Nunavut Impact Review Board

Final Report for the

# Strategic Environmental Assessment in Baffin Bay and Davis Strait

NIRB File No. 17SN034

## Volume 3: Analysis of Scenarios, Key Findings and Recommendations

July 2019

# INSIDE COVER PAGE

**The Nunavut Impact Review Board has conducted this assessment under the authority of Article 12, Section 12.2.4 of the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada* (*Nunavut Agreement*) and in accordance with the Board's Primary Objectives set out in Article 12, Section 12.2.5 of the *Nunavut Agreement* and the *Nunavut Planning and Project Assessment Act*, S.C. 2013, c. 14, s. 23 as set out below:**

> 12.2.5
> In carrying out its functions, the primary objectives of NIRB shall be at all times to protect and promote the existing and future well-being of the residents and communities of the Nunavut Settlement Area, and to protect the ecosystemic integrity of the Nunavut Settlement Area. NIRB shall take into account the well-being of residents of Canada outside the Nunavut Settlement Area.

> 23(1) The Board must exercise its powers and perform its duties and functions in accordance with the following primary objectives:
> (a) to protect and promote the existing and future well-being of the residents and communities of the designated area; and
> (b) to protect the ecosystemic integrity of the designated area.

> 23(2) In exercising its powers or performing its duties and functions in accordance with the objective set out in paragraph (1)(a), the Board must take into account the well-being of residents of Canada outside the designated area.

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**Cover Photo Credits:** Board staff

# SIGNATURE PAGE

Photo 1: Board Members (left to right): Guy Alikut, Catherine Emrick, Philip (Omingmakyok) Kadlun, Kaviq Kaluraq, Elizabeth Copland, Allen Maghagak, Henry Ohokannoak, Uriash Puqiqnak, and Madeleine Qumuatuq.

THIS REPORT IS SUBMITTED TO THE HONOURABLE CAROLYN BENNETT, MINISTER OF CROWN-INDIGENOUS RELATIONS AND NORTHERN AFFAIRS BY THE NUNAVUT IMPACT REVIEW BOARD ON THIS 31st DAY OF JULY 2019.

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| Kaviq Kaluraq, Acting Chairperson | Philip (Omingmakyok) Kadlun, Board Member |
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| Guy Alikut, Board Member | Henry Ohokannoak, Board Member |
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| Allen Maghagak, Board Member | Madeleine Qumuatuq, Board Member |
| | |
| Catherine Emrick, Board Member | Uriash Puqiqnak, Board Member |

# FOREWORD

The Nunavut Impact Review Board (NIRB or Board) is an independent Institution of Public Government created by the *Nunavut Agreement* that has extensive experience performing impact assessments throughout the Nunavut Settlement Area. The Strategic Environmental Assessment of the potential for oil and gas development in Baffin Bay and Davis Strait (the SEA) was coordinated by the NIRB following a referral by the Minister of Northern Affairs in February 2017 through to the Final Public Meeting in March 2019 and issuance of this Final SEA Report in July 2019.

Currently there is a moratorium or ban on oil and gas exploration in the waters of the Canadian Arctic. This moratorium was put in place for five (5) years by the Government of Canada in December 2016. In 2021 the Government of Canada will revisit this decision. The findings and recommendations of the NIRB resulting from the SEA will contribute a Nunavut-based perspective to be considered by the Government when making this decision. The Board believes that these findings and recommendations will also be useful for informing other policy and planning initiatives for Nunavut and the Canadian Arctic moving forward.

The purpose of the SEA was to better understand the possible types of oil and gas related activities that could be proposed in Baffin Bay and Davis Strait and the potential risks, benefits, and management strategies related to these activities. The Final SEA Report describes the hypothetical development scenarios that were examined to better understand what these activities could look like, identify gaps in available information, address questions and gauge public concern, and lead to recommendations for moving forward. Summaries are provided of the comprehensive review of available literature and the extensive public engagement that was undertaken throughout this assessment, as well as the outcomes of the analysis of potential effects of possible oil and gas activities. Importantly, the report also includes extensive references to the background documentation and the knowledge and Inuit Qaujimajatuqangit that informed and enriched the SEA, leading to the Board's central conclusion and approximately 79 recommendations for moving forward, set out in summary form in Chapter 1 and discussed in detail in the balance of the report.

The SEA was truly a collaborative effort that would not have been possible without the significant and ongoing contributions of the NIRB, Nunavut Tunngavik Incorporated, the Qikiqtani Inuit Association, the Government of Nunavut, Crown-Indigenous Relations and Northern Affairs Canada (collectively 'the SEA Working Group'), Nunami Stantec, intervenors, and the many community members from the 10 interested communities of Grise Fiord, Resolute, Arctic Bay, Pond Inlet, Clyde River, Qikiqtarjuaq, Pangnirtung, Iqaluit, Cape Dorset, and Kimmirut. Although at times this has been a challenging process for all concerned, the NIRB is confident that the lessons learned in this assessment establish an important foundation for future strategic assessments in Nunavut and the Canadian Arctic and for other types of development.

In particular, the Board recognizes that this assessment has made significant progress with the respect for and treatment of Inuit knowledge and experience, and the NIRB applauds the significant efforts of the Qikiqtani Inuit Association to coordinate the collection of input from communities and advise on its appropriate treatment. The Board thanks all who gave so generously of their time, knowledge, experiences, stories, and perspectives; while the NIRB acknowledges that many participants faced time, capacity, and financial limits that affected their ability to fully engage in the SEA process, the Board is grateful for the contributions and sacrifices made by all who chose to participate.

The Board Members of the NIRB would like to thank the NIRB's staff for their professionalism and hard work over the past 2+ years to bring the SEA to completion. In particular, the Board recognizes that the SEA benefited significantly from the dedication and commitment of Heather Rasmussen, the Board's guiding hand throughout. Thank you, Heather for the countless hours you have dedicated to leading this work and ensuring that the Board heard a diverse range of perspectives and voices to support our decision-making for the SEA.

Sincerely,

Kaviq Kaluraq
Acting Chairperson
Nunavut Impact Review Board

# **ᐃᑦᓯᕙᐅᑕᐅᑉ ᑎᑎᕋᖅᑕᕐᓚ**

ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᕐᒋᑦ (NIRB ᐅᖒᕙᓘᓐᓃᑦ ᑲᑎᒪᔨᑦ) ᐃᒻᒥᒃᑯᑦ ᑎᒥᐅᔪᑦ ᑭᒃᑯᑐᐃᓐᓇᓄᑦ ᒐᕙᒪᓕᕆᓂᕐᒧᑦ ᓴᖅᑭᑎᑕᐅᓯᒪᔪᑦ *ᓄᓇᕗᑦᖃᖅᓯᒪᓂᕐᒧᑦ ᐊᖏᕈᑎᐊᒍᑦ* ᐊᖏᖃᒃᑯᑦ ᐃᓕᓯᒪᔪᑦ ᐱᕙᓪᓕᐊᓯᒪᔪᓄᑦ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᓄᓇᕗᒻᒥ. ᐱᓕᕆᐊᖑᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ ᑕᐃᒪᐅᑐᐃᓐᓇᓕᐊᕐᑲᖅᑐᑦ ᐅᖅᓱᐊᓗᐃᑦ ᐊᒻᒪᓗ ᐅᖅᓱᑦ ᐱᕙᓪᓕᐊᔪᑦ ᕿᑭᖅᑖᓗᒃ ᐊᑯᑭᑦᑐᓪᓗ ᐃᑭᖕᒐᓂ ᐊᒻᒪᓗ ᓴᓐᓂᕈᑎᐅᑉ ᐃᒪᖕᒐᓂ (ᑕᓇᐅᖅ) ᐊᐅᓚᑕᐅᓚᐅᖅᑐᑦ ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᕐᒋᑦ ᐅᖃᐅᓯᖅᑕᐅᓯᒪᔪᓪᓗᑎᒃ ᒥᓂᔅᑕ ᐃᓄᓕᕆᔨᒃᑯᓐᓂᑦ ᖁᕝᕙᐊᓇ 2017-ᖑᑎᓪᓗᒍ ᑭᖑᓪᓕᖅᐹᒥ ᐃᓄᓕᒫᓂᑦ ᑲᑎᒪᑎᑦᑎᓂᖅ ᒪᔾ 2019-ᒥ ᐊᒻᒪᓗ ᑐᓂᓯᓪᓗᑎᒃ ᑭᖑᓪᓕᖅᐹᖑᑕ ᐱᓕᕆᐊᖑᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ ᐅᓂᒃᑳᓴᓕᐊᖕᒋᓐᓂᒃ ᔪᓚᐃ 2019-ᒥ.

ᒫᓐᓇᐅᔪᖅ ᒪᓕᒐᖅᑎᒎᑦ ᓅᖅᑲᐃᑎᑦᑎᓯᒪᔪᑦ ᐅᖒᕙᓘᓐᓃᑦ ᐊᑐᖅᑕᐅᔭᕆᐊᖃᙱᑦᑐᑦ ᐅᖅᓱᐊᓗᑦ ᐊᒻᒪᓗ ᐅᖅᓱᓄᑦ ᕿᒥᕐᕈᐊᕐᓂᕐᒧᑦ ᑲᓇᑕᐅᑉ ᐅᑭᐅᖅᑕᖅᑐᒥ ᐃᒪᖏᓐᓂ. ᒪᓕᒐᖅᑎᒎᑦ ᓅᖅᑲᐃᑎᑦᑎᓯᒪᔪᑦ ᐊᑐᖅᑕᐅᕙᓪᓕᐊᓯᒪᔪᑦ ᑕᓪᓕᒪᓄᑦ (5)ᐅᑭᐅᓄᑦ ᒐᕙᒪᑦ ᑲᓇᑕᒃᑯᖓᓂᑦ ᑎᓯᐱᕆ 2016-ᖑᑎᓪᓗᒍ. 2021-ᖑᑎᓪᓗᒍ ᒐᕙᒪᑦ ᑲᓇᑕ ᐅᐸᒃᑲᓂᕐᓂᐊᖅᑕᕐᒋᑦ ᐃᓱᒪᒃᓴᖅᓯᐅᕆᑕᐅᔪᑦ. ᖃᐅᔨᔭᐅᓯᒪᔪᑦ ᐊᒻᒪᓗ ᐅᖃᐅᔾᔪᖅᑕᐅᖖᒍᐊᖅᓯᒪᔪᑦ ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᕐᒋᓐᓂᑦ ᖃᓄᐃᓕᐅᖅᓯᒪᓂᕐᒋᑕ ᐱᓕᕆᐊᖑᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ ᐃᑲᔫᑕᐅᓂᐊᖅᑐᑦ ᓄᓇᕗᒻᒥ-ᑐᙵᕕᒃ ᐃᓱᒪᒃᓴᖅᓯᐅᕐᓂᖅ ᒐᕙᒪᒃᑯᓐᓄᑦ ᐃᓱᒪᒃᓴᖅᓯᐅᕐᓂᐊᖅᑎᓪᓗᒋᑦ. ᑲᑎᒫᑦ ᐅᐱᐳᓯᒃᑐᑦ ᖃᐅᔨᔭᐅᓯᒪᔪᑦ ᐊᒻᒪᓗ ᐅᖃᐅᔾᔪᖅᑕᐅᖖᒍᐊᖅᓯᒪᔪᑦ ᐊᑐᖅᑕᐅᔪᓐᓇᖅᑐᑦ ᓇᓗᓇᐃᔭᐃᓗᑎᒃ ᒪᓕᒐᓕᕆᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐸᕐᓇᐅᑎᓄᑦ ᐃᓱᒪᒃᓴᖅᓯᐅᕐᓂᕐᒧᑦ ᓄᓇᕗᒻᒧᑦ ᐊᒻᒪᓗ ᑲᓇᑕᐅᑉ ᐅᑭᐅᖅᑕᖅᑐᖕᒐᓄᑦ ᓯᕗᓗᐊᕐᓂᐊᖅᑎᓪᓗᒋᑦ.

ᑐᕌᒋᔭᐅᔪᑦ ᐱᓕᕆᐊᖑᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ ᑐᑭᓯᐊᒃᑲᓐᓂᕐᓂᐊᕐᓗᑎᒃ ᑕᐃᒪᐅᔪᓐᓇᖅᑐᑦ ᐊᔾᔨᒌᙱᑦᑐᑦ ᐅᖅᓱᐊᓗᐃᑦ ᐊᒻᒪᓗ ᐅᖅᓱᓄᑦ ᐱᕙᓪᓕᐊᔪᑦ ᑐᒃᓯᕋᖅᑕᐅᔪᓐᓇᖅᑐᑦ ᕿᑭᖅᑖᓗᒃ ᐊᑯᑭᑦᑐᓪᓗ ᐃᑭᖕᒐᓂ ᐊᒻᒪᓗ ᓴᓐᓂᕈᑎᐅᑉ ᐃᒪᖕᒐᓂ ᐊᒻᒪᓗ ᐊᑦᑕᕐᓇᑐᐃᓐᓇᓕᐊᕐᑲᖅᑐᑦ, ᐃᑲᔫᓯᐊᑦ, ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᓄᑦ ᐃᓚᕐᑲᖅᑐᑦ ᐱᕙᓪᓕᐊᔪᓄᑦ. ᐱᓕᕆᐊᖑᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ ᐅᓂᒃᑳᓴᓕᐊᑦ ᓇᓗᓇᐃᔭᐃᓯᒪᔪᑦ ᖃᓄᐃᓕᐅᖅᑕᐅᓯᒪᔪᑦ ᐱᕙᓪᓕᐊᔪᓄᑦ ᐃᓱᒪᒃᓴᖅᓯᐅᕈᑕᐅᔪᑦ ᖃᐅᔨᓴᖅᑕᐅᓯᒪᔪᑦ ᑐᑭᓯᐊᒃᑲᓐᓂᕐᓂᐊᕐᓗᑎᒃ ᐱᓕᕆᐊᕆᔭᐅᔪᑦ ᖃᓄᐃᓐᓇᔭᕐᒪᖔᑕ, ᓇᓗᓇᐃᔭᕆᐊᕐᓗᑎᑦ ᐊᑲᐅᙱᑦᑐᐃᕈᑕᐅᔪᑦ ᑐᑭᓯᐊᔾᔭᑎᓭᓄᑦ, ᐊᐱᖅᑰᑎᓄᑦ ᐊᒻᒪᓗ ᐃᓱᒪᒋᔭᐅᔪᑦ ᑭᒃᑯᑐᐃᓐᓇᓄᑦ, ᐊᒻᒪᓗ ᐊᐅᓚᕝᕕᓪᓕᐊᓗᑎᒃ ᐅᖃᐅᔾᔫᑎᖅᑕᐅᔪᒃᑯᑦ ᓯᕗᒧᐊᖅᐸᓪᓕᐊᓗᑎᒃ. ᓇᐃᓈᖅᓯᒪᔪᑦ ᐅᓂᒃᑳᓕᐊᑦ ᓇᓗᓇᐃᔭᕐᑎᐊᖅᓯᒪᔪᑦ ᖃᐅᔨᓴᖅᑕᐅᓯᒪᔪᑦ ᐊᑐᐃᓐᓇᐅᔪᑦ ᐅᖃᓘᕐᓂᕐᒧᑦ ᐊᒻᒪᓗ ᑭᒃᑯᑐᐃᓐᓇᓄᑦ ᑲᑎᕙᓪᓕᐊᔾᔪᑕᐅᓗᑎᒃ ᐊᑐᖅᑕᐅᓯᒪᔪᑦ ᖃᐅᔨᓴᖅᑎᓪᓗᒋᑦ, ᐊᒻᒪᓗ ᖃᓄᐃᓕᐅᖅᓯᒪᓂᕐᒋᑦ ᖃᐅᔨᓴᖅᑕᐅᓯᒪᔪᓄᑦ ᑕᐃᒪᐅᑐᐃᓐᓇᓕᐊᕐᑲᖅᑐᑦ ᐱᕙᓪᓕᐊᔪᓄᑦ ᐅᖅᓱᐊᓗᓐᓄᑦ ᐊᒻᒪᓗ ᐅᖅᓱᓄᑦ. ᐱᓪᓚᕆᐅᔪᖅ, ᐅᓂᒃᑳᓴᓕᐊᖅ ᐃᓚᖅᑲᖅᑐᑦ ᓇᓗᓇᐃᒃᑯᑕᔭᐅᔪᓂᑦ ᑎᑎᕋᖅᑕᐅᓯᒪᔪᓄᑦ ᐊᒻᒪᓗ ᖃᐅᔨᒪᓂᒃᑯᑦ ᐊᒻᒪᓗ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖃᖏᑦ ᓇᓗᓇᐃᔭᖅᓯᒪᔪᑦ ᐊᒻᒪᓗ ᐱᕋᔅᓕᕆᑕᐅᔪᑦ ᐱᓕᕆᐊᖑᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ, ᐊᐅᓚᑦᑎᓂᖅ ᑲᑎᒪᔾᔪᑎᒥᒃ ᐃᓱᒪᒃᓴᖅᓯᐅᕈᑎᕆᔭᕆᐊᖃᕐᓂᖅ ᐊᒻᒪᓗ 79 ᐅᖃᐅᔾᔪᖅᑕᐅᓂᖅ ᓯᕗᓗᐊᕐᓂᕐᒧᑦ, ᐋᖅᑭᒃᓯᓗᑎᒃ ᓇᐃᓈᖅᓯᒪᔪᑦ ᐅᓂᒃᑳᓴᓕᐊᓂ ᐃᓚᖓ 1 ᐊᒻᒪᓗ ᐅᖃᓪᓚᒃᑲᓴᐅᔪᑦ ᓇᓗᓇᐃᔭᑦᑎᐊᖅᓯᒪᓪᓗᑎᒃ ᐊᑲᐅᓈᖅᑐᒃᑯᑦ ᐅᓂᒃᑳᓴᓕᐊᓂ.

ᐱᓕᕆᐊᖑᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ ᐃᑲᔪᖅᑎᕆᓂᖓᓐᓂᒃ ᐱᓕᕆᐊᕆᔭᐅᓯᒪᔪᑦ ᐱᔪᓐᓇᓚᐅᙱᑦᑐᑦ ᐱᓪᓚᕆᐅᔭᒃᑯᑦ ᐊᒻᒪᓗ ᑲᔪᓯᓂᒃᑯᑦ ᐃᑲᔪᖅᑎᕆᓂᖏᓐᓄᑦ ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᕐᒋᑦ, ᓄᓇᕗᑦ ᑐᙵᕕᒃ, ᕿᑭᖅᑖᓂ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᑦ, ᒐᕙᒪᑦ ᓄᓇᕗᑦ, ᑯᐃᓐ ᒧᑦ–ᓄᓇᖅᑲᖅᑳᖅᓯᒪᔪᓕᕆᔨᒃᑯᑦ ᐊᒻᒪᓗ ᐅᑭᐅᖅᑕᖅᑐᓕᕆᔨᒃᑯᑦ ᑲᓇᑕᒥ (ᑲᑎᒫᑦ ᐱᓕᕆᐊᖑᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ ᐃᖅᑲᓇᐃᔭᖅᑎᖏᑦ) ᓄᓇᒥ ᓵᖓᑎᒃ, ᖃᓄᐃᓕᐅᖅᑯᔨᔪᑦ, ᐊᒻᒪᓗ ᐊᒥᓱᑦ ᓄᓇᒥᐅᑕᓂᑦ ᖁᓕᓂᙳᐊᖅᑐᑦ ᓄᓇᖕᓂᑦ ᐅᓂᖁᖕᒐ ᐊᐅᓯᐃᑦᑐᖅ, ᖃᐅᓯᐃᑦᑐᖅ, ᐃᒃᐱᐊᕐᔪᒃ, ᒥᑦᑎᒪᑕᓕᒃ, ᑲᖏᖅᖢᒐᐱᒃ, ᕿᑭᖅᑕᕐᔪᐊᖅ, ᐸᓐᓂᖅᑑᖅ, ᐃᖃᓗᐃᑦ, ᑭᙵᐃᑦ ᐊᒻᒪᓗ ᑭᒻᒥᕈᑦ. ᐊᒃᓱᕈᕐᓇᖅᑲᐃᓐᓇᖅᑕᖅᓯᒪᓗᐊᖅᑎᓪᓗᒍ ᐱᕙᓪᓕᐊᓯᒪᔪᑦ ᐃᓱᓕᑦᑎᑎᕆᔭᐅᔪᓄᑦ, ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᕐᒋᑦ ᐅᐱᒍᓱᒃᑐᑦ ᐃᓕᑕᐅᓯᒪᔪᑦ ᑖᔅᓱᒥᖓ ᖃᐅᔨᓴᖅᑎᓪᓗᒋᑦ ᓴᖅᑭᑎᑕᐅᔪᑦ ᐱᓪᓚᕆᐅᔪᑦ ᑐᙵᕕᒋᓪᓗᒍ ᓯᕗᓂᒧᑦ ᐸᕐᓇᐅᑕᐅᔪᓄᑦ ᓄᓇᕗᒻᒥ ᐊᒻᒪᓗ ᑲᓇᑕᐅᑉ ᐅᑭᐅᖅᑕᖅᑐᖕᒐᓂ ᐊᓯᖏᓐᓄᑦ ᐱᕙᓪᓕᐊᑕᐅᔪᓄᑦ.

ᐱᑐᐊᕐᑐᒍ, ᑲᑎᒪᔩᑦ ᐃᓕᑕᖅᓯᒪᔪᑦ ᑖᔅᓱᒪ ᖃᐅᔨᓴᖅᑕᐅᓂᖏᓐᓄᑦ ᐱᒻᒪᕆᐅᔪᒃᑯᑦ ᐱᕚᓪᓕᕈᑕᐅᓯᒪᔪᑦ ᐃᑉᐱᕆᑦᑎᐊᕐᓂᒃᑯᑦ ᐊᒻᒪᓗ ᐃᓄᖕᓄᑦ ᖃᐅᔨᒪᔾᔪᓄᑦ ᕿᑭᖅᑖᓂ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᖏᑦ ᑲᒪᑐᑎᒃ ᑲᑎᖅᓱᐃᓂᕐᒧᑦ ᐅᖃᐅᓯᕆᔭᐅᔪᓂᒃ ᓄᓇᓕᓐᓂ ᐊᒻᒪᓗ ᓇᑐᓇᐃᔭᐃᑐᑎᒃ ᐊᑲᐅᓈᖅᑐᒃᑯᑦ ᖃᓄᐃᓕᐅᖅᑕᐅᓂᕐᒧᑦ. ᑲᑎᒪᔩᑦ ᖁᔭᓐᓇᒦᖅᑐᑦ ᑕᐃᒃᑯᓄᖓ ᐃᑲᔪᖅᑐᓄᑦ, ᖃᐅᔨᒪᓂᖏᓐᓄᑦ, ᐃᓕᓯᒪᓂᖏᓐᓄᑦ, ᐅᓂᒃᑳᖏᓐᓄᑦ, ᐊᒻᒪᓗ ᐃᓱᒪᒃᓴᖅᓯᐅᕈᑕᐅᔪᓄᑦ; ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏᑦ ᓇᑐᓇᐃᔭᖅᓯᒪᔪᑦ ᐊᒥᓱᑦ ᐃᓚᒋᔭᐅᔪᑦ ᑲᑎᒪᑎᓪᓗᒋᑦ, ᐊᖏᓂᖏᓐᓄᑦ, ᐊᒻᒪᓗ ᑮᓇᐅᔭᓕᕆᓂᕐᒧᑦ ᑭᒡᓕᖅᑲᕐᓂᕐᒧᑦ ᐱᕚᓪᓕᕈᑕᐅᓯᒪᔪᑦ ᐃᑲᔪᖅᑎᒌᓐᓂᕐᒧᑦ ᐱᓕᕆᔾᔪᑎᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ ᐱᕙᓪᓕᐊᔪᓄᑦ, ᑲᑎᒪᔩᑦ ᖁᔭᓕᓯᒪᔪᑦ ᐃᑲᔪᕈᓐᓇᖅᑐᓄᑦ ᐊᒻᒪᓗ ᐃᓅᓯᕐᒥᓂ ᑐᓂᓯᓪᓗᑎᒃ ᑕᐃᒃᑯᓄᖓ ᐃᓚᒋᔭᐅᔪᒪᔪᓄᑦ.

ᑲᑎᒪᔩᑦ ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏᑦ ᖁᔭᓐᓇᒦᕈᒪᔪᑦ ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏᑦ ᐃᖅᑲᓇᐃᔭᖅᑎᖏᓐᓄᑦ ᐃᖅᑲᓱᐃᔭᒥᑎᒍᑦ ᐊᒻᒪᓗ ᐱᓕᕆᐊᕆᔭᒥᓄᑦ ᒪᕐᕉᒃ ᐅᑭᐅᒃ ᐅᖓᑖᓂ ᓴᖅᑭᑦᑎᓗᑎᒃ ᐱᓕᕆᔾᔪᑎᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ. ᐱᑐᐊᕐᑐᒍ, ᑲᑎᒪᔩᑦ ᐃᓕᑕᖅᓯᒪᔪᑦ ᐱᓕᕆᔾᔪᑎᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ ᐃᑲᔫᓯᐊᕐᑲᕐᒪᑕ ᐱᒻᒪᕆᐅᔪᒃᑯᑦ ᐱᔪᒪᔪᓄᑦ ᐊᒻᒪᓗ ᐱᔪᒪᖏᑎᒍᑦ HᐃᐊC ᕌᔅᒥᐅᓴᖓᑦ, ᑲᑎᒪᔩᑦ ᐃᑲᔪᕐᓂᖏᓐᓄᑦ ᐱᓕᕆᐊᕆᔭᐅᑎᓪᓗᒋᑦ. ᖁᔭᓐᓇᒦᒃ, HᐃᐊC ᐊᒥᓱᓄᑦ ᐃᑲᕐᕋᓄᑦ ᐱᓕᕆᐊᕆᔭᕐᓄᑦ ᐊᐅᓚᓗᒍ ᑖᔅᓱᒪ ᐱᓕᕆᐊᕆᔭᐅᔪᓄᑦ ᐊᒻᒪᓗ ᓇᑐᓇᐃᔭᐃᓪᓗᑎᑦ ᑲᑎᒪᔩᑦ ᑐᓴᖅᓯᒪᓂᐊᕐᓂᖏᑕ ᐃᓱᒪᒃᓴᖅᓯᐅᕈᑕᐅᔪᓄᑦ ᐊᒻᒪᓗ ᓂᐱᓂᒃ ᑐᓴᖅᑕᐅᔭᕆᐊᖅᑲᖅᑐᑦ ᐃᑲᔫᑕᐅᓗᑎᒃ ᐃᓱᒪᒃᓴᖅᓯᐅᕐᓂᕐᒧᑦ ᐱᓕᕆᔾᔪᑎᓄᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥ.

