

**Environmental Assessment of HMDC's  
2D/3D/4D Seismic Projects  
2013-Life of Field  
Newfoundland Offshore Area:  
Proposed Changes to the Project**

**Prepared by**



**for**



**July 2014  
LGL Project No. SA1207**



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Proposed Changes to the Project**

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## Preface

This document describes proposed changes to Hibernia's (HMDC) seismic project description and the environmental assessment (EA) submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) in April 2013 (LGL 2013a). An Addendum to the EA was submitted as a response to reviewer comments in July 2013 (LGL 2013b). The present document is submitted to slightly revise the Project Description upon which the original EA was based, and to evaluate the original EA in light of these changes. It incorporates additional project detail that has become available since the EA and the Addendum were prepared. Focus is on those key components of the Project and the ecosystem (i.e., the valued ecosystem components or VECs) with at least some potential to affect the seismic EA predictions.

Detailed information on seismic surveys for 2015 to End of Field (EF) will be provided prior to commencement of individual surveys including a review of the EA to ensure all information is current and relevant, particularly with respect to Commercial Fisheries and Species at Risk (SAR).

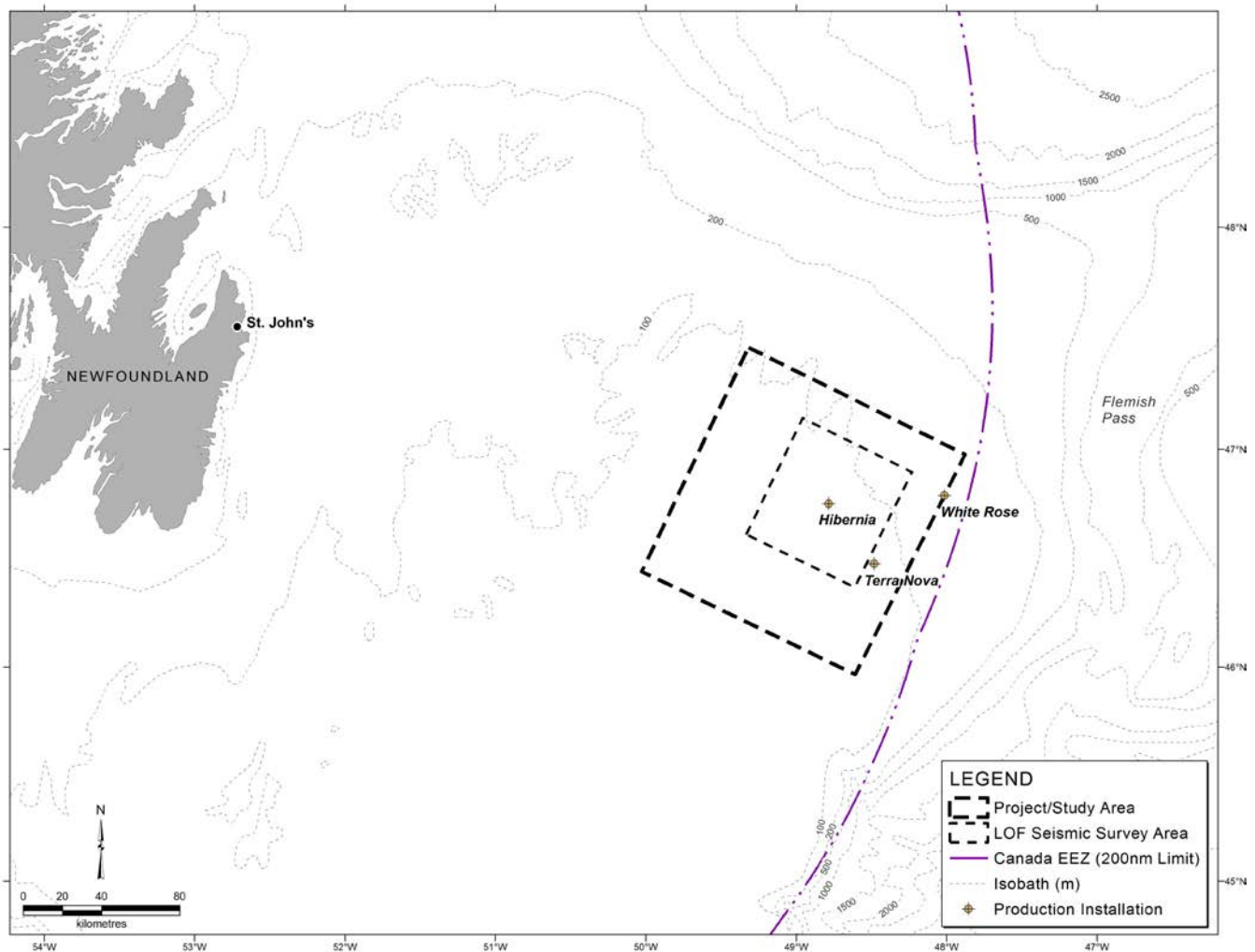
The format of this document follows the organization of the original EA as each EA section was analyzed for potential changes to the main findings or conclusions.

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## 1.0 Introduction

The primary change to the Project described in this document is the expansion of the original Study Area (see Figure 1.1 in the EA) to the west and south for the years 2015 and beyond so as to ensure inclusion of all Project activities including the deployment of streamers (Figure 1). The area labelled as the Project Area in Figure 1.1 of the EA is now labelled (see Figure 1 below) as the Life of Field (LOF) Seismic Survey Area. The Study Area and the Project Area now share the same boundary. In addition, the outer boundaries have been squared off to coincide with the inner block as defined by HMDC geophysicists.

Figure 1 below replaces Figure 1.1 in LGL (2013a).



**Figure 1. HMDC Project/Study Area and the Proposed LOF Seismic Survey Area.**

## 2.0 Project Description

The Project remains a 2D/3D/4D seismic project for the Life of Field (LOF). The Project Description is updated to include the expanded Study and Project Area boundaries which now encompass all Project activities including streamer deployment and vessel turns (see Figure 1). Figure 1 defines an inner block (LOF Seismic Survey Area) where source arrays may be active and this area is essentially the same as defined in the EA as the Project Area. Source arrays will not be activated beyond this boundary. The outer block now defines the Project Area as the total area where all routine activities, including non-activated array and streamer deployment will occur. This outer boundary also describes the Study Area within which all potential effects from routine activities including those from underwater noise may occur. In the present case, given that source activation will not occur outside the LOF Seismic Survey Area, the Study and Project Areas are essentially the same.

