | + |
| ***Operation and Maintenance of Permanent Graving Dock*** | | | |
| Dewatering of graving dock | x | | |
| Flooding of graving dock | x | | |
| **Offshore** | | | |
| ***Wellhead Platform Installation/Commissioning*** | | | |
| Clearance surveys (e.g., sidescan sonar) prior to installation of WHP or pipelines/ flowlines | x | | |
| Operation of helicopters and vessels/barges | x | | |
| Installation of flowlines and pipelines between WHP, subsea drill centre(s) and existing infrastructure | x | | |
| Potential rock berms for flowline protection | | x/+ | |
| Lighting | x | | |
| Safety zone | | | + |
| Drilling-associated seismic (VSPs and wellsite surveys) | x | | |
| ***Subsea Drill Centre Installation/Commissioning*** **(Previously assessed; LGL 2007a)** | | | |
| Dredging and disposal of dredge material | x | x | x |
| Clearance surveys (e.g., sidescan sonar) prior to installation of pipelines/flowlines | x | | |
| Operation of helicopters and supply, support, standby and tow vessels/barges | x | | |
| Lighting | x | | |
| Safety zone | | | + |
| Installation of subsea equipment, flowlines and tie-in modules to existing subsea infrastructure | x | x/+ | |
| Drilling-associated seismic (VSPs and wellsite surveys) | x | | x |
| ***Production/Operation and Maintenance (Wellhead or Subsea Drill Centre)*** | | | |
| Presence of structure | x | x/+ | |
| Safety zone | | | + |
| Noise from drilling from a MODU and WHP | x | | |
| WBM (from either WHP or MODU) and SBM (from MODU only) cuttings [A] | x | x | x |
| Lighting | x | | |
| Operation of seawater systems (cooling, firewater) | x | | |
| Operation of helicopters, supply, support, standby and tow vessels/barges/ROVs | x | | |
| Surveys (geotechnical, geophysical and environmental) | x | | x |
| Cementing and completing wells | x | | |

| Potential WREP Activities, Physical Works, Discharges and Emissions | Change in Habitat Quality | Change in Habitat Quantity | Potential Mortality |
|---|---|---|---|
| Oily water treatment (B) | x | | |
| ***Decommissioning and Abandonment (WHP or Subsea Drill Centre)*** | | | |
| Removal of WHP | | x/+ | |
| Plugging and Abandoning Wells | x | | |
| Operation of Vessels (supply/support/standby/tow vessels/barges/diving/ROVs | x | | |
| Lighting | x | | |
| Safety zone | | | x |
| Surveys (geotechnical, geophysical and environmental) | x | | x |
| **Potential Future Activities** | | | |
| Surveys (e.g., geophysical, geological, geotechnical, environmental, ROV, diving) | x | | |
| Excavation of drill centres (including disposal of dredge spoils) | x | x | x |
| Noise from drilling from MODU at potential future subsea drill centres | x | x | |
| WBM and SBM Cuttings | x | x | x |
| Installation of Pipeline(s)/Flowline(s) and Testing from Drill Centres to FPSO, including Flowline Protection | x | x | x |
| Chemical Use and management (e.g., BOP fluids, well treatment fluids, corrosion inhibitors (C)) | x | | |
| **Accidental Events** | | | |
| Marine diesel fuel spill from support vessel | x | | x |
| Graving dock breach | x | x | |
| SBM whole mud spill | x | | |
| Subsea hydrocarbon blowout | x | | x |
| Hydrocarbon surface spill | x | | x |
| Other spills (e.g., fuel, waste materials) | x | | x |
| Marine vessel incident including collisions (i.e., marine diesel fuel spill) | x | | x |
| **Cumulative Environmental Effects** | | | |
| Commercial fisheries (nearshore and offshore) | x | | x |
| Marine traffic (nearshore and offshore) | x | | |
| White Rose Oilfield Development (including North Amethyst and the South White Rose extension drill centre) | x | x | x |
| Terra Nova Development | x | x | x |
| Hibernia Oil Development | x | x | x |
| Hibernia Southern Extension Project | x | x | x |
| Hebron Oil Development | x | x | x |
| Offshore Exploration Seismic Activity | x | | x |
| Offshore Exploration Drilling Activity | x | x | |

Notes:

(A) Water-based drilling fluids and cuttings will be discharged overboard. Husky will evaluate best available cuttings management technology and practices to identify a waste management strategy for spent non-aqueous fluid and non-aqueous fluid cuttings from the MODU. SBM cuttings will be re-injected into a dedicated well from the WHP, pending confirmation of a suitable disposal formation

(B) Water (including from open drains) will be treated prior to being discharged to the sea in accordance with the *Offshore Waste Treatment Guidelines* (OWTG) (National Energy Board (NEB) et al. 2010)

(C) Husky will evaluate the use of biocides other than chlorine. The discharge from the hypochlorite system will be treated to meet a limit approved by the C-NLOPB's Chief Conservation Officer

**Table 22 Revised Table 8-7 Potential Environmental Effects Assessment Summary for Fish and Fish Habitat – Accidental Events in the Nearshore**

| WREP Activity | Potential Positive (P) or Negative (N) Environmental Effect | Mitigation Measure | Evaluation Criteria for Assessing Environmental Effects (A) | | | | | | Significance Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Frequency | Duration | Reversibility | Ecological/Socio-cultural/Economic Significance | | |
| Hydrocarbon spill from vessel (marine diesel) due to collision or accidental release | Change in habitat quality (N)<br>Potential mortality (N) | • Training, preparation, equipment inventory, prevention, and emergency response drills<br>• Oil Spill Response Plan<br>• Vessels will not be re-fueled in the Nearshore Project Area<br>• Adhere to MARPOL | H | 3 | 1 | 2 | R | 3 | NS | M |
| Graving dock breach | Change in habitat quality (N)<br>Potential mortality (N) | • Design<br>• Use of best practices and continual improvement programs | L | 1 | 1 | 1 | R | 3 | NS | H |
| Collapse of Settling Pond or Breach of Berm at The Pond | Change in habitat quality (N)<br>Potential mortality (N) | • Design<br>• Monitoring<br>• Use of best practices and continual improvement programs | L | 1 | 1 | 1 | R | 3 | NS | H |

Key:

**Magnitude:**
N = Negligible (essentially no effect)
L = Low: <10 percent of the population or habitat in the Study Area will be affected
M = Medium: 11 to 25 percent of the population or habitat in the Study Area will be affected
H = High: >25 percent of the population or habitat in the Study Area will be affected

**Geographic Extent:**
1 = <1 km radius
2 = 1 to 10 km radius
3 = 11 to 100 km radius
4 = 101 to 1,000 km radius
5 = 1,001 to 10,000 km radius
6 = >10,000 km radius

**Frequency:**
1 = <11 events/year
2 = 11 to 50 events/year
3 = 51 to 100 events/year
4 = 101 to 200 events/year
5 = >200 events/year
6 = continuous

**Duration:**
1 = <1 month
2 = 1 to 12 months
3 = 13 to 36 months
4 = 37 to 72 months
5 = >72 months

**Reversibility** (population level):
R = Reversible
I = Irreversible

**Ecological/Socio-cultural/Economic Significance:**
1 = Relatively pristine area not affected by human activity
2 = Evidence of existing adverse activity
3 = High level of existing adverse activity

**Significance Rating:**
S = Significant
NS = Not Significant
P = Positive

**Level of Confidence:**
L = Low level of confidence
M = Medium level of confidence
H = High level of confidence

(A) Where there is more than one potential environmental effect, the evaluation criteria rating is assigned to the environmental effect with the greatest potential for harm

**Table 23 Revised Table 8-8 Potential Environmental Effects Assessment Summary for Fish and Fish Habitat –Wellhead Platform or Subsea Drill Centre Installation**

| WREP Activity | Potential Positive (P) or Negative (N) Environmental Effect | Mitigation Measure | Evaluation Criteria for Assessing Environmental Effects [A] | | | | | | Significance Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Frequency | Duration | Reversibility | Ecological/Socio-cultural/Economic Significance | | |
| Lighting | Change in habitat quality (N) | • Use only lights as necessary for safe operations | N | 1 | 6 | 3 | R | 2 | NS | H |
| Safety zone | Potential mortality (P) | | N | 2 | 6 | 5 | R | 2 | NS | H |
| Dredging | Change in habitat quality (N)<br>Change in habitat quantity (N)<br>Potential mortality (of benthos) (N) | • Compliance with *Fisheries Act*. | L | 1 | 1 | 2 | R | 2 | NS | H |
| Clearance surveys (e.g., sidescan sonar) prior to installation of WHP or pipelines/ flowlines | Change in habitat quality (N) | • Use of best practices and improvement programs | N | 1 | 1 | 1 | R | 2 | NS | H |
| Operation of vessels and barges | Change in habitat quality (N) | • Adhere to *Canada Shipping Act, 2001* and industry best practices<br>• Follow marine traffic rules and regulations | N | 4 | 6 | 5 | R | 2 | NS | H |
| Installation of flowlines and pipelines between WHP, subsea drill centre(s) and existing infrastructure | Change in habitat quantity (N) | • Minimize seabed disturbance<br>• Compliance with *Fisheries Act*<br>• Use of best practices and improvement programs | N | 1 | 1 | 2 | R | 2 | NS | H |
| Installation of subsea equipment, flowlines and tie-in modules to existing subsea infrastructure | Change in habitat quantity (N) | • Minimize seabed disturbance<br>• Use of best practices and improvement programs | N | 1 | 1 | 2 | R | 2 | NS | H |
| Potential rock berms for flowline protection | Change in habitat quality (N)<br>Change in habitat quantity (N/P) | • Compliance with *Fisheries Act* | N | 1 | 6 | 5 | R | 2 | NS | H |
| Drilling-associated seismic (VSPs and wellsite surveys) | Change in habitat quality (N)<br>Potential mortality (N) | • Adherence to the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012d) | L | 2 | 1 | 1 | R | 2 | NS | M |

| WREP Activity | Potential Positive (P) or Negative (N) Environmental Effect | Mitigation Measure | Evaluation Criteria for Assessing Environmental Effects (A) | | | | | | Significance Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Frequency | Duration | Reversibility | Ecological/Socio-cultural/Economic Significance | | |

