EMCP Comment 8: C-NLOPB 6

The proponent's response implies that a determination of no significant environmental effects is sufficient. However, Section 5.3.4.1 of the scoping document, Construction and Operational Discharges, states that the Proponent must evaluate means to reduce or recover waste beyond those specified in the regulations or in guidance. This means that even where waste discharge may be determined to have no significant adverse environmental effects, that waste discharge should be further reduced where feasible. In the case of produced water, that means reducing the produced water oil content, or the volume discharged.

Section 1.3, Waste Minimization, of the C-NLOPB's December 2010 Offshore Waste Treatment Guidelines (OWTG), states:

> Offshore operators are expected to take all reasonable measures to minimize the volumes of waste materials generated by their operations, and to minimize the quantity of substances of potential environmental concern contained within these waste materials.

and

> In keeping with the spirit of waste minimization and the regulatory requirement for continual improvement outlined in subsections 5(2)(b) and 5(2)(i) of the Regulations, the Boards expect that operators will strive to minimize the concentrations and volumes of waste materials discharged to the environment, and will adopt best practices in waste management and treatment.

In addition, Section 2.2.1, *Treatment and Monitoring,* of the OWTG states:

> *…[T]he operator should consider the technical and economic feasibility of alternatives to conventional marine discharge of produced water. Operators should consider proven and practicable best practices in produced water management and treatment, to reduce oil-in-water concentrations to as low as practicable, or to reduce or eliminate produced water discharges to sea.*

The proponent therefore should describe its technical and economic rationale for concluding that re-injection of produced water into a non-producing formation is not reasonable to undertake at this time.

> **Response:** **Section 2.6.4.3 Produced Water Management**, has been revised to include additional text regarding the technical and economic limitations associated with the re-injection of produced water into non-producing formation(s). Section 2.6.4.3 was revised as follows.
>
> **Introduction**
>
> The management of water during Hebron production operations will be one of the most technically complex and challenging operations for an offshore production facility. Produced water discharge rates from the Hebron Platform are estimated at up to 56,000 m^3/d. The management of such high water volumes requires extensive equipment and associated piping which contributes significantly to topsides weight and costs as well as operational complexity.
>
> As part of its overall water mangment strategy the operator is investigating the feasibility of injecting produced water mixed with seawater, into the reservoir for

pressure maintenance. A mix of seawater and produced water is required, as the volumes of produced water are insufficient to maintain reservoir pressure.

EMCP has completed its initial assessment of produced water re-injection (PWRI) into the producing formations and has concluded there are unacceptable risks associated with initiating PWRI until factors associated with these risks are better known. Initial assessment indicates that PWRI into the producing formations for pressure maintenance purposes may be technically feasible, if technical risks can be reduced through further data acquisition and studies post start-up. ExxonMobil is committed to adopting PWRI once it is demonstrated that the risks and costs are manageable.

Preliminary studies identified several potential risks to adopting PWRI:

- Souring potential is up to 50 percent greater than with injecting seawater only due to temperature and the presence of volatile fatty acids (VFAs)
- PWRI could result in greater than predicted increases in injection pressure (potentially beyond pressure limits)
- Fracture containment could be compromised with increasing use of produced water
- Scaling potential is increased when injecting produced water into the formation

Confirming that these risks are manageable requires additional data that can only be obtained and analyzed post start-up and after several years of operation. For example, VFA content is highly variable across reservoirs and more produced water samples are required. Further, only a very small number of formation water samples are currently available – more are needed to draw firm conclusions.

The operator examined the potential to inject produced water (including partial re-injection) into dedicated disposal reservoir(s). Based on this evaluation, suitable reservoir capacity to accept the produced water was limited. The cumulative volume of water produced in 30 years is approximately 366 million m^3. Over-pressuring of the disposal formation would also be a significant risk. With regard to partial re-injection, such an approach would require a duplication of the pumping facilities and associated piping currently required for seawater injection, additional well slots, and increased power generation capacity. The topsides design includes approximately 100 MW of power generation. Adding separate pumping facilities would require an increase in power generation of approximately 25 percent, and thereby increase the emissions. Produced water injection into dedicated reservoirs would exacerabate the weight, cost and operational challenges already inherent in offshore processing of a heavy crude. The added pumps and power generation equipment, as well as the use of well slots for additional dedicated injection wells, is not technically feasible, economically viable, nor environmentally sound.