ᓱᓕᓪᓗᖓ,

ᑲᕕᖅ ᑲᓗᕋᖅ
ᐃᒃᓯᕙᐅᑕᙳᓚᐅᑲᖅᑐᖅ
ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏᑦ

# AVANT-PROPOS DE LA PRÉSIDENTE

La Commission du Nunavut chargée de l'examen des répercussions (la CNER ou la Commission) est un organisme gouvernemental public et indépendant créé en vertu de l'*Accord du Nunavut*. Elle possède une vaste expérience en matière d'évaluation environnementale dans la région du Nunavut. L'évaluation environnementale stratégique (l'EES) des possibilités d'exploitation pétrolière et gazière dans la baie de Baffin et le détroit de Davis a été coordonnée par la CNER à la suite d'une recommandation du ministre des Affaires du Nord. Le processus a été amorcé en février 2017 et s'est terminé avec la dernière assemblée publique ayant eu lieu en mars 2019 et la publication du rapport définitif de l'EES en juillet 2019.

En ce moment, il y a un moratoire ou une interdiction d'exploration pétrolière et gazière dans les eaux de l'Arctique canadien. Ce moratoire a été imposé par le gouvernement du Canada en décembre 2016 pour une période de cinq (5) ans. Cette décision fera l'objet d'une révision par le gouvernement du Canada en 2021. Grâce aux observations et aux recommandations de la CNER découlant de l'EES, le gouvernement pourra prendre cette décision à la lumière de la perspective du Nunavut. Selon la Commission, ces observations et recommandations serviront également à éclairer d'autres initiatives de planification et politiques futures concernant le Nunavut et l'Arctique canadien.

L'EES avait pour but de mieux comprendre les types d'activités pétrolières et gazières pouvant être proposés pour la baie de Baffin et le détroit de Davis, de même que les retombées, les stratégies de gestion et les risques éventuels se rapportant à ces activités. Le rapport définitif de l'EES présente les scénarios d'exploitation hypothétiques qui ont été examinés dans le but de mieux comprendre à quoi ces activités pourraient ressembler, de déterminer les lacunes qui existent sur le plan de l'information, de répondre aux questions du public et de mesurer ses inquiétudes, puis d'aboutir à des recommandations. L'analyse approfondie de la documentation disponible et les résultats de la mobilisation du public à grande échelle qui ont eu lieu dans le cadre de cette évaluation, de même que les résultats de l'analyse des effets potentiels des activités pétrolières et gazières possibles, sont résumés dans le rapport. Fait important, le rapport comprend également de nombreuses références à la documentation de base utilisée de même qu'aux connaissances et aux Inuit Qaujimajatuqangit qui ont éclairé et enrichi l'EES et permis d'aboutir à la conclusion centrale de la Commission ainsi qu'aux 79 recommandations, celles-ci étant résumées au chapitre 1 et abordées en détail dans le reste du rapport.

L'EES est le fruit d'un effort collectif qui n'aurait pu se concrétiser sans l'apport considérable et constant de la CNER, de Nunavut Tunngavik Incorporated, de la Qikiqtani Inuit Association, du gouvernement du Nunavut, de Relations Couronne-Autochtones et Affaires du Nord Canada (collectivement le « groupe de travail de l'EES »), de Nunami Stantec, de divers intervenants et de nombreux membres des dix collectivités concernées, soit Grise Fiord, Resolute Bay, Arctic Bay, Pond Inlet, Clyde River, Qikiqtarjuaq, Pangnirtung, Iqaluit, Cape Dorset et Kimmirut. Bien que le processus se soit avéré difficile pour toutes les personnes concernées par moments, la CNER estime que les leçons apprises dans le cadre de cette évaluation serviront de fondement important aux évaluations stratégiques susceptibles d'être menées à bien au Nunavut et dans l'Arctique canadien pour d'autres types de projets d'exploitation à l'avenir.

Par ailleurs, la Commission est d'avis que cette évaluation a permis de réaliser d'importants progrès sur le plan du respect et du traitement des connaissances et des expériences des Inuit. La CNER tient à souligner les efforts remarquables déployés par la Qikiqtani Inuit Association en matière de coordination de collecte de données auprès des collectivités ainsi que de conseils pour le traitement adéquat des données. La Commission tient à remercier toutes les personnes et tous les organismes qui ont généreusement fait don de leur temps, de leurs connaissances, de leurs expériences, de leurs histoires et de leurs perspectives. La CNER sait que de nombreux participants ont fait face à des contraintes sur le plan du temps, des capacités et des finances, contraintes qui les ont empêchés de se vouer entièrement au processus de l'EES. Néanmoins, elle est reconnaissante pour les contributions et les sacrifices faits par toutes les personnes qui ont prêté main-forte.

Les membres du conseil d'administration de la CNER remercient le personnel de la CNER pour son professionnalisme et son dur labeur au cours des deux dernières années et plus dans le but de mener l'EES à bien. En particulier, la Commission reconnaît que l'EES a considérablement bénéficié du dévouement et de l'engagement d'Heather Rasmussen, qui a su bien guider la Commission pendant toute la durée de l'évaluation. Heather, nous vous remercions pour les heures innombrables que vous avez consacrées à la direction de cette tâche et pour avoir permis à la Commission d'être à l'écoute d'un éventail de perspectives et d'opinions venant étayer les décisions prises dans le cadre de l'EES.

Cordialement,

Kaviq Kaluraq
Présidente intérimaire
Commission du Nunavut chargée de l'examen des répercussions

# KEY TERMS

For the purposes of the NIRB's SEA Final Report, the Board uses the following key terms in accordance with the definitions that follow:

| | |
|---|---|
| **Ballast Water** | water carried in special tanks in a ship to improve stability and balance of the vessel. |
| **Bathymetry** | the study of water depth: the distance of the seabed from the water surface. |
| **Benthic flora and fauna** | plants and animals on the seabed. |
| **Bilge Water** | wastewater that collects inside the hull of a ship. |
| **Blowout Preventer** | large piece of equipment that sits on top of the well with a valve that can be closed to prevent an uncontrolled release of oil or gas. |
| **Climate Change** | changes to weather conditions and climate that may be caused by human activities. |
| **Cumulative Impacts** | combined environmental impacts from past, present, and future projects and activities in an area. |
| **Delineation Drilling** | used to determine whether an oil or gas resource (reservoir) is there and how deep it is. |
| **Effect** | a change to a valued component of the environment from an activity. |
| **Exploration Drilling** | used to determine how wide the oil or gas resource (reservoir) is. |
| **Fouling** | accumulation of oil on equipment such as fishing gear of vessels. |
| **Fracture gradient** | the amount of pressure needed to generate fractures in a rock at a given depth. |
| **Gas Hydrate** | a solid ice-like form of water that contains gas inside its cavities. The gas is mostly methane and can form in pipelines and pose problems, so a substance is used to slow down or prevent gas-hydrates from forming. |
| **Global Warming** | the warming of the Earth from the release of greenhouse gases, such as carbon dioxide, into the air from human activities. |
| **Greenhouse Gas** | a gas that contributes to the warming of the Earth, for example, carbon dioxide. |
| **Hydrocarbon** | oil and/or gas. |
| **Iceberg** | a large piece of freshwater ice that has broken off a glacier and is floating freely in open water. |
| **Impact** | negative or positive influence from an activity and the environment. |
| **Invasive Species** | animals and plants that are not naturally found in the area and have been brought from somewhere else. |

| | |
|---|---|
| **Inuit Qaujimajatuqangit** | a morality that is the base for Inuit existence. It is the belief system at the core of Inuit identity and governs Inuit society. |
| **Inuit Qaujimaningit** | what Inuit know and a collective knowledge that is more recent in nature. It can be related to Inuit Qaujimajatuqangit that has evolved or changed in recent times. |
| **Mitigation** | a plan or an action taken to avoid or reduce a negative effect. |
| **Oil and Gas Field** | a location in the seabed where oil and gas quantities are large enough to support oil and gas production. |
| **Plankton** | small (microscopic) plants and animals living in marine water; are a source of food for other animals (for example, fish). |
| **Polynya** | open water surrounded by ice. |
| **Pore pressure** | the pressure of fluids within the pores of a reservoir. |
| **Reservoir** | a subsurface pool of oil or gas resource. |
| **Sediment** | a layer of sand particles on the seabed. |
| **Seismic Activity** | earthquakes and resulting tsunamis. |
| **Seismic Survey** | the use of sound generating devices to assist in locating oil and gas fields in the seabed. |
| **Transboundary Effects** | environmental impacts that can spread across other territories, provinces, or countries. |
| **Turbot** | commonly used in the communities to refer to Greenland halibut. |
| **Wareship** | anchored vessel for offshore storage to: carry fuel, drilling materials and other supplies; store and ship waste products; provide maintenance and repair operations, and support helicopter, well control, and oil spill response operations |
| **Wellbore** | hole drilled in explore and recover oil and gas resources. |
| **Worst-case scenario** | refers to the worst possible type of accident with the most negative effects that could potentially occur associated with a development, used for planning and preparing for required responses and prevention |

# ACRONYMS AND ABBREVIATIONS

| ACRONYM | DEFINITION |
|---|---|
| **AFA** | Arctic Fishery Alliance LP |
| **AMAP** | Arctic Monitoring and Assessment Programme |
| **BF** | Baffin Fisheries |
| **BOP** | Blowout preventer |
| **CAAQS** | Canadian Ambient Air Quality Standards |
| **CAPP** | Canadian Association of Petroleum Producers |
| **CCG** | Canadian Coast Guard |
| **CDD** | Commercial Discovery Declaration |
| **CIRNAC** | Crown-Indigenous Relations and Northern Affairs Canada |
| **CNG** | Compressed Natural Gas |
| **COGOA** | Canada Oil and Gas Operations Act |
| **CPRA** | Canada Petroleum Resources Act |
| **dBA** | Decibel |
| **DFO** | Fisheries and Oceans Canada |
| **EAMRA** | Environment Agency for Mineral Resources Activities |
| **EBSA** | Ecologically and Biologically Significant Area |
| **ECCC** | Environment and Climate Change Canada |
| **EL** | Exploration Licence |
| **FEED** | Front end engineering and development |
| **FLNG** | Floating Liquefied Natural Gas vessel |
| **FPSO** | Floating Production Storage and Offloading vessel |
| **GHG** | Greenhouse gas |
| **GN** | Government of Nunavut |
| **Hz** | Hertz |
| **HTA** | Hunters and Trappers Association |
| **HTO** | Hunters and Trappers Organization |
| **IBA** | Important Bird Areas |
| **INAC** | Indigenous and Northern Affairs Canada |
| **IPCC** | Intergovernmental Panel for Climate Change |
| **IUCN** | International Union for the Conservation of Nature |
| **km** | Kilometre |
| **LNG** | Liquefied Natural Gas |
| **M** | Magnitude (Richter scale) |
| **m** | Metre |
| **MBS** | Migratory Bird Sanctuary |
| **NADF** | Non-aqueous drilling fluids |
| **NEB** | National Energy Board |
| **NWA** | National Wildlife Area |
| **NFA** | Nunavut Fisheries Association |
| **NIRB** | Nunavut Impact Review Board |
| **NMCA** | National Marine Conservation Area |
| **NOx** | Nitrogen Oxides |
| **NRCan** | Natural Resources Canada |
| **NTI** | Nunavut Tunngavik Incorporated |
| **NWA** | National Wildlife Area |
| **NWMB** | Nunavut Wildlife Management Board |
| **PC** | Parks Canada |
| **PL** | Production Licence |
| **$PM_{2.5}$** | Particulate Matter |
| **QC** | Qikiqtaaluk Corporation |
| **QIA** | Qikiqtani Inuit Association |

| | |
|---|---|
| **QWB** | Qikiqtaaluk Wildlife Board |
| **RCP** | Representative Concentration Pathways |
| **SARA** | *Species at Risk Act* |
| **SBA** | Significant Benthic Areas |
| **SDL** | Significant Discovery Licence |
| **SEA** | Strategic Environmental Assessment |
| **SSRW** | Same Season Relief Well |
| **TC** | Transport Canada |
| **TCF** | Trillion cubic feet |
| **USD** | United States Dollars |
| **VEC** | Valued Ecosystem Component |
| **VOC** | Volatile Organic Compounds |
| **VSEC** | Valued Socio-Economic Component |
| **VSP** | Vertical seismic profiling |
| **WBDF** | Water-based drilling fluids |
| **WWF** | World Wildlife Fund |
| **2D** | Two dimensional |
| **3D** | Three dimensiona |

# REPORT MAP


## Volume 1: SEA Summary Report




## Volume 2: Background Information




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# CHAPTER 6: POSSIBLE DEVELOPMENT SCENARIOS IN BAFFIN BAY/DAVIS STRAIT

The following is a summary based on the *Oil and Gas Life Cycle Activities and Hypothetical Scenarios Report* (Nunami Stantec, 2018b). Please see Section 9: Hypothetical Oil and Gas Scenarios of this *Report* for additional information.

The descriptions included in this section of possible oil and gas development in Baffin Bay and Davis Strait are not tied to any specific company and do not predict that oil and gas development may happen in the Arctic in the future. These descriptions are meant to be general in nature and any details such as the depth of drilling, area to be surveyed, or number of people to be employed would be available during project level assessment and regulatory phases, should oil and gas be allowed to proceed. Nunami Stantec considered the following when developing the scenarios: approximate timelines, activities, financial feasibility, domestic policy and regulations, geological interest in the region, and climate.

The scenarios outlined below are not associated with any specific location and are meant to represent activities, components, and infrastructure based on the current technology at the time of the report. The scenarios apply throughout the Canadian waters of Baffin Bay and Davis Strait, outside of the Nunavut Settlement Area and the Tallurutiup Imanga (Lancaster Sound) National Marine Conservation Area. As outlined in the previous sections of this report, the sedimentary basin underlying the region is predominantly unexplored to date; however, existing data suggests that the highest geological potential at the time of the report lies within southern Davis Strait. Therefore, Nunami Stantec assumed that oil and gas exploration and development would most likely be focused in southern Davis Bay. However, it was noted that the activities and infrastructure described within the hypothetical scenarios would be similar throughout the Development Scenario Area.

An individual project would not necessarily advance through each of these scenarios. For example, even if a company received the rights to conduct seismic surveys, this does not guarantee it would conduct exploration drilling. This could be for multiple reasons, including: not enough oil and gas resources were identified; not economically feasible to continue; or no licence was granted.

The scenarios were developed with the assumption that the scenarios and the SEA should be adjusted as new information becomes available.

## 6.1. SCENARIO A: EXPLORATION WITH OFFSHORE SEISMIC SURVEYS

### 6.1.1 *Description*

As there is limited data on the hydrocarbon potential in the Development Scenario Area, additional seismic surveys would be required to determine the potential for hydrocarbons by identifying potential geological structures that could contain oil and gas. This information would need to be collected before companies could consider undertaking exploration activities and potentially developing the area. Two dimensional (2D) marine seismic surveys would initially be conducted to gain a general understanding of the regional geological structure. The survey would cover a large area and seismic lines would be spaced several kilometers apart. This would be conducted during open water season and could take 1-3 years to complete. Once a company secured an exploration licence, it could then conduct three dimensional (3D) marine seismic surveys to collect additional information on known geological targets. This would be conducted during the open water season and would be completed within one (1) season and seismic lines would be spaced 200-400 m apart.

### 6.1.2 *Equipment and Infrastructure*

For both 2D and 3D seismic surveys, one (1) seismic vessel and one (1) or two (2) ice capable support vessels would be required (Figure 30: 3D Seismic Survey, Offshore China and Figure 31: Support Vessels Assisting Seismic Survey in West Greenland). Support vessels would be used to provide supplies for the seismic vessel. Support vessels would also travel in front of a seismic vessel when surveying to warn other vessels of the activity. Requirements for onshore support, such as a base for crew transfer, would be limited. Helicopter support would be limited and likely provided from Nuuk, Greenland or Newfoundland and Labrador where appropriate infrastructure is already in place. Crew transfers could be based from the Iqaluit airport or any of the communities in the region if feasible and closer to the survey location.

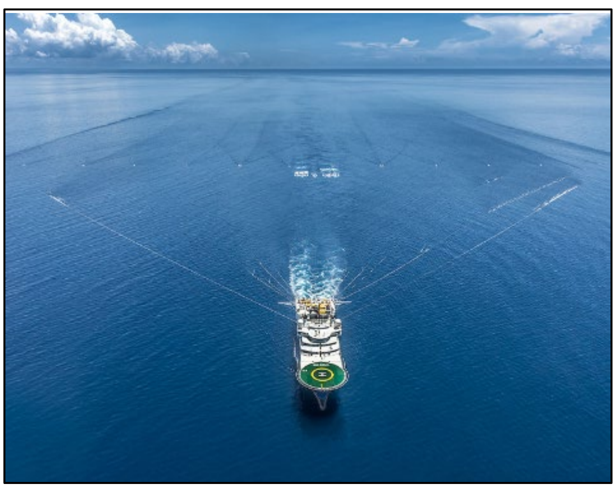


**Figure 30: 3D Seismic Survey, Offshore China (Source: Empyrean Energy, n.d., as cited in Nunami Stantec, 2018b)**


**Figure 31: Support Vessels Assisting Seismic Survey in West Greenland (Source: Cairn Energy, n.d., as cited in Nunami Stantec, 2018b)**

### 6.1.3 *Financial and Human Resources*

The cost to complete both a 2D survey and a 3D survey could range from approximately USD $7 million to $18.5 million.

A seismic survey needs fully trained and experienced workers and typically the contracted vessels come fully staffed with very little onshore support needed. Local employment opportunities in the Area of Focus might include 6–10 seasonal positions as Marine Wildlife Observers on board seismic vessels to implement and monitor mitigation commitments. There could also be indirect employment opportunities associated with supplies and services from local sources.

### 6.1.4 *Timelines*

<u>Exploration to Development (Scenarios A and B): Approximately 15-20 years from an EL to SDL</u>
Additional data would likely first be acquired through two dimensional (2D) seismic surveying to obtain additional and higher quality data and to gain a general understanding of the seabed geology and associated oil and gas potential in Baffin Bay and Davis Strait. The seasons for undertaking a seismic survey would last for approximately four (4) months (June to September).

A company may request a call-for-nominations or the federal government may initiate a call-for-bids for a selected area. This process typically takes approximately one (1) year and can lead to a decision by Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) to issue an Exploration Licence (EL), with conditions. Once an EL is issued, more detailed three dimensional (3D) seismic surveying, seabed surveys, and exploratory drilling could then be undertaken to gain a better understanding of the hydrocarbon potential of a selected area. Additional requirements include, but are not limited to:

- Planning;
- Community consultation;
- Contracting a seismic vessel and geophysical company;
- Securing a Geophysical Operations Authorization from the National Energy Board (NEB);
- Conduction the field seismic program; and
- Processing and interpreting the data.

It could take 3-4 years for a company to identify a preferred drilling location. Once a company has made a discovery of oil and gas that they would like to recover, they can apply for a Significant Discovery Licence (SDL) from the NEB. The duration for an EL is currently nine (9) years, and it can take approximately 15-20 years from the time an EL is issued to when a SDL is issued. Project specific timelines can vary widely. Typical timelines associated with specific activities would include, but are not limited to:

- Conduct 3D marine seismic surveys (including hiring a geophysical company and seismic vessel, undertake public consultation, secure authorizations, conduct seismic surveys, and analyze and interpret date);

- Undertake geohazard surveys to analyze the seabed for hazards before drilling occurs, secure authorizations, and interpret data;
- Undertake drilling activities, analyze results, abandonment and cleanup, and
- Obtain authorizations related to a SDL.

### 6.1.5 *Potential Accidents and Malfunctions*

Potential accidents and malfunctions associated with offshore seismic surveys include:

- Fire and explosions
- Loss of life (falling off the vessel)
- Downed aircraft (helicopter)
- Vessel collisions
- Major weather and sea ice conditions
- Vessel strike with marine mammals
- Batch spill

Nunami Stantec noted that accidents and malfunctions during seismic surveys are not common due to the slow speeds that seismic vessels travel as well as international safety standards that the vessels must follow. It was further noted that as the Area of Focus is not heavily used commercially (e.g., commercial fishing, tourism, commercial shipping, etc.), the likelihood for interactions that could lead to accidents or malfunctions is further reduced.

## 6.2. SCENARIO B: EXPLORATION DRILLING

### 6.2.1 *Description*

If the 3D seismic survey identifies promising hydrocarbon potential within the lease area and the lease holder decides that it is economically feasible to continue exploration, the next step would be to drill into the reservoir to a certain distance below the seabed to confirm the presence and type of hydrocarbon and the vertical extent of the reservoir. Delineation drilling would be conducted to determine the horizontal extent of the field. Based on timelines to drill wells in offshore Newfoundland at the time of this report, it was assumed that a well would be drilled in 35-65 days. While exploration drilling could be conducted year-round it is expected to occur during the open water seasons. Year-round drilling would require ice management, drilling waste management, and air emissions management programs that comply with regulatory conditions, mitigation plans and commitments, and follow standard industry best practices.

Exploration drilling would be expected to follow the general process as outlined in Appendix F: Life Cycle of Oil and Gas Development and include the use of geotechnical and geohazard surveys and formation evaluation. Assumptions for this scenario included:

- Flow testing would not be required;
- Drilling activities would be suspended at the end of each drilling season and secured until the next season commences; and

- Wells would be plugged and abandoned in accordance with NEB regulations once testing was completed.

### 6.2.2 *Equipment and Infrastructure*

The major components of an Arctic offshore drilling program in the Development Scenario Area would be expected to include:

- Arctic class drillship or semi-submersible (see Table 12: Two types of drilling platforms that could be used for exploration drilling in Baffin Bay and Davis Strait);
- 1–2 icebreaker support vessels;
- 1–2 ice strengthened wareships for offshore storage;[1]
- 2–3 ice strengthened supply vessels;
- 1–5 ice strengthened fuel tankers;
- Helicopters and aircraft; and
- Onshore storage facilities in coastal communities for emergency equipment.

**Table 15: Two types of drilling platforms that could be used for exploration drilling in Baffin Bay and Davis Strait**

| Drillship | Semi-submersibles |
|---|---|
| Operates in water depths ranging from 600-3,000 metres (m) and drilling depths of more than 12,000 m below the seabed. | Operational at water depths of 500–3,000 m. |
| Can be over 200 m long and more than 40 m wide. | Can be 120 by 120 m and stand 40-50 m high when partially submerged. |
| Fully mobile. | While in transit, towed by tugboats to a location and then partially lowered by filling the legs with water to provide stability. |
| Can be agitated by wind, waves, and currents. This can be a challenge when drilling because the vessel is connected to equipment that can be thousands of metres under the sea. | Often chosen for harsh conditions because of their ability to withstand rough waters. |
| **Both Drillships and Semi-submersibles** | |
| Drilling equipment is passed through the vessel's opening by a flexible riser pipe that extends from the middle of a drillship to the seabed (called a moonpool). | |
| Anchors and/or computer-controlled dynamic positioning system controlling vessels propellers and thrusters used to keep the rigs position (i.e., station keeping). | |

[1] Wareship: an anchored vessel for offshore storage, if no deep-water port is available, to: carry fuel, drilling materials and other supplies; store and ship waste products; provide maintenance and repair operations, and support helicopter, well control, and oil spill response operations.

| Figure 32: Floating Drillship Designed and Configured for Arctic Drilling (Source: Stena Drilling, n.d., as cited in Nunami Stantec, 2018b) | Figure 33: Semi-submersible Drilling Platform (Source: Husky Oil, n.d., as cited in Nunami Stantec, 2018b) |
|---|---|
|  |  |

Shore-based facilities and services could be provided in Nuuk (Greenland) or St. John's, Newfoundland and Labrador, as there is already established infrastructure that specializes in the offshore oil and gas industry. Facilities could include office space, warehouses, equipment staging sites, storage yards, and storage facilities for emergency equipment. Services could include: communications, land transportation, air transportation, and waste management services for waste materials and used chemicals removed from the drilling platform.

Services and facilities in Iqaluit could be used if available, but Nunami Stantec considered it unlikely that additional infrastructure would be built specifically for offshore oil and gas, unless it was deemed to be more economical or practical than using existing infrastructure in Greenland or Newfoundland. The exception to this would likely be related to storage of emergency equipment at key locations in Nunavut.

**Figure 34: Example of support vessel/icebreaker (credit Janine Beckett, n.d., as cited in Nunami Stantec, 2018b)**

Both drillships and semi-submersibles require certification that the drilling unit is operational and in compliance with regulations.

### 6.2.3 *Financial and Human Resources*

The cost to complete an exploration drilling program could range from $100 to $150 million United States Dollars (USD). The daily costs of renting a drillship can be USD $250,000–$400,000 per day and a drillship can cost USD $500 million or more to build. The daily costs of renting a semi-submersible are usually less than a drillship at approximately USD $200,000–$250,000 per day. Within comments on the *Oil and Gas Hypothetical Scenarios Report,* the National Energy Board noted that rates for specialized drilling units capable of drilling in colder conditions could be significantly higher.

Drilling units usually come fully staffed with experienced workers. Offshore exploration programs employ skilled and unskilled workers including engineers, welders, electricians, cooks, support staff, health and safety specialists, environmental specialists, helicopter pilots, technicians, geologists, and healthcare staff. Local employment opportunities might include full-time positions as environmental monitors on board the drilling platform and support vessel to implement and monitor mitigation commitments. It was noted that with advance training, additional employment opportunities could be available for residents of Nunavut. There could also be indirect employment opportunities associated with supplies and services from local sources.

### 6.2.4 *Timelines*

For general timelines from Exploration to Development, see 6.1.4 Timelines.

### 6.2.5 *Potential Accidents and Malfunctions*

Potential accidents and malfunctions associated with exploration drilling include:

- Fire and explosions
- Loss of life (falling off the vessel)
- Downed aircraft (helicopter)
- Drilling rig loss of integrity

- Vessel collisions
- Major weather and sea ice conditions
- Vessel strike with marine mammals
- Batch spills
- Subsea blowout

## 6.3. Scenario C: Field Development and Production

### 6.3.1 *Description*

If a business decision is made to proceed with developing an oil or gas field, the operator would complete a field development plan and proceed with field development and production drilling after licencing. Although there are several development options, this scenario assumes that the system would be similar to what has recently been used in Norway and would be expected to limit or avoid land-based production infrastructure in the Nunavut Settlement Area and associated transportation pipelines. Alternatively, it is assumed that Floating Production Storage and Offloading (FPSO) for oil production and Floating Liquefied Natural Gas (FLNG) vessels would be used to process, store, and transfer extracted oil and gas to tankers for transport to an export destination.