The Project Description is also updated to account for any future contractor upgrades in terms of streamer numbers and lengths. The streamer length is updated from 8,100 m to 10,000 m (approx.) and the numbers of streamers to a maximum of 16. For the next seismic survey (now proposed for 2015), the streamer length may be upgraded to 10,000 m but the numbers will likely remain the same as the original Project Description (i.e., 12 streamers).

None of these changes in the Project Description change any of the discussion of potential effects or the subsequent effects predictions provided in the EA.

### 2.1 Spatial and Temporal Boundaries of the Project

This section is changed to the following:

The **Project Area** is defined as the area within which all routine project activities occur, including streamer and non-activated source array deployment and vessel turns (see Figure 1). A **LOF Seismic Survey Area** within the Project Area is defined as the area within which the sound source arrays may be active (for data acquisition and survey).

The **Study Area** is defined as the area within which any potential effects of the Project on the VECs, based on the scientific literature, could occur. The Study Area is the same as the “Affected Area” as originally defined by CEAA. Note that for this Project, the Study Area and the Project Area share the same boundary.

The **Regional Area** is loosely defined as the northern Grand Banks and Orphan Basin (e.g., to include the major Grand Banks developments such as Hibernia, Terra Nova, White Rose, and Hebron). This area is referred to when considering cumulative effects.

Detailed information on seismic surveys for each survey season during the Life of Field (LOF) will be provided prior to commencement of these surveys including a review of the EA to ensure all information is current and relevant, particularly with respect to Commercial Fisheries and Species at Risk (SAR).

The temporal boundaries include LOF wherein surveys may occur anytime between 1 May and 31 December.

## 2.2 Project Overview

The Project Overview remains the same with the following exceptions: (1) Table 1 below changes Table 2.1 on p. 8 in the EA in order to update the defined EA areas and to account for potential streamer upgrades; (2) additional detail on the OBS (Ocean Bottom Seismic), and (3) increase in streamer length from 8 to 10 km. None of these changes result in changes to the ultimate effects assessment.

Proposed future surveys could include 2-D, 3-D and 4-D programs. Towed solid streamer technology will be used in 2015; however, future programs may include use of OBS. An OBS consists of sensors (e.g., hydrophones, geophones, accelerometers) temporarily placed on the seabed to record seismic signals. These sensors can either be embedded inside cables or deployed as independent recording nodes.

The seismic survey vessel(s) used during the Project will be approved for operation in Canadian waters and will be typical of the worldwide seismic fleet. In the case of either 2-D, 3-D or 4-D surveys, the seismic survey ship will have air source arrays and one or more streamers (up to approximately 10 km in length). In 2015 (a 4-D survey), the vessel will tow a dual sound source and up to twelve seismic streamers of an approximate length of six kilometers.

**Table 1. Known Seismic Survey Parameters.**

| <b>General Information</b>                    |                                                                                                                   |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Operating Company:                            | Hibernia Management & Development Company Ltd. (HMDC) and ExxonMobil Canada Properties Ltd., a partnership (EMCP) |
| Vessel Name(s):                               | TBD                                                                                                               |
| Location:                                     | See Figure 1 (above) and Table 2 (below)                                                                          |
| Type of Survey:                               | 2-D, 3-D, 4-D; OBS                                                                                                |
| Area:                                         | Project Area = 15,261 km <sup>2</sup> . Life of field Seismic Survey Area = 4,035 km <sup>2</sup>                 |
| Average line length (including 3 km run-out): | 2013 4-D program was 18 km (may be about 31 km in 2015)                                                           |
| Line direction:                               | 24.5° / 204.5° (may vary)                                                                                         |
| <b>Source Parameters</b>                      |                                                                                                                   |
| <b>Source type</b>                            | Bolt, Soder G or sleeve (steerable source preferred)                                                              |
| Number of sources                             | 2 (flip-flop)                                                                                                     |
| Shot to shot interval                         | 18.75 m (37.5 m per source) (may vary in subsequent years)                                                        |
| Total volume per source                       | 3,000-6,000 cu inch                                                                                               |
| Source operating pressure                     | 2,000 psi (may vary in subsequent years)                                                                          |
| Source depth                                  | 6 m +/- 0.5 meters tolerance (may vary in subsequent years)                                                       |
| Output                                        | Approximately 120 bar-meter peak-to-peak                                                                          |
| <b>Streamer Parameters</b>                    |                                                                                                                   |
| <b>Streamer type</b>                          | Digital 24 bit (solid or gel-filled streamers required)                                                           |
| Number of active streamers                    | Up to 16 streamers (12 streamers on 8 streamer pre-plot in 2015)                                                  |
| Streamer separation                           | 50 or 75 meters (may vary in subsequent years)                                                                    |
| Active streamer length                        | Up to 10,000 meters                                                                                               |
| Steerable streamer device (REQUIRED)          | DigiFin, Qfin, eBird, Nautilus or equivalent                                                                      |
| Streamer depth                                | 7-24 m +/- 1.0 m tolerance (TBC) (may vary in subsequent years)                                                   |
| Minimum line run-in distance                  | 1.5 x active streamer length (unobstructed areas)                                                                 |

### **2.2.1 Objective and Rationale**

This section remains the same.

### **2.2.2 Alternatives to the Project/Alternative Means within the Project**

The last sentence is slightly modified to read “Alternatives within the Project include the different contractors’ vessels and equipment as described in the following sections. These alternatives may be decided by the competitive bidding process.”

### **2.2.3 Project Phases**

This section remains the same.

### **2.2.4 Project Scheduling**

This section remains the same.

### **2.2.5 Site Plans**

This section remains the same.

### **2.2.6 Project Components**

The first paragraph changes to reflect the potential use of a second source vessel (an undershoot vessel).

The components of a seismic survey include a seismic vessel; the towed seismic air source (s) array; the towed streamer (s) receiver array; and may also include a picket vessel; a logistics supply vessel; helicopter; and a shore base. Additionally, there may be an undershoot vessel for data acquisition in challenging areas or complex acquisition techniques. If required; the undershoot vessel would be equipped with a towed seismic air source (s) array and would not tow a seismic streamer array. The undershoot vessel seismic air source(s) array strength (volume) and configuration would be within the range of the primary equipment.

### **2.2.7 Personnel**

This section remains the same.