Produced Water Management Strategy

Hebron will initially operate with marine discharge of produced water at start-up. As more wells come on-line and production data and experience is gathered, further testing on rock properties and produced water / seawater / reservoir compatibility will be carried out as additional core samples and produced water become available. Hebron will switch to PWRI for routine operations, once testing and studies (post-start-up) demonstrate that the risk and impacts of PWRI are understood and acceptable. When PWRI is adopted, the facility will maintain flexibility for marine

discharge during unplanned events (e.g., equipment failure) or planned maintenance. In addition, it will be necessary to preserve the option to return to marine discharge if unexpected complications arise with PWRI (e.g., loss of oil recovery, reservoir souring, scaling, plugging).

In the base design, the water injection system is designed to inject at the predicted pressures required for PWRI. The Topsides facilities include space and connections for the future installation of the low pressure incremental equipment required to route produced water into the water injection system.

Produced Water Re-injection Feasibility Studies

Large volumes of seawater will be needed for pressure maintenance and the design team investigated if produced water could be used to satisfy a portion of those needs. Several risks arise when mixing produced water with seawater and injecting into a producing formation that need to be well understood before committing to produced water re-injection:

- Compatibility of seawater and produced water with each other and the reservoir
- Potential to "plug" the formation
- Potential for injection pressures to increase with produced water / seawater mix compared to seawater only injection
- Potential for bacterial contamination of the producing formation

The proceeding sections summarize the studies completed to date, and further work to be completed.

Injectivity

Water injectivity (the ability to inject water into the producing formation) can be impaired over time by injecting produced water with higher concentrations of suspended solids and even relatively low concentrations of oil-in-water. Both of these would increase the risk of plugging pore throats in the near-well region where the injected water first enters the formation. In turn, such plugging may accelerate the rate of fracture growth and extend fractures beyond desired boundaries, leading to a potential loss of conformance and thereby reduced effectiveness in supporting reservoir pressure.

Thermal effects of PWRI may also influence water injectivity since PWRI is likely to raise the injected water temperature (compared to seawater-only) and thus increase the fracture extension pressure, leading to a reduction in injectivity index.

An injectivity study was conducted to assess the required injection pressure to achieve fracture injection for all potential injection wells in Hebron and how the injection requirements may change PWRI versus seawater injection.

The injectivity study found that PWRI is technically feasible from an injectivity standpoint; however, there are several vulnerabilities that require additional operational data to confirm. A key area of risk is that fracture pressure will increase through time with PWRI, and increasing fracture pressures can lead to a greater risk for loss of fracture containment during injection.

Scaling

Both seawater and produced water are a complex solution of dissolved components (many types of “salts”). Upon mixing, the positive and negative ions in each must

reach a new balance and sometimes they combine to form a solid that precipitates out of solution. Some of these chemical reactions take time to occur and precipitation can occur during injection process, as pressure and temperature changes take place. The rock fractures and pore spaces can then get plugged by these solids and hinder or prevent future injection.

The only way to obtain a clear answer on the compatibility of Hebron produced water with seawater from the Grand Banks is to mix the two waters in a laboratory study and observe what happens under different temperature and pressure conditions. Such a definitive study cannot be done as yet, since there are no production wells available to sample. The produced water at the Hebron Platform will be a mix of produced water from several different reservoirs and, therefore, is not presently available for study.

However, the Project does have small samples of what is now "aged" water produced from individual reservoirs. These samples were obtained during production testing of individual wells from individual reservoirs in the late 1990s. These are now considered "aged" samples and, although ionic composition is the same, the potential loss of volatile organics and possible changes in organic composition could alter ionic reactions when mixed with seawater. Using these samples, the Project has proceeded with a small-scale study to obtain a preliminary understanding regarding the compatibility of the two waters.

The results of this small-scale study suggest with low certainty that mixing produced water and seawater is possible. However, further investigation is required, using samples of Hebron produced water from actual production wells, to confirm and validate these preliminary compatibility test results.

Souring (bacterial contamination)

In the oil producing reservoir, bacteria are present. Hydrogen sulphides (H_2S) act as an energy source and VFAs are the nutrient source. An increase in growth of bacteria could result in a plugging of the formation, or souring of the reservoir. Levels of souring are dependent upon VFA concentration in formation water.