Production could take place through a subsea system of oil or gas producing wells, water injection wells, and gas injection wells. The number of tankers and their frequency of transit would depend on production rates, storage capacity on the offshore or onshore facility, vessel capacity, and destination locations. A typical large offshore oil production field could require 200,000 deadweight tonnage tankers, or Liquefied Natural Gas tankers, loading every few days. The assumed production life for this scenario is up to 30 years and would take place year-round.

Similar to Exploration Drilling (Scenario B), the program would require:

- an ice management program;
- a drilling waste management program;
- an air emissions management program;
- mitigation measures to reduce or prevent potential impacts;
- commitments; and
- regulatory conditions.

However, unlike the exploration drilling, production would require the use of ice breakers and other support vessels. All facilities on the seabed and wells would be dismantled, removed, and reclaimed, and the wells would be put into a permanent safe state once the production rates became uneconomical. A field could be preserved and re-opened later to extract left-over oil and gas.

### 6.3.2 *Equipment and Infrastructure*

The major components of an Arctic offshore drilling program in Baffin Bay and Davis Strait would be expected to include:

- Arctic class semi-submersible drilling platform and Floating Production Storage and Offloading (FPSO) or Floating Liquefied Natural Gas (FLNG) vessel;
- 1–2 icebreaker support vessels;
- 2–3 ice strengthened supply vessels;
- 1–5 ice strengthened fuel tankers;
- 1–2 ice strengthened wareships;[2] and
- Onshore storage facilities in coastal communities for emergency equipment such as oil spill response equipment and other emergency equipment.

The support infrastructure for development and production is similar to that described for Exploration Drilling (*Scenario B*) and would consist of a permanent fleet of supply and support vessels, icebreakers, and aviation support which could be located in Iqaluit. This scenario assumes that any onshore infrastructure and services required on Baffin Island to support a drilling program would be located in Iqaluit, except for storage facilities for emergency response equipment, which could be located in other communities.

Nunami Stantec identified two (2) different type of production and storage vessels that could be used:

- *Floating Production Storage and Offloading* vessel (FPSO) to lift, process, store, and offload oil and gas. These vessels are essentially tankers with added production and processing equipment and can be used in deeper waters. After processing, the produced oil and gas are stored until it can be offloaded to tankers.
- *Floating Liquefied Natural Gas* vessels (FLNG) are offshore Liquefied Natural Gas facilities designed to enable the development of offshore natural gas resources.

Both types of vessels can be used in deeper waters where structures resting on the seabed cannot be installed. FPSO and FLNG vessels are usually moored (tied down) and permanently secured at a specific location, could be used seasonal or year-round, and could be detached from their anchors in case of extreme weather conditions.

[2] Wareship: an anchored vessel for offshore storage, if no deep-water port is available, to: carry fuel, drilling materials and other supplies; store and ship waste products; provide maintenance and repair operations, and support helicopter, well control, and oil spill response operations.

Figure 35: Schematic of Terra Nova (Source: Suncor, n.d., as cited in Nunami Stantec, 2018b)

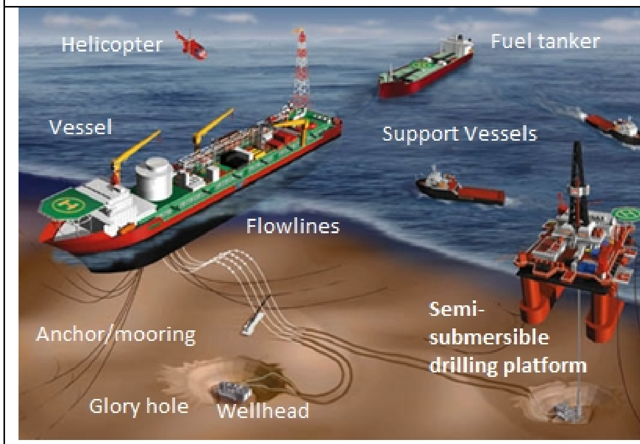



Figure 36: Terra Nova Floating Production, Storage and Offloading (Source: Suncor)

To give an indication of size, the following are details on the equipment and components used for the Terra Nova oil and gas development 350 kilometres (km) southeast of Newfoundland in an area with sea ice and icebergs (Figure 35: Schematic of Terra Nova and Figure 36: Terra Nova Floating Production, Storage and Offloading):

- FPSO vessel is 300 metres (m) long and 45m wide, approximately the size of three (3) football fields laid end to end, and 18 stories high. The Terra Nova FPSO is one of the largest ever built;
- Storage capacity of 960,000 barrels of oil (45 gallons or about 160 litres);
- Accommodations for 120 people;
- Wells pre-drilled by a semi-submersible drilling unit;
- Depressions called glory holes were dug to protect the wellhead equipment from icebergs and pack ice;
- More than 40 km of flexible flowlines are used to bring the hydrocarbons from the wellhead to the vessel;
- Gas produced is re-injected into the resource to support oil production and possible future extraction;
- Crude oil is offloaded from the FPSO onto large shuttle tankers for shipment; and
- FPSO has quick-disconnect feature in the event of an emergency.

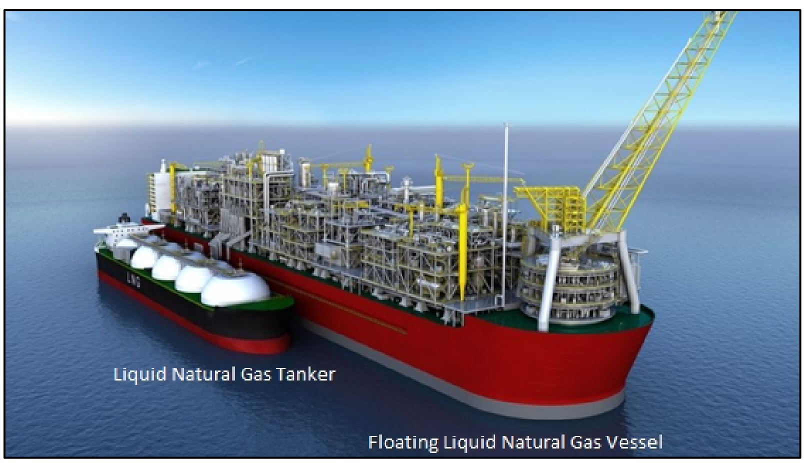
There are currently six (6) FLNG vessels in service around the world, with more in design or under construction. There are currently no FLNG facilities in the Arctic, but research and technology are being developed to expand their use into harsh and cold environments. When using FLNG, the gas is processed once it reaches the vessel to separate it from liquids and natural gas that is changed into a liquid form (condensate). The processed gas is then treated and liquefied through freezing down to minus 160 degrees Celsius and stored in the hull of the vessel. Ocean going LNG carriers off-load the liquid gas for delivery to terminals around the world. Some of the advantages and challenges of FLNG vessels are identified in Table 16: Advantages and Disadvantages of Floating Liquefied Natural Gas Vessels.

**Table 16: Advantages and Disadvantages of Floating Liquefied Natural Gas Vessels**

| Advantages of Floating Liquefied Natural Gas | Challenges of Floating Liquefied Natural Gas |
|---|---|
| ▪ All processing done at sea with no need to lay long pipelines along the seabed to connect to a shore base.<br>▪ Well suited for fields with high production rates and far from land.<br>▪ Quicker to build than a shore-based processing facility.<br>▪ Allows flexibility to move the vessel to a new location when the field is depleted.<br>▪ Can be more economic than other alternatives. | ▪ The vessel would be much smaller than a shore-based processing facility but still need the same components.<br>▪ Wave action on the vessel would need to be reduced to avoid sloshing of the liquefied gas in a partially filled tank.<br>▪ Need to safely transfer the liquefied gas into a liquefied natural gas tanker. |

The Shell Prelude, shown in Figure 37: Shell Prelude Floating Liquefied Natural Gas Vessel and Liquefied Natural Gas Tanker, is an example of a new FLNG vessel, which has been designed and built to stay anchored in harsh weather conditions and is over four (4) football fields in length and the largest of such vessels built.

**Figure 37: Shell Prelude Floating Liquefied Natural Gas Vessel and Liquefied Natural Gas Tanker (Source: Shell, n.d., as cited in Nunami Stantec, 2018b)**




In addition to liquefied natural gas, dry gas can also be converted to compressed natural gas (CNG) at 2,900 pounds per square inch (psi). CNG tankers are less expensive to build than LNG tankers, but are considered more dangerous because of the high pressure. CNG systems are generally used for smaller to medium sized regional gas delivery and LNG tankers for long distances.

### 6.3.3 *Financial and Human Resources*

Nunami Stantec calculated that it would cost approximately USD $14 billion to conduct field development and production. Examples of potential skilled and unskilled jobs associated with offshore field development and production are listed in Table 17.

**Table 17: Potential Skilled and Unskilled Jobs Associated with Offshore Field Development and Production**

| Direct employment of skilled and unskilled workers | Onshore support |
|---|---|
| ▪ Engineers<br>▪ Welders<br>▪ Electricians<br>▪ Cooks<br>▪ Support staff<br>▪ Health and safety specialists<br>▪ Environmental specialists<br>▪ Helicopter pilots<br>▪ Technicians<br>▪ Geologists<br>▪ Healthcare staff | ▪ Supply base operations<br>▪ Flight support<br>▪ Providing supplies<br>▪ Consulting<br>▪ Legal support<br>▪ Human resources and administration<br>▪ Logistics and customs brokers<br>▪ Catering |

Local employment opportunities would likely include full-time positions as environmental monitors on board the drilling rig and support vessels to implement and monitor mitigation commitments. Additional opportunities for employment of Nunavut residents and business for Nunavut companies were also considered likely due to the longer lead time for production activities. This could include a number of initiatives to train Nunavut residents to work on the production platform in some capacity, or on the supply vessels that support the platform. In addition, given the long lead time for production activities, development of procurement strategies by local businesses, training and apprentice programs, and support for local capacity building would help provide additional employment opportunities within Nunavut. The long lead time and duration of production activities makes it feasible and justifiable for local residents and businesses to invest in relevant training and business development initiatives.

### 6.3.4 *Timelines*

Development to End of Development (Scenario C): Approximately 30-60 years

Once the NEB issues a SDL, and before a company would consider developing an oil or gas reserve, it would conduct extensive internal reviews to determine if it was financially feasible to do so and then apply for a Commercial Discovery Declaration (CDD) from the NEB. This would take approximately 2-4 years to carry out and project specific timelines can vary widely. Typical timelines associated with specific activities from the time a SDL is issued through production activities and then decommissioning and abandonment[3] would include, but are not limited to:

- Front end engineering and development (FEED) studies including reservoir appraisals, costing, and scheduling;
- Additional field work conducted at the site, including analyzing the seabed and undertaking environmental studies;
- Development of construction and engineering designs;
- Environmental assessment and regulatory approvals, including public engagement;
- Detailed project design, including training; and
- Issuance of Production Licence (PL), production activities, and decommissioning and abandonment (20-30 years or more).

### 6.3.5 *Potential Accidents and Malfunctions*

The potential accidents and malfunctions associated with field development and production drilling include:

- Fire and explosions
- Loss of life (falling off the vessel)
- Downed aircraft (helicopter)
- Terrorist threats
- Drilling rig loss of integrity
- Vessel collisions (for example, with other vessels or icebergs)
- Major weather and sea ice conditions
- Vessel strike with marine mammals
- Batch spills
- Subsea blowout

## 6.4. SCENARIO D: NO OFFSHORE OIL AND GAS ACTIVITY

If through planning, consultation, and regulatory decision-making processes, it is decided that the Area of Focus is not an appropriate region for oil and gas activities, then oil and gas resources would remain undeveloped and activities associated with the exploration and development of these resources would not occur.

### 6.4.1 *Views of Parties*

*Production Infrastructure*

Within their respective final written submissions and during the Final Public Meeting, Nunavut Tunngavik Incorporated (NTI) and the Government of Nunavut (GN) discussed interest in developing a production scenario specific to the Saglek Basin, particularly the Hekja gas field where a Significant Discovery Licence was previously issued. Both parties noted interest in assessing an onshore processing facility and transportation pipeline along the seabed as an

[3] Under the *Canada Oil and Gas Drilling and Production Regulations*, abandonment is defined as a well, or part of a well, that is permanently plugged.

alternative to the use of a Floating Liquefied Natural Gas (FLNG) vessel. NTI presented a *Saglek Basin Production Scenario* that was modelled on the Snøhvit Project off the coast of Norway and took ice conditions and currents into account. Both parties noted that onshore processing infrastructure, particularly on Inuit Owned Lands, could result in more benefits accruing to Nunavut while reducing potential risks associated with floating structures. In its public written comments, the GN further identified a lack of information on the profitability of using FLNG vessels rather than developing onshore processing capabilities. NTI and the GN provided similar recommendations that a scenario be developed that includes the development and assessment of onshore processing facilities, including terrestrial valued ecosystem components.

> NTI and the GN identified interest in assessing onshore oil and gas processing infrastructure and associated environmental effects and benefits to Nunavut.
>
> NTI, 2019 and GN, 2019

In response to questions raised by Nunami Stantec during the Final Public Meeting, NTI noted that one of its predominant concerns with the scenarios as developed was the lack of examples of floating production structures in similar Arctic environments and in the presence of ice in particular.[4] The GN noted its support of NTI's *Saglek Basin Production Scenario* and stated that "*one of the reason why we would have liked to see this scenario is specifically to better understand the impacts of this type of development on the land animals and the types of benefits that could be associated with them more closer to -- to land type of development*".[5] The Canadian Association of Petroleum Producers (CAPP) identified consideration of a similar type of concept of a floating LNG facility to transport hydrocarbons from the Beaufort Sea and Mackenzie Delta in Canada to markets in Asia. It was further noted that the ongoing Western Arctic SEA in the Beaufort Sea may also address this scenario.[6]

In response to questions raised by NIRB staff during the Final Public Meeting on factors influencing the feasibility of developing shore-based infrastructure in Nunavut, CAPP noted that the distance from wellhead to shore would be a major factor in assessing whether this type of infrastructure would be feasible. As shorter distances would be less costly, the closer the wellhead to the shore, the more likely it is that shore-based infrastructure would be considered. In addition, a developer would need to consider how the integrity of a pipeline on land would be protected, for example from ice. Lastly, CAPP indicated that the onshore production would become less feasible the further north the wellhead would be in the Development Scenario Area.[7]

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[4] Exchange between J. Beckett, Nunami Stantec, and W. Johnson, Nunavut Tunngavik Incorporated, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 261-265.
[5] A. Cyr-Parent, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 269, lines 14-19.
[6] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 273, lines 22-26.
[7] Exchange between R. Barry, NIRB Staff, and P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 673-676.

NTI further highlighted previously identified hydrocarbon potential within Lancaster Sound and extending into Baffin Bay, in the Baffin Fan. It was noted that while development in this area would be less likely to occur than in the Saglek Basin, further study should be undertaken.[8]

The Danish Centre for Environment and Energy suggested that environmental impacts from shallow coring (stratigraphic drilling) activities be included in the development scenarios if relevant and provided Greenland guidelines for preparing an Environmental Impact Assessment for such activities.

*Type of Scenarios*
CIRNAC noted that the scenarios should represent multiple alternative, plausible, and realistic stories and that each scenario should not present a single point in time, but a hypothetical sequence of events with each being contingent on the previous. The GN similarly noted that hypothetical yet realistic scenarios should set out sequences of events with details such as location, economic estimates, best practices, and mitigations. P. Croal stated that 'scenarios' denote different configurations of oil and gas activities, locations, and objectives. It was further suggested that there could be additional integrative analysis of Inuit Qaujimajatuqangit, climate change, and the future of the oil and gas industry in the face of alternative fuels, economic development options, and Nunavut community aspirations. Within its public written comments, Greenpeace Canada noted that for further assessments, non-industry experts, including Inuit Elders and coastal community members, should provide input onto developing iterations of oil and gas scenarios.

Multiple parties provided comments on the *Oil and Gas Hypothetical Scenarios Report* regarding the type of scenarios developed and there was general consensus that although parties may have wanted additional development scenarios to be considered, the report did provide comprehensive information on the typical oil and gas lifecycle, types of activities, and timelines etc. Natural Resources Canada (NRCan), the National Energy Board (NEB), Parks Canada (PC), and CAPP noted within their respective written comments that the scenarios were accurately represented. Alternatively, multiple parties identified differences in expectations of what should be included in a scenario within their respective comments, final written submissions, and during the Final Public Meeting, including the QIA, GN, CIRNAC, P. Croal, and the WWF. It was often noted that, as currently presented, the hypothetical scenarios are representative of phases of oil and gas and did not differentiate between the possible scale and intensity of operations (e.g., differences between one (1) and 12 wells drilled), different possible configurations of activities, or potential cumulative effects (e.g., how many exploration projects could be operated simultaneously without significant effects from underwater noise). Consequently, these parties suggested that it was difficult to get an accurate 'picture' of potential offshore oil and gas development because this level of detail was not provided. Associated recommendations to address these issues were made by parties including the GN, CIRNAC, P. Croal, and the WWF.

The GN further recommended that the scenarios be presented by region or specific physical environmental categories. The GN, CIRNAC, and NRCan similarly recommended that scenarios incorporate factors including, but not limited to: existing exploration agreements and known seismic activity; previously identified drilling prospects; geological formations; ice coverage;

[8] W. Johnson, Nunavut Tunngavik Incorporated, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 245-247.

distance to shore; bathymetry (water depth); and technological advances. P. Croal further suggested that there could be additional integrative analysis of Inuit Qaujimajatuqangit, climate change, and the future of the oil and gas industry in the face of alternative fuels, economic development options, and Nunavut community aspirations.

In response to related questions and comments during the Final Public Meeting on the development of the scenarios, Nunami Stantec noted:

> *We wanted to make sure we covered all the phases of oil and gas. We were also conscious of the process behind how oil and gas development occurs. There are many different ways to define the hypothetical scenarios. And, you know, we discussed those options. It felt like this would maybe be the easiest way to follow through the life cycle as well as the effects that are associated with the activities associated with those scenarios. So it's not -- it's not the only way to do the hypothetical scenarios. It was, in the end, the way we felt would make the most sense to carry through in the review of effects. ... an intensity of development where there's more than one platform operating at the same time or a seismic program and drilling at the same time. I think that can be addressed in cumulative effects ...* [9]
>
> *... oil and gas activity was considered in the list of activities when we addressed cumulative effects, so that's where you would bring in, you know, multiple activities occurring in the same region and the overlap and how that might affect value components.* [10]

## 6.5. ALTERNATIVES TO THE POSSIBLE DEVELOPMENT SCENARIOS

The focus of the SEA is to study the suitability of oil and gas development activities within the Canadian offshore waters of Baffin Bay and Davis Strait. While the Board has considered recommendations from the parties with regards to future studies on alternative forms of development, the Board also recognizes the reality that much of the specific information needed to better define the location, configuration, and scope of likely oil and gas development scenarios as requested by the parties is unknown. In light of these significant information gaps and uncertainties, the alternatives analysis for the SEA in this assessment was limited to alternative means of carrying out each scenario, including alternatives to individual components and/or activities, alternate timing, and development options. Accordingly, Nunami Stantec considered the following in its discussion of alternatives in the development scenarios:

- *Identification of an oil or gas reservoir:* It was noted that more intensive studies, including the collection of modern seismic data and possibly exploratory drilling, would be required to identify the presence of an oil or gas reservoir. Development of a reservoir is not always technically feasible, even if an initial discovery is made.

[9] J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 73-74, lines 23-26, 1-8, and 20-24.
[10] . Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 112, lines 3-7.

- *Reservoir development:* The development of a reservoir would be determined at a project level and would consider efficiency and cost-effectiveness.
- *Seismic surveys:* It was noted that there is currently no effective alternative to two dimensional (2D) and three dimensional (3D) seismic surveys for the Development Scenario Area. It was further identified that 3D seismic surveys were required to best identify the drilling location and total depth. For both 2D and 3D surveys, the use, duration, and location would vary among surveys.
- *Drilling:* In addition to the type of drilling rig used, it was noted that a company could drill only to the first formation to secure a Significant Discovery Licence, which could reduce the time spent on location. Alternative options for drilling would require regulatory approval.
- *Development:* The use of landfall or floating facilities was considered the main alternative for development. It was noted that the avoidance of landfall facilities and use of floating facilities is increasingly the preferred option.

### 6.5.1 *Views of Parties*

*Alternative Analysis*

Throughout the SEA, multiple parties – including Nunavut Tunngavik Incorporated (NTI), the Qikiqtani Inuit Association (QIA), the Government of Nunavut (GN), Greenpeace Canada (Greenpeace), Oceans North Canada (Oceans North), P. Croal, the World Wildlife Fund (WWF), and community members – have noted that strategic environmental assessments should also consider development scenarios for industries/economic development opportunities as alternatives to offshore oil and gas development, including the development of alternative forms of energy. These commenters indicated that a comparative analysis of the risks and benefits of different development options was necessary to truly assess whether future offshore oil and gas development would be beneficial in the region. These parties also indicated that without an analysis of the other realistic economic development opportunities in the region it would be unclear whether development of an offshore oil and gas sector would be the preferred option for Nunavut. In general, it was recommended that prior to a decision to lift the moratorium, an alternatives assessment incorporating risks and benefits should be completed that would consider other economic development options in the region such as commercial fisheries, tourism, mining, shipping, and wind and solar power in comparison to offshore oil and gas.

Within their respective written submissions and/or during the Final Public Meeting, the GN, P. Croal, and the WWF similarly discussed different processes and principles for conducting a strategic environmental assessment. In particular, the evaluation of alternative development options was noted as an important aspect of a strategic environmental assessment process and to shape regional outcomes. The GN discussed guiding principles for strategic environmental assessments under the federal Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals and the Canadian Council of Ministers of the Environment's Regional Strategic Environmental Assessment in Canada. The WWF similarly discussed strategic environmental assessment best practices and an approach undertaken by the International Centre for Environmental Management. It was concluded that the question of whether the offshore oil and gas industry should be developed cannot be answered in an informed manner if overall sustainability objectives are not considered and more specific information regarding the potential jobs, benefits, and impacts of offshore oil and gas remain unknown. WWF recommended that clear development and sustainability goals be established for Nunavut and that scenarios be developed that are flexible, iterative, and customized to the Nunavut context, and analyzed against these goals. P. Croal similarly recommended that there be more integrative analysis on Inuit Qaujimajatuqangit, climate change, and the future of the oil and gas industry in the face of alternative fuels, economic development options, and Nunavut community aspirations. For further discussions on potential economic effects and opportunities from alternative development opportunities to offshore oil and gas see Chapters: 7.3.1.2 Economic Development and Opportunities, Employment, and Contracting and Business Development, and 7.3.1.5 Commercial Harvesting. Information on the approach taken for the SEA is available in Volume 2, Chapter: 2.3: Strategic Environmental Assessment Overview.

> Many parties expressed interest in conducting a strategic environmental assessment that included alternative development options, including renewable energy alternatives, in addition to offshore oil and gas activities.

P. Croal. the WWF, and community representatives discussed interest in renewable energy alternatives. Within its public written comments and final written submission, WWF suggested that renewable energy alternatives, such as wind and solar, in northern communities could provide employment and revenue benefits as well as significant other advantages, including reducing the reliance of northern communities on diesel fuel.

During the Final Public Meeting, a Community Representative from Grise Fiord commented on whether oil and gas activities should take place in the Development Scenarios Area and noted that "*this water should be the last for exploration. The communities -- the Land Settlement is huge that has not been touched for -- in explorations*".[11] Another Community Representative indicated that conducting land-based oil and gas development should be considered before development in the should be considered.[12] Others indicated that the future of oil and gas development in the region needs to consider changing energy needs and options:

> *we keep being reminded in my final statement by the people around the world, gasoline and diesel are not the only energy we need today. There are so many different ways to use energy today.*[13]
>
> *there are other alternative ways to – to make energy. Oil and gas impacts our – our atmosphere. ... I think there should be alternative ways that we should be looking for a cleaner, safer way to produce energy. And solar power, the sun –*

[11] L. Ningiuk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 540, lines 23-26.
[12] L. Ishulutaq, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 848, lines 20-24.
[13] L. Audlaluk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 814, lines 21-24.

*there'll be sun forever, but you know that. There'll be wind. Wind can give us energy.*[14]

Through feedback from the SEA Working Group, energy security and diversification were included as a subject of note in the SEA. One of the questions raised was: "What could the long-term implications of offshore oil and gas development be on Nunavut's energy security?" For example, could development of an oil and gas industry in the offshore of Baffin Bay become an opportunity to invest in Nunavut infrastructure, or alternative power generation or other sectors of the economy and be leveraged to make the Territory more energy secure? In response to the NIRB's request for additional information related to energy security and diversification, CAPP provided access to documents outlining diversification and the scale and range of economic benefits accruing to Newfoundland and Labrador as a result of the oil and gas industry (see Appendix C: Recommended Documents). It was noted that various case studies were used to identify how local supply and service companies have been able to diversify their client base by starting out supplying the local oil and gas industry with products and services and progressing to now exporting products and services globally.

*Alternative Technology for Seismic Programs*

Within its public written comments, the Government of Nunavut (GN) referenced community concerns about the potential effects of noise from seismic surveys on marine wildlife and noted that there is a lack of information provided on alternative technologies and approaches to conducting seismic surveys. The GN recommended that additional explanation be provided regarding how the following variables can affect the choice of seismic technology used:

- bathymetry;
- seabed sediment properties;
- ice coverage;
- vertical and horizontal speed profiles;
- water salinity and temperature; and
- air gun size, pulse rate, and peak-to-peak pressure.

The GN further recommended that following the SEA, the Government of Canada, in consultation with stakeholders, coordinate additional information and analysis of the potential effects, including cumulative effects, of seismic exploration, particularly on wildlife. It noted that communities should be engaged during this process and provided with opportunities to comment. Natural Resources Canada (NRCan) and the World Wildlife Fund (WWF) similarly commented that alternative technologies to seismic surveying should be considered, such as marine vibroseis. During the Final Public Meeting, the WWF discussed marine vibroseis as an alternative to seismic surveying[15], noting that it "*can send sound waves just as deeply as seismic testing, and it's*

[14] H. Oshutapik, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 22, 2019, pp. 893-894, lines 19-26 and 1-2.

[15] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 101, lines 13-16.