### **2.2.8 Seismic Vessel(s)**

The first paragraph changes to reflect the potential use of a second source vessel (an undershoot vessel).

Vessel specifics will be provided in subsequent document submissions once the contractors are selected. The selected ship(s) will be a fully equipped, modern vessel suited to the environment and task.

### **2.2.9 Seismic Energy Source Parameters**

This section is updated to reflect 2015 parameters.

The proposed 2015 4-D survey sound source will consist of two air source arrays, with sufficient volume to output approximately 120 bar-meters peak-to-peak (see Table 1) to match the previous survey. The air source will operate at a towed depth of approximately six meters. The air sources will be operated with compressed air at a pressure of approximately 2,000 psi. While towing the survey lines, the two air source arrays are discharged alternately, one each approximately every 18.75 meters down the line. Seismic air source array specifications may vary in subsequent years.

A typical OBS 2-D, 3-D or 4-D survey sound source consists of one or two air source arrays, 3,000 to 6,000 in<sup>3</sup> in total volumes, which operate at towed depths between 6 m and 15 m. The air source operates on compressed air at pressures 1,800 to 2,500 psi, and produce approximate peak-to-peak pressures 100 to 180 bar-m.

### **2.2.10 Seismic Survey Receivers**

This section is updated to better describe the proposed 2015 program.

The 2015 4-D seismic survey will use 12 towed streamers with an active length of approximately 6,000 m and deployed at a depth of approximately seven to 24 meters (see Table 1). The streamers will be separated by 75 meters. The streamers will be solid or gel-filled to minimize the environmental impact in the case of breaks or tears. Lead-in and stretch sections may contain limited amounts of isopar. Streamer configurations may vary in subsequent years. In subsequent surveys, 2-D, 3-D, and 4-D seismic surveys may use up to 16 towed streamers with an approximate length of up to 10,050 m and deployed at depths ranging from five to 30 m. Streamer equipment specifications will be provided when program designs are complete.

## **2.3 Mitigations**

This section remains unchanged.

## **2.4 Project Site Information**

This section is changed to the following.

The seismic Project Area is approximately 15,261 km<sup>2</sup> in size and generally centered upon the Hibernia gravity based structure (GBS) (charted position 46 45.01N, 48 46.9W) (Table 2). For the present Project, the Study Area has the same boundaries as the Project Area to accommodate all ship turning, holding, and streamer and non-activated source array deployment (Figure 1; Table 2). The Project and Study Areas also include the area which is the focus of any and all HMDC future seismic programs until end of field (EF) (i.e., the LOF Seismic Survey Area, Figure 1; Table 2). The LOF Seismic Survey Area is 4,035 km<sup>2</sup> in area and is the area within which sound source activation will be confined.

The Project/Study Areas are contained inside the North Atlantic Fisheries Organization (NAFO) 3Lh, i, r, t Unit Areas, in an area generally referred to as the Jeanne d'Arc Basin.

**Table 2. Area Coordinates. See also Figure 1.**

|                            |        | WGS84 UTM<br>22N |              | WGS84<br>(unprojected) |                |
|----------------------------|--------|------------------|--------------|------------------------|----------------|
| Boundary_Block             | Corner | Easting (m)      | Northing (m) | Latitude (DD)          | Longitude (DD) |
| LOF Seismic<br>Survey Area | NE     | 710844           | 5197280      | 46.895577              | -48.231988     |
| LOF Seismic<br>Survey Area | SE     | 683660           | 5137689      | 46.367839              | -48.612217     |
| LOF Seismic<br>Survey Area | SW     | 627615           | 5163253      | 46.610700              | -49.333473     |
| LOF Seismic<br>Survey Area | NW     | 654800           | 5222847      | 47.140926              | -48.958437     |
| Project/Study Area         | NE     | 737337           | 5207185      | 46.975646              | -47.879508     |
| Project/Study Area         | SE     | 685271           | 5092997      | 45.965522              | -48.608779     |
| Project/Study Area         | SW     | 574629           | 5143442      | 46.440423              | -50.028464     |
| Project/Study Area         | NW     | 626695           | 5257634      | 47.459821              | -49.319025     |

### 3.0 Physical Environment

There have been no changes in the physical environment or related literature which could affect any of the discussion or conclusions provided in the original EA.

### 4.0 Biological and Socio-economic Environments

There are no changes to the biological and socio-economic environments that have implications for environmental assessment with the exceptions described below.

#### 4.1 Ecosystem

No changes or addition due to the updated Study Area.