An initial study of Pool 1 (Ben Nevis reservoir) souring susceptibility was conducted in 2005, using a range of levels of souring nutrients (VFAs) in formation water. Pool 1 predictions indicate potential for substantial total-wellstream mass of H_2S, and that the sulphide content forecast for mixed produced water / seawater injection is up to 50 percent higher than that for seawater-only injection.

PWRI is likely to increase the souring susceptibility of Pool 1 verses seawater only injection; however, further studies are required to determine the effects and extent of souring from PWRI and if mitigations are available to control bacterial contamination, and prevent reservoir souring.

Disposal Reservoir

An evaluation was made to identify non-producing subsurface formations that could potentially serve as repositories for produced water. Ideally, such formations would be relatively thick and laterally continuous with high capacity for accepting a large volume of fluid, and would provide minimal potential for migration of injected fluid into other formations, or for entering subsurface faults that are conductive in character.

Screening of wireline well logs and mud logs revealed only one prospective non-producing formation that would merit quantitative analysis of its potential water storage capacity. A unit of porcelaneous mudstone (also known as the Tilton Member) exists in the Paleocene section approximately 300 m above the top of the Ben Nevis formation in the Hebron initial development area, and this unit was subjected to preliminary investigation as a possible storage compartment for Hebron produced water. Screening-level calculations were performed to estimate the thickness trend, average net-to-gross, average porosity and, subsequently, the net pore volume of this formation within the Hebron Unit boundary.

Results indicated that the porcelaneous mudstone unit is predicted to have far too little storage capacity to accept the forecasted volume of produced water over the life of the Hebron Project (an estimated 366 million m^3 plus additional produced water if future expansions are developed).

A screening assessment of the implications for topside facilites design indicated a requirement for additional dedicated pumping facilities and associated piping, additional well slots, and increased power generation capacity. This would exacerabate the weight, cost and operational challenges already inherent in offshore processing of a heavy crude and result in increased carbon dioxide emissions (approximately 150,000 tonnes of carbon dioxide eqivalents) released into the atmosphere annually (4.5 million tonnes over 30 years).

The overall conclusion of the Project's evaluation is that disposal of produced water into Hebron non-producing formation(s) is not feasible when considering technical and economic factors. The operator's preferred approach is re-injection into the producing formation when all operational, technical, environmental, regulatory compliance, and economic factors are considered.

Plan for Completing further Produced Water Re-injection Feasibility Assessment

In order to complete an assessment of PWRI and ensure all risks are understood, additional formation water samples are required. This can only be completed post start-up and analyses will include measuring produced water compositions for each distinct hydrocarbon resource and determining the degree of intra-reservoir variability in water compositions. Produced water from a few geographically-distributed wells is likely to provide the highest-confidence data.

Further testing of produced water is required to confirm the scaling tendency / severity of seawater / produced water for both in-situ reservoir conditions and for operating conditions of wells / facilities. The concentration of VFA nutrients in produced water is needed for better forecasting of souring behaviour and additional measurements of variability will aid in characterizing the effects of mixed produced water / seawater.

Further testing is also required on the reservoir rock properties, and some fresh core material will be acquired in select new wells to enable lab displacement measurements of mixed-produced water- / seawater- waterflooding.

Topsides Facilities

The Hebron Topsides facilities include the best commercially proven water treatment technology and equipment for offshore applications. Heavy oil separation challenges

warrant a robust produced water treatment system that includes hydrocyclones, CFUs, and degassing drum.

In addition, Hebron will include Vessel Internal Electrostatic Coalsescer technology, which minimizes emulsion layer thickness and creates a better defined oil / water interface, helping to mitigate oil carry-under from separators to the produced water treating system.

Pre-investment has been made in the water injections system to allow for PWRI to be initiated at a later date. Design elements include:

- System designed to inject at predicted pressures required for PWRI
- Inclusion of manifolds to blend produced water with seawater make-up,
- Injection pump seals designed for the fine particles in produced water (a specialist application)
- Include space and connections for the future installation of the low pressure incremental equipment required to route produced water into the water injection system (*i.e.*, low pressure booster pumps and filters)

Summary

ExxonMobil is committed to adopting PWRI for routine operations once it is demonstrated that the associated risks are acceptable.