Key:

**Magnitude:**
N = Negligible (essentially no effect)
L = Low: <10 percent of the population or habitat in the Study Area will be affected
M = Medium: 11 to 25 percent of the population or habitat in the Study Area will be affected
H = High: >25 percent of the population or habitat in the Study Area will be affected

**Geographic Extent:**
1 = <1 km radius
2 = 1 to 10 km radius
3 = 11 to 100 km radius
4 = 101 to 1,000 km radius
5 = 1,001 to 10,000 km radius
6 = >10,000 km radius

**Frequency:**
1 = <11 events/year
2 = 11 to 50 events/year
3 = 51 to 100 events/year
4 = 101 to 200 events/year
5 = >200 events/year
6 = continuous

**Duration:**
1 = <1 month
2 = 1 to 12 months
3 = 13 to 36 months
4 = 37 to 72 months
5 = >72 months

**Reversibility** (population level):
R = Reversible
I = Irreversible

**Ecological/Socio-cultural/Economic Significance:**
1 = Relatively pristine area not affected by human activity
2 = Evidence of existing adverse activity
3 = High level of existing adverse activity

**Significance Rating:**
S = Significant
NS = Not Significant
P = Positive

**Level of Confidence:**
L = Low level of confidence
M = Medium level of confidence
H = High level of confidence

(A) Where there is more than one potential environmental effect, the evaluation criteria rating is assigned to the environmental effect with the greatest potential for harm

**Table 24 Revised Table 11-9 Potential White Rose Extension Project-related Interactions: Marine Mammals and Sea Turtles**

| Potential WREP Activities, Physical Works, Discharges and Emissions | Change in Habitat Quality | Change in Habitat Quantity | Potential Mortality |
|---|---|---|---|
| **Nearshore** | | | |
| ***Pre-construction and Installation*** | | | |
| Construction of Graving Dock (include sheet pile/driving, potential grouting) | x | | |
| Air Emissions | x | | |
| Water discharge from The Pond/Dewater graving dock | x | | |
| ***CGS Construction and Installation*** | | | |
| *Marine (Argentia and Deep-water Mating Site)* | | | |
| Additional Nearshore Surveys (e.g., geotechnical, geophysical, environmental) | x | | |
| Dredging | x | | x |
| CGS Solid Ballasting (which may include disposal of water containing fine material) | x | | |
| CGS Water Ballasting and De-ballasting | x | | |
| CGS Towing to Deep-water mating site | x | | |
| Noise from Topsides Mating | x | | |
| Air Emissions | x | | |
| Additional Hook-up and Commissioning of Topsides | x | | |
| Operation of Helicopters, Supply, Support, Standby, Mooring and Tow Vessels/ Barges/ROVs | x | | x |
| ***Offshore*** | | | |
| ***Wellhead Platform Installation/Commissioning*** | | | |
| Clearance Surveys (e.g., sidescan sonar) Prior to Installation of WHP or Pipelines/Flowlines | x | | |
| Tow-out/offshore Installation | x | | |
| Operation of Helicopters and Vessels/Barges | x | | x |
| Diving Activities/Operation of ROVs | x | | |
| Installation of Flowlines and Pipelines between WHP, Subsea Drill Centre(s) and Existing Infrastructure | x | | |
| Potential Rock Berms for Flowline Protection | x | | |
| Additional Hook-up, Production Testing and Commissioning | x | | |
| Air Emissions | x | | |
| Hydrostatic Test Fluid (flowlines) | x | | |
| Possible Use of Corrosion Inhibitors or Biocides (flowlines) [(A)] | x | | |
| Waste Generated (domestic waste, construction waste, hazardous waste, sanitary waste) | x | | |
| Drilling-associated Seismic (VSPs and wellsite surveys) | x | x | |
| ***Subsea Drill Centre Excavation/Installation (previously assessed by LGL 2007a)*** | | | |
| Dredging and Disposal of Dredge Material | x | | |
| Clearance Surveys (e.g., sidescan sonar) Prior to Installation of Pipelines/Flowlines | x | | |
| Operation of Helicopters and Supply, Support, Standby and Tow Vessels/Barges | x | | x |
| Diving Activities / Operation of ROVs | x | | |
| Air Emissions | x | | |
| Installation of Subsea Equipment, Flowlines and tie-in Modules to Existing Subsea Infrastructure | x | | |
| Hydrostatic Test Fluid (flowlines) | x | | |
| Possible Use of Corrosion Inhibitors or Biocides (flowlines) [(A)] | x | | |
| Waste Generated (domestic waste, construction waste, hazardous waste, sanitary waste) | x | | |
| Drilling-associated Seismic (VSPs and wellsite surveys) | x | x | |
| ***Production/Operation and Maintenance*** | | | |
| Presence of Structure | x | x | |
| Noise from Drilling from a MODU and WHP | x | | |

| Potential WREP Activities, Physical Works, Discharges and Emissions | Change in Habitat Quality | Change in Habitat Quantity | Potential Mortality |
|---|---|---|---|
| WBM (from either WHP or MODU) and SBM (from MODU only) cuttings (B) | x | | |
| Air emissions | x | | |
| Chemical Use and Management (e.g. BOP fluids, fuel, well treatment fluids, corrosion inhibitors) | x | | |
| Waste Generated (domestic waste, construction waste, hazardous, sanitary waste) | x | | |
| Operation of Helicopters, Supply, Support, Standby and Tow Vessels/Barges/ROVs | x | | x |
| Surveys (geotechnical, geophysical and environmental) | x | x | |
| Oily Water Treatment (C) | x | | |
| Diving Activities / Operation of ROVs | x | | |
| ***Decommissioning and Abandonment*** | | | |
| Removal of WHP | x | x | |
| Plugging and Abandoning Wells | x | | |
| Operation of Helicopters | x | | |
| Operation of Vessels (supply/support/standby/tow vessels/barges/diving/ROVs) | x | | x |
| Air Emissions | x | | |
| Surveys (geotechnical, geophysical and environmental) | x | | |
| **Potential Future Activities** | | | |
| Surveys (e.g., geophysical, geological, geotechnical, environmental, ROV, diving) | x | x | |
| Excavation of Drill Centres (including disposal of dredge spoils) | x | | |
| Noise from Drilling Operations from MODU at Potential Future Drilling Centres | x | | |
| WBM and SBM Cuttings | x | | |
| Hook-Up And Commissioning of Drill Centres | x | | |
| Installation of Pipeline(s)/Flowline(s) and Testing from Drill Centres to FPSO, including Flowline Protection | x | | |
| Chemical Use and Management (e.g., BOP fluids, fuels, well treatment fluids, corrosion inhibitors) | x | | |
| **Accidental Events** | | | |
| Marine Diesel Fuel Spill from Support Vessel | x | | x |
| Graving Dock Breach | x | | |
| SBM Whole Mud Spill | x | | |
| Subsea Hydrocarbon Blowout | x | | x |
| Hydrocarbon Surface Spill | x | | x |
| Other Spills (e.g., fuel, waste materials) | x | | x |
| Marine Vessel Incident (including collisions) (i.e., marine diesel fuel spill) | x | | x |
| **Cumulative Environmental Effects** | | | |
| Commercial Fisheries (nearshore and offshore) | x | | x |
| Marine Traffic (nearshore and offshore) | x | | x |
| White Rose Oilfield Development (including North Amethyst and South White Rose extension drill centre) | x | | |
| Terra Nova Development | x | | |
| Hibernia Oil Development | x | | |
| Hibernia Southern Extension Project | x | | |
| Hebron Oil Development | x | | |
| Offshore Exploration Seismic Activity | x | | |
| Offshore Exploration Drilling Activity | x | | |

Notes:

(A) Husky will evaluate the use of biocides other than chlorine. The discharge from the hypochlorite system will be treated to meet a limit approved by the C-NLOPB's Chief Conservation Officer.

(B) Water-based drilling fluids and cuttings will be discharged overboard. Husky will evaluate best available cuttings management technology and practices to identify a waste management strategy for spent non-aqueous fluid and non-aqueous fluid cuttings from the semi-submersible drilling rig. Synthetic-based mud cuttings will be re-injected into a dedicated well from the WHP, pending confirmation of a suitable disposal formation.