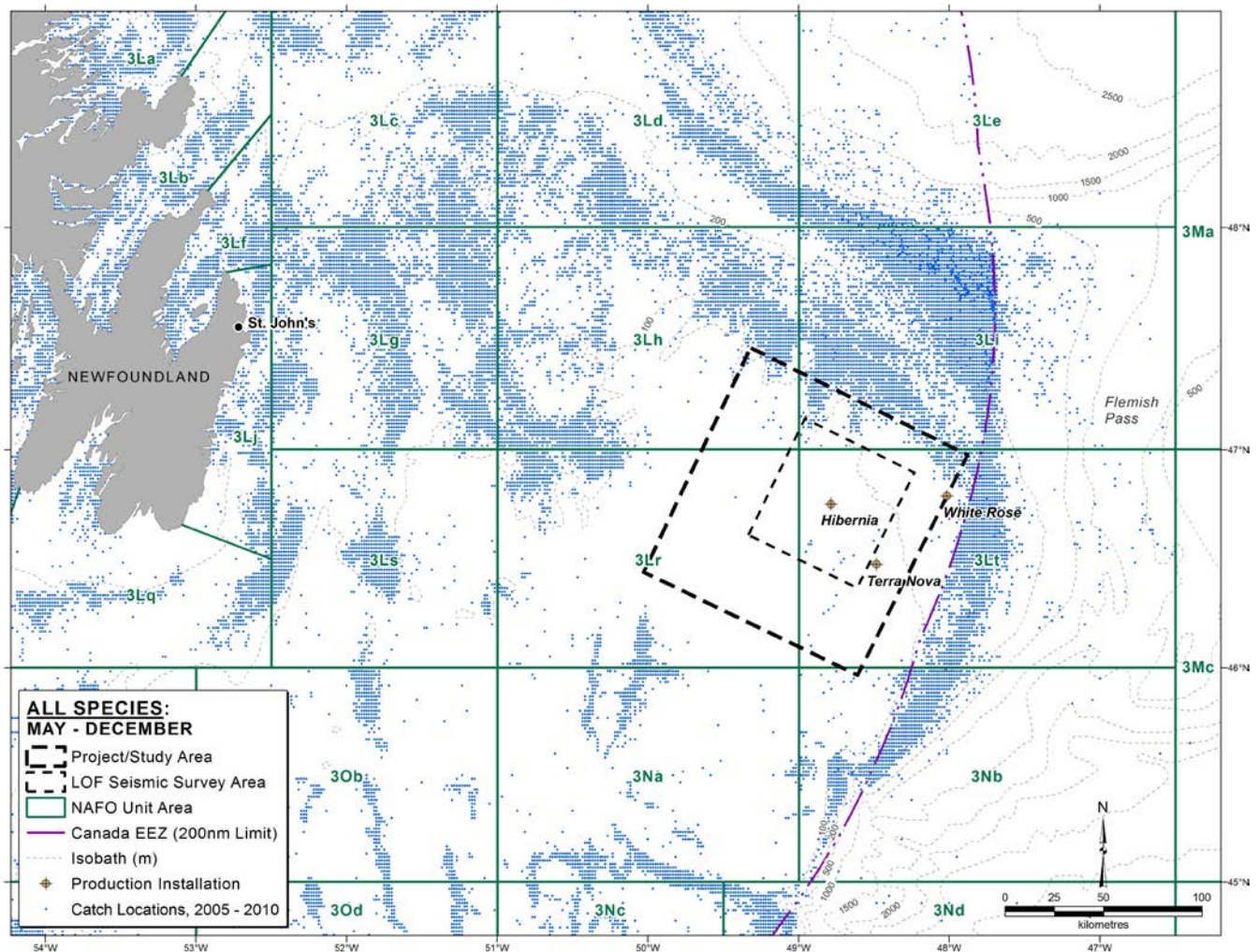
#### 4.2 Fish and Fish Habitat

No changes or addition due to the updated Study Area.

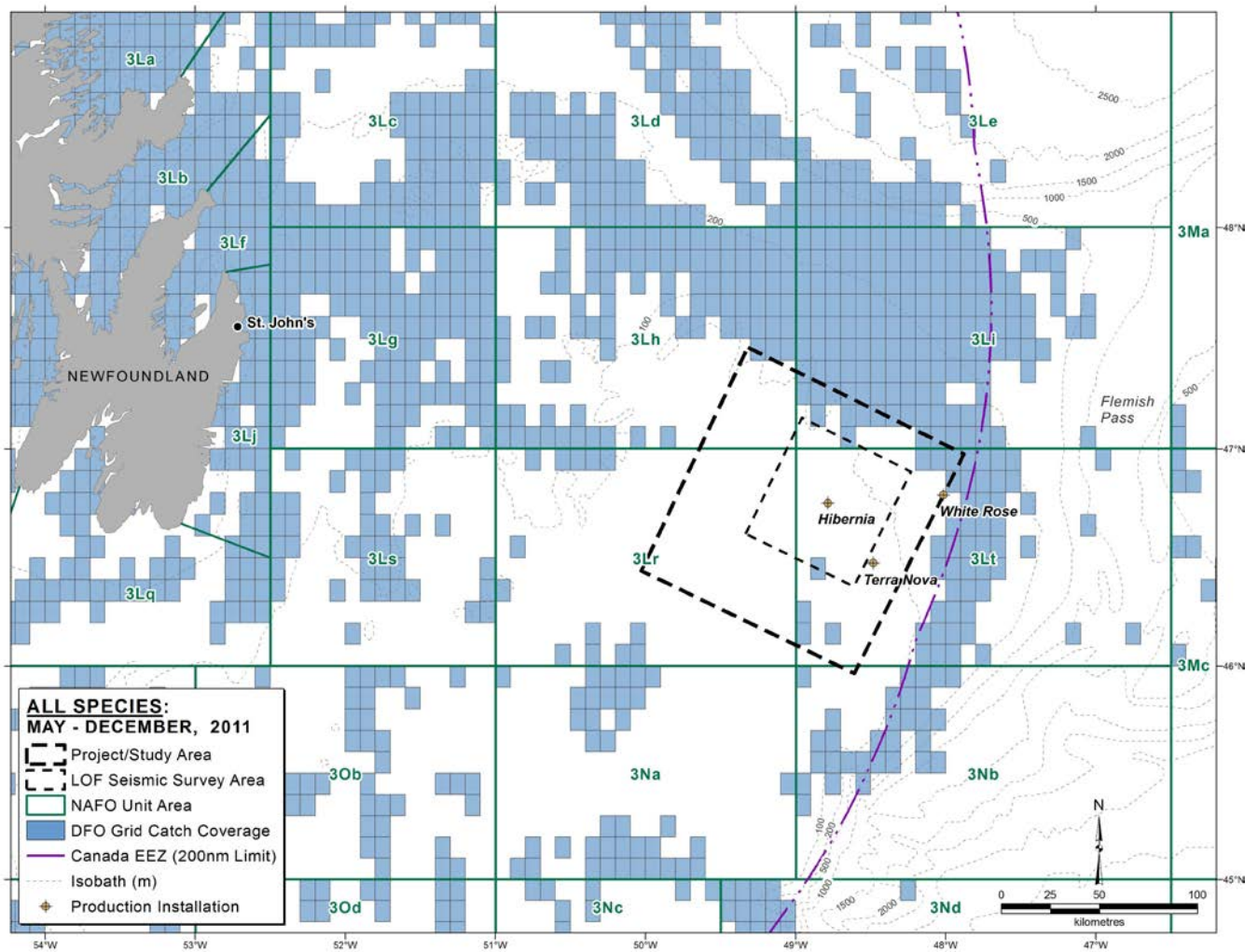


### 4.3 Commercial Fisheries

Analysis of commercial fisheries data indicates no major differences in the distributions of catches between the original EA (see Figures 4.9 to 4.23 in LGL 2013a) and the expanded Study/Project Areas (Figures 2, 3 and 4 below). [Note that Figure 2 and 3 for 2011 and 2012 data are presented differently because DFO no longer provides geo-referenced catch data after 2010.] There have been relatively few recorded catches in these areas, at least in recent years (Figures 2, 3 and 4).