The Produced Water management strategy will be to operate with marine discharge of produced water at start-up using the best proven treatment technology available today. Hebron will switch to PWRI for routine operations, if testing and studies demonstrate that the risk and impacts of PWRI are understood and acceptable. The option will be preserved to return to marine discharge if unexpected complications arise with PWRI (e.g., loss of oil recovery, reservoir souring, scaling, plugging).

The Hebron water injection system will be designed to inject at predicted pressures required for PWRI, and include pre-investment for potential establishment of PWRI (space and connections for additional PWRI equipment). A post-start-up study and testing plan will be developed to address uncertainties.

EMCP Comment 28: EC 14 Regarding Offshore Wind Climate

14a: The response was satisfactory. There is one additional request (sorry this was not noted earlier): Please clarify in the CSR (3.2.2.6) that the adjustment of one-hour means to 10-minute mean wind speeds is an adjustment for the peak one-hour mean to the peak reported 10-minute mean wind speed.

Response: The term *peak* has been added to the text.

14b: The response clarifies that the wave radar data were not used directly. However, ExxonMobil URC (2009) estimates of design wave criteria for the Hebron Project were developed using a calibration equation based on the MIROS data, which cannot be independently assessed. It is regrettable that the Hibernia MIROS data are not generally available to the offshore environmental/scientific communities. These data could be used to enhance the understanding of differences or similarities between wave radar, wave buoy, and wave modelled data, and to improve knowledge of wave climatology in the area.

> **Response**: To clarify, it is our understanding that MIROS data is typically available to the public. However, the data in question, had not yet been released by the operator-HMDC, and therefore was not available. We are not stating that the data "are not generally available to the offshore environmental/scientific communities."

The response to the EC 14 request for indication of the level of uncertainty or confidence interval for the extreme wave criteria (Section 3.2.2.1 and 3.2.2.6) was not satisfactory. The ExxonMobil URC (2009) 100-year return period estimate was 14.8m. The Oceans Ltd (2010) analysis included estimates of 15.1 m and 15.8 m, depending on the method. The response indicated that differences in results arising from differences in approach do not affect the overall environmental assessment. However the request concerned estimates used for engineering design. An example of what was requested is the 95% upper limit given in Table 3-41 for extreme storm surge. Could the CSR include confidence intervals or at least some description of how the differences/range of results might be accounted for in the final design process?

> **Response**: "The Oceans Ltd analysis resulting in a range of 100-year Hs of 15.1 to 15.8 m" is the result of using the "environmental contour analysis" method to develop a suite of Hs, Tp combinations which all have a 1% annual chance of being exceeded (and are hence all "100-year" events). From these multiple 100-year events, a design criteria is set based on a maximum response of the structure. It is our opinion that use of this analysis technique is quite unusual for this type of application. It is much more commonly used when setting design criteria for a floating system because it is not known *a priori* which combination leads to the maximum response. For fixed steel jackets and gravity-based structures in relatively shallow water, it is recognized that the design condition will be defined by the 100-year significant wave height, Hs. That assumption leads to the commonly-used, well established, approach to the development of design metocean loads: a peaks-over-threshold analysis of historic values of Hs (measured or hindcast). The results of this analysis of Hs lead to return period values of Hs and we determine associated values of Tp, water level, wind speed, etc., based on correlations.
>
> There are numerous assumptions made in environmental contour analysis. It is important to note that the Oceans Ltd value for the 100-year Hs using the traditional approach (also used by ExxonMobil URC) is 15.1 m versus URC's value of 14.8 m, a difference of only about 2%. There are numerous choices made by an analyst performing extreme value analysis to create this level of difference in our estimates.

EMCP Comment 75: DFO 13

This response is considered adequate, provided the following comments are addressed:

The following revisions should be made to the updated Section 7.5 provided by ECMP:

Section 7.5.1.1

- As previously requested, the following text "…will be quantified and detailed within the Habitat Compensation Strategy report for the Hebron Project." in the first paragraph in the Nearshore section, should be revised as, "…will be quantified and detailed within the **HADD Quantification Report** for the Hebron Project" as HADD quantification will be detailed in a report separate from the Habitat Compensation Strategy.