*something that WWF has recommended and should our submission be considered by the Board as a possible alternative to seismic testing which we know has serious impacts on marine wildlife*".[16]

The Canadian Association of Petroleum Producers (CAPP) also addressed technology used for seismic surveying during its presentation at the Final Public Meeting, and while it noted that different types of technology are used to study geology, the "*the use of airguns is the primary one used around the world for undertaking offshore seismic programs*."[17] While further stating that marine vibroseis is predominantly used on land or in very shallow water "*because it's really not as effective as airguns and is somewhat cumbersome to use*", CAPP noted that the global seismic and oil and gas industries are investing in improving this technology with the goal of reducing noise and resulting impacts.[18] When asked about appropriate and feasible alternative techniques to two dimensional and three dimensional seismic surveys, the National Energy Board (NEB) referenced CAPP's presentation.[19] CAPP further clarified in response to questions raised by Nunami Stantec that aeromagnetic surveys are used to detect oil on the water's surface and not subsurface in the seabed.[20]

## 6.6. ADDITIONAL FACTORS TO CONSIDER

This section summarizes the potential challenges and factors to consider for possible oil and gas development in the Development Scenarios Area in Baffin Bay and Davis Strait from Section 6: Additional Factors to Consider in the *Oil and Gas Hypothetical Scenarios Report*.

### 6.6.1 *Background*

#### 6.6.1.1. *Operating Environmental Challenges*

There are many factors an operator would need to consider when deciding to develop an oil and gas project, particularly as this industry operates offshore and often in extreme conditions. Nunami Stantec noted that operating environments in the Development Scenario Area are similar to other Arctic regions where oil and gas development currently occurs or has occurred in the past and would not pose any unique technical constraints or obstacles with respect to water depth, ice, or oceanographic or meteorological conditions. Some of the potential environmental challenges that proponents may face that could lead to long or repeated delays to marine seismic or exploration drilling from weather conditions include:

- Icebergs, sea ice, and ice packs migrating south along the coast of Baffin Island:

[16] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 110, lines 15-20.
[17] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No. 17SN034 Transcript, March 20, 2019, p. 605, lines 22-24.
[18] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No. 17SN034 Transcript, March 20, 2019, p. 606, lines 2-13.
[19] C. Wickenheiser, National Energy Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 663, lines 3-13.
[20] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No. 17SN034 Transcript, March 20, 2019, p. 617, lines 1-7.

    - Management for icebergs, sea ice, or ice packs that may calve off the Greenland, Baffin Island, and Canadian Arctic Island glaciers that may migrate south along the coast of Baffin Island would be required, along with sound and flexible ice management plans in place.
- Lack of shore-based infrastructure and remoteness:
    - Due to the lack of shore-based infrastructure and remoteness in Baffin Bay and Davis Strait, it was noted that offshore fields would need to be self-reliant and cannot rely on large shore-based infrastructure. These challenges could be partially offset by using offshore infrastructure as well as established infrastructure in Newfoundland and Labrador and/or Greenland.
- Impacts from climate change in the Arctic:
    - Climate change could lead to increased icebergs and diminished ice packs. Less ice could allow for longer open water seasons, extended summer drilling seasons, and decreased risks from multi-year ice incursions. However, climate change could also increase the frequency and severity of open water storms and severe fog, which could result in restrictions to aircraft operations and vessel traffic from shore base to offshore facilities.

#### 6.6.1.2. *Potential for Expansion and/or new Discoveries*

Nunami Stantec highlighted difficulties in projecting the potential for expansion when there has not been any initial development in the region. Industry experience from elsewhere was used to predict how development projects would likely begin and be built-out over time. Potential sequences could include:

- Starting with a single production platform and minimal number of wells;
- Adding additional production platforms if a reservoir cannot be reached by existing platform(s);
- Drilling additional infill production wells over the producing life of a field to allow for the conservation of hydrocarbon reserves from the entire reservoir; and
- Taking measures such as infield drilling, water flooding, and well workovers (any downhole activity in the wellbore that could increase productivity) to conserve the reservoir and maximize hydrocarbon recovery.

The potential for new discoveries in the region could increase the level of production resulting in reduced costs. For example, if additional exploration and development of new hydrocarbon reserves occur next to existing development, this could increase production and maximize the use and lifespan of project infrastructure. New discoveries can lead to the expansion of commercial satellite fields (small oil and gas pools near a larger resource), which could tie into an anchor field and be cost-effective.

### 6.6.1.3. *New Technologies and Operating Practices*

New technologies could improve operating practices, especially in the collection of marine seismic data and in the development of new types of drilling methods and tools. Focus has been placed on acquiring higher quality data while reducing noise lost in the water column when collecting marine seismic data, including the use of marine vibrators and underwater vehicles that would operate closer to the floor. Further, the global trend in offshore development is submerged production at the seabed to a floating vessel. This improved technology has been noted to have significantly reduced or avoided an onshore footprint and increased the ability to shut down the seabed wellhead flow and move the vessel in the event of iceberg presence.

### 6.6.1.4. *Cost and Business Outlook*

Costs and business outlook and supply and demand were considered the most important factors in determining the feasibility of an oil and gas project in the offshore waters. Current cost estimates for offshore exploration and development in Arctic waters is almost two (2) times higher compared to other regions. Nunami Stantec estimated that offshore Arctic development could require sustained and predictable oil and gas prices in the range of $80–100 United States Dollars (USD)/barrel and $8–10 USD/trillion cubic feet (or greater), respectively. It was noted that the identification of cost reduction opportunities, new research, and technological development could reduce this threshold. Arctic developments would have to compete with lower cost and more accessible discoveries in other parts of the world. Demand for oil and gas was predicted to continue for the foreseeable future, with natural gas likely to increase in demand as a replacement for coal in power plants.

### 6.6.1.5. *External Events*

External events can have a significant impact on the timing of a potential oil and gas project and decision to proceed or not; including, but not limited to:

- Political and regulatory stability and predictability;
- Growing supply of worldwide oil and gas resources in more accessible areas and at moderate prices;
- Increasing supply diversity such as shale resources;
- New market storage availability;
- Growing pipeline and marine transport capacity; and
- Continuing competition and reduction in costs for offshore exploration and development.

From an industry standpoint, Nunami Stantec considered the impact of political and regulatory uncertainty and unpredictability to potentially be a substantial risk to the oil and gas industry in Canada's Arctic offshore. This was identified to include the:

- Current moratorium on offshore oil and gas licences in the Canadian Arctic waters;[21] and
- Lack of extensive history with oil and gas development in the Development Scenario Area and likely needs for planning and policy development.

##### 6.6.1.6. *No Activity*

It was noted that a decision to allow or ban oil and gas development activities would need to be considered by all relative stakeholders including governments, Indigenous people, local communities, the general public, and industry. Nunami Stantec noted the following points from an industry perspective if there was no offshore oil and gas development in the region:

- There is no value to the hydrocarbon industry in making incremental decisions (e.g., marine seismic is approved, but no follow-up exploration or production drilling is allowed);
- If temporary or permanent restrictions are placed on development, industry would not consider that particular area; and
- Industry interest would shift to an area where oil and gas development was encouraged and profitable.

### 6.6.2 *Views of Interested Parties*

*Cost and Business Outlook*
The Canadian Association of Petroleum Producers (CAPP), Greenpeace Canada (Greenpeace), and the World Wildlife Fund (WWF) commented on the potential cost and financial feasibility of oil and gas development in the Development Scenario Area. Within its public written comments, CAPP noted that given the current market prices for oil and natural gas commodities, there is limited industry interest in pursuing these reserves in the near future, unless the commodity prices increase significantly. It was suggested, however, that interest in the development of Nunavut's oil and gas resources may increase in the future as the Arctic becomes increasingly accessible. CAPP concluded that developing new infrastructure to support economic development and putting in place clear government policy and regulatory conditions to enable oil and gas development would be critical to allow for internationally-competitive resource investment to be attracted to development in the region.

*Potential for Expansion and/or New Discoveries*
In response to a Community Representative's question on whether results from oil exploration in Greenland could be indicative of resources in the Development Scenario Area and whether industry is interested in oil and gas development in Baffin Bay, CAPP noted that

> *the drilling and exploration results off of Greenland have not been encouraging for our industry, and the geology, we think, is pretty similar here to what's in Greenland. So the interest in drilling here based on Greenland results may not be as high as it once was or what it could have been if there was more success in*

[21] The 2016 US-Canada Joint Arctic Statement announced Canadian Arctic waters as indefinitely off limits to new oil and gas licences, to be reviewed every five (5) years (https://pm.gc.ca/eng/news/2016/12/20/united-states-canada-joint-arctic-leaders-statement).

*Greenland. Having said that, there's some interest -- interesting basins just south of here off of Labrador which the Newfoundland Labrador energy corporation Nalcor has mapped out with some of its seismic work which looked very promising, and I'll be giving some information about that during my presentation. And if there's success there, that may bode well to having industry have a further interest in the Baffin Bay and Davis Strait area, just because of success not far south of here.*[22]

CAPP further discussed current and potential development in offshore Labrador and Newfoundland as well as potential for Qikiqtani communities and organizations to be consulted for potential future project proposals in that area.[23] Multiple parties raised questions or comments on potential timing of activities and when different stages could be expected, if oil and gas development were allowed to proceed in the region. In response to questions raised by the QIA, CAPP indicated that it was difficult to predict how far in the future offshore oil and gas development activities could realistically be expected to occur in the region. It was noted that if oil and gas exploration were to occur in Labrador around 2025, as is currently a possibility, there could conceivably be interest in conducting exploration activities in 2030 in the Development Scenario Area.[24]

When discussing areas of interest for industry in Canada's Arctic Basin, CAPP noted that both the Beaufort Sea area in the Western Arctic and the Sverdrup Basin in the Central Arctic have potential for a significant amount of hydrocarbon resources and that these basins are areas of interest. Comparatively, CAPP noted that available information indicates that the Development Scenario Area is prone to natural gas, of which there is an abundance of natural gas already discovered in North America (approximately 100 years worth), more accessible, and closer to markets:[25]

*So to develop gas offshore anywhere in Canada, including off of Newfoundland or in the Beaufort Sea or especially here in the High Arctic where there's -- in the Eastern Arctic where there's -- there's little infrastructure, the costs will largely be -- excuse me -- prohibitive. So, therefore, it is an area at this point in time that is of little interest as oil explorers, developers, and producers.*

[P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No. 17SN034 Transcript, March 20, 2019, p. 594, lines 16-23]

CAPP identified that, from an industry perspective, once the moratorium is lifted the following preconditions would need to be met in order for future oil and gas exploration in offshore Nunavut to take place:

- completion of the SEA;

[22] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No. 17SN034 Transcript, March 18, 2019, p. 87, lines 5-21.
[23] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No. 17SN034 Transcript, March 20, 2019, pp. 598-602.
[24] Exchange between R. D'Orazio, Qikiqtani Inuit Association and P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034, March 20, 2019, pp. 627-628.
[25] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No. 17SN034 Transcript, March 20, 2019, pp. 593-597.

- government recognition for future oil and gas investment and completion of an Arctic Policy Framework to provide certainty to investors;
- industry advancement of Arctic research and development priorities;
- geological and economic assessment undertaken;
- successful Greenland/Labrador exploration results; and
- a shift in global supply and demand.

Current priorities for Arctic development included the following: marine seismic noise reduction; design and construction of new Arctic class drilling units; ice management; safe drilling and production; and well control and oil spill prevention.[26] In response to NTI questioning whether there would be oil and gas development activities in Nunavut if no significant oil discovery was made, CAPP noted that "*the likelihood of that happening would be pretty remote*".[27]

*Other Areas of Interest*
Throughout the SEA and during the Final Public Meeting, many parties, including community members, questioned whether the government should consider offshore oil and gas development in other areas in the region. Within its final written submission, the GN recommended that additional strategic environmental assessments be conducted in other regions of Nunavut with oil and gas potential, such as the Sverdrup Basin, Foxe Basin, Hudson Bay, and Hudson Strait areas.

*Climate Policies*
NTI, Greenpeace, and the WWF discussed potential impacts of national climate policies on the prospects for oil and gas developments in the Arctic. NTI developed a C*limate Change/No Development Scenario* that focused on possible effects of international measures to slow and stop climate change by keeping global temperatures from exceeding 2 or 1.5 °C above pre-industrial levels. It was also noted that decisions to develop offshore oil and gas may not be made by regulatory authorities, but rather by companies. NTI concluded that measures to address climate change – if carried out effectively by the international community – would result in reduced demand for oil and gas, especially from high-cost areas such as the Canadian Arctic. NTI recommended that a detailed study be carried out to determine if, and under what circumstances the *Saglek Basin Production Scenario,* if developed, would be consistent with the reduced oil and gas use envisioned in the Climate Change/No Development scenario, or, whether any oil and gas development in Nunavut would be consistent with existing government commitments to climate change mitigation.

In response to NTI's presentation during the Final Public Meeting, the Board questioned NTI on whether any of the studies used in its projections and associated *Climate Change Scenario* were on the public record. While NTI noted that while these reports were not provided in a written

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[26] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No. 17SN034 Transcript, March 20, 2019, pp. 601-602.
[27] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No. 17SN034 Transcript, March 20, 2019, p. 618, lines 12-14.

submission to the Board, they were publicly available.[28] The World Wildlife Fund (WWF) referenced this exchange later in the Meeting and discussed the global carbon budget and viability of Arctic oil with an increase of two (2) degrees Celsius. WWF referenced the Paris Agreement and noted that "*there is a general consensus that all the world's known fossil fuels cannot be burned, as the level of potential carbon emissions exceeds any reasonable carbon budget under this 2 degrees Celsius scenario*".[29] The WWF referenced additional studies supporting this conclusion, including the Carbon Tracker report referenced by NTI that concluded that in order to meet global commitments and limit the global average temperature increase to 2 degrees Celsius (the Paris Agreement scenario), only 20 percent of total global fossil fuel reserves could be burned.[30] Similarly, the Board asked ECCC whether it had developed a forecast on oil and gas demand under the Paris Agreement scenario that could be used to compare to NTI's projections. ECCC noted that it did not have a specific forecast developed on domestic or global oil and gas demand under the Paris Agreement scenario.[31]

When asked its view on the economic viability of Arctic oil in a carbon-constrained world in the future, CAPP noted that:

> *our industry in Canada certainly takes very seriously the efforts to reduce our carbon emissions. In fact, in Western Canada, the oil sands have spent about $1.8 billion to date on reducing carbon emission. In the offshore environment in -- in Newfoundland, there's very little emitted from offshore oil production, largely because of the newer technology used in the offshore and the nature of the -- the oil that's been produced. It's a very light oil. And we've been very successful off of Newfoundland as well in capturing some of the emissions from the generation of -- from diesel generation.*[32]

During its presentation at the Final Public Meeting, Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) noted that the outcomes of climate change are highly uncertain and complex in terms of how air temperatures, water temperatures, water flows, behavior of ice, and behavior of wildlife interact to create a complicated set of conditions under which oil and gas would need to operate. CIRNAC noted that a life cycle climate assessment was to be undertaken and considered as part of the five (5) year review of the moratorium. It was also noted that the purpose of this climate assessment was to identify whether the exploitation of hydrocarbon resources would be compatible with the Government of Canada's commitments under the *Paris Agreement.* CIRNAC emphasized that this is a critical question that needs to be answered before a decision can be made as to whether oil and gas exploration can proceed in the region.[33]

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[28] Exchange between W. Johnson, Nunavut Tunngavik Incorporated, and C. Emrick, NIRB Board Member, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 287-288, lines 22-26 and 1-20.

[29] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 22, 2019, p. 930, lines 10-14.

[30] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 22, 2019, pp. 929-931, lines 17-26, 1-26, and 1-26.

[31] Exchange between C. Emrick, NIRB Board, and B. Summerfield, Environment and Climate Change Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 422, lines 8-20.

[32] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 637, lines 8-19.

[33] M. Hopkins, Crown-Indigenous Relations and Northern Affairs Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 366, lines 12-23.

WWF noted that cost estimates of future production as well as the future price of oil are highly uncertain, difficult to predict, and do not always properly account for the growing market share of renewable energy and technological advances in energy efficiency. WWF concluded that it was unknown whether the high oil prices needed to make offshore oil and gas development viable in the Arctic would ever materialize:

> *Board members may want to consider what is the business case for fossil fuels in the Arctic in a world rapidly trying to decarbonize. These projects require billions in investments, including massive government investment. And they are intended to produce oil for decades in order to be economically viable. Yet by 2050, only 30 years away, an 80 percent reduction in carbon emissions is required. Is Nunavut and Canada willing to massively invest to prepare for the possibility of a future industry that may or may not arrive?*[34]

*Public Opinion*

In response to a question raised by the QIA during the Final Public Meeting on how 'public appetite towards development' weighs into industry pursuing a project, CAPP noted that:

> *I would think it carries an extreme amount of weight. Because while an area may have known potential, it's not in our best interest as an oil and gas company or industry to attempt to undertake activity without -- without the support of the local communities or -- or government, because it would just make for, obviously, poor relationships and the inability to undertake our work through a length of time*".[35]

### 6.6.3 *Views of the Board*

#### 6.6.3.1. ***Hypothetical Oil and Gas Development Scenarios***

The Board heard varying opinions expressed on the representation of the hypothetical oil and gas development scenarios developed by Nunami Stantec for the SEA. In particular, the Board notes the comments and recommendations by the Qikiqtani Inuit Association (QIA), the Government of Nunavut (GN), Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC), P. Croal, and the World Wildlife Fund (WWF) that hypothetical oil and gas development scenarios should be presented in various formats, including regional and environmental criteria, scale, and multiple configurations of operations. For this SEA the hypothetical scenarios were developed based on: direction and parameters set by CIRNAC; the Final Scope List developed with public input and feedback from the SEA Working Group; large data gaps; industry professional judgement; and ability to conduct an effects assessment. A key objective of the SEA was to collect information and identify gaps in an area were only extremely limited preliminary exploration has occurred to date, and where significant gaps in information had been previously identified. Through this SEA several key objectives were prioritized: gathering existing information into a central location, increasing familiarity with the oil and gas industry and associated activities, and providing the

[34] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 22, 2019, p. 932, lines 2-12.
[35] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No.: 17SN034 Transcript, March 20, 2019, p. 621, lines 14-21.

groundwork for future planning, assessments and studies including the review of the current oil and gas moratorium for the Canadian Arctic. The Board agrees with parties that there would be value in assessing different configuration of scenarios in future when additional information is made available.

The Board further heard from NTI and the GN on the desire to assess oil and gas related infrastructure within the Nunavut Settlement Area and associated potential risks and benefits. While the Board was necessarily constrained by the agreed-upon scope for the SEA and industry engagement indicated that onshore processing infrastructure and transportation pipeline would likely not be probable, the Board recognizes that with additional information, including economic estimates, as well as changes in environmental and economic conditions, there could be value in investigating these concepts and scenarios through future assessments.

As a result of information provided throughout the SEA and particularly at the Final Public Meeting, the Board sees a need and desire for marine planning to be undertaken within the region. The Board emphasizes the importance of including Inuit Qaujimajatuqangit, Inuit Qaujimaningit, and community views in any such future planning and research efforts.

#### 6.6.3.2. *Alternatives to Possible Development Scenarios*

*Alternative Analysis*

Numerous parties – including Nunavut Tunngavik Incorporated (NTI), the Qikiqtani Inuit Association (QIA), the GN, Greenpeace Canada (Greenpeace), Oceans North Canada (Oceans North), P. Croal, the WWF, and community members – commented on the desire and need for assessing and focusing on alternative development options to offshore oil and gas, including alternative and sustainable forms of energy. The Board further heard of uncertainty and lack of desire currently by industry to develop offshore oil and gas resources in the Area of Focus, especially based on current conditions. While the focus of the SEA was to study the suitability of oil and gas activities within the Canadian offshore waters of Baffin Bay and Davis Strait, the Board agrees that prior to decisions being made on whether offshore oil and gas development should proceed in the Area of Focus, additional information on the effects, risks, and benefits of alternative forms of development needs to be contrasted with possible offshore oil and gas development. The Board further heard from the QIA, WWF, and P. Croal on the importance of developing territorial and regional priorities with which to compare development options. This further highlights the need for marine planning within the region. Discussions and associated recommendations regarding other industries and economic drivers is available in Chapter 7.3.1: Analysis of Potential Effects – Economic Development and Opportunities.

*Alternative Technology for Seismic Programs*

Concerns were expressed by numerous parties about the sound levels and consequential effects on marine life from the use of two dimensional (2D) and three dimensional (3D) seismic surveys. The GN and the WWF requested that additional consideration be given to alternative technologies, such as marine vibroseis. The GN further recommended that additional explanation be provided on how the following variables could affect the choice of technology: bathymetry, seabed sediment properties, ice coverage, vertical and horizontal speed profiles, water salinity and temperature, and air gun size, pulse rate, and peak-to-peak pressure. From discussions with Nunami Stantec, the

NEB, and CAPP during the Final Public Meeting, the Board is of the understanding that while 2D and 3D seismic surveys are considered to be the most appropriate and feasible technology for the Development Scenario Area at this time, research is being conducted to identify other alternatives. The Board suggests that until more information becomes available and alternative technologies more viable, seismic technology should be studied further and acceptable thresholds and guidelines developed which can be demonstrated to effectively protect marine wildlife and the marine environment.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to alternative development options and hypothetical oil and gas development scenarios, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research and impact assessment:

***Recommendations to address prior to lifting the current moratorium***:

- Incorporating all relevant updated baseline data (including Inuit Qaujimajatuqangit and Inuit Qaujimaningit) and in collaboration with the Nunavut government, Inuit organizations, and local communities, initiate marine-based regional planning throughout the Area of Focus, including the development of regional priorities (#51);
- Reflecting updated baseline information and regional priorities identified in #51, conduct an analysis of the risks and benefits of:
  - alternative economic development options (e.g., commercial fishing, renewable energy, and tourism) for the Area of Focus; and
  - development of alternative energy sources which could support domestic energy consumption in Nunavut (#52).

***Recommendations to address through future assessments***

- Strategic environmental assessments on offshore oil and gas activities in specific areas of known resources, such as the Saglek Basin and the Sverdrup Basin should be undertaken prior to project-specific assessment. Future SEAs should:
  - analyze different configurations and phases of potential oil and gas activities; and
  - choose locations, environmental conditions, and study objectives in collaboration with the Nunavut government, Designated Inuit Organizations, and local communities (#59).
- Any future SEAs or project-specific assessments should include consideration of alternative technologies, particularly for marine seismic surveys (#60).

#### 6.6.3.3. *Additional Factors to Consider*

Input provided by parties, particularly the Canadian Association of Petroleum Producers (CAPP), Greenpeace Canada, and the World Wildlife Fund, made it clear that not only is offshore oil and gas development in the region not economically viable at present, it may continue to be unfeasible for the foreseeable future. Conditions that could change this include the potential discovery of resources in Greenland and/or Labrador generating interest in the region, a sharp increase in current pricing of petroleum products, or development of government policies which increase certainty for investors. In further considering comments from parties during the Final Public Meeting, the current lack of readiness for offshore oil and gas in the region is self-evident. This lack of readiness will be discussed further throughout this Report.

The Board heard interest from some parties in conducting strategic environmental assessments on offshore oil and gas activities in other areas in the Arctic where research indicates greater potential for economically viable hydrocarbon resources.

The Board also heard very clearly that climate change is a pressing concern for almost all parties and should be considered when making decisions on the viability of offshore oil and gas development in the Area of Focus moving forward. While it is beyond the Board's mandate to comment on the federal government's adherence with climate policies and international commitments, the Board recognizes that the federal government is undertaking a life cycle climate assessment independent of this SEA that will be used to inform the five (5) year review of the Moratorium. The Board strongly encourages the federal government to make the results of this life cycle assessment available to the general public, once completed.

# CHAPTER 7: ANALYSIS OF POTENTIAL EFFECTS

The activities associated with each of the oil and gas scenarios described in the previous section have the potential to interact with valued components of the environment and have an impact where interaction occurs which could result in an effect on a component of the environment. Potential impacts and effects were assessed from three (3) perspectives:

- *Local* – potential effect would be restricted to the footprint of the activity;
- *Regional* – potential effect would extend outside of the footprint of the activity (for example, within the Area of Focus and/or the Nunavut Settlement Area); and
- *Transboundary* – potential effect would extend beyond Federal waters associated with the Area of Focus to the Nunavut Settlement Area, to other provinces or territories, or to other countries (e.g., Greenland).

***Impact***: Negative or positive influence from an activity on the environment. *For example, seismic surveying produces noise.*

***Effect***: A change to a valued component of the environment from an activity. *For example, noise from seismic surveying could lead to a change in a whale's behaviour.*

***Mitigation***: A plan or an action taken to avoid or reduce a negative effect. *For example, the gradual increase in sound for seismic surveys.*

Nunami Stantec used experience with offshore oil and gas activities elsewhere to make a reasonable judgement of potential effects, including: size, area, when and how often an effect could occur, and the length of time an effect could last in creating the *Environmental Setting and Review of Potential Effects of Oil and Gas Activities* Report.

The possible scenarios of oil and gas development in Baffin Bay and Davis Strait that were assessed for potential impacts and effects included the following:

- Use of seismic surveys to explore for oil and gas in the seabed (*Scenario A*).
- Use of drills to explore for oil and gas in the seabed (*Scenario B*).
- Construction and operation of offshore facilities to pump and transfer oil and gas from identified oil fields in the seabed (*Scenario C*).

In addition, a fourth scenario, where no oil and gas development activities occur in future in Baffin Bay and Davis Strait (*Scenario D*), was also assessed. In this case, it was concluded that there would be no effects to the physical, biological, or human environments from oil and gas development. However, impacts to the physical environment in Baffin Bay and Davis Strait may still occur from other activities such as marine shipping, marine-based tourism, and from climate change. Scenario D becomes the base condition against which the other three (3) scenarios could be compared. Detailed information about the level of potential effects to the physical environment from oil and gas development in Baffin Bay and Davis Strait is presented below. This information is based on existing state of knowledge. Table 18: Activities According to Season summarizes the seasonality of activities according to the six (6) Inuit calendar seasons.

**Table 18: Activities According to Season**

| Seasons | Offshore Seismic Surveys | Exploration Drilling | Field Development and Production |
|---|---|---|---|
| Ukiuq (winter) | | X[36] | X |
| Upirngasaaq (early spring) | | X | X |
| Upirngaaq (late spring) | | X | X |
| Aujaq (summer) | X | X | X |
| Ukiassaaq (early fall) | X | X | X |
| Ukiaq (fall, early winter) | | X | X |
| **Note:** Table developed by the QIA and the NIRB using information shared in the *Qikiqtaaluk Inuit Qaujimajatuqangit and Inuit Qaujimaningit for the Baffin Bay and Davis Strait Marine Environment* Report, and the *Oil and Gas Life Cycle Activities and Hypothetical Scenarios* Report | | | |

## 7.1. PHYSICAL ENVIRONMENT

As part of the SEA, potential impacts to valued ecosystem components (VECs) of the physical environment were assessed to gain a better understanding of the nature of the potential effects to the Area of Focus (e.g., air quality, water quality, and acoustic environment). The selection of VECs was informed by public engagement and community scoping meetings conducted by the NIRB in potentially interested communities in the Qikiqtani region in 2017. The full list of VECs considered for the SEA is available in Appendix D: Final SEA Scope List.