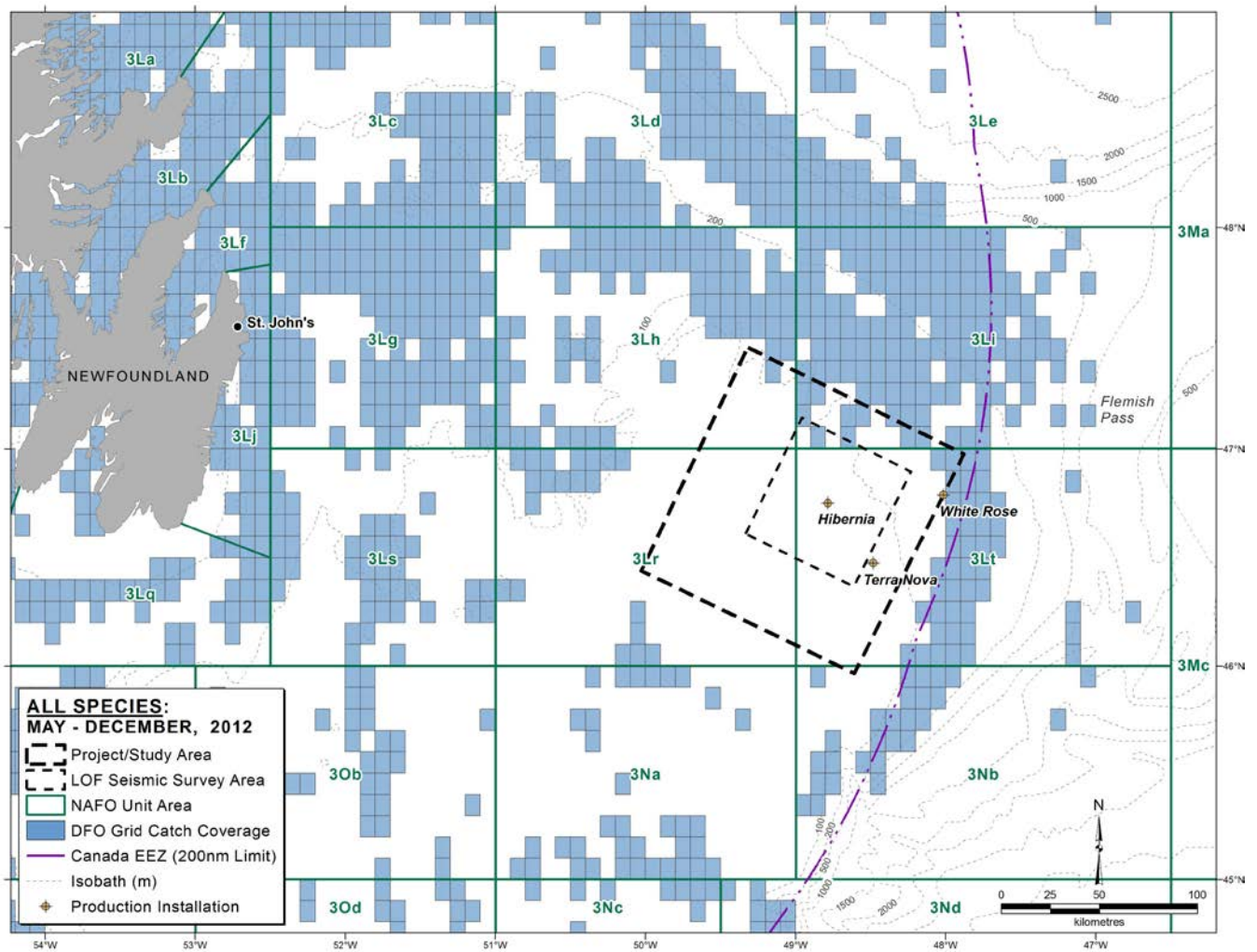


**Figure 2. Commercial Catches (All Species) May to December 2005-2010.**



**Figure 3. Commercial Catches (All Species) May to December 2011.**





**Figure 4. Commercial Catches (All Species) May to December 2012.**

#### 4.4 Seabirds

The updated Project/Study Area does not change the spatial or temporal distribution of birds as described in Section 4.4 nor the location of IBAs as presented in Figure 4.25, p. 67 in LGL (2013a).

## 4.5 Marine Mammals and Sea Turtles

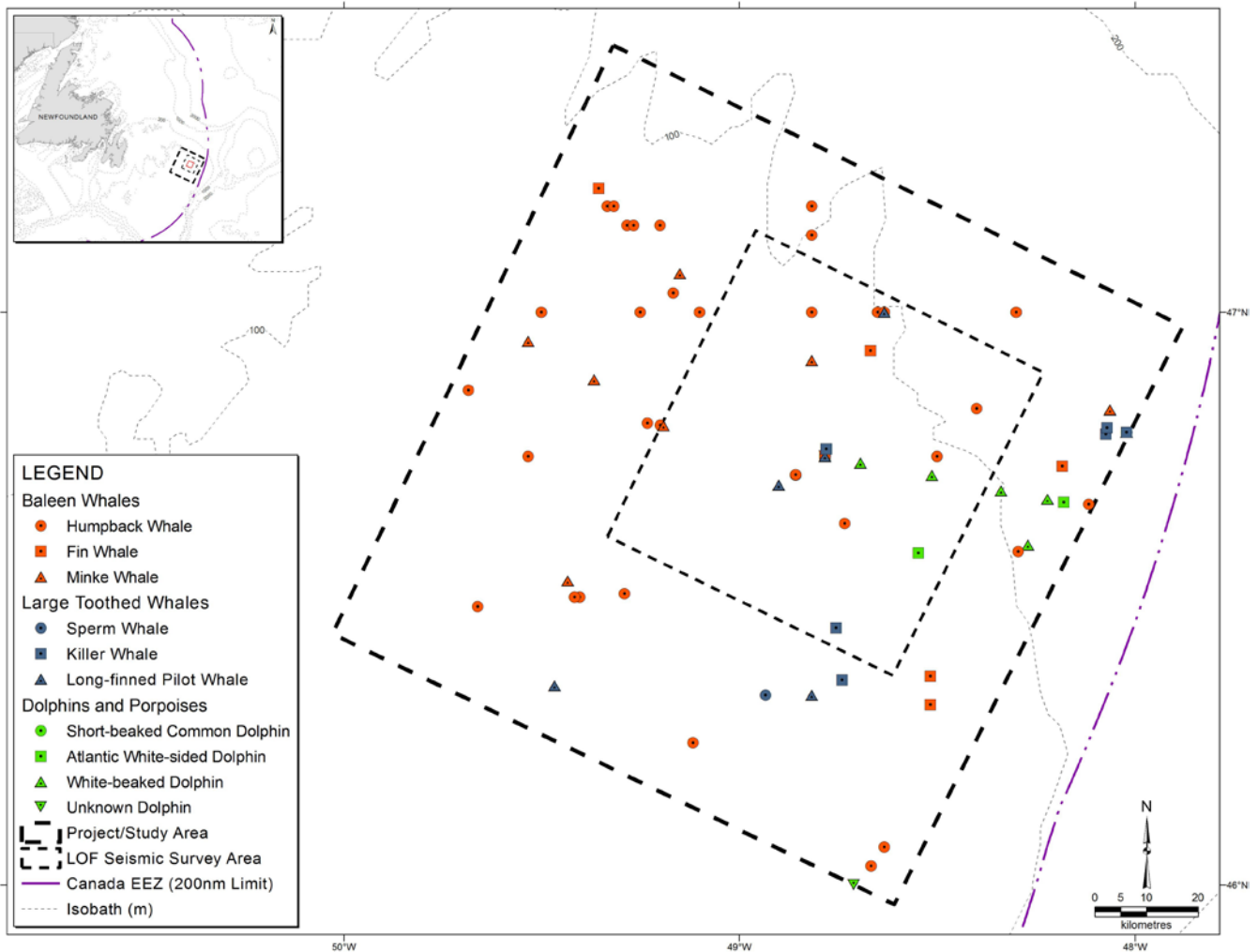
Analysis of marine mammal data within the updated Project/Study Area indicated little to no change in either the number of sightings or minimum number of individuals observed as compared to the original Study Area (see Table 4.11, p. 80 in LGL 2013a and Table 3 below). The largest observed difference was an increase in humpback sightings and individuals of 18 and 26, respectively (Table 3 below). No additional marine mammal species were observed in the updated Project/Study Area versus the original Study Area. Sighting locations for the expanded Project/Study Area are summarized in Figure 5 below.