> **Response:** Text has been changed as noted above.

- Text contained within the second paragraph of the Nearshore section leads the reader to believe that the upgrades to the Back Cove ferry terminal (pier) will be temporary in nature. It is our understanding that this will not be a temporary structure (i.e., less than 1 year duration). Please correct the text or provide clarification.

  Response: Per EMCP discussions with DFO regarding the upgrades to the Back Cove pier, EMCP indicated that the original footprint of the pier will not be increased, based on current requirements, therefore, it is not anticipated that there will be any potential affects on Habitat Quantity. However, reference to potential impacts resulting from the upgrades/repairs to this pier will be addressed under Habitat Quality (*i.e.*, potential siltation).

- The words "*to a small degree*" should be removed from the first sentence in the second paragraph of the Nearshore section as it misrepresents the effect the project footprint will have on habitat quantity.

  Response: Text has been deleted

- Text contained within the second paragraph of the Offshore section should be rearranged to clarify the relationship between the positive and negative effects of the project infrastructure on fish habitat. The paragraph should be revised as follows:

  "*There is currently no plan to trench the OLS, but to protect the line with rock cover and or concrete mattresses. The footprint of the OLS on the seafloor will restrict access by fish and shellfish to some habitat and may be declared a HADD of fish habitat by DFO and likely require a Section 35(2) Fisheries Act Authorization, requiring any loss of fish habitat to be compensated with the objective to achieve no net loss of productive capacity of fish habitat. However, the presence of unburied material over the OLS (i.e., concrete mattresses and rock cover) is expected to create habitat by increasing the amount of available hard substrate habitat that could be colonized by local flora and fauna, creating a reef effect for fish populations in otherwise barren sandy or soft bottom areas. Where flowlines and equipment are buried, the overlying sediments will provide habitat upon which benthic communities will recover."*

  Response: The following text, which reflects the above comment, will be included in the CSR**:**

  There is currently no plan to trench the OLS, but to protect the line with rock cover and or concrete mattresses. The footprint of the OLS on the seafloor will restrict access by fish and shellfish to some habitat and may be declared a HADD of fish habitat by DFO and likely require a Section 35(2) Fisheries Act Authorization, requiring any loss of fish habitat to be compensated with the objective to achieve no net loss of productive capacity of fish habitat. However, the presence of unburied material over the OLS (i.e., concrete mattresses and rock cover) is expected to create habitat by increasing the amount of available hard substrate habitat that could be colonized by local flora and fauna, creating a reef effect for fish populations in otherwise barren sandy or soft bottom areas. Where flowlines and equipment are buried, the overlying sediments will provide habitat upon which benthic communities will recover.

- Text contained within the third paragraph of the Offshore section should be rearranged to clarify the relationship between the positive and negative effects of the project infrastructure on fish habitat. The paragraph should be revised as follows:

  "*Installation of the GBS will have a similar effect in that access to habitat under the GBS will be lost to fish and shellfish and may be declared a HADD of fish habitat by DFO and likely require a Section 35(2) Fisheries Act Authorization, requiring any loss of fish habitat to be compensated with the objective to achieve no net loss of productive capacity of fish habitat*. *However, colonization by invertebrates on the concrete GBS is expected.*"

  Response: The following text, which reflects the above comment, will be included in the CSR**:**

  Installation of the GBS will have a similar effect in that access to habitat under the GBS will be lost to fish and shellfish and may be declared a HADD of fish habitat by DFO and likely require a Section 35(2) Fisheries Act Authorization, requiring any loss of fish habitat to be compensated with the objective to achieve no net loss of productive capacity of fish habitat. However, colonization by invertebrates on the concrete GBS is expected.