The following is a summary of Nunami Stantec's assessment of potential impacts (negative or positive influence from an activity) and effects (change to a valued component) from the hypothetical oil and gas scenarios on the physical environment. For additional information, see Section 7.1: Physical Environment of the *Environmental Setting and Potential Effects Report* (Nunami Stantec, 2018).

The possible scenarios for oil and gas development in Baffin Bay and Davis Strait are described in detail in Chapter 6: Possible Development Scenarios in Baffin Bay/Davis Strait of this Report.

[36] Exploration drilling would likely be conducted in a 1-2 month period from August to October when there is open water (however, drilling could be conducted year-round).

### 7.1.1 *Background*

#### 7.1.1.1. *Potential Impacts and Effects*

Based on the assessment of the possible scenarios, it was noted that activities associated with scenarios may cause the following impacts:

- Air emissions from marine-based oil and gas exploration, drilling, production, and transport activities;
- Noise from seismic surveys, marine shipping, and drilling activities;
- Discharge of liquids (such as wastewater) to the marine environment from routine oil and gas operations;
- Waste and mud from drilling activities; and
- Changes to ice conditions by icebreaking vessels and facilities and equipment used for drilling operations.

A summary of potential impacts on marine water, the seabed, sea ice, noise levels, and air quality, as identified in the study is presented in Table 19: Summary of Potential Impacts on the Physical Environment. As identified in Table 19, activities associated with scenarios A, B, and C of oil and gas development may result in impacts such as air emissions, noise, discharge of liquids (such as wastewater), release of mud from drilling activities, and ice disturbance. Of these, air emissions and changes in ice conditions may extend beyond the Development Scenario Area (Figure 2). These impacts may affect some components of the physical environment including air quality and gases that contribute to the warming of the Earth (greenhouse gases); marine water quality; sea ice and iceberg conditions; noise levels; and marine sediment quality. Based on the study, it is predicted that activities associated with the possible oil and gas development scenarios would not impact climate and meteorology, geology, or coastal landforms. As such, the remainder of the discussion focuses on components of the physical environment that may be impacted by activities associated with the possible oil and gas development scenarios.

**Table 19: Summary of Potential Impacts on the Physical Environment**

| Components of the Physical Environment | Potential Environmental Impacts | | | | |
|---|---|---|---|---|---|
| | Air Emissions | Noise | Routine Discharge | Waste and Mud from Drilling | Ice Disturbance |
| Climate and Meteorology | | | | | |
| Air Quality and Greenhouse Gases | ✓ | | | | |
| Oceanography | | | ✓ | | |
| Sea Ice and Iceberg Conditions | | | | | ✓ |
| Acoustic Environment | | ✓ | | | |
| Geology | | | | | |
| Coastal Landforms | | | | | |
| Marine Sediment Quality | | | | ✓ | |
| **Note:** "✓" = Indicates potential effect from oil and gas activities for all development scenarios. | | | | | |

#### 7.1.1.2. *Air Quality and Greenhouse Gas Emissions*

As described in the *Environmental Setting and Potential Effects Report* (see Section 7.1.1.1: Air Emissions; Nunami Stantec, 2018a), the atmospheric environment is a pathway to the biological environment and changes to air quality may impact components of the marine environment such as ice conditions, fish and fish habitat, waterbirds, and marine mammals. Greenhouse gases (GHG) are also known to contribute to global warming which causes changes in the world's atmosphere, land, and oceans. Air emissions from marine-based oil and gas exploration, drilling, production, and transport activities may release gases and particles like dust into the air and result in changes to air quality that can affect climate change, ecosystems, and human health. Potential impacts from offshore oil and gas development activities may also extend beyond the Development Scenario Area.

Activities associated with marine-based oil and gas development, as described in the possible scenarios for marine-based oil and gas development (see Chapter 6: Possible Development Scenarios in Baffin Bay/Davis Strait), would result in the release of gases and particles into the air, including the following:

- Gases containing nitrogen, oxygen, sulphur, carbon, and hydrogen which may change the quality of the air (e.g., nitrogen oxides (NOx), sulphur dioxide ($SO_2$), carbon monoxide (CO), volatile organic compounds (VOC), and ozone ($O_3$);
- Dust particles which may change the quality of the air (e.g., Total Particulate Matter (TSP), Particulate Matter less than 10 and 2.5 micrometres in diameter ($PM_{10}$ and $PM_{2.5}$); and
- Greenhouse gases (e.g., carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$)), which may contribute to global warming and climate change.

The quantities of air contaminants and GHGs could not be estimated for the scenarios as the details and the specifications of equipment and marine support vessels is not fully known for each scenario. However, estimates were made based on emission levels published by the Federal Government for the oil and gas sector. While these estimated emissions make up a large portion of the total Nunavut emissions (2% to 48%) they are considered relatively small compared to other provinces with a higher level of industrial activity.

Air contaminants released were expected to disperse downwind in a direction from points of release and may approach ambient levels (natural conditions) within 5 to 10 kilometres (km) from sites where the substances are released into the air. It was also predicted that there would be a rapid recovery of air quality to ambient air quality levels once activities associated with any of the oil and gas development scenarios are completed. Given that the offshore activities are likely to be several kilometres offshore, potential changes to air quality from possible marine-based oil and gas activities in Baffin Bay and Davis Strait were not expected to exceed Nunavut air quality standards at any location on land.

Commercial marine vessels are a significant source of air pollution and GHG emissions within the Baffin Bay and Davis Strait area. As arctic shipping increases there is a need to consider the cumulative effects of air pollutants from Arctic marine shipping. For additional discussion, see 7.5 Cumulative Effects.

**Views of Interested Parties**

Within its final written submission, the World Wildlife Fund (WWF) discussed the need to consider both upstream and downstream greenhouse gas emissions in the SEA. It was noted that if the scale of offshore petroleum activities in the eastern Canadian Arctic is extensive, this could constitute an important contribution to Canada's overall greenhouse gas emissions and would negatively impact global efforts to limit warming. It was further stated that "Canada's greenhouse gas footprint roughly doubles with inclusion of emissions associated with the foreign combustion of oil produced in Canada and exported abroad" (Lee, M., 2017 as cited in WWF 2019). WWF recommended that research be conducted to analyze upstream and downstream greenhouse gas emissions at various possible scales of offshore oil and gas development in the eastern Canadian Arctic to determine if and to what extent Arctic oil can be developed within national and international carbon reduction targets.

#### 7.1.1.3. *Oceanography (including water quality)*

As described in the *Environmental Setting and Potential Effects Report* (see Section 7.1.1.3: Routine Discharge; Nunami Stantec, 2018a), routine liquid and solid discharges associated with the possible scenarios of oil and gas development in Baffin Bay and Davis Strait, such as marine-based or offshore drilling, may cause a change in the water quality in the marine environment at the site of the oil and gas activities. In addition, the effects of climate change on the oceanography in the Area of Focus were not expected to alter the prediction of effects of routine discharge on water quality.

Routine liquid and solid discharges from marine-based oil and gas development activities that may impact marine water quality include the following:

- Sewage, grey water (for example, laundry, and kitchen wastewater), cooling water, and deck drainage water from marine vessels and other support facilities;
- Wastewater that collects inside the hull of a ship (bilge water) and water carried in special tanks in a ship to improve stability and balance of the vessel (ballast water); and
- Drill muds, cement, oil, fluids, and other chemicals from drilling equipment.

A recent assessment of effects for an offshore drilling program in Atlantic Canada with similar activities to those included in the scenarios predicted that activities may result in small-scale and localized releases of waste products, and potentially contaminants, during routine operations. Results from ongoing Grand Banks Environmental Effects Monitoring programs have shown no environmental effects on the marine environment from contamination due to operational discharges. Based on this information, the *Environmental Setting and Potential Effects Report* concluded the following for each scenario considered:

- *Scenario A – Exploration with Offshore Seismic Surveys:* No change in water quality.
- *Scenario B and Scenario C – Exploration Drilling and Field Development and Production:* Potential change in water quality as a result of routine discharges from drilling activities and the operation of project vessels.
- *Scenario D – No Offshore Oil and Gas Activity:* No change in water quality.

Nunami Stantec predicted that any change in marine water quality from routine liquid discharges associated with possible oil and gas development activities in Baffin Bay and Davis Strait would be limited to the immediate area of the discharge and would be minimal. As predicted, it is expected that the contaminants from routine liquid discharges would dilute with water in the surrounding sea, breakdown in the water, and/or evaporate. However, Nunami Stantec indicated that there are concerns regarding the discharge of produced water under the ice, as it was noted that there is a risk of accumulation just below the ice, where degradation, evaporation, and other processes are slower.

> Any change in marine water quality from routine liquid discharge would be limited to the immediate area of discharge and minimal.
>
> Nunami Stantec, 2018a

During the Public Engagement Sessions, the NIRB heard concerns about the potential for negative effects from ship ballast water on water quality and the potential for invasive species.

### Views of Interested Parties

During the Final Public Meeting, Nunavut Tunngavik Incorporated (NTI) noted concern with respect to the currents in the area, specifically the West Greenland Current, and the capability of large ships being able to anchor and withstand currents of 10 to 15 kilometres per day for six (6) to seven (7) months of the year, as well as the potential of ice being swept into the area due to the currents.[37]

Within the *Uqausirisimajavut Report,* the Qikiqtani Inuit Association noted that the largest habitat is the ocean waters themselves and is the medium by which communications takes place, where prey is found, where breeding is done, and how marine mammals move from one location to another. It was further noted that the marine environment is subject to noise and vibration, vessel movements and infrastructure anchoring, and spills and other contaminants.

The Nangmautaq (Clyde River) Hunters and Trappers Organization (Nangmautaq HTO) noted that the currents need to be better understood as it relates to spills and the potential impacts from the different currents in the region. The Nangmautaq HTO requested the moratorium be extended so that all parties involved have a better understanding of the current conditions, and time to train for oil spills and put a safety plan in place for the community.[38] A similar concern was raised by a Community Representative from Iqaluit on currents and the flow of water following a spill.[39]

In addition, the Board requested clarification from Transport Canada (TC) to describe how describe how the potential for introduction of invasive species by ships or vessels operating in the offshore is managed, including how fouling of vessel hulls with invasive species is prevented or regulated in the Area of Focus.[40] TC noted that vessels entering Canadian waters are required to exchange ballast waters outside of Canadian waters to limit introduction of invasive species from ballast waters.[41] With respect to antifouling of vessel hulls, TC provided information on international guidelines that Canada follows for the control and management of ships' bifouling: the International Maritime Organizations Guidelines for the Control and Management of Ships' Biofouling Guidelines and the Control of Harmful Antifouling Systems. It was noted that the International Maritime Organization's guidelines encourage the use of appropriate antifouling systems and are voluntary and currently under review.[42]

#### 7.1.1.4. ***Sea Ice and Iceberg Conditions***

As described in the *Environmental Setting and Potential Effects Report* (see Section 7.1.1.5: Ice Disturbance; Nunami Stantec, 2018a), activities associated with the possible oil and gas development scenarios in Baffin Bay and Davis Strait may result in changes to sea ice conditions. Specifically, the use of icebreakers to support oil and gas exploration surveys and to protect marine-based oil and gas development facilities from sea ice may result in changes to the sea ice quality (e.g., thickness) and the extent or size of sea ice. The use of icebreakers to support seismic

[37] W. Johnson, Nunavut Tunngavik Inc., NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 249, lines 9-23.
[38] J. Price for the Clyde River Hunters and Trappers Organization, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 789, lines 3-11.
[39] B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 22, 2019, p. 898, lines 18-20.
[40] E. Copland, NIRB Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 563 and 565, lines 16-20 and 4-6.
[41] O. Jihangir, Transport Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 564-565, lines 13-26 and 1.
[42] A. Gudmundson, Transport Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 665-666, lines 22-26 and 1-12.

survey programs and exploration and production drilling platforms would likely result in localized changes to the sea ice along the transit route.

Nunami Stantec predicted that the area of sea ice that might be impacted or disturbed by icebreakers would be small compared to the total area of sea ice in Baffin Bay and Davis Strait. Also, areas of disturbed ice would be expected to refreeze during the winter months after the icebreaking activities cease. In addition, it was predicted that the physical disturbances associated with oil and gas development activities may not change the natural course of iceberg development or movement in Baffin Bay and Davis Strait.

> The area of sea ice that might be impacted would be small compared to the total area of sea ice in Baffin Bay and Davis Strait.
>
> Nunami Stantec, 2018a

Given that the area of sea ice that might be affected would be small compared to the overall extent of ice in Baffin Bay and Davis Strait, and that ice cover would refreeze after disturbance during winter months, it was predicted that there would not likely be any appreciable change to sea ice quality or cover on average within the Area of Focus. In addition, it was predicted that the physical disturbances associated with oil and gas development activities may not change the natural course of iceberg development or iceberg drift over Baffin Bay and Davis Strait. Effects of ice disturbance in the offshore marine environment would be primarily relevant to habitat alteration for biological environment valued ecosystemic components, particularly marine mammals (see 7.2.1.6 Marine Mammals for further details).

Throughout the duration of the SEA, the NIRB heard comments, questions, and concerns from community members about the potential for offshore oil and gas activities to negatively affect sea ice.

### Views of Interested Parties

During the Final Public Meeting, Nunavut Tunngavik Incorporated (NTI) noted the importance of considering the challenges presented by sea ice to operations and that climate change needs to be taken into account. NTI also expressed concern that the current floating production vessels included in the scenarios may not be able to operate in the ice conditions found in Nunavut and the Area of Focus, noting that ice forms from late October to July or August.[43]

Within the *Uqausirisimajavut Report,* the Qikiqtani Inuit Association (QIA) indicated that one of the more overlooked marine habitats are ice and icebergs. It was noted that the harvesters interviewed for the QIA *Inuit Qaujimajatuqangit Report* and the Inuit Qaujimajatuqangit Advisory Committee spoke of the importance of ice as habitat, specifically land fast ice, and icebergs. It was identified in the *Uqausirisimajavut*

> Icebergs were identified as a unique habitat. They are used as haul outs by walrus and the wake attracts birds and marine mammals.
>
> QIA, 2019

[43] W. Johnson, Nunavut Tunngavik Inc., NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 244, 248-249, lines 21-23, 12-26 and 1-8.

*Report* that the majority of the potential oil and gas development area is pan ice in the winter and the possible impact to ice habitat would be from shipping from production platforms in the winter. This will likely need to be determined on a project-by-project basis. Another potential impact identified to the pan ice habitat frequented by marine mammals in the winter would come from spills and blowouts. The QIA noted that it is aware that there are still inadequate technologies for cleaning up in ice conditions, especially the under-ice surfaces. In addition, according to the Inuit Qaujimajatuqangit Advisory Committee, the strength of currents in Baffin Bay and Davis could carry oil or contaminants from spills and blowouts quite some distance. As with pan ice, contaminants could be carried away some distance by icebergs. In addition, under ice contamination could kill marine animals and change the quality of the harvested animal.

In its public written comments, Environment and Climate Change Canada (ECCC) noted that although sea ice incursions pose less risk than icebergs, they should still be considered as a separate factor when discussing the management of sea ice incursions as part of the activities associated with offshore oil and gas exploration and development in Baffin Bay and Davis Strait. In addition, ECCC noted that the International Ice Patrol and the Canadian Ice Service conduct airborne reconnaissance further north to ascertain the potential iceberg population for the upcoming season; however, this should not be considered a regular patrol of the Davis Strait and Baffin Bay when considering operating environment challenges. ECCC finally noted that recent publications are available that indicates that multi-year ice incursions may result in marine hazards due to climate change. ECCC recommended one (1) report be reviewed for any future work to be conducted (see Appendix C: Recommended Documents). During its presentation at the Final Public Meeting, ECCC reiterated its recommendation related to the requirement of further research related to the inconsistencies to the potential local and regional effects on sea ice related to climate change, multiyear ice, and ice movement and the requirement to improve the information on iceberg behaviour.[44]

> *And I think it's not entirely difficult to imagine a scenario in which perhaps an iceberg collides with an oil -- oil platform…*
>
> [M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 489, line 6-9.]

#### 7.1.1.5. ***Acoustic Environment***

As described in the *Environmental Setting and Potential Effects Report* (see Section 7.1.1.2: Noise; Nunami Stantec, 2018a), activities associated with the possible scenarios of oil and gas development in Baffin Bay and Davis Strait may increase airborne and underwater noise levels in and around the site of such activities. The primary source of underwater noise from oil and gas activities is associated with seismic exploration, drilling activities, and vessels used to transport products, personnel, and equipment or undertake icebreaking activities. Atmospheric noise is anticipated to be associated with vessels used for seismic exploration and survey and drilling support, or from aerial support (i.e., helicopters) used to support crew transfer to and from seismic vessels and drilling platforms. Based on an assessment of similar marine-based activities in other

[44] B. Summerfield, Environment and Climate Change Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 387, lines 2-7.

parts of the Arctic (Beaufort Sea), underwater and airborne noise from possible activities associated with marine-based oil and gas development in Baffin Bay and Davis Strait, such as sea bottom trenching or ice augering, could reach median background noise levels at 3 kilometres (km) for airborne sounds, 7.5 km for underwater sounds, and less than 10 km for in-ice vibration from the source of the activities generating the noise. Another study in the Beaufort Sea in the summer determined that marine vessels (crew boat, tugs, and self-propelled barges) were the main contributors to the underwater sound field and were often detectable underwater, as much as approximately 30 km offshore. In air, noise reached background levels between 5 to 10 km (Shepard et al. 2001 and Blackwell et al. 2004; as cited in Nunami Stantec, 2018a, p.7.10).

The potential effects of airborne noise from any offshore oil and gas activities are expected to be relatively small because the distance to any sensitive receptors on or over the water (or ice) is likely to be large. Nevertheless, it is useful to understand the acoustics environment in the air above Baffin Bay and Davis Strait to confirm this expectation.

> The potential effects of airborne noise from any offshore oil and gas activities are expected to be relatively small.
>
> Nunami Stantec, 2018a

It was identified that confidence in the potential effects and cumulative effects of underwater noise from oil and gas activities on marine fishes, waterbirds, and marine mammals would be improved by increasing the collection of ambient sound data specific to the Area of Focus, and in particular Davis Strait. Although it is generally believed that underwater noise has little effect on arthropods or shellfish, further research is needed to better understand potential effects of underwater noise on invertebrates.

During its Public Engagement Sessions, the NIRB heard questions about noise produced by offshore oil and gas activities, particularly from seismic surveys. Questions were primarily centred around the potential for negative effects to marine wildlife, particularly marine mammals and fish.

### Views of Interested Parties

The Qikiqtani Inuit Association (QIA) noted during the Final Public Meeting that "…*IQ committee members speak about how narwhals are notoriously just very skittish and highly, highly sensitive to noise to the point where footsteps on the land while hunting them must be kept to a minimum.*" It was stressed that the case studies with respect to seismic research as presented did not include examples specific to the North and that proper studies should be conducted to fit the area being studied.[45] In response to a deferred question by the QIA on whether the case studies included narwhal and ringed seals, the Canadian Association of Petroleum Producers (CAPP) noted that a number of research projects have been conducted on a variety of marine species and although the research did not include walrus, there were some research related to seals.[46]

[45] S. Lonsdale, Qikiqtani Inuit Association, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 623-624, lines 26 and 1-16.
[46] P. Barnes, CAPP, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 667-668, lines 19-25 and 1-9.

Within its public written comments, the World Wildlife Fund (WWF) discussed the acoustic environment impact assessment within the *Environmental Settings and Potential Effects Report* which is summarized below:

- The treatment of impact from seismic activities downplays the risks posed to marine life and contains some scientifically unsubstantiated conclusions and misleading statements. Other research as conducted indicates that seismic testing can harm marine wildlife, which many Inuit depend upon for their livelihoods. To date 130 species have been documented to be impacted by human-caused underwater noise pollution.
- Studies have shown underwater noise from vessel traffic can readily propagate over 100 kilometres (km) in the Arctic and the noise from seismic surveys can be heard almost continuously in some areas for distances of up to 4,000 km as airgun seismic surveys are among the loudest of human produced sounds, and sound travels very fast and efficiently in water. The effects from underwater noise associated with oil and gas activities would not be 'localized' or 'return to natural or background conditions within a small area from the source of impacts'.
- Impacts from underwater noise is not limited to seismic activities but noise from increase in shipping traffic needs to be considered and a precautionary and "hold the noise" approach is needed in Arctic waters at current levels until safe noise levels can be determined.
- Recommended more seismic research is needed on plankton, benthic organisms, whales, invertebrates, some fish species, narwhals, harbour porpoises, squid, and shrimp, all of which are present in the area, and that the precautionary approach should be applied for those species in which seismic impacts are unknown or uncertain. Further recommended that thorough, long-term studies should be carried out to gain robust baseline biological information on the distribution and abundance of some species (plankton, benthic organisms, fish, marine mammals, and marine habitat).
- Noted that seismic activities should not be conducted in sensitive marine environments until more is known about the full impacts on certain species and recommended restricting underwater noise from vessels to sensitive area of interest to at least 100 km away from its boundaries.

WWF also recommended 13 reports related to the effects of anthropogenic noise on marine mammals and the implications on their behaviour be reviewed for any future work conducted. During the Final Public Meeting, WWF provided a summary of studies that have been identified that indicates that seismic activity and seismic testing pose a risk of mortality to marine organisms.[47] WWF also noted during the Final Public Meeting that studies have shown that seals have intense acoustic stimuli startle reflexes and fear conditioning that can lead to sustained long-term avoidance of an area.[48] Further, WWF noted that another study showed "*repeated startling by anthropogenic sources that may have severe impacts on long-term behaviour of marine*

[47] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 634, lines 8-23.
[48] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 634-635, lines 24-26, and 1.

*mammal populations which could be associated with reduced individual fitnessed -- fitness or even longevity of individuals.*[49]

Within its final written submission, the Ikajutit (Arctic Bay) Hunters and Trappers Organization (Ikajutit HTO) noted concern that the *Environmental Setting and Potential Effects Report* downplayed the impact of seismic surveying and implied that seismic blasts of similar volume under water are no worse to marine life than cracking ice. The HTO stressed that sounds on the surface are not the same as those underwater as the sound travels differently into a marine animal versus airborne sound into a terrestrial animal. Further, the HTO indicated that Elders have noticed that previous seismic programs had impacts on marine animals such as seals, who couldn't get into the water through breathing holes because the sounds were too loud for them to be in the water. The HTO indicated that they cannot support seismic testing in their area, but if it were to occur there must first be an impact study that includes representatives from the five (5) High Arctic communities.

> Elders have noticed that previous seismic programs had impacts on marine animals such as seals, who couldn't get into the water through breathing holes because the sounds were too loud for them to be in the water.
>
> Ikajutit (Arctic Bay) HTO, 2018

> Why are there strict rules for seismic testing when human divers are in the water but not for the marine animals? What is known about the impacts of seismic blasting on fish?
>
> Ikajutit (Arctic Bay) HTO, 2018

In response to a question from the Ikajutit HTO at the Final Public Meeting on the impacts to fish from seismic testing, CAPP stated that although it was possible for certain species of fish to be temporarily scared away from airgun activity, "*our experience with respect to drilling activity, at least often to Newfoundland and other areas where we undertake offshore oil and gas activity, there's been virtually no impact to - to fish from - from that activity.*"[50] A Board member also asked whether CAPP could provide "*scenario to understand the effects of seismic testing on fish and whether blasting is done when the fish are at sea or when they're upstream. And when they're -- when it's assessed, are the assessments of impacts from noise done while they're in the sea or up river? As well as a map, a noise-level map, that could help us understand the impacts of noise on fish or other marine life.*"[51] In response, CAPP noted that the information available is on the species itself regardless of where the species would be located but was not able to provide information on the noise-level map.

The Mittimatalik (Pond Inlet) Hunters and Trappers Organization (Mittimatalik HTO) indicated that wintering areas near Pond Inlet and Arctic Bay should be off limits to seismic surveying as the impacts on marine mammals should be better understood before any seismic activity occurs.

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[49] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 703, lines 10-22.

[50] Exchange between J. Kango, Ikajutit HTO and P. Barnes, CAPP, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 639, lines 6-18.

[51] K. Kaluraq, NIRB Board Member, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 676-677, lines 20-26 and 1.

Concern was noted that oil and gas activities would add more noise to the environment and have negative impacts. The HTO noted observations to "narwhal behaviour from the Baffinland shipping activity which is already creating a lot of underwater noise and impacting some animals." The HTO also noted observation in the area that narwhal have been behaving differently which may be due to seismic surveying on the Greenlandic side. Finally, the HTO referenced a study done in the 1960s that demonstrated how far sound could travel underwater.

During the Final Public Meeting, community representatives shared traditional knowledge indicating that marine mammals such as whales[52] and walrus[53] are very sensitive to sound, and stressed that even the slightest noise could cause them to alter their movements. A Representative from Cape Dorset noted concerns related to noise from ships and surveys and disturbing mammals in the area.[54]

#### 7.1.1.6. ***Marine Sediment***

As described in the *Environmental Setting and Potential Effects Report* (see Section 7.1.1.4: Drill and Mud Cuttings; Nunami Stantec, 2018a), Baffin Bay and Davis Strait may experience changes in marine sediment quality in and around the activities associated with the possible stages, or scenarios, of oil and gas development.

Activities associated with the possible stages, or scenarios, of oil and gas development in Baffin Bay and Davis Strait may change marine sediment quality in and around the site of such activities. As there would be no contact with the seabed, exploration with offshore seismic surveys would not result in changes in sediment quality. There could be a change in sediment quality during exploration drilling and development drilling specifically. Seabed drilling activities associated with marine-based oil and gas exploration and production generate large amount of drilling waste made up of rocks, muds mixed with water, and muds mixed with drilling fluids, which are usually placed on the seabed near the drilling equipment during oil and gas development. These drill muds and rocks may impact marine sediment quality by changing the physical nature and the types of chemicals in the marine sediment from natural conditions.

> Sediment quality in affected marine areas are expected to approach natural sediment quality conditions in weeks to months, and possibly years, after the drilling activities have ceased.
>
> Nunami Stantec, 2018b

Based on an assessment of similar oil and gas drilling activities in other marine regions in Canada, Nunami Stantec expected that potential effects to marine sediment quality from oil and gas development activities would be localized to the immediate area of the drilling activities (within less than 10 kilometres) from drilling sites). The duration of the impacts to marine sediment quality was expected to be medium to long term (weeks to months; in some cases, years beyond

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[52] L. Ishulutaq, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 784, lines 3-23.

[53] A. Alasuaq, Cape Dorset, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 727, lines 11-13

[54] M. Savearjuk Jaw, Cape Dorset, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 720, lines 18-22.

the duration of the activity). The impacts to marine sediment quality were predicted to be reversible, with sediment quality in affected marine areas expected to approach natural sediment quality conditions in weeks to months, and possibly years, after the drilling activities have ceased.