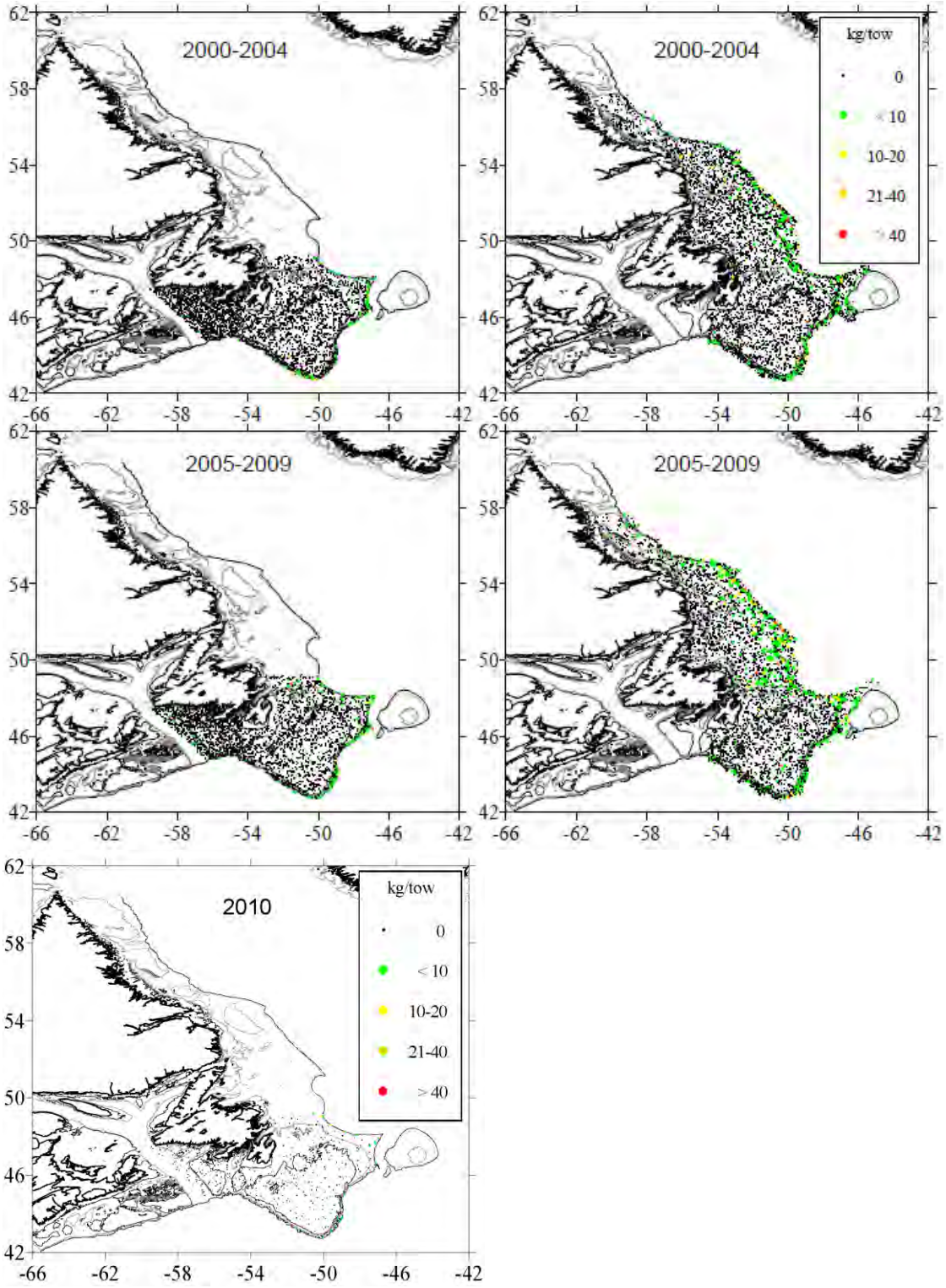
(C) Water (including from open drains) will be treated prior to being discharged to the sea in accordance with OWTG

**Table 25 Table 12-3 List of Species Assessed as 'At Risk' by the Committee on the Status of Endangered Wildlife in Canada that Could Occur Within the Nearshore and Offshore Study Areas**

| Common Name | Species Name | COSEWIC Assessment | Occurrence in Relation to the WREP |
|---|---|---|---|
| Atlantic Cod (Newfoundland and Labrador population) | *Gadus morhua* | Endangered | High potential for occurrence in Nearshore and Offshore Study Areas. Atlantic cod from this population inhabit waters from the northern tip of Labrador to the southern Grand Banks |
| Atlantic Cod (Southern population) | | Endangered | High potential for occurrence in the Nearshore and Offshore Study Areas. Atlantic cod from this population inhabit waters from the Bay of Fundy and southern Nova Scotia to the southern extent of the Grand Banks. Large numbers of this stock are known to spawn in Placentia Bay. This population has recovered better than other populations in Northwest Atlantic |
| Roundnose Grenadier | *Coryphaenoides rupestris* | Endangered | Moderate potential for occurrence in the Nearshore. Moderate to high potential for occurrence in Offshore Study Area. Closely associated with the seafloor and commonly found inhabiting depths of 800 to 1,000 m. Occurs year-round, with spawning in fall |
| Porbeagle Shark | *Lamna nasus* | Endangered | Moderate potential for occurrence in Nearshore and Offshore Study Areas. Migrant in Atlantic Canadian waters. Most common May to December in water depths of 35 to 100 m |
| Atlantic Bluefin Tuna | *Thunnus thynnus* | Endangered | Low to moderate potential for occurrence in Nearshore and Offshore Study Areas. Atlantic bluefin tuna may migrate through the Grand Banks following food stocks in July through December. May form schools |
| Smooth Skate (Funk Island Deep population) | *Malacoraja senta* | Endangered | Low potential for occurrence in Offshore Study Area. Moderate potential in Nearshore Study Area. Concentrates north of the Offshore Study Area. Occurs from 50 to 600 m (commonly 400 to 600 m) in Newfoundland waters |
| Deepwater Redfish (northern population) | *Sebastes mentalla* | Threatened | Low potential for occurrence Offshore Study Area. Not known to occur in Nearshore Study Area. Closely associated with the seafloor, commonly found inhabiting waters 350 to 500 m. Uncommon on the Grand Banks |
| Acadian Redfish (Atlantic population) | *Sebastes fasciatus* | Threatened | Unlikely to occur in Nearshore Study Area. Low to moderate potential for occurrence in Offshore Study Area. Closely associated with the seafloor and commonly found inhabiting waters 150 to 300 m. Mature individuals most common in area from May to October. Spawning occurs in fall. Larvae may be present in water column May to August |
| Shortfin Mako | *Isurus oxyrinchus* | Threatened | Low to moderate potential for occurrence in Nearshore and Offshore Study Areas. A pelagic species that migrates north following food stocks (i.e., mackerel, herring, tuna). Any occurrence would likely be transient in nature |
| American plaice (Maritime population) | *Hippoglossus platessoides* | Threatened | Low potential for occurrence in Nearshore Study Area. Moderate potential for occurrence in Offshore Study Area. Closely associated with the seafloor and commonly found at depths of 100 to 200 m where soft sediments are present. Spawning occurs in April/May. Larvae may be present in the water column between May and June. This species was once highly abundant |