- Text contained within the fifth and a portion of the sixth paragraph of the Potential Expansion Opportunities section should be rearranged to clarify the relationship between the positive and negative effects of the project infrastructure on fish habitat. The paragraph should be revised as follows:

  "*As with the nearshore, any offshore activities including excavated drill centre(s) and spoils disposal, the OLS or installations of pipeline(s) / flowline(s) (including related infrastructure such as concrete mattresses, rock cover or other flowline insulation) and testing from excavated drill centre(s) to the Hebron Platform may be declared to cause a HADD by DFO and require a Section 35(2) Fisheries Act Authorization and any loss of fish habitat will be fully compensated with the objective to achieve no net loss of productive capacity of fish habitat. The concrete mattresses, rock cover and other flowline insulations have the potential to provide new hard substrate habitat to be colonized and function as an artificial reef and would likely be colonized by sponges, anemones, brittlestars and seastars.*"

  Response: The following text, which reflects the above comment, will be included in the CSR**:**

  As with the nearshore, any offshore activities including construction of excavated drill centre(s) and spoils disposal, installations of pipeline(s) / flowline(s) (including related infrastructure such as concrete mattresses, rock cover or other flowline insulation) and tie-back from excavated drill centre(s) to the Hebron Platform may be declared a HADD of fish habitat by DFO and likely require a Section 35(2) Fisheries Act Authorization, requiring any loss of fish habitat to be compensated with the objective to achieve no net loss of productive capacity of fish habitat. Concrete mattresses, rock cover or other flowline insulation have the potential to provide new hard substrate habitat to be colonized and function as an artificial reef and would likely be colonized by sponges, anemones, brittlestars and seastars.

- Section 7.5.1.3 states that, "Drydock dewatering and the re-establishment of moorings at the Bull Arm deepwater site may affect habitat use as there will be a loss of habitat quantity in

these areas". The effect of re-establishment of Moorings at the Bull Arm Deepwater Site on habitat quantity should be discussed in this section and noted in Table 7-11.

Response: The Re-establishment of moorings at Bull Arm deepwater site will not affect fish habitat. All existing mooring locations are located on land. The re-establishment means that mooring chains will be hooked to the mooring point to a tension barge and from the barge to the GBS at the deepwater site. There is no interaction of the mooring chains with physical fish habitat (*i.e.*, seafloor); they remain in the water column. The reference to "re-establishment of moorings…affect habitat use as there will be a loss of…quantity…" will be removed from the CSR.

Section 7.5.1.2

- The effects of Upgrades to the Ferry Terminal at Back Cove on habitat quality should be discussed in this section as well as indicated in Table 7-11.

Response: Upgrades to the Ferry Terminal have been included in Section 7.5.1.2

Section 7.5.1.3

- The reference to Section 7.5.1.2 made in the first paragraph of the Nearshore section should be Section 7.5.1.1.

Response: The section reference has been revised.

- Reference to Upgrades to Ferry Terminal in Back Cove should be made in this section as its effect on habitat use is indicated in Table 7-11.

Response: Upgrades to the Ferry Terminal have been included in Section 7.5.1.3

- As previously requested, please include "*Implement chemical selection management system*" and "*Adherence to regulatory limits with respect to discharges in to marine waters*" as mitigations in this section as they are included in Table 7-11 under Hook-Up, Production Testing and Commissioning of Excavated Drill Centres.

Response: Change in Habitat Use is addressed in the CSR in terms of noise from Project Activities that has the potential to affect the behaviour of fish (*i.e.*, avoidance or attraction behaviours). The mitigations referred to above, are addressed in Section 7.5.1.2 in reference to potential changes in water quality. In addition, the activity "Hook-up Production testing and commissioning of Excavated Drill Centres" has been changed to "Hook-up and Commissioning of Drill Centres". Production testing is an activity that occurs from the Platform, whereby any dicharges would be from the Platform. There are no production related discharges from a drill centre.

Section 7.5.1.4

- While it is noted that Bund Wall Construction could cause fish mortality, it is not explained how this activity could potentially kill fish and invertebrates. As previously requested, please include this explanation.

Response: The following text will be included in Section 7.5.1.4:

Bund wall construction may result in fish mortality due to the smothering of bottom-dwelling fish and invertebrates during the placement of the rock fill for the bund wall.

- The following sentence should be added to the last paragraph of the Offshore section, "EMCP will consult with DFO prior to water extraction to ensure fish screens are adequately sized."

  Response: Upon clarification from DFO, the reference to the placement in the section should read Nearshore. Therefore, the following text will be included in Section 7.5.1.4 - Nearshore.

  With regard to potential entrainment of fish during the dewatering of the drydock, EMCP will consult with DFO regarding the sizing of fish screens to ensure adequate water flow is maintained.