No sea turtles have been recorded within the updated Project/Study Area.

**Table 3. Cetacean Sightings within the Project/Study Area, 1961 to 2009.**

| Species                       | Number of Sightings |                            | Minimum Number of Individuals |                            | Months Observed        |
|-------------------------------|---------------------|----------------------------|-------------------------------|----------------------------|------------------------|
|                               | Original Study Area | Updated Project/Study Area | Original Study Area           | Updated Project/Study Area |                        |
| <i>Mysticetes</i>             |                     |                            |                               |                            |                        |
| Humpback Whale                | 85                  | 103                        | 279                           | 305                        | March-Dec              |
| Fin Whale                     | 6                   | 7                          | 14                            | 15                         | June-Sept              |
| Minke Whale                   | 13                  | 14                         | 20                            | 21                         | May-Oct; Dec           |
| <i>Large Odontocetes</i>      |                     |                            |                               |                            |                        |
| Sperm Whale                   | 1                   | 1                          | 1                             | 1                          | Aug                    |
| Killer Whale                  | 6                   | 6                          | 26                            | 26                         | May-June; Aug; Oct-Nov |
| Long-finned Pilot Whale       | 6                   | 7                          | 24                            | 27                         | March; July-Sept       |
| <i>Delphinids</i>             |                     |                            |                               |                            |                        |
| Short-beaked Common           | 1                   | 1                          | 90                            | 90                         | March                  |
| Atlantic White-sided          | 3                   | 3                          | 19                            | 19                         | July-Aug               |
| White-beaked Dolphin          | 5                   | 5                          | 34                            | 34                         | Aug                    |
| <i>Unidentified Cetaceans</i> |                     |                            |                               |                            |                        |
| Unidentified Dolphin          | 2                   | 3                          | 21                            | 22                         | Aug; Nov               |
| Unidentified Cetacean         | 17                  | 22                         | 24                            | 30                         | April; June-Nov        |

Source: DFO sightings database.



Source: DFO sightings database.

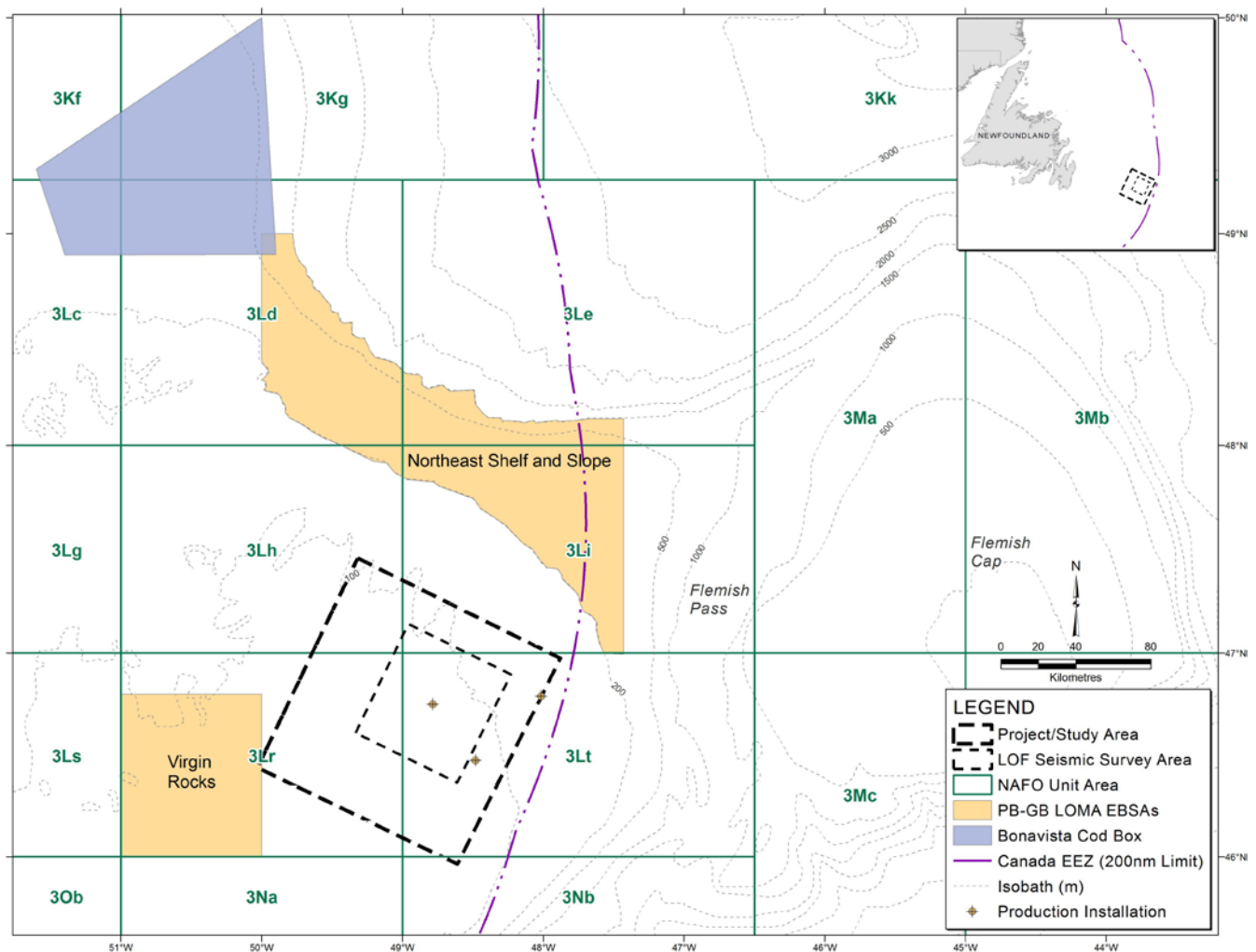
**Figure 5. Marine Mammal Sightings within the HMDC Project/Study Areas.**