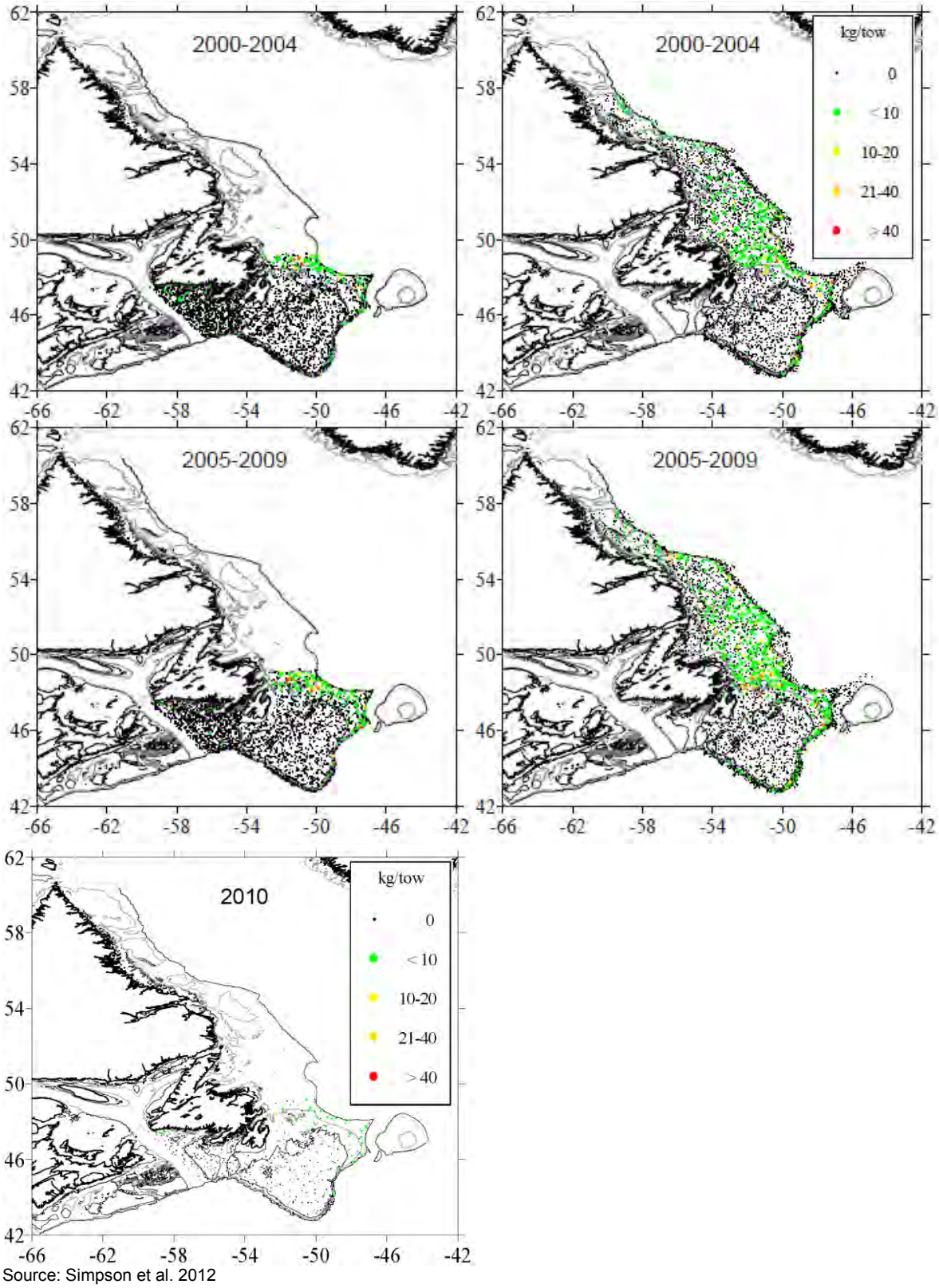
| Common Name | Species Name | COSEWIC Assessment | Occurrence in Relation to the WREP |
|---|---|---|---|
| American plaice (Newfoundland and Labrador population) | | Threatened | Low potential for occurrence in Nearshore Study Area. High potential for occurrence in Offshore Study Area. Closely associated with the seafloor, and found at 100 to 200 m where soft sediments are present. The Newfoundland and Labrador population is located from the Grand Banks north to the northern tip of Newfoundland |
| Cusk | *Brosme brosme* | Threatened | Low potential for occurrence in Nearshore and Offshore Study Area. Rare species that occurs in deep waters between the Gulf of Maine and southern Scotian Shelf. Rare along the continental shelf off Newfoundland and Labrador |
| Atlantic Salmon (South Newfoundland population) | *Salmo salar* | Threatened | Moderate to high potential for occurrence in Nearshore and Offshore Study Areas. Juvenile Atlantic salmon migrating from freshwaters streams to the North Atlantic may occur in Placentia Bay or on Grand Banks |
| American Eel | *Anguilla rostrata* | Threatened | Moderate potential for occurrence in Nearshore and low potential for occurrence Offshore Study Areas. Adult American eels migrate from freshwater streams to the Sargasso Sea. Juveniles and adults may occur on the continental shelf |
| Spiny Dogfish (Atlantic population) | *Squalus acanthias* | Special Concern | Low potential for occurrence in Nearshore Study Area and moderate to high potential for occurrence in Offshore Study Area. Commonly found from the intertidal zone to the continental slope in water depths up to 730 m. Most abundant between Nova Scotia and Cape Hattaras, less common in Newfoundland waters |
| Blue Shark (Atlantic population) | *Priomace glauca* | Special Concern | Moderate potential for occurrence in Nearshore and Offshore Study Areas during summer and late fall. Low potential for occurrence at other times of year. Commonly found in pelagic waters in water depths up to 350 m. Most abundant along the coast of Nova Scotia and offshore Scotian Shelf |
| Basking Shark (Atlantic population) | *Cetorhinus maximus* | Special Concern | Low potential for occurrence in Offshore Study Area. Low to moderate potential for occurrence in Nearshore Study Area during summer; usually present in surface waters of Newfoundland bays feeding on plankton from May to September. Found in offshore waters and coastal waters of Newfoundland, concentrated between Port aux Basques and Hermitage. May be present feeding on plankton from May to September |
| Roughhead Grenadier | *Macrourus berglax* | Of Special Concern | Low potential for occurrence in Nearshore Study Area. Moderate to high potential for occurrence in Offshore Study Area. Demersal species that occur in deep water |
| Thorny Skate | *Amblyraja radiata* | Of Special Concern | Moderate potential for occurrence in Offshore Study Area and moderate to high potential for occurrence in the Nearshore Study Area. Occurs from 50 to 1,000 m, with depth preference varying spatially |

| Common Name | Species Name | COSEWIC Assessment | Occurrence in Relation to the WREP |
|---|---|---|---|
| Northern Bottlenose Whale (Davis Strait-Baffin Bay-Labrador Sea population) | *Hyperoodon ampullatus* | Special Concern | No potential for occurrence in the Nearshore Study Area. Moderate potential for occurrence in the Offshore Study Areas. Found most commonly in deep water around 1,000 m deep, only found in the North Atlantic |
| Killer Whale | *Orcinus orca* | Special Concern | Moderate potential for occurrence in the Nearshore Study Area. Moderate to high potential for occurrence in the Offshore Study Areas. Prefers deep water but often found in estuaries, shallow bays and inland seas |
| Harbour Porpoise | *Phocoena phocoena* | Special Concern | High potential for occurrence in the Nearshore Study Area. Low to no potential for occurrence in the Offshore Study Area. Found most commonly in harbours and bays |
| Loggerhead Sea Turtle | *Caretta caretta* | Endangered | Low potential for occurrence in the Nearshore Study Area. Low potential for occurrence in the Offshore Study Areas. Widely distributed in the Atlantic Ocean, with juveniles routinely found in Atlantic Canadian waters. Usually associated with warmer offshore waters of the Gulf Stream, most often on the Scotian Shelf, Scotian Slope, Georges Bank, and the Grand Banks |
| Sowerby's Beaked Whale | *Mesoplodon bidens* | Special Concern | Low potential for occurrence in Nearshore Study Area. Moderate potential for occurrence in Offshore Study Areas. Distribution is poorly known, but only found in the North Atlantic. Range offshore from Davis Strait to Cape Cod in the Northwest Atlantic ocean, and rarely seen in coastal waters |
| Red Knot *rufa* subspecies | *Calidris canutus rufa* | Endangered | Low potential for occurrence in the Nearshore Study Area; it does not occur offshore. It prefers open sandy beaches, often with rotting kelp piles and extensive mud flats, for feeding. Such habitats occur sparingly in Placentia Bay. Red Knot may occasionally occur in small numbers at various locations on the coast of Placentia Bay during fall migration in August to October |