**Views of Interested Parties**

Within the *Uqausirisimajavut Report,* the Qikiqtani Inuit Association indicated that the ocean bottom would be changed by drilling, cabling, pipeline laying, and production installations activities. Bottom dwelling animals including bottom fish, benthic invertebrates, and some shellfish, may be at risk from drilling, anchoring, and extraction infrastructure, as well as sediment and water quality alterations. These are activities most closely associated with exploration drilling and production. Ultimately, depending on location, the changes to the ocean bottom may result in disruption of the food web. For example, Greenland halibut and Arctic cod all rely on the underwater corals found in the potential development area for breeding and any change to the breeding areas may reduce the number of prey species available to *puijiit*.

During the Final Public Meeting, a Community Representative from Iqaluit questioned how seismic activities would affect sediments from moving to the water's surface and where suspended sediments could end up, especially considering the strong tidal currents in the area.[55] In response, Nunami Stantec noted that seismic activities (airguns) would not disturb sediments if conducted in the Development Scenario Area as the sound source is suspended a few metres below the surface of the water and that the surveys would be conducted in deep water.[56]

#### 7.1.1.7. *Mitigation Measures and Planning Considerations*

Mitigation measures are recommended to avoid or reduce negative effects to the environment from activities associated with the possible oil and gas development scenarios. Many of the mitigation measures are standard to oil and gas development and are part of the usual design of potential projects. The potential effects identified above are what would remain after standard mitigation measures have been applied. Specific measures and commitments by a proponent to decrease potential effects of activities and components would be determined during a project level environmental assessment. During the regulatory process, companies would be responsible for submitting a variety of plans for approval, including, but not limited to: safety, environmental protection, ice management, emergency response, contingencies, and for offshore installations. A company would further have reporting requirements, including those related to spills, incidents, drilling, production, and the environment.

Nunami Stantec identified standard mitigation measures recommended to avoid or reduce releases of air contaminants and greenhouse gases, including (for additional detail, see Appendix B of the *Environmental Setting and Potential Effects Report*; Nunami Stantec 2018a):

- Use best available technology for fuel combustion and gas emission controls;
- Use high quality fuels (e.g., sulphur fuel) for operation of equipment;

[55] B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 92, lines 19-26.
[56] J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 95-96, lines 18-26 and 1.

- Reduce marine vessel and aircraft traffic through planning;
- Monitor and reduce the number of gas flaring events;
- Maintenance, inspections, and efficient operation of equipment;
- Follow guidelines and regulations established by Nunavut and Canada for oil and gas activities; and
- Follow applicable international guidelines for oil and gas and marine-based activities (for example, the International Convention for the Prevention of Pollution from Ships).

Specific mitigation measures to avoid or reduce effects on water and sediment quality from the release of routine discharges and deposition of drill and mud cuttings include the following (for additional detail see Section 7.1.5 and Appendix B of the *Environmental Setting and Potential Effects Report*):

- Treat discharges and wastewater before released to the environment in accordance with applicable Nunavut, federal, and international regulations and standards;
- Marine vessels used for oil and gas activities should carry out ballast water exchanges before arriving in Canadian waters;
- Appropriate handling, storage, transport, and disposal of solid and hazardous waste at approved facilities;
- Treat all drill muds and fluids to meet applicable standards before discharged to the marine environment or disposed in an approved facility; and
- Dispose of any excess cement from oil well construction in an approved facility.

### Views of Interested Parties

Within its final written submission and during the Final Public Meeting, the Government of Nunavut (GN), recommended that information about the effectiveness (or limitations) of standard mitigations measures in the Arctic environment be provided. It was further recommended that the Government of Canada, in collaboration with the GN, engage with other jurisdictions active in oil and gas in the Arctic environment to refine their understanding of existing and emerging mitigation measures and their effectiveness in the Arctic environment.

Within its final written submission, the World Wildlife Fund (WWF) noted that many of the noise mitigation plans provided within the *Environmental Setting and Potential Effects Report* are not always supported by research, and in some cases their effectiveness is unproven. In addition, WWF noted that what a truly "safe distance" is unknown in many cases, and negative effects beyond the horizon, such as masking, cannot be easily mitigated. Finally, WWF noted that assumptions were made about the effectiveness of marine mammal monitoring to mitigate seismic noise impacts and recommended that more research is required to ensure mitigation plans are effective.

During the Final Public Meeting, the Board questioned why mitigation and planning considerations associated with exploration drilling and field development and production drilling were almost identical when the former would consist of primarily open-season work compared to year-round activities during production. Nunami Stantec clarified that the list of standard mitigation measures discussed were general and that key differences would include ice-breaking activities in the winter, timing considerations, and key habitat to protect being different in the summer compared to the winter.[57] In response to further questions raised by the Board on planning and mitigation considerations for the shipping of product, the Canadian Association of Petroleum Producers (CAPP) noted that mitigation measures associated with shipping would be specific to project specific considerations such as location and mode of shipping. CAPP further discussed difficulties in generalizing risk mitigations and noted that the timing and selection of transportation routes would comprise a large part of risk mitigation.[58]

Following discussions on the consideration of ice, a Community Representative asked CAPP about the navigation systems that would be used for vessels. In response, CAPP noted that the navigation system is "*world class, especially in areas where there's higher risk, like areas where there's ice or icebergs*".[59]

### 7.1.2 *Views of the Board*

#### 7.1.2.1. *Air Quality and Greenhouse Gas Emissions*

The Board acknowledges concerns shared by the World Wildlife Fund that the scale of offshore petroleum activities could significantly affect greenhouse gas emissions and its recommendations that upstream and downstream greenhouse gas emissions be analyzed. As expressed in 7.4 Climate Change, the Board has significant concerns about current and future changes to climate and the resultant effects on all aspects of the environment. However, as noted in the NIRB's response to comments received on the *Revised Draft Scope* for the SEA:

> With the level of information available through the hypothetical possible development scenarios it would be difficult to assess the possible end use of any possible future extracted petroleum (e.g., used as fuel or processed for a petrochemical use, used to generate a formerly coal powered plant or a brand new plant, etc.), predicted greenhouse gas emissions (including intensity), and associated factors (e.g., the use of GHG mitigation technology) would be too speculative. This level of information could be applicable to potential future project level environmental assessments.[60]

As greenhouse gas emissions are a key contributing factor of climate change, the Board agrees that detailed modelling to forecast emission impacts from various scales of development of offshore oil and gas development in the Area of Focus would contribute positively to future strategic environmental assessments and project-specific assessments.

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[57] Exchange between C. Emrick, NIRB Board, and J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp.8-79, lines 10-26 and 1-8.

[58] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 79-80.

[59] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 620, lines 13-20.

[60] Public Registry ID: 316051

The Board has carefully considered the identified information gaps and areas of uncertainty relating to air quality and greenhouse gas emissions, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research and impact assessment:

***Recommendations to address through future assessments:***

- Conduct research to:
    - assess upstream and downstream greenhouse gas emissions at various scales of offshore oil and gas development in Baffin Bay and Davis Strait; and
    - determine if, and to what extent, oil and gas resources can be developed in the Area of Focus within the limits imposed under national and international carbon reduction targets (#46).

#### 7.1.2.2. *Oceanography*

The Board acknowledges that the predictions regarding changes to marine water quality from routine liquid discharges associated with possible oil and gas development activities in Baffin Bay and Davis Strait would be limited to the immediate area of the discharge and that the expected effects would be minimal due to dilution of contaminants with water in the surrounding waters. Further, it is recognized that overall more research needs to be completed to better understand the current oceanographic processes before any substantive predictions can be made.

During the Final Public Meeting, the Board heard comments on the lack of information about the current conditions in both Baffin Bay and Davis Strait and their potential influence as it relates to spills. Available information however does indicate that in many areas of Baffin Bay and Davis Strait there are very strong currents which could magnify the impacts of the deposition of deleterious substances and expand the impact footprint throughout the region. As noted in Volume 2, Chapter 5.1.2, the Board had concerns with the gaps in the available knowledge of the physical environment and highlighted in Volume 2, Chapter 5.1.2.4 information on chemical and physical oceanography that would be required to assess potential effects of oil and gas developments, as well as to better understand important oceanographic processes in the Area of Focus, and potential effects of climate change.

#### 7.1.2.3. *Sea Ice and Iceberg Conditions*

Within the *Environmental Setting and Potential Effects Report* prepared by Nunami Stantec it was predicted that the area of sea ice that might be impacted or disturbed by icebreakers would be relatively small compared to the total area of sea ice in Baffin Bay and Davis Strait and that the physical disturbances associated with oil and gas development activities may not change the natural course of iceberg development or movement in Baffin Bay and Davis Strait. However, the Board agrees with the Qikiqtani Inuit Association that ice and icebergs as marine habitats, especially land fast ice and icebergs, should be considered important components when assessing the potential impacts from oil and gas development. Specifically, ice habitat frequented by marine mammals in the winter may be impacted from spills and blowouts and technology needs to be improved to prevent such accidents from occurring and to enable effective cleanup if they do occur, especially the under-ice surfaces. The Board also heard concerns by parties during the during the Final Public Meeting on the potential effects that ice disturbance would have on habitat alteration for marine mammals. For Board recommendations related to marine mammals addressing baseline research and impact mitigation see 7.2.2.3 Fish and Fish Habitat.

While ECCC provided several recommendations around the management of sea ice incursions as part of the activities associated with offshore oil and gas exploration and development, the Board acknowledges that these are already part of the current regulatory process.

#### 7.1.2.4. *Acoustic Environment*

In reviewing the information and predictions made within the *Environmental Setting and Potential Effects Report*, as well as input by interested parties, the Board finds that the confidence on the potential effects of airborne noise and underwater noise from any offshore oil and gas activities on sensitive receptors could be improved upon by increasing the collection of ambient sound data specific to the Area of Focus. As noted in Volume 2, Chapter 5.1.2, the Board had concerns with the identified knowledge gaps in the physical environment and highlighted in Volume 2, Chapter 5.1.2.6 that information on the acoustic atmosphere of Baffin Bay and Davis Strait would be required to assess potential effects of oil and gas developments, as well as to better understand the dispersion of noise in the Arctic atmosphere.

The Board concurs with parties that more research is needed on the potential effects of seismic activities on plankton, benthic organisms, whales, invertebrates, some fish species, and marine mammals, to determine the complete range of impacts from seismic activities and underwater noise on the marine species found in the Area of Focus. The Board believes that this research could be designed to improve our understanding of all anthropogenic noise associated with the marine environment, not just those associated with oil and gas development activities (e.g., ice-breaking). Additional research would be required to ensure that mitigation measures for the potential effects from both underwater noise and atmospheric noise are effective. Finally, additional research is also needed to more confidently characterize the effects of in-air and underwater noise on waterbird species and to develop more relevant threshold criteria for assessing injury and behavioural disturbance.

While World Wildlife Fund provided a recommendation related to limiting seismic activities in sensitive marine environments, the Board notes that these types of activities are restricted in most sensitive marine environments through legislation applicable to the sensitive area (e.g., National Marine Conservation Areas).

For Board recommendations related to the acoustic environment and addressing baseline research see Volume 2, Chapter 5.1.1.6: Acoustic Environment.

### 7.1.2.5. *Marine Sediment*

The Board acknowledges that the ocean bottom and marine sediment would be altered by the installation of oil and gas infrastructure (e.g., drilling, anchoring, and extraction infrastructure), the discharge and deposition of drill cuttings, or accidental spills. These activities could potentially destroy or alter fish habitats, and potentially affect bottom dwelling animals such as bottom-feeding fish, benthic invertebrates, and some shellfish. As noted in Volume 2, Chapter 5.2.11, the Board also had concerns with the gaps in the available information related to the physical environment and in Volume 2, Chapter 5.1.2.9 had highlighted that information related to sediment quality was difficult to assess due to the limited information available. Recommendations related to the potential impacts from oil and gas development to benthic invertebrates and fish and fish habitat can be found in Chapter 7.2.2.2 and Chapter 7.2.2.3, respectively.

For Board recommendations related to marine sediment and addressing baseline research see Volume 2, Chapter 5.1.2.9: Marine Sediment.

### 7.1.2.6. *Mitigation Measures and Planning Considerations*

The Board agrees with the Government of Nunavut that additional information is needed on the effectiveness or limitations of standard mitigation measures in the Arctic environment. The Board considers the project level assessment process the most applicable stage to assess specific mitigation measures, recognizing that only then are project level considerations such as location, scale, timing, and intensity known. However, given the significant concerns expressed by parties regarding identified information gaps and recognizing the potential magnitude of adverse effects, the Board agrees that increased confidence is required that potential negative effects can be properly mitigated. The Board appreciates and acknowledges the mitigation measures provided by the QIA and informed by the Inuit Qaujimajatuqangit Committee. The Board strongly recommends that Inuit Qaujimajatuqangit and Inuit Qaujimaningit and associated traditional rules be sought to develop appropriate mitigation measures in future, should the moratorium be lifted. The Board has commented on specific recommendations within its views on individual valued components throughout the Report.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to mitigation measures and planning considerations, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing mitigation, monitoring, modelling, mapping, and predictions:

***Recommendations to address prior to lifting the current moratorium:***

- Reflecting updated baseline and effects assessment data, and the experience of the National Energy Board, Canada-Newfoundland and Labrador Offshore Petroleum Board, Canada-Nova Scotia Offshore Petroleum Board, and other relevant parties, and in collaboration with the Government of Nunavut, Inuit Organizations, and local communities and informed by Inuit Qaujimajatuqangit and Inuit Qaujimaningit conduct research to:

- o identify standard impact mitigation measures associated with offshore oil and gas development; and
- o assess the effectiveness (or limitations) of these standard impact mitigation measures in the Arctic environment; and develop standard mitigation measures for potential impacts associated with oil and gas developments in the Area of Focus (#61).

## 7.2. BIOLOGICAL ENVIRONMENT

As part of the SEA, potential impacts to Valued Ecosystem Components (VECs) of the biological environment that are considered important to the region (e.g., fish and fish habitat, waterbirds, and marine mammals) were assessed to gain a better understanding of the nature of these potential impacts and effects to the Area of Focus. The selection of VECs was informed by public engagement and community scoping meetings conducted by the NIRB in potentially interested communities in the Qikiqtani region in 2017. The full list of VECs considered are available in Appendix D: Final SEA Scope List.

The following is a summary of Nunami Stantec's assessment of potential impacts (negative or positive influence from an activity) and effects (change to a valued component) from the hypothetical oil and gas scenarios on VECs of the biological environment. For additional information, see Section 7.2: Biological Environment of the *Environmental Setting and Potential Effects Report.* The possible scenarios for oil and gas development in Baffin Bay and Davis Strait are described in detail in Chapter 6: Possible Development Scenarios in Baffin Bay/Davis Strait of this Report.

### 7.2.1 *Background*

#### 7.2.1.1. *Potential Impacts and Effects*

Based on the assessment of the possible scenarios, it was noted that activities associated with the scenarios may cause the following impacts to components of the biological environment that are considered important to the region (i.e., fish and fish habitat, waterbirds, and marine mammals):

- Noise from seismic surveys, marine shipping, and drilling.
- Air emissions from marine-based oil and gas exploration, drilling, production and transport activities.
- Discharge of liquids (including wastewater) to the marine environment from routine oil and gas operations such as marine transport.
- Waste and mud from drilling activities.
- Changes to the habitat for marine wildlife from icebreaking vessel and marine-based facilities for oil and gas production, including equipment used for drilling operations.
- Contact or direct disturbance / interference especially with migratory path.

A summary of potential impacts of activities associated with the possible oil and gas development scenarios in Baffin Bay and Davis Strait to small living organisms in marine water (plankton), benthic flora and fauna (sea bottom-dwelling living organisms), fish and fish habitat, waterbirds, marine mammals, and marine areas of concern or importance as identified in the study is presented in Table 20. As noted in Table 20: Summary of Potential Impacts on the Biological Environment, activities associated with possible scenarios of oil and gas development may result in impacts related to noise, discharges of liquids (including wastewater), release of drill and mud from drilling activities, and changes to marine wildlife habitat. Nunami Stantec predicted that activities associated with the possible oil and gas development scenarios may not impact the coast and shoreline, but as Baffin Bay and Davis Strait are wintering habitat, such as for marine mammals and fish, the other potential impacts would apply. As such, the remainder of the discussion focuses on components of the biological environment that may be impacted by activities associated with the possible oil and gas development scenarios.

**Table 20: Summary of Potential Impacts on the Biological Environment**

| Valued Ecosystem Component | Potential Impacts: Noise | Routine Discharge | Waste and Mud from Drill | Changes to Marine Wildlife Habitat |
|---|---|---|---|---|
| Species at Risk[1] | ✓ | ✓ | ✓ | ✓ |
| Coast and Shoreline | | | | |
| Plankton | ✓ | | | X |
| Benthic Flora and Fauna | ✓ | ✓ | ✓ | ✓ |
| Fish and Fish Habitat | ✓ | ✓ | ✓ | ✓ |
| Waterbirds | ✓ | ✓ | ✓ | ✓ |
| Marine Mammals | ✓ | ✓ | ✓ | ✓ |
| Special and Sensitive Areas | | | | ✓ |
| Areas of Concern or Importance | | | | ✓ |

**Notes:** "✓" = Indicates potential effect from oil and gas activities.
X = The QIA added 'Changes to Marine Wildlife Habitat' on Plankton as a change to ice could represent a habitat change for marine wildlife.

#### 7.2.1.2. *Plankton*

As described in the *Environmental Setting and Potential Effects Report* (see Section 7.2.1: Potential Effects from Routine Activities; Nunami Stantec, 2018a), activities associated with the possible scenarios of oil and gas development in Baffin Bay and Davis Strait may result in changes to marine plankton due to increase in noise, and habitat alteration.

**Noise**

Marine plankton could be affected by noise during seismic exploration (*Scenario A*) but no effects are expected from noise associated with *Scenario B* and *Scenario C* as noise levels are not expected to be intense enough to harm plankton. Exposure to underwater noise associated with seismic sound source arrays may result in death of marine plankton in the immediate vicinity of the seismic activity. Zooplankton and ichtyoplankton (fish and invertebrate eggs and larvae) cannot avoid the pressure wave created by air guns and can be killed within a distance of less than two (2) metres (m) and incur sub-lethal injuries within five (5) m of the sound source. While effects of seismic operations on plankton can be adverse, it was predicted that the effects would be restricted to a portion of the area surrounding the sound source of the seismic activities (approximately 1.2 kilometres from the source). It was further predicted that plankton populations would recover rapidly once seismic operations have ceased (months through to the next reproductive cycle). As seismic operations are not expected to be frequent in space or time within the Area of Focus, seismic operations were expected to have a low to moderate magnitude effect on the regional abundance or sustainability of plankton. As seismic surveys are expected to be seasonal, limited to ice free periods, and only used to determine if oil and gas sources exist, or to gather details on the formation, it was predicted that the level of the effects of these activities to plankton are expected to be low to moderate in the region. However, uncertainty surrounds the effects characterization as a result from the lack of research on seismic effects on plankton, and specifically Arctic plankton. Potential non-linear feedback loops between climate change and plankton are also not well understood, such as changes in bloom phenology due to sea ice changes, and changes in abundance and species composition due to changes in ocean circulation, surface conditions, and temperatures.

The QIA *Inuit Qaujimajatuqangit Report* noted reference to under ice conditions and ice moving with the currents especially icebergs. While the *Environmental Setting and Potential Effects Report* discussed localized changes, these changes due to discharges could be transported elsewhere because of currents.

### Habitat Alteration

Change in health and change in mortality risk on plankton may occur due to habitat alteration caused by icebreaking activities associated with *Scenario A*, *Scenario B*, and *Scenario C*. No effects on plankton were expected due to habitat alterations caused by the physical presence of drilling platforms and other marine infrastructure. Icebreaking activities during exploration drilling and production can increase the amount of edge effects in pack ice which leads to secondary (e.g., plankton) production in the water column, providing a significant portion of the biomass at the base of the Arctic marine food chain. The disruption and overturning of ice by the icebreakers during the winter may disrupt ice algal production below the ice which in turn can have important consequences for food web functioning and carbon dynamics of the pelagic system. Overall, habitat alteration caused by *Scenario A*, *Scenario B*, and *Scenario C* are likely to have negligible effects on plankton as the effect would be localized to the path of the icebreaker (affecting a very small proportion of the plankton community), short-term (i.e., limited to hours/days after the icebreaker has transited), and be limited to multiple-irregular events. Reduced future ice cover and duration as a result of climate change may alter this characterization as it would likely result in a change in ice-algae abundance and distribution. It was noted that there was little uncertainty in this effects assessment as it is restricted to ice breaking activities only, which are well understood.

### Views of Interested Parties

Fisheries and Oceans Canada (DFO) noted in their public written comments that produced water discharge have high concentrations of nutrients as well as contaminants that can impact community structure of phytoplankton. DFO indicated that routine discharge should also be identified as having a potential effect on plankton and the description of possible effects of nutrient pollution from gray water on plankton should be included in the description of effects. Discharge of ballast water is also a likely pathway for the introduction of non-native plankton species to the region. Further, the discussion was missing on the potential impacts of produced water reported in the North Sea due to endocrine disruption. DFO noted that the effects on zooplankton from seismic air guns is limited due to short the life-cycles and recruitment from surrounding waters.

During the Final Public Meeting, a Community Representative from Iqaluit clarified that if zooplankton are impacted from oil and gas then the food chain would be impacted including marine mammals and people eating the mammals.[61]

#### 7.2.1.3. ***Benthic Flora and Fauna (including soft corals and seaweed)***

As described in the *Environmental Setting and Potential Effects Report* (see Section 7.2.1: Potential Effects from Routine Activities; Nunami Stantec, 2018a), activities associated with the possible scenarios of oil and gas development in Baffin Bay and Davis Strait may result in changes to the marine benthic flora and fauna.

### Noise

Benthic flora and fauna (invertebrates) could be affected by noise during seismic exploration (*Scenario A*), but no effects are expected from noise associated with *Scenario B* and *Scenario C* as noise levels were not expected to be intense enough to harm benthic flora and invertebrates. It has been suspected that seismic noise can cause changes in behaviour, dominated by startle responses, and physiological damage to arthropods or shellfish and thus increase their mortality risk.

Based on past research, noise from seismic surveys may change the behaviour of benthic organisms, cause injury or death, and reduce the population of these organisms. However, based on studies conducted in other marine regions regarding effects of noise from seismic surveys, benthic organisms, such as shellfish, appear to be less impacted by seismic surveys when compared to marine plankton while scallop beds were significantly impacted by seismic surveys. In addition, corals, sea pens, and sponges are sensitive to bottom disturbance such as trawling and oil and gas infrastructure placement due to their vertical structure, fragile nature and slow growth (Campbell & Simms, 2009; Watanabe et al., 2009). Within the coral group, black corals, and large and small gorgonians are considered most vulnerable to disturbance due to the inability of these organisms to reattach to the substrate after being dislodged (Gilkinson & Edinger, 2009).

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[61] B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 342, lines 4-7.

It was concluded in the *Environmental Setting and Potential Effects Report* that benthic flora and invertebrates appear relatively resilient to noise disturbances and effects on behaviour and mortality are expected to be low or negligible, local, restricted to the seismic activity and of medium-term duration (i.e., months to a year or more). However, it was noted that comprehensive field studies during seismic operations are needed to discern between potential project effects and natural variability in behaviour, distribution, abundance and mortality of benthic invertebrates. Some uncertainty of future effect characterization also results from interactions with climate change impacts on benthic invertebrates (e.g., changes in benthic pelagic coupling in the Arctic, ocean acidification) which may alter species composition, abundance and distribution, and thus could potentially alter effects from noise on the local benthic fauna.

### Routine Discharge

Benthic flora and fauna may be affected by routine discharges of liquid wastes from marine vessels under *Scenario A*, *Scenario B*, and *Scenario C*. Effects under these scenarios may include changes in habitat through chronic contamination, particularly by metals and hydrocarbons, and associated changes in health, as well as through the introduction of invasive species from ballast water. Liquid and solid discharges containing high concentrations of metals, chemicals, and suspended solids may be ingested or absorbed by benthic flora and fauna and accumulate harmful constituents over time. Bioaccumulation of some contaminants (e.g., heavy metals) may lead to cascading effects through the Arctic food web, which is primarily dependent on benthic biomass. However, routine discharges from oil and gas activities do not contain high levels of these types of contaminants. Regular discharges of ballast water can also introduce biological invasive species into new ecosystems, particularly invertebrates. Overall, the effects of routine discharges related to activities in *Scenario A*, *Scenario B*, and *Scenario C* on marine benthic flora and fauna in Baffin Bay and Davis Strait were expected to be negligible or low, local, continuous and if present, long-term.

### Drill and Mud Cuttings

Drill and mud cuttings can directly affect the habitat, health, and mortality risk of benthic flora and fauna in the vicinity of the drill site during either exploration drilling (*Scenario B*) or production drilling (*Scenario C*). Waste mud from drilling, which may be up to two (2) metres deep in the immediate surrounding area around drilling operations, could result in the removal of benthic habitat and bury the associated flora and fauna in the direct area of influence. This can locally fragment habitat on the seabed, creating a zone of cuttings along benthic habitat, even though the zone is expected to be relatively small in comparison to the size of the study area. Drill and mud cuttings also contain a variety of constituents such as metals, hydrocarbons, drilling additives, and other chemicals that benthic flora and fauna can become exposed to. Local increases in turbidity and suspended sediments can also take place both directly from the initial discharge of cuttings, and subsequently from resuspension of cuttings during strong currents and storms. These can decrease the available sunlight for benthic flora or inhibit/clog membranes used for metabolic functions. Overall, drill and mud cuttings are expected to create a low to moderate level of change to existing conditions. The effects are local, generally near-field, but continuous and potentially long-term.

## Habitat Alteration

Under *Scenario A*, *Scenario B*, and *Scenario C*, benthic flora and fauna may be affected by habitat alterations caused by these activities. Specifically, icebreaking activities during under *Scenario A*, *Scenario B*, and *Scenario C* activities could affect the production and location of sea-ice algae and thus affect benthic-pelagic coupling, resulting in changes in habitat. The physical presence of drilling platforms and other marine infrastructure associated with *Scenario B* and *Scenario C* could result in physical removal of habitat and increased mortality risk, but also have the potential to create new habitat. Exploration wells, flowlines, and associated sea-floor equipment would alter benthic habitat. Anchors can drag, leaving disturbed paths across bottom habitat. These types of disturbances may change the availability of habitat for local species and cover important substrate.

Overall, changes in habitat for benthic flora and fauna due to habitat alterations is expected to be low to moderate, local, and long term. Changes may occur immediately around the development footprint, but these are likely to be small areas when compared to the large study area.