#### 4.6 Species at Risk

There are no changes to this section as a result of the Project Description change.

#### 4.7 Special Areas

The expanded Study Area now just touches the eastern boundary of the Virgin Rocks which are part of the Placentia Bay-Grand Banks LOMA EBSA (see revised Figure 6 below). This does not affect the outcome of the EA as no effects are predicted outside the Study Area boundary.

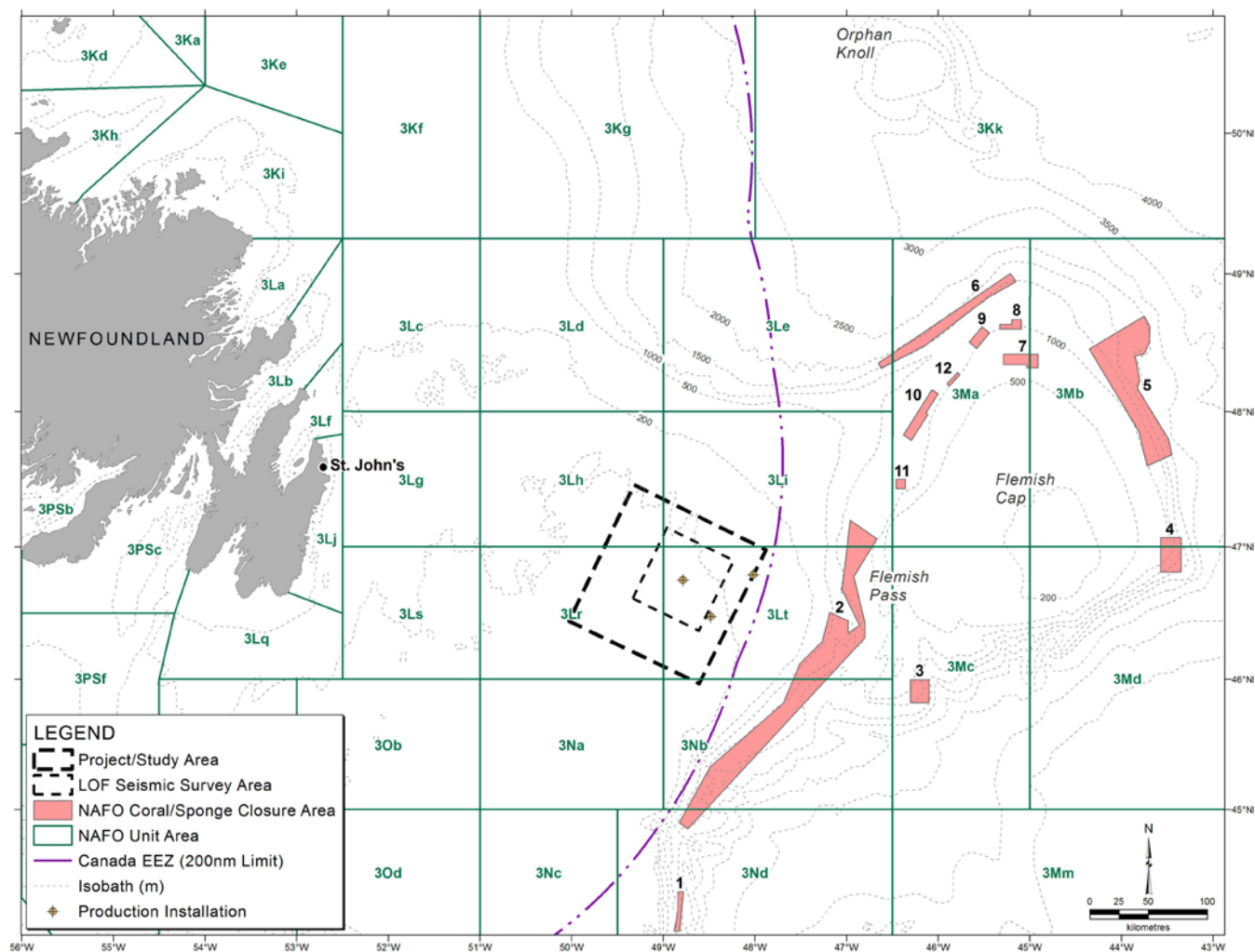


**Figure 6. Locations of the PBGB LOMA EBSAs and Bonavista Cod Box Relative to the HMDC Project and Study Areas.**

Updates to fishery closure areas have been made by the NAFO Scientific Council based on new data on coral and sponges concentrations. As a result, the following changes are provided.

The third paragraph in Section 4.7.1 Special Areas, p. 96 in LGL (2013a) should be changed to the following text.

In 2008 and 2009, the North Atlantic Fisheries Organization (NAFO) Scientific Council identified areas of significant coral and sponge concentrations within the NAFO Regulatory Area. NAFO Coral/Sponge Closure Area Five was updated in 2012. These areas that are closed to fishing with bottom gear are shown in Figure 7 (see also Potentially Sensitive Areas in DFO 2010). Figure 7 shows the locations of these 12 areas, none of which occur either entirely or partially within the proposed HMDC Study Area. Given the nature of seismic survey equipment, with the possible exception of OBC (if used), there should be no interaction with corals and sponges.