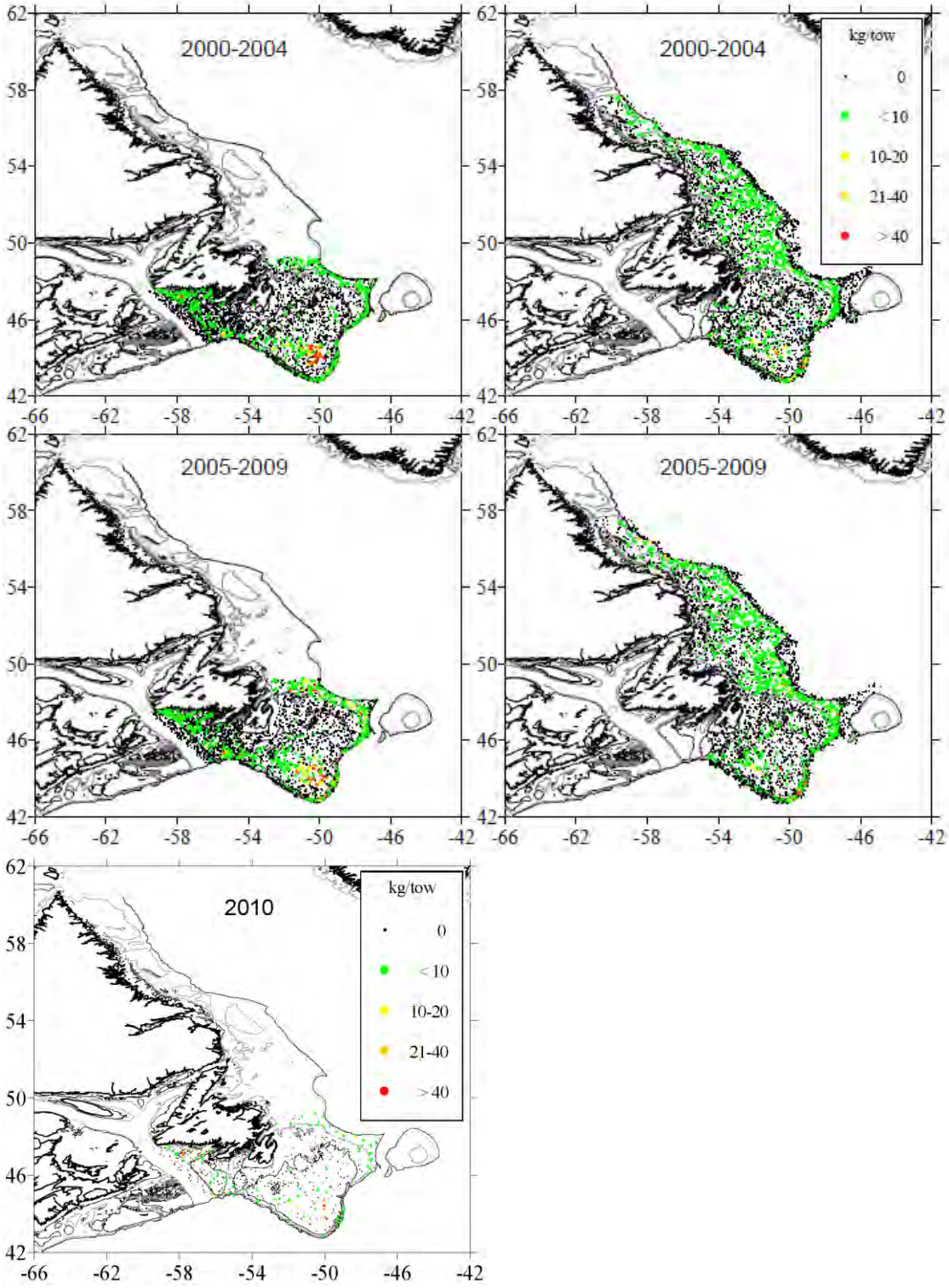

Source: Simpson et al. 2012

**Figure 34 Revised Figure 12-1 Geographic Distribution of Spring (left panel) and Fall (right panel) Research Survey Catch Rates (kg/tow) of Northern Wolffish in the Newfoundland and Labrador Region, 2000 to 2010**



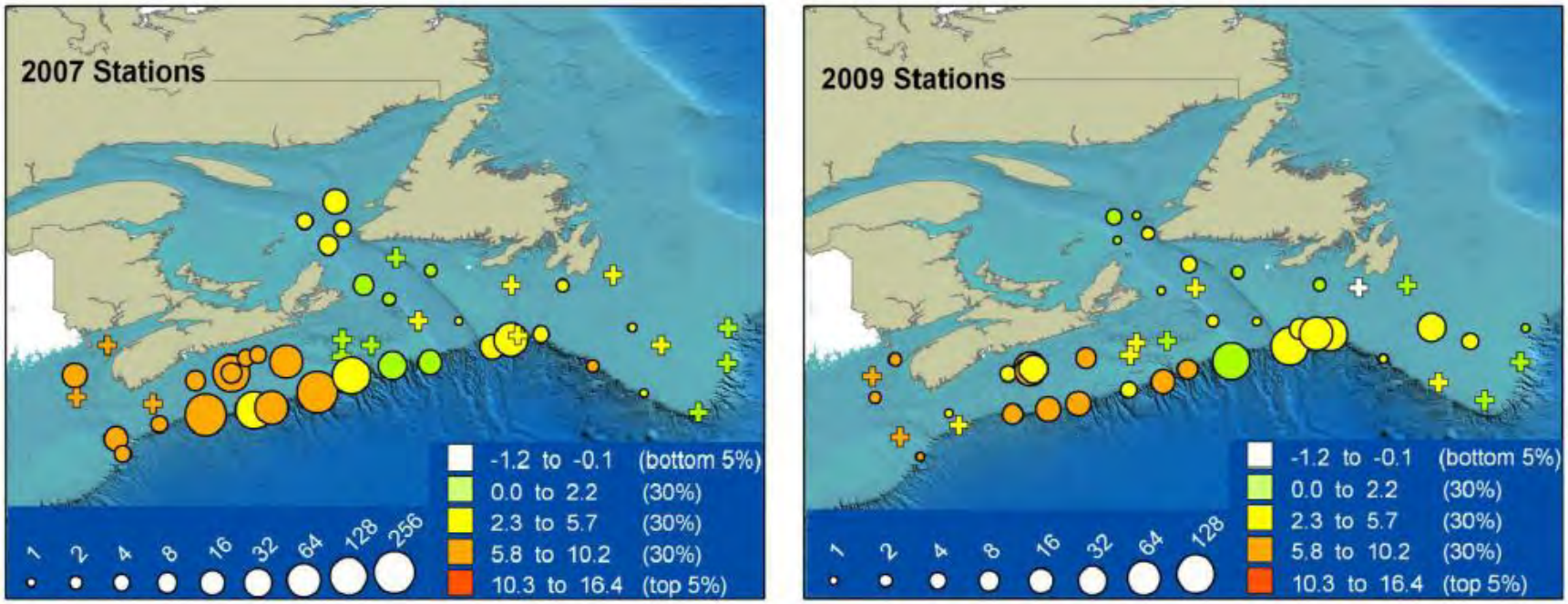

Source: Simpson et al. 2012

**Figure 35 Revised Figure 12-2 Geographic Distribution of Spring (left panel) and Fall (right panel) Research Survey Catch Rates (kg/tow) of Spotted Wolffish in the Newfoundland and Labrador Region, 2000 to 2010**



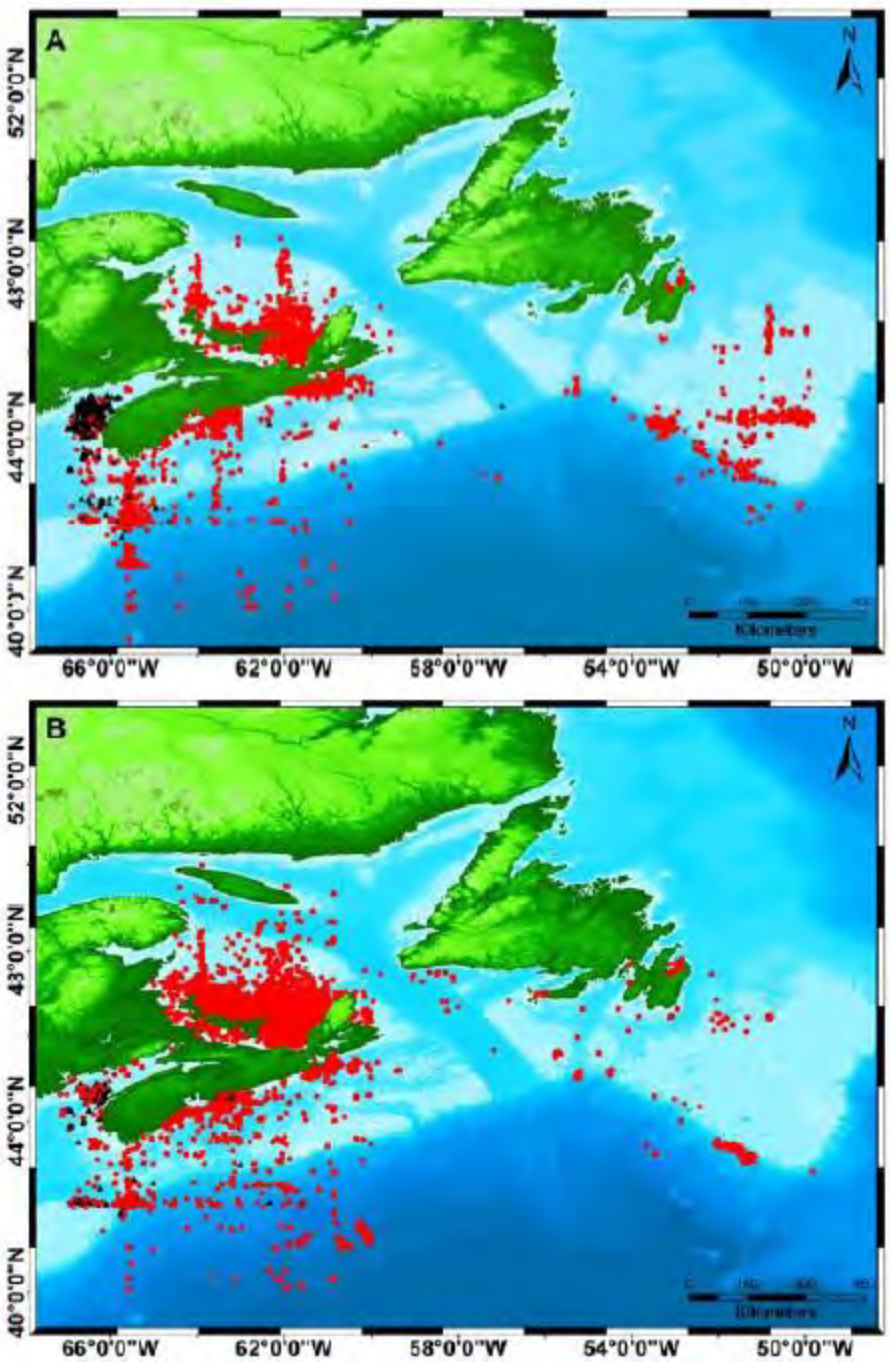

Source: Simpson et al. 2012

**Figure 36 Revised Figure 12-3 Geographic Distribution of Spring (left panel) and Fall (right panel) Research Survey Catch Rates (kg/tow) of Atlantic Wolffish in the Newfoundland and Labrador Region, 2000 to 2010**