## Views of Interested Parties

Fisheries and Oceans Canada (DFO) provided comments on the benthic flora and fauna impact assessment as conducted by Nunami Stantec in the *Environmental Setting and Potential Effects Report* which is summarized below:

- Habitat for benthic flora and fauna throughout study area is not homogenous and that habitat destruction in small areas may in fact be very significant. What is important is the amount of each given habitat type within the larger study area and the percentage that is affected and the species which are affected. For vulnerable coral, sponge, and sea pen species the first pass of equipment causes the most damage and may not be recoverable. In many areas of Baffin Bay and Davis Strait there are very strong currents which magnify the impacts of the deposition of deleterious substances and expand the impact footprint.
- Physical presence of drilling platforms and other marine infrastructure associated with Scenarios B and C could result in physical removal of habitat and increased mortality risk, but also have the potential to create new habitat. These types of disturbances may change the availability of habitat for local species and cover important substrate. Overall, changes in habitat for benthic flora and fauna due to habitat alterations is expected to be low to moderate, local, and long term. Changes may occur immediately around the development footprint, but these are likely to be small areas when compared to the large study area.
- Insufficient baseline information on benthic habitat for the Area of Focus to discern effects from natural variability, if any.
- Many hydrocarbons are known to bioaccumulate and should be included in the impact assessment discussion.

- As with benthic filter feeding organisms, there is a need to discuss the uptake of suspended particles (e.g., drilling muds) due to increased turbidity that has no nutritional value as this results in lower productivity.
- Cold-water coral and/or sponge-dominated habitats are Significant Benthic Areas (SBAs) and there is little understanding of the ecological function of the SBA types (beyond their role in locally increasing biodiversity). However, international research on ecosystem services provided by corals and sponges is growing and it is expected that the importance of SBAs as fish habitat, biogeochemical processing, and in benthic pelagic coupling will soon be advanced enough to allow for quantitative evaluations. Given the vulnerability of SBAs to bottom contact activities, generally speaking, mitigation of local impacts can be achieved only by preventing such activities within a SBA. Different SBA types constitute different habitats, and hence, provide different suites of ecosystem services. SBA types are not interchangeable; increased protection for one (1) SBA type does not compensate for low protection of another. Current SBA types are defined as very broad classes (e.g., sponges, sea pens, small, and large gorgonians), but species compositions of individual units within each class are expected to have differences. Therefore, it is important that each individual SBA unit be considered independently as sufficient knowledge of the connectivity within and among SBAs is not yet available.

#### 7.2.1.4. ***Fish and Fish Habitat***

As described in the *Environmental Setting and Potential Effects Report* (see Section 7.2.1: Potential Effects from Routine Activities; Nunami Stantec, 2018a), activities associated with the possible scenarios of oil and gas development in Baffin Bay and Davis Strait may result in changes to the fish and fish habitat. See 7.1.1.3 Oceanography (including water quality) of this report for a discussion on the potential impacts of the possible scenarios of oil and gas development in Baffin Bay and Davis Strait on marine water quality.

**Noise**

It was identified that marine fish could be affected by underwater noise generated by seismic exploration (*Scenario A*), exploration drilling (*Scenario B*), or production drilling (*Scenario C*). Underwater noise generated by oil and gas activities, such as seismic surveys, exploration or production drilling, and increased marine shipping traffic associated with possible marine-based oil and gas development in Baffin Bay and Davis Strait, may result in localized and temporary changes in behaviour of marine fishes.

The potential effects associated with exposure of marine fishes to underwater noise may include a change in behaviour such as localized and temporary avoidance; weakened swimming response; potential masking of biologically important sounds (e.g., signals used by fish for prey detection); or increase in mortality of fish and fish eggs. It was concluded that the effects of underwater noise associated with seismic exploration, exploration drilling, and production drilling on marine fish are adverse and expected to be of low to high magnitude depending on the species, life stage, and type of noise. Effects would be local, restricted to the immediate area of those activities, and be continuous. Changes in behaviour of marine fish exposed to underwater noise are expected to be reversible in the short term (hours to days) following removal of the sound source. Potential mortalities from underwater noise generated by seismic activity would be low in number, and numbers affected are not expected to be at a level that would substantially affect the regional abundance or sustainability of marine fish populations. However, it was noted that uncertainty in the effects characterization exists stemming from a lack of detailed knowledge of fish species composition, distribution, and abundance in the Area of Focus. In addition, expected changes in physical and chemical ocean conditions (mainly sea ice, temperature, and nutrients) may alter the species composition, productivity, prey availability, and distribution and abundance of marine fishes in the Arctic, potentially altering the percentage of species vulnerable to noise effects.

As noted in the *QIA Inuit Qaujimajatuqangit Report*, community members noted their experience with seismic surveys and the impact to fish. Most of the comments received for the report related to the effect of percussion causing disorientation and/or death when explosives were used. The loss of the fishery was of immediate concern to community members. They also noted the changes in marine mammal behaviour when the fish disappeared. The community members interviewed for the report did speak to changes in behaviour of fish, but that with time, the effects disappeared, and the fish returned. In addition, community members during the NIRB's Scoping Sessions provided comments, questions, and concerns about potential noise-related effects to fish from offshore oil and gas activities, specifically seismic surveys. Community members who worked with Panarctic Oils Ltd. shared observations of negative effects from noise on fish. Concerns about the potential negative effects from a possible oil spill on fish were also raised.

### Routine Discharge

Marine fish and fish habitat may be affected by routine discharges of liquid wastes from marine vessels under *Scenario A*, *Scenario B*, and *Scenario C*. Effects under these scenarios may include changes in health through chronic contamination, particularly by metals and hydrocarbons, and associated changes in health. Effects might occur on fishes from direct ingestion/absorption of the constituents in the water column or indirectly through feeding on contaminated benthic prey (see Chapter 7.2.2.3). These discharges may also indirectly affect marine fish by reducing access to food sources in the marine environment. Groundfish (such as Greenland halibut) are potentially at particular risk as their main prey is benthic, and they often disturb the top surface layer of the benthos, agitating and redistributing potential contaminates into the substrate. Overall, the effects of routine discharges related to activities in *Scenario A*, *Scenario B*, and *Scenario C* on fish and fish habitat in Baffin Bay and Davis Strait are expected to be negligible or low and local. If present, effects are expected to be local, sporadic (for exploration drilling), and continuous and long-term for production.

### Drill and Mud Cuttings

Drill and mud cuttings can directly affect the habitat, health, and mortality risk of fish and fish habitat in the vicinity of the drill site during either exploration drilling (*Scenario B*) or production drilling (*Scenario C*). Discharges can locally elevate constituents above background levels and provide a variety of pathways for exposure. Groundfish (such as Greenland halibut) face direct exposure from using cuttings as habitat. Exposure can also come from fish feeding on benthic flora and fauna and other prey which have accumulated harmful constituents (e.g., copepods or other invertebrates).

Discharge of drill cuttings can cover the local benthic environment (see 7.2.1.3 Drill and Mud Cuttings) close to the drilling activity. This can cause direct mortality of shellfish, and reduce the available of healthy fish habitat, causing individuals to move to other locations. Local reefs, topographic variation, substrate diversity, or other important habitat may be lost under the cone of cuttings. Impacts would vary by species and the importance of the habitat to the local ecosystem.

Cuttings can also locally increase turbidity by increasing the amount of total suspended solids which can decrease visibility in the water column, reducing the efficacy of sight-based activities such as mating or predation, or clog gills or fish or fish egg membranes, inhibiting respiration, or result in temporary avoidance behavior. Overall, drill and mud cuttings are expected to have a low to moderate impact on fish and fish habitats. The effects are local, but continuous and potentially long-term.

### Habitat Alteration

Icebreaking activities during *Scenario A*, *Scenario B*, and *Scenario C* could affect the production and location of sea-ice algae and thus affect benthic-pelagic coupling, resulting in changes in fish habitat and behaviour. The physical presence of drilling platforms and other marine infrastructure associated with *Scenario B*, and *Scenario C* could result in physical removal of fish habitat and increased mortality risk.

The placement of marine infrastructure on the ocean floor (such as mooring anchors, well heads, etc.) may remove important coral, shoals, or essential fish habitat and cause fish to move to alternate locations. In addition, infrastructure can also serve as a stable substrate and act as an anchor for invertebrates or plants, creating new fish habitat in an otherwise often monotypic mud or sand environment.

Overall effects on fish habitat and behaviour due to habitat alterations in *Scenario A*, *Scenario B*, and *Scenario C* are expected to be negligible or low. Positive and negative effects on habitat may occur at a local scale and depending on the alteration be a single event (e.g., laying buried pipeline), be multiple irregular events (e.g., ice breaking) or continuous (e.g., covering of previous habitat with infrastructure). Likewise, the associated duration of the effects may range from short-term to permanent.

### Views of Interested Parties

Within its final written submission, the Arctic Fishery Alliance (AFA) noted uncertainty in the assessment of interactions between oil and gas development activities and the current fisheries' activities. It noted that the fisheries and marine science in Nunavut lags far behind that of Canada's southern fisheries. Consequently, with such an incomplete understanding of the environment in its current state, it was stated that it is impossible to fully quantify what the consequences of oil and gas would be on this ecosystem. AFA provided examples of current research conducted on fish migratory patterns and stock connectivity (e.g., turbot).

The Government of Nunavut (GN) noted within its final written submission that consideration was not given for the potential use of oil and gas extraction platforms as 'artificial reefs or islands'. Furthermore, that the possibility or implications of platforms leading to localized increases in biodiversity and trophic interactions should be considered in the assessment. The GN also noted concern that proximity of floating or anchored platforms to the productive habitats that exist in the Area of Focus could increase recruitment to the platforms and increase the likelihood of project interactions. The GN noted that there is abundant information on the effects of in-water infrastructure acting as artificial reefs and becoming biological hotspots, which it reiterated during the Final Public Meeting.[62] The GN recommended the need to assess the potential biological effects and discuss effects associated with the removal of these in-water structures when oil and gas production ceases.

Fisheries and Oceans Canada (DFO) noted in its written comments that a discussion on the potential mitigation measures to reduce noise effects on fish and marine mammals (e.g., schedule changes around spawning events, etc.) was not included and should be described accurately. DFO also recommended that three (3) reports related to impacts of potential impacts on the marine environment associated with offshore petroleum activities be reviewed for any future work conducted (see Appendix C: Recommended Documents).

DFO further noted that sound production and communication is an essential part of the behavioural repertoire, particularly during reproduction and would be different for different fish species. Accordingly, the linkage of noise produced by hydrocarbon activities as it may interact with fishes needs to be better developed. Sedentary 'nesting' benthic fishes such as wolffishes may similar be differentially affected by noise. DFO noted that the focus of noise effects on fish was unduly weighted to those surrounding seismic activities and that regular and routine ongoing noise resulting from production activities should be assessed as well.

> *It [is] noted that there was a lack of information about the distribution, the ecology, habitat of important species both commercial and subsistence fisheries as well species at risk and the effects on these important or sensitive species or areas.*
>
> [A. Doherty, Fisheries and Oceans Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 396, lines 14-19]

DFO noted in its comments that potential effects resulting from underwater noise were not included as a "change in habitat". According to the *Fisheries Act*, "fish" includes marine animals and that "fish habitat" "means spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes." The inclusion of "food supply" within the definition of fish habitat provides rationale to include effects resulting from underwater noise as a "change in habitat".

[62] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 182-183, lines 25-26 and 1-1-7.

During the Final Public Meeting, the Ikajutit (Arctic Bay) Hunters and Trappers Organization recommended that an impact study on the effects of seismic blasting on fish, which directly involved Arctic community representatives, should be conducted prior to any future seismic testing.[63]

DFO also noted that removal of corals or shoals may cause fish to move to alternate locations, however, this assumes that alternate locations exist. Removal of important habitat features may permanently impact the productivity of the related fish populations.

The Nunavut Fisheries Association (NFA) noted in its final written submission concern with the lack of information included on the current and potential future activities and socio-economic impact of the offshore and inshore fishery in Nunavut, specifically as it relates to the Baffin Bay and Davis Strait areas and adjacent communities. The NFA noted concern with respect to the unknowns and risks that remain with respect to long-term impacts on fish and marine mammals from seismic activities. The NFA also noted concern with respect to controlling spills in the Eastern Arctic and the potential impacts of a single spill in the North will have on fish, marine mammals, seabirds and/or local communities.

WWF noted in its final written submission that due to the important life stages spent by Arctic char in the near-shore environment, and the brief period of time available for char to feed in that environment, steps must be taken to reduce impacts of potential activity in that near-shore environment. WWF recommended that no exploration activity take place in near-shore Arctic char feeding grounds.

During the Final Public Meeting, a Community Representative recommended the need for additional studies to determine how turbot would be impacted by oil and gas development, including blasting, and more specifically the impact to turbot fisheries in the South Baffin area.[64]

#### 7.2.1.5. ***Waterbirds (Seabirds, Waterfowl, and Shorebirds)***

As described in the *Environmental Setting and Potential Effects Report* (see Section 7.2.1: Potential Effects from Routine Activities; Nunami Stantec, 2018a), activities associated with the possible scenarios of oil and gas development in Baffin Bay and Davis Strait may result in changes to waterbirds. Please refer to this section and report for additional information.

**Noise**

In-air and underwater noise have the potential to create a change in behaviour and mortality risk to waterbirds. It was identified that waterbirds could be affected by in-air or underwater noise during seismic exploration (*Scenario A*), exploration drilling (*Scenario B*), field development and production drilling (*Scenario C*), and by ship and air traffic associated with *Scenarios A, B,* or *C*.

[63] J. Kiguktak, Ikajutit HTO, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 743, lines 3-12.
[64] S. Keenainak, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 798, lines 2-14.

Depending on the activity and associated level of noise production, waterbirds may adjust patterns in habitat use or behaviour due to noise-based sensory disturbance. Noise production may also result in temporary or permanent injury or mortality for exposed birds. Noise from activities associated with oil and gas production may make it difficult for waterbirds, especially those gathering in large groups, to access food for migration, fledging (sufficiently developing the muscles and feathers for flight), or nesting in areas where the noise occurs. This could have consequences for the health and survival of waterbirds, especially for waterbird species that feed in groups as noise-based disturbances may interfere with underwater acoustic cues from members of their species. The magnitude of effects of in-air or underwater noise was considered to be moderate since these changes are not anticipated to adversely impact the viability of waterbirds present within areas of Baffin Bay and Davis Strait.

It was anticipated that changes in waterbird behaviour as a result of seismic exploration and ice-breaking activities, including associated vessel and air traffic, would be medium-term in duration (i.e., occurring over several breeding seasons), local in extent (restricted to the immediate area of those activities), and continuous while the activity is occurring. Effects would be reversible once conditions return to baseline after activities cease. Changes in waterbird behaviour as a result of noise produced during drilling, and associated vessel and air traffic, may be long-term in duration, depending on the scenario and the intensity of the activity. However, changes were predicted to likely be localized and reversible. Effects of in-air and underwater noise on change in mortality risk for waterbirds are anticipated to be localized, occur as multiple irregular events, and may be short- or medium-term in duration (depending on the scenario). However, it was noted there was some uncertainty in the effects characterization due to the fact that there are few studies that characterize effects to waterbirds from acute or chronic in-air or underwater noise, and species-specific differences remain poorly described in the literature. Generally, waterbirds may adjust patterns in habitat use or behaviour in response to in-air or underwater noise produced during seismic exploration surveys (i.e., avoidance of disturbed areas), or in response to marine infrastructure or activities. Further, expected changes in physical and chemical ocean conditions (mainly sea ice, temperature, and nutrients) may alter the species composition, productivity, prey availability, habitats, and distribution and abundance of waterbirds in the Arctic, potentially altering the time, place, and percentage of species vulnerable to noise effects.

The NIRB heard questions on the potential effects of seismic surveys on waterbirds during its Public Engagement Sessions.

#### Routine Discharge

Waterbirds may be affected by routine discharges of liquid wastes from marine vessels under *Scenario A*, *Scenario B*, and *Scenario C*. The effects under these scenarios may include changes in behavior, health, and mortality risk, mediated through changes in the availability and quality of prey and potential direct exposure to contaminants. Substances that can be ingested or absorbed by marine benthos or fish (see 7.2.1.3 - Routine Discharge) have potential to exert sublethal toxicological effects on internal tissues and organs if regularly consumed and bioaccumulated by waterbirds. The extent to which sublethal effects may be expressed among waterbirds is influenced by their dependency on habitats that are exposed to routine discharges, the duration and seasonality of exposure to such habitats, as well as the composition of their diet.

In addition, discharged produced water can, and often does, create thin surface sheens of oil within several hundred metres of the discharge site which may result in death to waterbirds by affecting their feathers (reduced waterproofing, insulation and buoyancy properties provided by feathers) and internal organs. Studies have shown that feather weight and microstructure of common murres and dovekies changed significantly after exposure to thin sheens of crude oil and synthetic drilling fluids. This indicated that seabirds may be impacted by from discharged produced water containing hydrocarbons (O'Hara and Morandin, 2010). Overall, the effects of routine discharges related to activities in *Scenario A*, *Scenario B*, and *Scenario C* on waterbirds in Baffin Bay and Davis Strait were expected to be low in magnitude since changes are expected to be below environmental thresholds and were not anticipated to adversely affect the viability of waterbirds present within the Area of Focus. Impacts would be local, continuous, and short (oiling) to long-term (contaminated prey). It was noted that routine discharges are relatively limited in quantity and geographic scope, and climate change is unlikely to alter these effect characterizations. Confidence in the assessment was considered to be moderate to high as the extent to which sublethal effects of regular consumption of contaminated pray is influenced by their dependency on habitats that are exposed to discharges, the duration and seasonality of exposure to such habitats, as well as the composition of their diet.

### Drill and Mud Cuttings

Waterbirds could directly or indirectly be affected by discharges of drill and mud cuttings during exploration drilling (*Scenario B*), and field development and production drilling (*Scenario C*). Direct impacts, depending on the species, may include a localized increase in turbidity affecting foraging efficiency, and contaminated prey affecting their health (see the above sections on effects on marine benthos and fish communities).

Indirectly, alteration to the distribution, abundance, and health of benthos and fish communities due to discharges (see the above sections) may locally affect the availability and quality of prey for waterbird species. In addition, depending on the distribution of individual waterbird species relative to the location of drilling and mud cutting activities and prey distribution, some birds may alter their behavior and expend additional energy to seek out alternative feeding locations for feeding, or expand forage effort more broadly within existing feeding areas.

Effects from discharges of drill and mud cuttings from activities associated with *Scenario B* and *Scenario C* on waterbird behaviour and health were expected to be low in magnitude, localized, and long-term. Discharges of drill wastes is expected to occur as multiple irregular events and changes are expected to be below environmental thresholds and were not anticipated to adversely affect the viability of waterbirds present within the Area of Focus.

### Habitat Alteration

Ice-breaking and other project related vessel traffic during all three scenarios (*Scenario A*, *Scenario B*, and *Scenario C*) could result in direct and indirect changes in habitat, with effects on behaviour and mortality risk of waterbirds. Construction and development of subsea wells, pipelines, and rigs can result in loss or alteration of benthic substrates, marine benthos, and fish (as described above) in the vicinity of the facilities, as well changes in sensory fields.

Vessel traffic has potential to cause sensory disturbance to waterbirds such as a diving or flushing (i.e., avoidance) response. Larger aggregations of birds are also more sensitive (i.e., flush at increased distances) to vessel traffic. Changes in the presence, abundance, and distribution of marine vegetation, invertebrates, and fish can also alter the availability or distribution of foraging opportunities for coastal waterfowl, seabirds, and shorebirds. Physical disturbance can also result from marine infrastructure that may impose physical or perceived barriers for access to important habitats if situated in a way that excludes waterbirds from portions of the Area of Focus providing important resources (e.g., breeding habitat, migratory staging areas, open water foraging sites). Artificial lighting sourced from marine infrastructure or seismic and drilling vessels may affect waterbird behaviour and increase mortality risk.

While change in habitat use, behaviour, and risk of injury or mortality for waterbirds may occur under *Scenario A*, *Scenario B*, and *Scenario C*, the magnitude of habitat alteration were expected to be low to moderate. Changes were not anticipated to adversely affect the viability of waterbirds present within the Area of Focus. Changes in waterbird habitat from construction and development of marine infrastructure resulting in loss or alteration of benthic substrates, marine benthos, and fish were expected to be short- to long-term in duration (depending on the scenario and type of alteration), localized, and occur as single, multi-irregular, or continuous events and effects. Changes in waterbird habitat from artificial lighting sourced from marine infrastructure or seismic and drilling vessels resulting in increased risk of injury or mortality from collisions would have similar effects. Changes in waterbird habitat from vessel traffic and marine infrastructure resulting in physical disturbance (i.e., avoidance) were anticipated to be short- (seismic exploration and exploration drilling) to long-term (production and decommissioning and abandonment) in duration, localized, and reversible following completion of activities (*Scenario A* and *Scenario B*) or decommissioning and abandonment (*Scenario C*). Changes in waterbird migration and foraging patterns in response to artificial lighting sourced from marine infrastructure or seismic and drilling vessels are expected to be short- to long-term in duration (depending on the scenario), with effects extending from the local to regional scale.

### Views of Interested Parties

Within its public written comments, DFO noted that in addition to artificial lighting the burning gas-flare from oil rigs may also attract and disorientate birds and cause mortality by collisions with structures which should be considered as part of the assessment. DFO also noted that a discussion on avoidance (seasonal planning around migration) and mitigation to reduce effects on waterbirds was not included as part of the mitigation measures described in the *Environmental Setting and Potential Effects Report*.

Environment and Climate Change Canada (ECCC) noted within its public written comments that it agreed with the uncertainty related to the potential effects on the waterbirds from underwater noise. ECCC further indicated that there are significant regional differences in species composition and environmental conditions that could influence the characterization of effects. It was noted that the hearing capabilities of diving waterbirds are complex and poorly understood.

ECCC further noted that the associated risks of the attraction of birds to offshore structures for foraging, roosting, and shelter needs further explanation as seabirds are attracted to offshore structures due to a prey enhancement effect resulting from human waste discharges and attraction of fish to lights. Attraction to offshore structures has implications for health and safety (e.g., aircraft operations) and increases exposure of seabirds to oil and hazardous environments and exposure to predators. In addition, ECCC indicated that thin sheens resulting from routine discharges and cuttings can result in seabird feather microstructure damage, affecting their thermoregulation properties and making waterbirds more susceptible to increased health and mortality risks from waste discharge and accidental spills when they aggregate close to offshore structures. ECCC was also of the view that the uncertainty related to changes in habitat, behaviour, health, and mortality risks has been underestimated for waterbirds and that filling in many of the gaps in knowledge of waterbird species composition, abundance, and seasonal distribution in the offshore areas of the Area of Focus would improve the confidence in the assessment of potential effects. ECCC recommended five (5) articles related to the effects of bird interactions with offshore oil and gas platforms be reviewed for any future work to be conducted (see Appendix C: Recommended Documents).

ECCC also indicated that the information gaps identified related to waterbird species composition, abundance and seasonal distribution in the offshore areas limits the ability to accurately predict effects of potential offshore exploration and production activities on waterbirds in Baffin Bay and Davis Strait. Several deficiencies have been documented with respect to monitoring of effects of offshore exploration and development on seabirds in Atlantic Canada and ECCC recommended two (2) reports related to proposed mitigation measures and best practices for encountering offshore birds be reviewed for any future work to be conducted (see Appendix C). With respect to gaps and monitoring, ECCC recommended an additional three (3) articles be reviewed for any future work to be conducted (see Appendix C). During its presentation at the Final Public reiterated its recommendation related to the requirement that "…*more information on the potential effects and possible mitigations for migratory birds and listed species at risk was required. One big recommendation was avoiding key habitat sites for seabirds altogether and updating the potential magnitude of impacts*." ECCC also indicated that there is a lack of research on seismic effects on seabirds.[65] (see Appendix C). ECCC recommended research to understand potential physiological effects and behavioural responses of underwater noise on waterbird species in the Area of Focus, and to develop more relevant threshold criteria for assessing injury and behavioural disturbance. In addition, ECCC recommended baseline surveys be conducted prior to any activities to understand inter-annual seasonal abundance and distribution of waterbirds.

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[65] B. Summerfield, Environment and Climate Change Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 387-388, lines 25-26 and 1-12.

During the Final Public Meeting, a Community Representative from Pangnirtung requested clarification from the GN on whether any studies have been conducted on the potential impacts to nesting and young birds stating that "*…before they can fly, they are swimming in the waters...*"[66] The GN noted that prior to any project proceeding, studies would be required by the company and would be conducted by various governments to determine the impacts on marine birds and other animals at sensitive times of the year.[67]

> *Birds will not return to their original nesting areas if they were to be impacted or touched… Let it be known that it's not advisable to touch mammals and birds because they will not return to their original breeding grounds or their nesting areas.*
>
> [L. Ishulutaq, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p.414, lines 17-23.]

### 7.2.1.6. ***Marine Mammals***

As described in the *Environmental Setting and Potential Effects Report* (see Section 7.2.1: Potential Effects from Routine Activities; Nunami Stantec, 2018a), activities associated with the possible scenarios of oil and gas development in Baffin Bay and Davis Strait may result in changes to marine mammals. Please refer to this section and report for additional information.

During the NIRB's Public Scoping Sessions, a community member from Iqaluit shared their view that previous seismic surveying and drilling from Panarctic Oils Ltd., which was in operation during the 1960s and 1980s, resulted in effects to many sea organisms. In Clyde River, it was observed that wildlife that live in areas with no sound from development are highly sensitive to noise from seismic surveys and shipping, and even power boats and snow machines. Community members from Pond Inlet remarked that wildlife behaviour has changed with increased shipping and that wildlife move away from ships. In Qikiqtarjuaq, it was pointed out that wildlife population decreases are being seen, however, Elders say that wildlife is renewable and that they will be back.

#### Noise

Change in marine mammal behaviour can result from underwater noise created during seismic surveys, exploration and production drilling, including drilling support vessels such as ice breakers, shipping during production, and decommissioning and abandonment. The level of response to noise generated during oil and gas activities depends on the time of year, intensity and duration of the noise, distance from the sound source, the ability for the animals to hear the noise (i.e., the animals hearing frequency range), the species in question, its activity during noise exposure, and the novelty of the sound. Based on the information collected, the *Environmental Setting and Potential Effects Report* concluded that marine mammals could be affected by noise

[66] S. Keenainak, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 207, lines 19-26.
[67] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 209, lines 8-21.

from the oil and gas activities (seismic surveys, exploration, drilling and icebreaker activities for *Scenario A, Scenario B* and *Scenario C.*

Underwater noise sources may result in changes in behaviour such as masking of marine mammal communications, changes in surface activity and diving, and displacement. Such changes in behaviour have been documented for several species found in the Area of Focus. Based on studies conducted in Baffin Bay and Davis Strait and in other similar marine regions, it was concluded that seismic surveys and icebreaking activities are anticipated to result in temporary and short-term change in marine mammal behaviour and communication masking, lasting for the duration of the activity or continuing over the short term after the activity has ceased with the effects restricted to the area of the activity. Change in marine mammal behaviour from drilling and associated vessel activities may be long term in duration, depending on the scenario, but are considered to be likely localized, resulting in specific areas with levels of underwater noise above thresholds.