- As the installation of temporary moorings in the offshore may potentially affect habitat quality and use, the first three paragraphs of the Offshore section should be moved to either Section 7.5.1.2 or 7.5.1.3.

  Response: The potential effects associated with the installation of temporary moorings has already been addressed in Sections 7.5.1.2 and 7.5.1.3.

Table 7-11

- As previously requested, "*Bubble curtains, if required*" should be removed as EMCP has already clarified that blasting would not be required for Bund Wall Removal.

  Response: Noted. Table 7-11 will be revised.

- The effect of Platform Tow-Out/Offshore Installation on habitat quantity has been discussed in Section 7.5.1.2, therefore it should be re-entered as a potential environmental effect in Table 7-11.

  Response: Per clarification from DFO, the referenced section is 7.5.1.1. Table 7-11 has been amended per above comment.

- The effect of Excavated Drill Centre Dredging and Spoils Disposal on habitat quality has been discussed in Section 7.5.1.2, therefore it should be it should be re-entered as a potential environmental effect in Table 7-11.
  Response: Noted. Table 7-11 will be revised.

Section 7.5.2.2

- As previously requested, the effects of Well Activities on habitat quality should be discussed in this section as it is indicated in Table 7-12.

  Response: Discharges associated with well activities (e.g., well treatment and completions fluids) are included in operational discharge streams (*i.e.*, produced water). Section 7.5.2.2-Liquid Disharges addresses all discharges associated with drilling and production. Therefore, any discharges from well activities are included in this discussion. In addition, chemicals used in during well activities will be screened in accordance with an approved chemical screening process. The activity "well activities"

will be deleted from the assessment tables, as they are captured under the activity "waste water."

Section 7.5.2.3

- As previously discussed, the effect of the following activities on habitat use should be discussed in this section. It is also noted that "*Habitat Use*" has been removed from Table 7-12 for these activities, please ensure that "Habitat Use" is included as a potential environmental effect for these activities.
  - Wastewater (produced water, cooling water, storage, displacement)
  - Chemical Use/Management/Storage (e.g., corrosion inhibitors, well treatment fluids)
  - Well Activities (well completions, work overs)
  - WMB Cuttings
  - WMB and SMB Cuttings
  - Chemical Use and Management (BOP fluids, well treatment fluids, corrosion inhibitors)

  Response: Change in Habitat Use is addressed in the CSR in terms of noise from Project Activities having the potential to affect the behaviour of fish (*i.e.*, avoidance or attraction behaviours). The above listed activities have a greater likelihood to affect Habitat Quality, and not Habitat Use, and are therefore addressed under Habitat Quality. Table 7-12 will reflect potential affects on Habitat Quality, but not Habitat Use.

- This section states that the mitigation measures outlined in the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2011) will be applied. While this is correct, reference to the *Statement of Canadian Practice on Mitigation of Seismic Noise in the Marine Environment* should also be included. This statement of practice should also be referenced in Table 7-12.

  Response: Reference to the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2011) is intended to imply that all mitigations listed in these guidelines, including the Statement of Canadian Practice on Mitigation of Seismic Noise in the Marine Environment as appended, be applied, where applicable to program activities. However, for clarity, the reference to the Statement of Canadian Practice on Mitigation of Seismic Noise in the Marine Environment will be included in Section 7.5.2.3 and the appropriate effects assessment tables in Section 7.5.

Table 7-12

- As previously requested, "Change in Habitat Quality" should be removed from the potential environmental effects for Presence of Structures for the proposed project as well as the potential expansion opportunity.

  Response: Noted. The above referenced text has been removed from Table 7-12.

- It is noted that "Potential Mortality" has been removed as a potential environmental effect for Surveys for both the proposed project as well as the potential expansion opportunity. As seismic surveys can result in mortality please ensure that "Potential Mortality" is included as a potential environmental effect.

Response: Noted – the change has been corrected. The Table includes Potential Mortality as an environmental effect.

Section 7.5.3.3

- As previously requested, the effects of Lighting on habitat use should be discussed in this section as it is indicated in Table 7-13.

  Response: This section has been updated to include lighting as a potential effect. Section 7.5.1.3 is cross-referenced for a discussion on the potential effects of lighting to ensure the document is concise and informative for the reader

- As previously requested, reference to Operation of Vessels (supply, support, standby and tow vessels/barges/ROVs) and Surveys (e.g., geophysical, 2D/3D/4D seismic, VSP, geohazard, geological, geotechnical, environmental, ROV, diving) should be made in this section as their effect on habitat use is indicated in Table 7-13.