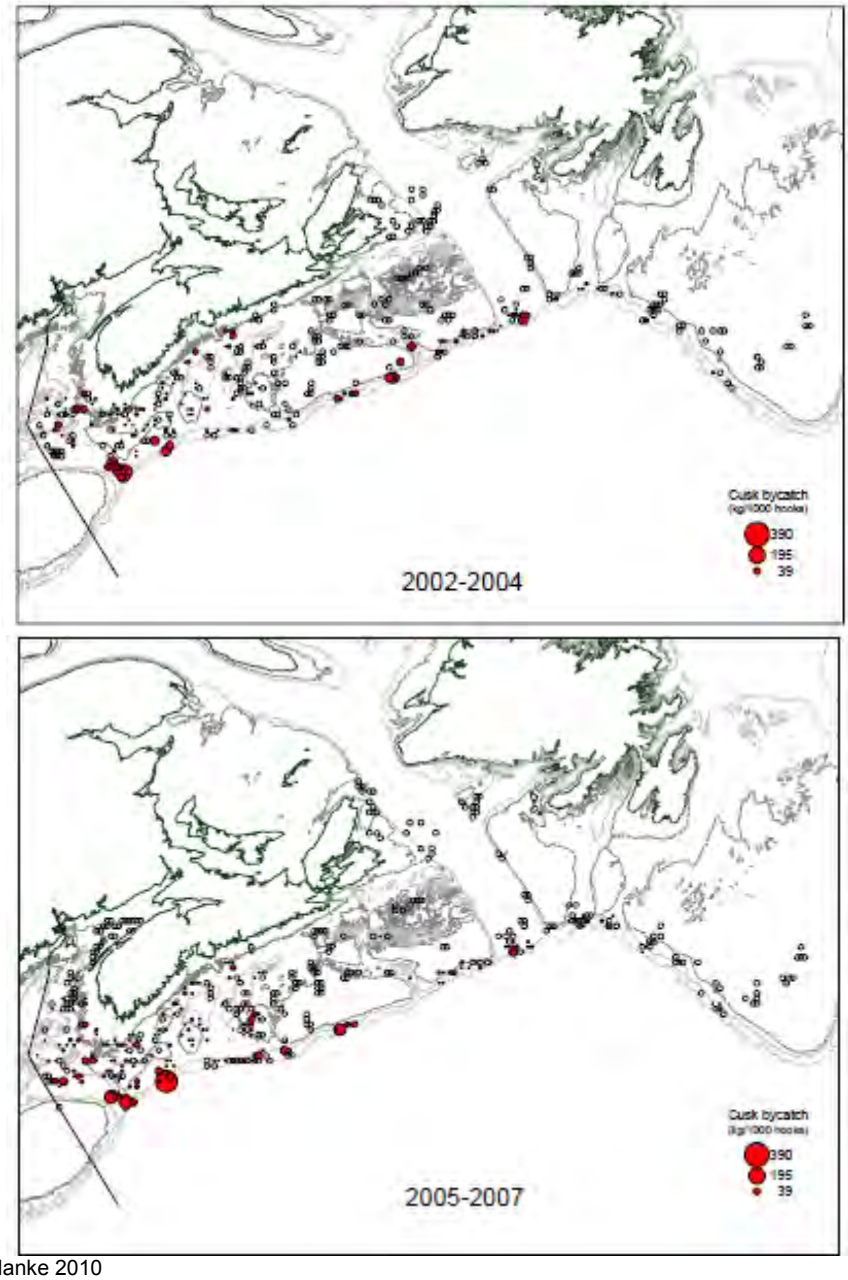

Source: Campana et al. 2012
Note: Abundance per survey station is represented by graduated symbology, and average temperature and depth of gear is represented by a colour ramp. Null catches are represented by crosses.

**Figure 37 Revised Figure 12-6 Porbeagle Shark Survey Abundance in 2007 and 2009**



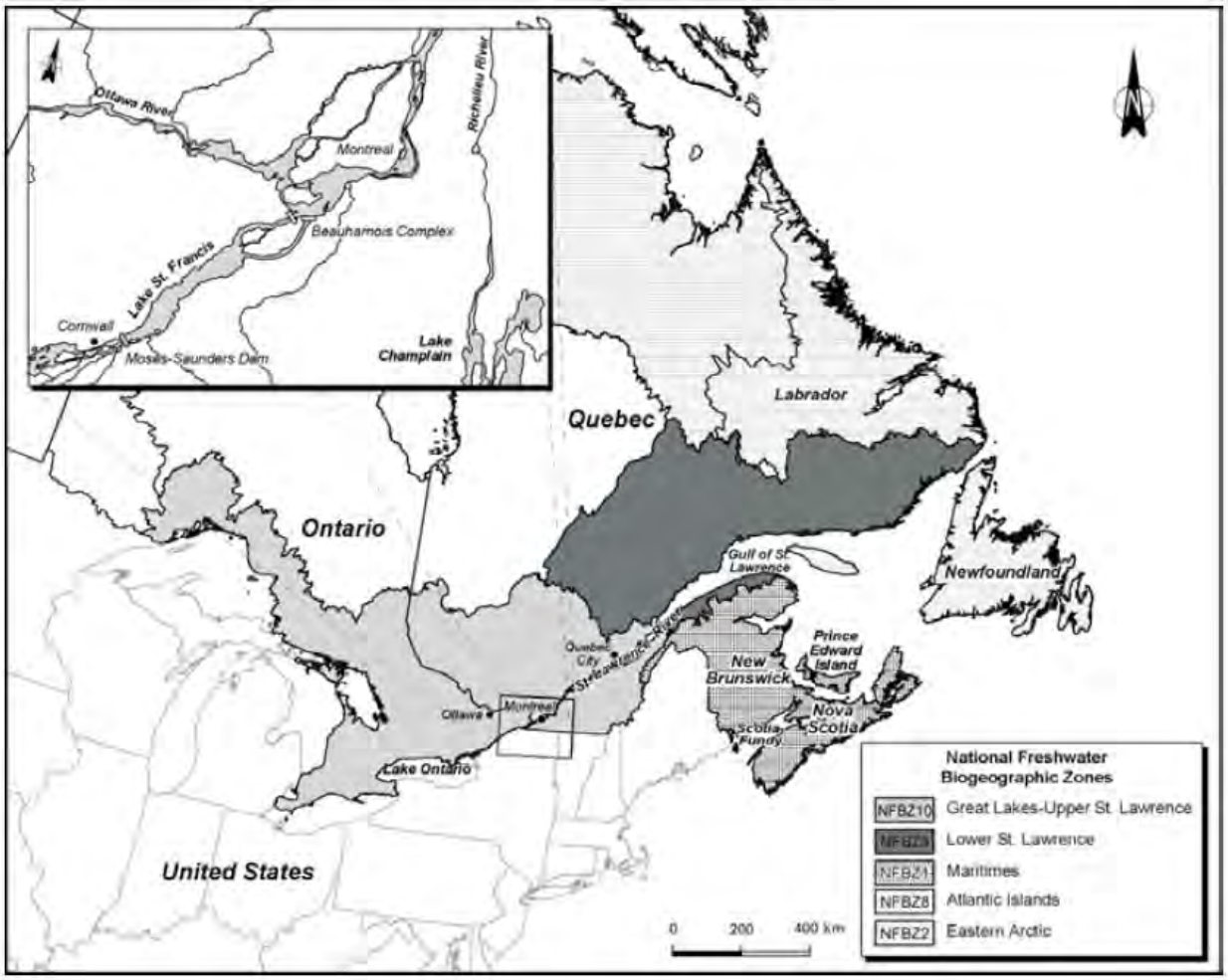

Source: Maguire et al. 2012

**Figure 38 Revised Figure 12-7 Location of Canadian Atlantic Bluefin Tuna Catches from Logbook Records from 1990-1999 (A) and 2000-2009 (B)**