**Figure 7. Locations of NAFO Coral/Sponge Closure Areas in Region of HMDC's Study and Project Areas.**

## 5.0 Effects Assessment

### 5.1 Scoping

There is no change in the scope of the EA due to the changes in Project Description as described in the preceding sections.

### 5.2 Valued Ecosystem Components

The VECs analyzed in the EA remain the same as there are no new ones to be added as the result of the expanded Study Area.

### **5.3 Boundaries**

This section is revised as follows: For the purposes of this EA, the following temporal and spatial boundaries were defined.

#### **5.3.1 Temporal**

Seismic surveys may occur from 1 May to 31 December in any given year through the Life of Field (LOF).

#### **5.3.2 Spatial**

The **Project Area** is defined as the area within which all routine project activities occur, including streamer and array deployment and vessel turns (see Figure 1). A **LOF Seismic Survey Area** a smaller area within the Project Area is defined as that area within which the sound source arrays may be active.

The **Study Area** is defined as the area within which any potential effects of the Project on the VECs, based on the scientific literature, could occur. The Study Area is the same as the “Affected Area” as originally defined by CEAA.

The **Regional Area** is loosely defined as the northern Grand Banks and Orphan Basin (e.g., to include the major Grand Banks developments such as Hibernia, Terra Nova, White Rose, and Hebron). This area is referred to when considering cumulative effects.

### **5.4 Effects Assessment Procedures**

Effects assessment procedures remain unchanged.

### **5.5 Effects of the Environment on the Project**

The expansion of the Study Area changes neither the discussion nor the conclusions regarding the potential effects of the environment on the Project. The effects of the environment on the Project were deemed *not significant*.

### **5.6 Effects of the Project on the Environment**

There are no changes to this section as a result of the Project Description change.

### **5.7 Cumulative Effects**

There are no changes to this section as a result of the Project Description change.



## 5.8 Mitigations and Follow-up

There are no changes to this section as a result of the Project Description change.

## 5.9 Residual Effects of the Project

The summary of potential effects remains the same, namely:

A summary of the Project's residual effects on the environment, in other words those effects that remain after mitigations have been instituted, are shown in Table 4 below. HMDC's seismic program is predicted to have *no significant effects* on the VECs.

**Table 4. Significance of Potential Residual Environmental Effects of HMDC's Proposed Seismic Program on VECs in the Study Area.**

| Valued Ecosystem Component:<br>Fish and Fish Habitat, Fishery, Seabirds, Marine Mammals and Sea Turtles, Species at Risk                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                          |                     |                           |                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------|---------------------------|----------------------|
| Project Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Significance Rating                                      | Level of Confidence | Likelihood <sup>a</sup>   |                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Significance of Predicted Residual Environmental Effects |                     | Probability of Occurrence | Scientific Certainty |
| <b>Sound Emissions and Receivers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                     |                           |                      |
| Air sources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | NS                                                       | 2-3                 | -                         | -                    |
| Seismic Vessel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | NS                                                       | 3                   | -                         | -                    |
| Picket vessel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | NS                                                       | 3                   | -                         | -                    |
| Supply Vessel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | NS                                                       | 3                   | -                         | -                    |
| OBC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | NS                                                       | 3                   | -                         | -                    |
| Helicopter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | NS                                                       | 3                   | -                         | -                    |
| Echosounder                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | NS                                                       | 2-3                 | -                         | -                    |
| Side Scan Sonar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NS                                                       | 2-3                 | -                         | -                    |
| Boomer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | NS                                                       | 2-3                 | -                         | -                    |
| <b>Vessel Lights</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | NS                                                       | 3                   | -                         | -                    |
| <b>Vessel Presence</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |                     |                           |                      |
| Seismic Vessel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | NS                                                       | 3                   | -                         | -                    |
| Supply Vessel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | NS                                                       | 3                   | -                         | -                    |
| Picket Vessel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | NS                                                       | 3                   | -                         | -                    |
| <b>Sanitary/Domestic Wastes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NS                                                       | 3                   | -                         | -                    |
| <b>Atmospheric Emissions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | NS                                                       | 3                   | -                         | -                    |
| <b>Helicopter Presence</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | NS                                                       | 3                   | -                         | -                    |
| <b>Accidental Releases</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | NS                                                       | 2-3                 | -                         | -                    |
| <p>Key:</p> <p>Residual environmental Effect Rating:</p> <p>S = Significant Negative Environmental Effect</p> <p>NS = Not-significant Negative Environmental Effect</p> <p>P = Positive Environmental Effect</p> <p>Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent &gt;100 km<sup>2</sup> (4 or greater rating).</p> <p>Level of Confidence: based on professional judgment:</p> <p>1 = Low Level of Confidence</p> <p>2 = Medium Level of Confidence</p> <p>3 = High Level of Confidence</p> <p><sup>a</sup> Considered only in the case where 'significant negative effect' is predicted.</p> <p>Probability of Occurrence: based on professional judgment:</p> <p>1 = Low Probability of Occurrence</p> <p>2 = Medium Probability of Occurrence</p> <p>3 = High Probability of Occurrence</p> <p>Scientific Certainty: based on scientific information and statistical analysis or professional judgment:</p> <p>1 = Low Level of Confidence</p> <p>2 = Medium Level of Confidence</p> <p>3 = High Level of Confidence</p> |                                                          |                     |                           |                      |

## 6.0 Literature Cited

The following references are added:

DFO. 2010. Occurrence, susceptibility to fishing, and ecological function of corals, sponges, and hydrothermal vents in Canadian waters. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2010/041.

LGL Limited. 2013a. Environmental Assessment of HMDC's 2D/3D/4D Seismic Projects 2013-Life of Field, Newfoundland Offshore Area. LGL Rep. SA1207. Prepared by LGL Limited for Hibernia Management and Development Company Ltd., St. John's, NL. 227 p. + appendices.

LGL Limited. 2013b. Environmental Assessment of HMDC's 2D/3D/4D Seismic Projects 2013-Life of Field, Newfoundland Offshore Area Addendum. LGL Rep. SA1207. Prepared by LGL Limited for Hibernia Management and Development Company Ltd., St. John's, NL. 11 p.