  Response: The above referenced "activity list" is all inclusive for each activity discussed. However, during decommissioning and abandonment, it is not anticipated that geophysical, seismic, geohazard, geological, geotechnical, environmental, surveys will be undertaken. To address the potential for vessel activity the following text has been included in Section 7.5.3.3

  The noise and underwater activity required during possible removal of subsea structures (e.g., OLS, flowlines and wellhead, operation of vessels, diving programs, ROV surveys) and lighting will be similar in nature to those of construction, but of less magnitude and geographic extent. Potential effects of noise, underwater activity and lighting on fish habitat use are discussed in Section 7.5.1.3.

Table 7-13

- "*Change in Habitat Quantity*" should be removed from the potential environmental effects for Operation of Vessels.

  Response: Noted. The text has been deleted from Table 7-13

Section 7.5.4.1

- The following, "*In any case, the quantity of fish habitat affected by an accidental event resulting in a hydrocarbon release would be negligible*" should be removed or reworded to clarify the effect a spill would have on the quantity of fish habitat.

  Response: The following text will be added to section 7.5.4.1 to clarify that, in the absence of spill countermeasures there is a potential for shoreline oiling, hence potential for affects on fish habitat, should an accidental event occur.

  Therefore, for nearshore and offshore areas, it is predicted that fish habitat quantity could be affected by an accidental event. The quantity of fish habitat that may be affected by an accidental event would be examined as part of an post-spill environmental effects monitoring program in the event of an accidental event.

EMCP Comment 78: DFO 14

This response is considered adequate, provided the following comments are addressed:

It is incorrect to say, "*compensation may not be required for the Offshore Project Area*". Although components of the project may create sufficient habitat to offset the HADD, that created habitat is still considered fish habitat compensation which must be detailed and quantified in a Fish Habitat Compensation Plan, committed to in an Authorization and adequately monitored. A portion of EMCP's response should be reworded as follows:

> "*Therefore, EMCP submits that **additional** ~~HADD~~ compensation may not be required for the Offshore Project Area based on preliminary design of these elements1 and current understanding of the existing fish and fish habitat within the Offshore Project Area.*"

Response: Text has been modified CSR to reflect the above.

EMCP Comment 129: EC 46 Regarding Attraction of Seabirds to Platforms

Environment Canada is not fully satisfied with this response, however, the Proponent's recognition of the need to develop a scientifically defensible program regarding seabird attraction to platforms is encouraging and we are eager to work with the Proponent to better define the key elements of such a program as a means to resolve this issue.

Response: EMCP is committed to undertaking a research program that, when designed, would provide scientifically defensible information regarding seabird attraction to offshore facilities. The following text will be included in the CSR.

> *In light of current knowledge of bird strikes associated with lighting on offshore platforms, EMCP commits to the development and implementation of a research monitoring program at the Hebron field location. This program will be designed to provide information regarding potential interactions between pelagic seabirds (significant concentrations hosted on the Grand Banks) and the Hebron platform. Information from the Hebron Platform site would provide additional data to allow assessment of risk and mortality regarding potential seabird attraction to offshore structures. The program design would be developed in consultation with Environment Canada Canadian Wildlife Service and would be completed prior to platform start-up in 2017. It is anticipated that field testing could begin upon completion of platform start-up and commissioning activities offshore.*

Comment from Transport Canada: Mitigation Measures Listed in Chapter 7:

TC has reviewed the revised Part1 of the April comments to the CSR and noted that new mitigations were added on page 7-93 of the revised Chapter 7. The third mitigation measure added states

> *"Adherence with all standard navigation procedures, Canadian Coast Guard requirements and navigation systems."*

As advised in July 2010, Transport Canada has responsibility for the Canada Shipping Act and the Navigable Waters Protection Act, therefore, TC suggest re-wording to:

"Adherence with all standard navigation procedures, Transport Canada requirements, Canadian Coast Guard requirements and navigation systems."

Response: The mitigation measure, as identified on page 7-93, has been modified to read per Transport Canada's comment.