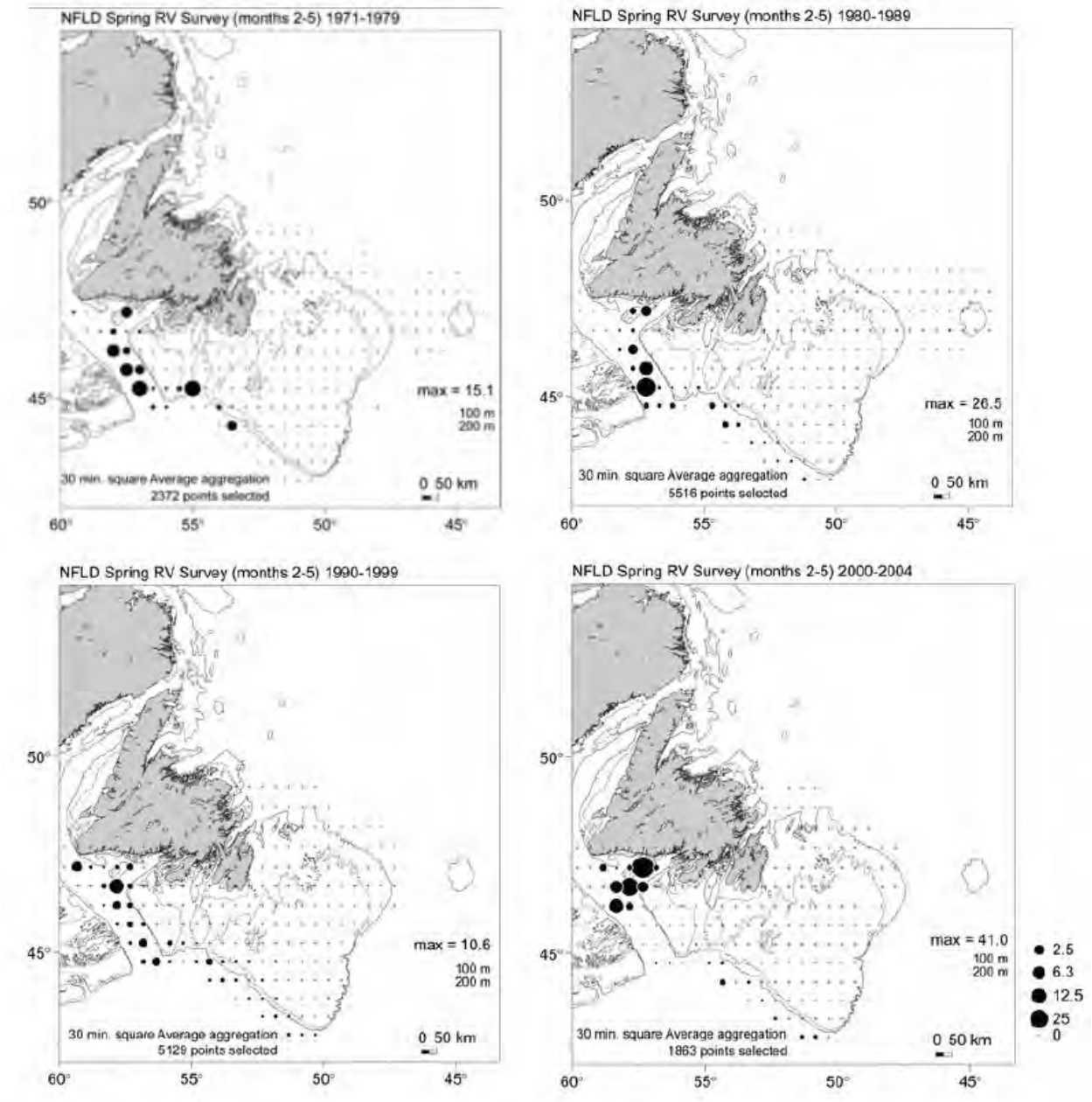

Source: Harris and Hanke 2010

**Figure 39 Revised Figure 12-12 Distribution of Cusk Catches in the Halibut Industry, 2002-2004 and 2005-2007**



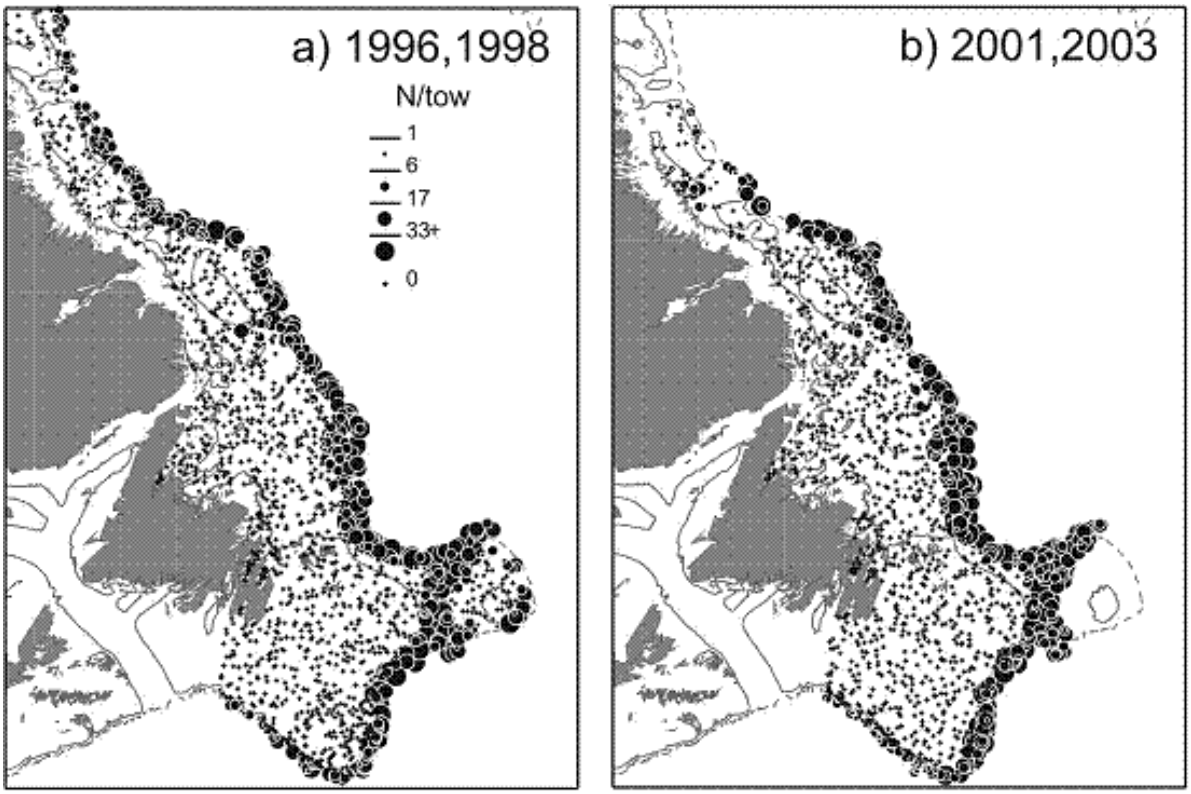

Source: COSEWIC 2012

**Figure 40 Revised Figure 12-14 Canadian Geographic Range of the American Eel**



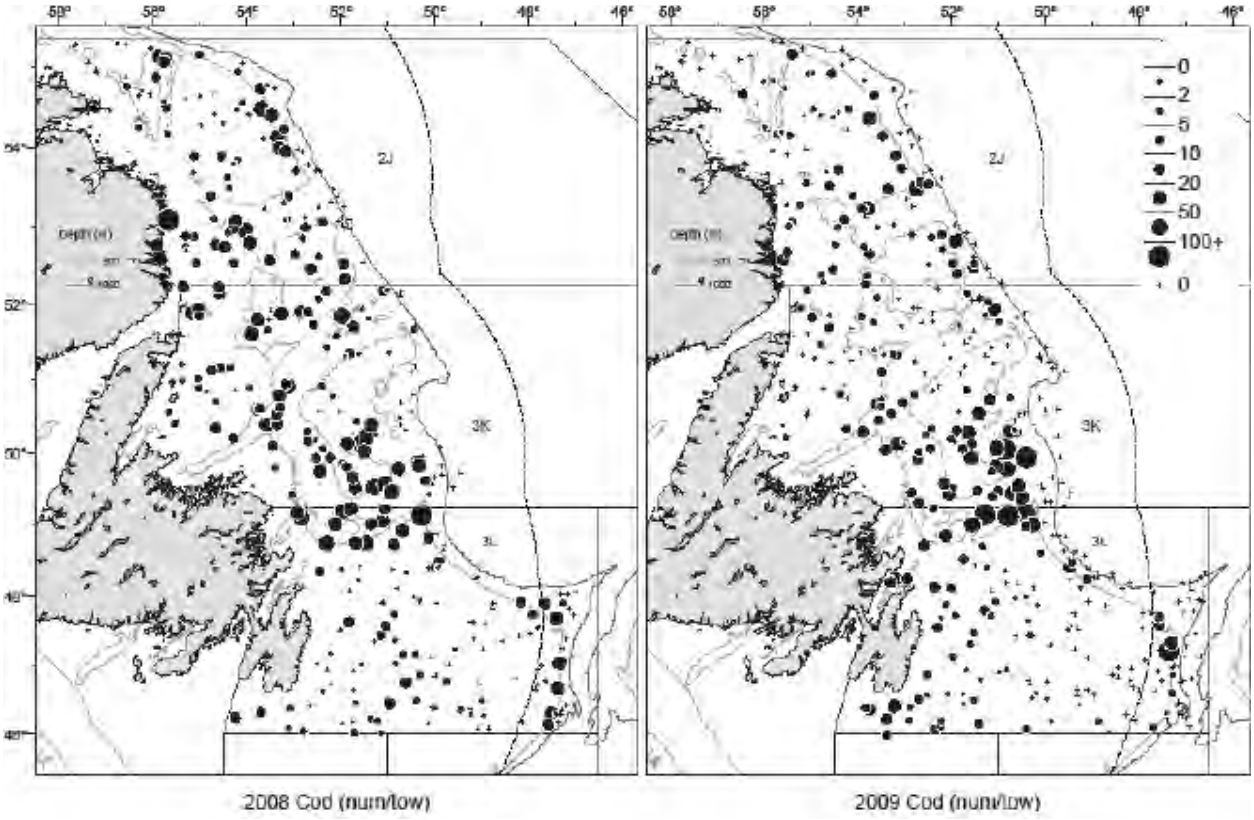

Source: Campana et al. 2007

**Figure 41 Revised Figure 12-15 Distribution of Spiny Dogfish in the Spring Research Vessel Surveys of Southern Newfoundland, 1972-2005**



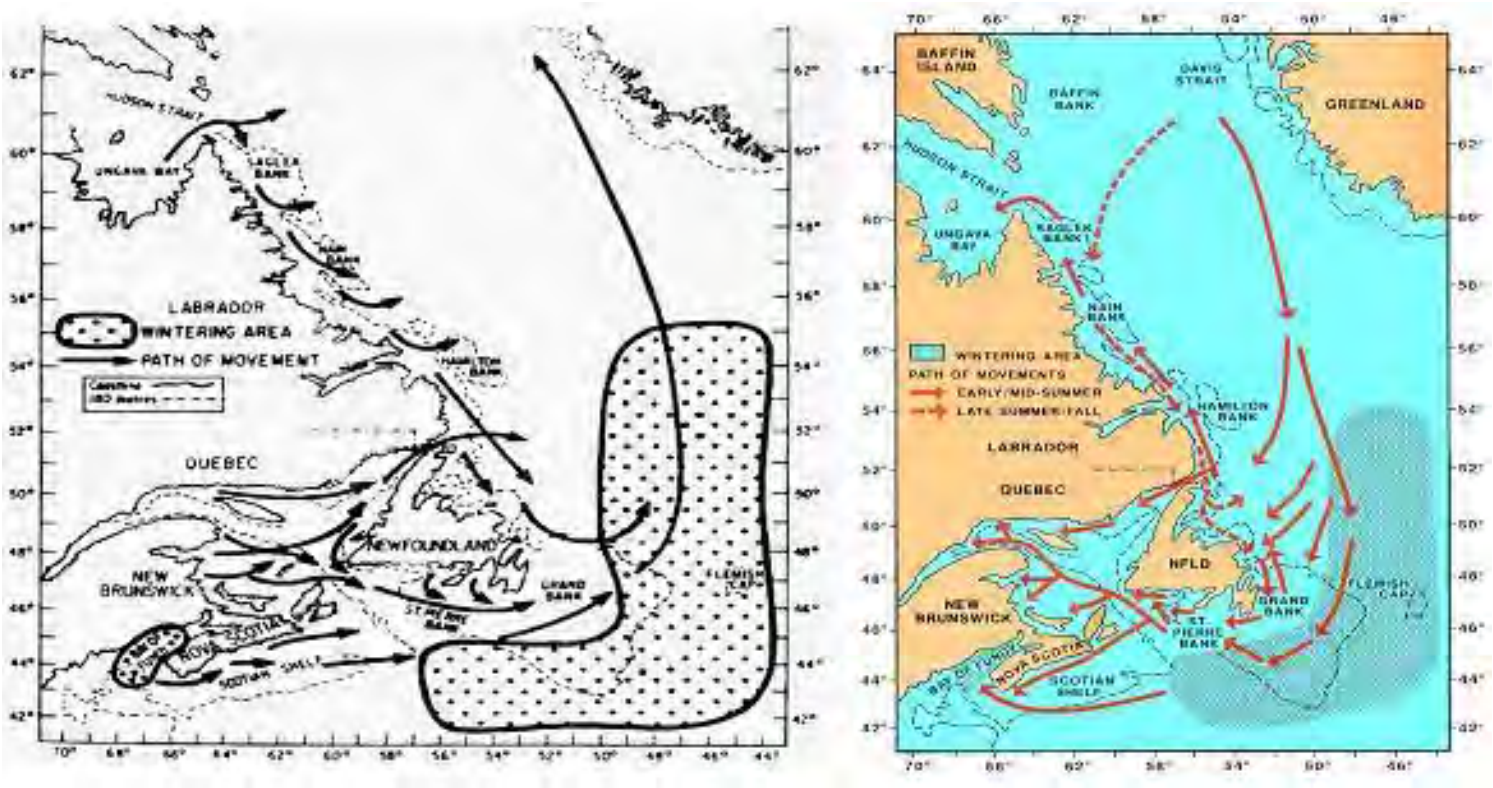

Source: COSEWIC 2007

**Figure 42 Revised Figure 12-18 Geographic Distribution of Roughhead Grenadier Catches in the Fall Survey of the Labrador and Northeastern Newfoundland Shelves and the Grand Bank for Selected Years between 1995 and 2000 (Campelen surveys)**




Source: Brattey et al. 2010

**Figure 43 Revised Figure 12-4 Cod Distribution (number per standard tow) during the Autumn Research Survey, 2008 and 2009**




Source: COSEWIC 2010c (modified from Reddin 2006)

**Figure 44 Revised Figure 12-13 Migratory Routes of Post-smolt (left) and Returning Adults (right) in Atlantic Canada**

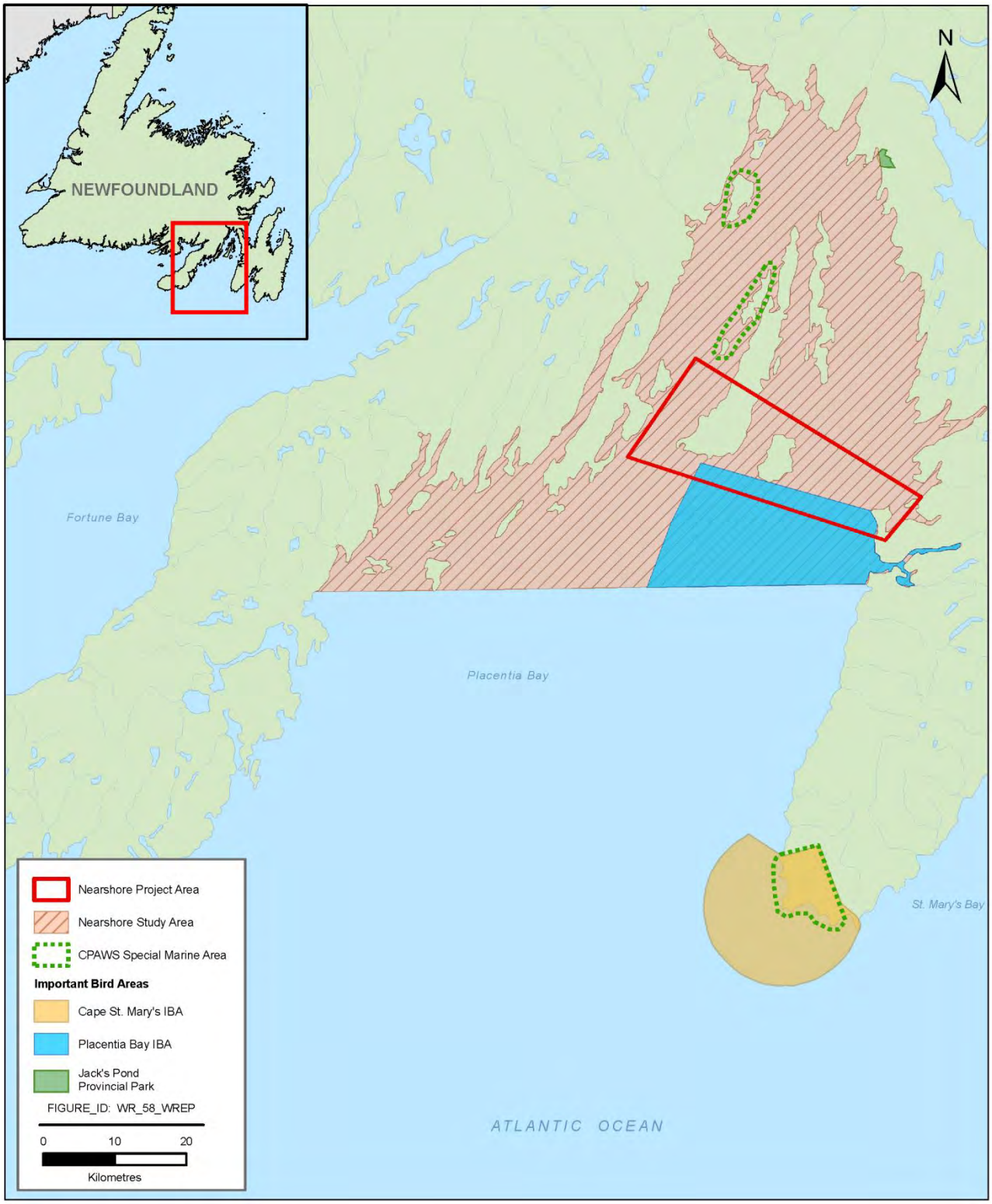



**Figure 45 Revised Figure 13-1 Nearshore Sensitive Areas**

**References for Revised Chapter 12 Figures (Figures 34 to 43) and Additional Responses**

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**Attachment 1**

**White Rose Extension Project Diversity Plan**

**Attachment 2**

**Onshore/Nearshore Construction Environmental Protection Plan - White Rose Extension Project - Argentia Site**

**Attachment 3**

**Baseline Hydrogeological Characterization Concrete Gravity Structure Graving Dock Site, Argentia, NL**