Changes in mortality risk are only anticipated for seismic surveys. The predicted effect would be short term, occurring only during the activity. Changes in mortality risk to ringed seal pups from seismic surveys were anticipated to be localized and long-term as it may take several years to replace dead pups. Although changes in mortality risk would be adverse, they were not anticipated to affect the viability of the marine mammal populations present and may occur as multiple irregular events.

The effects from seismic surveys, icebreaking activities, drilling, and associated vessel activities were considered to be moderate in magnitude, as underwater noise levels would be above current baseline conditions but were not anticipated to affect the viability of the marine mammal populations present and are reversible with conditions returning to baseline once activity ceases. However, it was noted that there was some uncertainty in the effects characterization as there is uncertainty associated with the types of changes in behaviour that may occur, the unknown relationship between individual changes in behaviour and population-level effects, and the amount of time required for recovery from the disturbance. In addition, expected changes in physical and chemical ocean conditions (mainly sea ice, temperature, and nutrients) may alter the species composition, productivity, prey availability, habitats, and distribution and abundance of marine mammals in the Arctic, potentially altering the time, place, and percentage of species vulnerable to noise effects.

Changes in behaviour in beluga and bowhead whales have been noted by community members in Iqaluit, Kimmirut, Pangnirtung, and Pond Inlet. During the NIRB Public Scoping Sessions, community members raised concerns about the potential noise-related effects to marine wildlife from offshore oil and gas activities, specifically seismic surveys. There was specific concern about the potential for hearing loss and changes in behaviour. Community members who worked with Panarctic Oils Ltd. shared observations of negative effects from noise on marine mammals. Concerns about potential effects from marine shipping activities on marine mammals were also discussed. Discussions also included rules, regulations, and best management practices to reduce impacts to marine mammals from oil and gas and associated activities. Changes in behaviour and avoidance of areas was also identified in the *QIA Inuit Qaujimajatuqangit Report*. The report noted extreme sensitivity to noise of whales and how traditional hunting rules included advice on how to move on ice because of the sensitivity and the need to be quiet otherwise whale and walrus would go elsewhere.

### Routine Discharge

Marine mammals may be affected by routine discharges of liquid wastes from marine vessels under *Scenario A*, *Scenario B*, and *Scenario C*. The effects under these scenarios may include changes in behavior, health, and mortality risk, mediated through changes in the availability and quality of prey and potential direct exposure to contaminants. Similar to the effects on waterbirds (see 7.2.1.5 - Routine Discharge), marine mammals may bioaccumulate substances from acting as a top-level predator. Changes to the distribution, abundance, and quality of the benthic environment and marine mammal prey may potentially result in increasing energy requirements to seek out alternative feeding locations. Produced oil may also interfere with fur and cause damage from inhalation, and a variety of other effects (see Section 7.2.4.4 of the *Environmental Setting and Potential Effects Report*).

Overall, effects of routine discharges released during activities associated with *Scenario A*, *Scenario B*, and *Scenario C* on marine mammals in Baffin Bay and Davis Strait were expected to be low in magnitude as changes were expected to be below environmental thresholds and were not anticipated to adversely impact the viability of marine mammals present within the Area of Focus. Indirect effects related to marine mammal prey were predicted to be localized, short term in duration, and of low magnitude, affecting limited amounts of marine mammal prey and habitat. Impacts were expected to be local, continuous, and short (exposure to sheens) to long-term (contaminated prey). Routine discharges are relatively limited in quantity and geographic scope; as a result, climate change was considered unlikely to alter these effect characterizations. Uncertainty in the assessment of change in behaviour, health, or mortality risk due to routine discharge was noted to be moderate to low.

### Drill and Mud Cuttings

Changes in health and changes in behaviour in marine mammals may occur because of discharges of drill and mud cuttings during either exploration drilling (*Scenario B*) or production drilling (*Scenario C*). Such effects would likely be indirect and mediated through changes in the distribution, abundance, and quality of prey species (see the above sections on benthic fauna and fish and fish habitat for potential effects). If prey is affected, marine mammals may be exposed to contaminated prey, and/or have to expend additional energy to seek out alternative feeding locations, or expand forage effort more broadly within existing feeding areas. The potential increase in turbidity, as a result of drill and mud cutting, was considered unlikely to affect marine mammals as pinnipeds (including ringed seals, walrus, and bearded seals) have highly developed sensory organs (i.e., vibrissae) which likely assist with foraging in dark or turbid conditions.

Effects from discharges of drill and mud cuttings from activities associated with *Scenario B* and *Scenario C* on marine mammal behaviour and health were expected to be low in magnitude, localized, and long-term. Discharges of drill wastes was expected to occur as multiple irregular events but with the implementation of established mitigation, changes were expected to be below environmental thresholds and were not anticipated to adversely affect the viability of marine mammals present within the Area of Focus.

### Habitat Alteration

Ice-breaking activities during all three (3) scenarios (*Scenario A*, *Scenario B*, and *Scenario C*) could result in direct and indirect changes in habitat, with effects on behaviour, as well as mortality risk. Construction and development of subsea wells, pipelines, and rigs can result in changes to marine mammal habitat (specifically ice habitat), as well as changes in prey species, and thus affect marine mammal habitat and behaviour. Habitat alterations may lead to changes in marine mammal behaviour and mortality risk, primarily for ice associated seals (i.e., bearded seal, ringed seal) and walrus, and secondarily for polar bear and cetaceans.

Icebreaking may also result in changes in cetacean behaviour and mortality risk. Cetaceans have been observed following icebreakers which may result in the cetaceans being inadvertently caught in isolated areas of open water. However, channels opened by the ship typically close quickly enough that this threat is minimal.

Changes in polar bear behaviour as a result of habitat alterations from ice breakers are likely to be minimal due to their wide range and access to other suitable habitat. Change in mortality risk may occur from the presence of offshore platforms for polar bear if they are utilizing habitat near platforms and need to be shot for crew safety.

Ice-breaking and benthic habitat alterations from marine infrastructure may result in changes in prey distribution and productivity of under-ice and ice edge habitats, that may indirectly affect marine mammal behaviour and change in mortality risk. The potential for leads to be formed in the lee of an offshore platform may result in increased open water habitat that may be utilized by ringed seals, bearded seals and walrus, resulting in change in behaviour and distribution in the region.

Overall, changes in behaviour as a result of habitat alterations from icebreaking and the presence of platforms were predicted to be localized and range from short to long term. Effects were anticipated to be multiple and irregular. The magnitude of the effect was considered to be moderate, as habitat alterations would change baseline conditions but were not anticipated to affect the viability of the marine mammal populations present. Changes in mortality risk from habitat alterations were anticipated to be localized and long-term. Effects were anticipated to be multiple and irregular. Although the effect would be adverse it was not anticipated to affect the viability of the populations in the Area of Focus.

Uncertainty in the effects assessment of habitat alterations on changes in behaviour and mortality risk of marine mammal was moderate. There was also uncertainty associated with the level of habitat use by ice associated seals in recent times and the extent and areas used for birthing lairs by ringed seals in the Area of Focus.

### Views of Interested Parties

Within the *Uqausirisimajavut Report,* the Qikiqtani Inuit Association (QIA) noted that while Inuit Qaujimajangit indicates that marine mammals winter in Baffin Bay and Davis Strait, further studies are required to understand the actual behaviour of the animals in that location. Based on observations of marine mammal behaviour in relation to human activities, there were concerns that that oil and gas activities could move them off their usual migration paths. The QIA noted that the anticipated effects on marine wildlife from oil and gas activities can be described as 1) a reduction in numbers, or 2) a change in individual and population health. Figure 38: Generalized seasonal distribution of marine mammals against oil and gas activities provided within QIA's report provides a visual sense of the main areas of overlap and conflict for the oil and gas activity phases with the seasonal location of marine mammals.

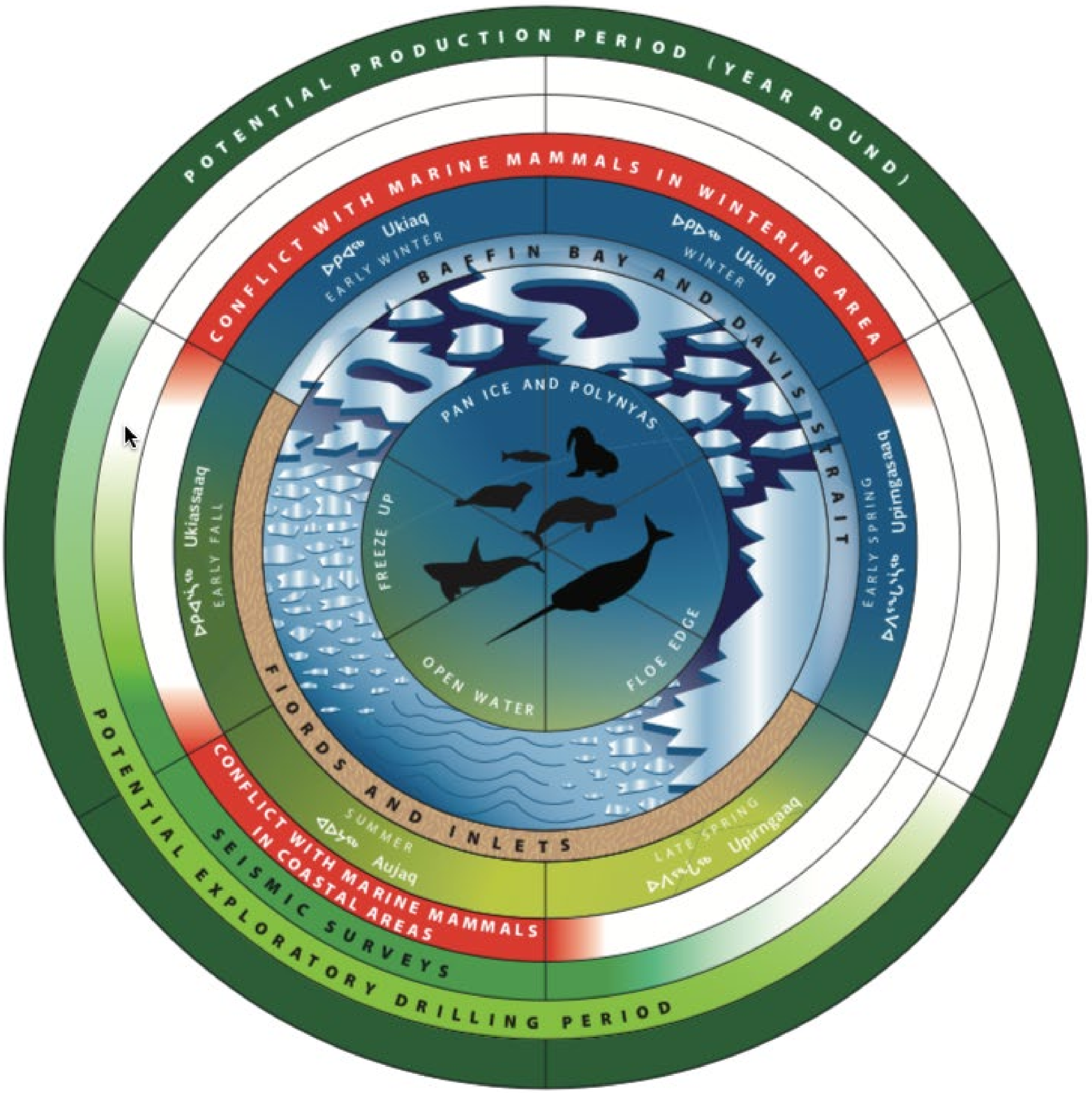
> Based on Inuit Qaujimajangit, it is expected that:
>
> - Marine mammals will move away from oil and gas activities because of their sensitivity to noise;
> - May be affected by loss of prey species;
> - May find it harder to hunt; and
> - May change where they go in the summer in response to oil and gas activities.
>
> QIA, 2019

The QIA summarized that the potential effects on wildlife and wildlife habitat from offshore oil and gas activities can be characterized as almost universally disruptive and negative, whether from seismic, exploration drilling, or production. Inuit laws require that animals be left alone unless you are harvesting them, and to protect animal habitat. Any disturbance effects from oil and gas development on animals or their habitat would not be in balance with these Inuit laws. The degree of impact would be dependent on the location and timing of the activities. The QIA noted that it anticipates that marine mammals would be affected by any of these activities, as well their prey species, but that effects would vary with the seasons. Both location-based (zoning) and timing-based (seasonal) restrictions would be critical to protect marine mammals, fish, and wildlife habitat for both. During its presentation at the Final Public Meeting, the QIA reiterated that there would be potential conflict between the offshore activities and marine mammals in the areas, highlighting that critical winter wildlife areas would overlap with activities from either production, shipping and exploration and summer wildlife areas would overlap with seismic activities. The QIA further noted that there would be impacts from noise on wildlife from large offshore infrastructure and shipping, and potential changes to habitat could occur from spills and other contaminants being released with changes to the integrity of ice and change in water and sediment quality. The QIA stressed that research would be required to fill the large gaps prior to lifting the moratorium.[68]

> *...research is critically needed to better inform decision-making. So before making the decision to lift the moratorium, some of these large gaps in research need to be filled;*
>
> [Qikiqtani Inuit Association, Final Public Meeting, March 19, 2019, p. 305, lines 10-13]

[68] R. D'Orazio, Qikiqtani Inuit Association, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 303-305, lines 16-26, 1-16 and 9-13.

**Figure 38: Generalized seasonal distribution of marine mammals against oil and gas activities (Source: QIA, 2019)**




The QIA provided a number of recommendations in relation to wildlife and wildlife habitat with the critical among them summarized in Table 21: QIA Recommendations Regarding Wildlife and

Wildlife Habitat on Oil and Gas Development in Davis Strait and Baffin Bay. For additional details, please refer to the *Uqausirisimajavut Report*.

**Table 21: QIA Recommendations Regarding Wildlife and Wildlife Habitat on Oil and Gas Development in Davis Strait and Baffin Bay (Source: QIA, 2019)**

| Prior to lifting the moratorium: | Post Moratorium Recommendations: |
|---|---|
| 1. Establishment of an Arctic Oil and Gas Research Institute.<br>2. Establish an Inuit Qaujimajangit Advisory Committee and Youth Committee:<br>3. Conduct Research to address critical knowledge gaps:<br>a. Research should include both Inuit Qaujimajangit and science to fill in knowledge gaps related to Baffin Bay and Davis Strait.<br>b. Research to reflect Inuit values to show respect to animals and their habitat.<br>c. Research to include all seasons, with emphasis to understand the use of marine mammal wintering areas.<br>d. Joint research with Greenland on marine mammal research and use of the Baffin Bay and Davis Strait.<br>e. Collaborate with the Nunavut Wildlife Management Board.<br>f. Research to understand the connection of the study area to surrounding existing and proposed areas.<br>g. Additional studies on impacts of shipping on marine mammals.<br>h. Multi-year and multi-season baseline studies required of the entire water column (including water temperature, sea-ice depth and extent, plankton and benthic invertebrates, fish species, waterbirds, and marine mammals).<br>i. Marine habitat studies to determine no-go zones.<br>j. Studies to determine the influence of climate change on marine mammals.<br>4. Establish a monitoring program<br>a. Use of Inuit laws and norms in monitoring program.<br>5. Develop noise-related regulatory prescriptions.<br>6. Develop light-related regulatory prescriptions. | 1. Development of seasonal restrictions for oil and gas activities.<br>2. Restrictions of activities as follows:<br>a. Restrict exploration and development activities during *Ukiaq* through *Upirngasaaq* and restrict activities to *Aujaq*.<br>b. Following community consultation, restrict seismic activities to *Aujaq*.<br>3. Establish "no-go" zones for oil and gas development based on outcome of research.<br>4. Conduct research on potential impacts on marine mammals from oil and gas industry.<br>5. Complete a zoning study based on Inuit Qaujimajangit that highlights sensitive marine areas.<br>6. Research the impacts of light from oil and gas activities on marine mammals.<br>7. Develop management measures to limit impacts to and protect wildlife and wildlife habitat.<br>8. Regulatory Changes required to protect wildlife and wildlife habitat. |

In response to a clarification question from the Canadian Association of Petroleum Producers (CAPP) with respect to the recommendation on the Arctic oil and gas research institute, the QIA noted that the recommendation was:

> *… focusing on the type of research that we thought was kind of the priority research to be conducted. We were thinking more of the framework characteristics and quality of the research institute as opposed to kind of the establishment of a specific institute at the moment. I think if there's already research being conducted, there's no need to overlap or duplicate, but we're kind of more looking for a vision as to how that research could occur and how we can intertwine the kind of Inuit values and Inuit Qaujimajatuqangit into that research. So we would definitely kind of look into what is happening at CHARS and other locations. And we were hoping to provide in a sense almost guidelines to help guide how this research could be done. But thank you very much for that information.*[69]

> *Restrict exploration and development activities during ukiaq through upirngasaaq; ensuring that, you know, if this goes ahead that there's the least amount of disruption.*
>
> [S. Lonsdale, Qikiqtani Inuit Association, Final Public Meeting, March 19, 2019, p. 325, lines 14-17]

Within its final written submission, the Government of Nunavut (GN) noted that there are knowledge gaps regarding the potential effects of oil and gas on wildlife and that additional research should be conducted to improve their understanding of potential effects of oil and gas on wildlife in the Area of Focus. The assessment of potential effects of oil and gas exploration and development on wildlife should be undertaken in consideration of the recommended updated baseline data for marine wildlife and the suggested revised development scenarios. Fisheries and Oceans Canada (DFO) also noted within its public written comments that additional information on potential mitigation measures for marine noise impacts on marine mammals, such as ramp-up of noise levels and alternative sound sources for seismic surveys, should be provided. During the Final Public Meeting, the GN emphasized that efforts should be taken to enhance the understanding of potential effects of oil and gas exploration and development on wildlife.[70,71]

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[69] R. D'Orazio, Qikiqtani Inuit Association, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 19, pp. 332-333, lines 17-26 and 1-6

[70] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 174, lines 17-19.

[71] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 181, lines 2-13.

> *There is a need for [improved] understanding of the impacts of icebreaking and associated habitat loss for polar bears, the effects of icebreaking activities on marine mammals, the effect of noise disturbance, the effects of helicopter and aircraft disturbance, how sound travels during periods of ice and potential effects on marine mammals, the effects of oil spills on open water and ice on polar bears, the effect of accidental spills of waterbirds.*
>
> [B. MacIsaac, Government of Nunavut, Final Public Meeting, March 19, 2019, p. 181, lines 4-12]

The GN provided several recommendations related to marine mammals noting that additional research should be conducted to understanding the potential effects of oil and gas exploration and development on polar bears, marine mammals (cetaceans and pinnipeds) and waterbirds in an Arctic environment. The GN noted that research should focus on understanding the potential effects of ice breaking, how sound travels under ice, and potential effects of underwater noise disturbance of ice breaking, both in open water and periods of ice for marine mammals, noise disturbance related to helicopter and aircraft, and potential effects of spills during all seasons on wildlife. In addition, the GN recommended that in the event of any oil and gas development in the Area of Focus, proponents should assess the effects of their specific oil and gas project on wildlife (marine and terrestrial), in consideration of the location, type of project, technology specifications, etc.

DFO also recommended within its public written comments that three (3) reports related to potential effects of seismic activities and icebreaking on marine mammals be reviewed for any future work conducted (see Appendix C: Recommended Documents).

CAPP commented during its presentation at the Final Public Meeting that research has shown that with appropriate mitigation measures, seismic surveys are "*unlikely to pose significant risk of mortality or death to marine organisms.*" While further stating that there has been no documented marine mammal mortality or injury, it was noted that "*it is certainly well known that seismic surveys could change the behaviour of certain mammals, especially whales, …whales sometimes leave areas where the seismic activity occurs. But the research also shows this is of short duration and those mammals return to those areas*. CAPP also noted that research has shown that there may be some physical damage to fish caused by seismic surveys but this would only occur within the immediate vicinity of the surveys with a distance of less than one (1) metre.[72] A representative from the Resolute Hunters and Trappers Association (Resolute HTA) questioned the applicability of studies referenced by CAPP to Arctic environments, specifically related to the behaviour of marine mammals following seismic testing and stressed the "*…real disconnect of how you guys use the information from the other side of the world to try to use the information up in our north.*"[73]

In its public written comments, Greenpeace Canada (Greenpeace) noted a lack of discussion on impacts on wildlife or communities and noted that the *Environmental Setting and Potential Effects Report* should include a comprehensive review of the impacts oil and gas development would have

[72] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No. 17SN034 Transcript, March 20, 2019, pp. 606-607, lines 14-26 and 1-11.
[73] J. Amagoalik, Resolute Hunters and Trappers Organization, NIRB Final Public Meeting No. 17SN034 Transcript, March 21, 2019, pp. 669-670, lines 12-26, and 1-13.

on hunting, fishing, and food security in the North as well as impacts on communities and wildlife. Greenpeace stressed the importance of knowing the frequency of accidents such as "vessel strike that could happen with marine mammals", or the number of whale injuries or deaths that could result from oil and gas development.

The World Wildlife Fund (WWF) noted that sea ice serves as an important habitat, and shipping through sea ice could lead to increased negative interactions with ice-bound marine mammals. Operations through sea ice creates channels of brash ice, which may remain if the ice does not refreeze rapidly. WWF indicated speculation that operations through sea ice have caused a few recent ice entrapment occurrences. For example, the passage of a ship creates a temporary opening in the sea ice, which can act as an artificial polynya and confuse marine mammals, causing them to become trapped too far from the ice edge as the channel eventually refreezes. During the Final Public Meeting, WWF indicated a highly unusual pattern of a recent narwhal entrapment coinciding with the area and time of a two dimensional seismic survey, which it noted was consistent with information from hunters and trappers organizations noting changes in marine mammal behaviour associated with seismic surveys.[74]

During the Final Public Meeting, WWF stressed that while significant research shows documented or potential impacts to marine mammals more research needs to be conducted on a variety of species, specifically plankton, benthic organisms, whales, invertebrates, some fish species, narwhals, squid, and shrimp (all of which are present in the area).[75]

The Mittimatalik (Pond Inlet) Hunters and Trappers Organization (Mittimatalkik HTO) noted concerns within its final written submission with respect to potential impacts from possible oil and gas activities on the marine environment, marine mammals, and on their community and livelihoods. The Mittimatalik HTO stressed that the seabed is a very sensitive marine environment where animals live as juveniles, is important for laying eggs/reproduction, and is sensitive to disturbance. The Mittimatalik HTO noted that while these habitats are not widespread (only specific sites in northern Baffin Bay) they impact the broader ecosystem and do not recover easily if there is damage to seagrasses, benthic species, and small fish. The Mittimatalik HTO requested that these sensitive sites be protected from any future disturbances due to oil and gas activities (e.g., areas where narwhals spend winter in northern Baffin Bay, Alexandra Fiord and *Pikialasorsuaq*). The HTO stressed that more baseline research on animal locations and populations in the study area is needed.

Within its public written comments, the Nangmautaq (Clyde River) Hunters and Trappers Organization (Nangmautaq HTO) recommended research be conducted with respect to potential impacts to marine mammals. The Nangmautaq HTO referred the Board to a study published in Nature Ecology (June 2017) that found that air guns used in seismic surveys could kill zooplankton at a distance of at least 1.2 kilometres. The HTO noted that the impacts of seismic testing on marine wildlife, including narwhals, whales, seals, fish, must be better understood before a seismic

[74] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 704, lines 7-21.
[75] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 703, lines 1-8.

program can take place especially related to the potential effects of marine seismic surveys on sea bottom dwelling organisms, as well as the possible impacts of seismic on other marine animals.

The Resolute HTA noted within its public written comments concerns about the potential impacts of seismic activities on animals and support of the efforts of Clyde River to prevent seismic surveying near their community. The Resolute HTA noted observations of change in behaviour and population of marine mammals by noise from passing ships. The Resolute HTA noted that it was not clear from the report where drilling and seismic activities would take place within the study area and that it is important for the determination on the impacts on the animals. The Resolute HTA also noted concern that the boundary limit for the SEA did not include the Queen Elizabeth Islands that also show potential oil and gas resources. The Resolute HTA stressed that Baffin Bay, Davis Strait, and the High Arctic are sensitive ecological zones within the study area, that everything is significant and all areas should be protected. During the Final Public Meeting the Resolute HTA requested clarification from Nunami Stantec on whether traditional knowledge from Inuvialuit was considered with respect to impacts on wildlife in the Beaufort Sea from exploration drilling. In response, Nunami Stantec provided a summary of impacts described in the report and additionally stated that "*I did look for specific traditional knowledge information from the Inuvialuit, and I couldn't find any specific to the long-term effects on marine mammals from drilling. But I did want to note – and it has been mentioned – that the strategic environmental assessment for the Beaufort Sea will be ongoing for the next year or so, and that will include traditional knowledge from the Inuvialuit.*"[76]

A Community Representative from Pangnirtung also requested clarification from Nunami Stantec on whether the report discussed how wildlife had been impacted in the Beaufort Sea area as activities have occurred in the Inuvialuit Region.[77] In response, Nunami Stantec noted the literature review report summarized the work that was conducted.[78]

*We worry that oil and gas activity such as seismic testing will scare away and harm our wildlife…The risk is too big for us, and we will suffer if the animals are harmed…if the government decides to allow offshore oil and gas activities in Nunavut, we believe local communities should be able to propose seasonal restrictions to minimize the impacts on wildlife.*

[J. Kiguktak, Arctic Bay Hunters and Trappers Organization, Final Public Meeting, March 21, 2019, pp. 740-741, lines 12-17 and 11-15]

A Community Representative from Arctic Bay requested if studies have been conducted by other countries on the impacts to marine mammals from the possibilities of a blowout and whether "*…there [can] be catastrophic impacts to sea mammals.*"[79] In response, Nunami Stantec noted that it is difficult to study the effects of oil spills on animals as this would require a spill to occur; however, monitoring programs do

[76] J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 655-657, lines 21-26, 1-26, and 1-2.
[77] S. Keenainak, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 75, lines 8-13.
[78] J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 76, lines 4-10.
[79] J. Kango, Arctic Bay, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 115, lines 1-9.

occur in the event of a spill to determine the effects on all marine species.[80] The Community Representative from Pangnirtung requested clarification from the GN on whether any studies have been conducted on the impacts of seismic surveys on marine wildlife, and birds and their habitat stating that "…*wildlife that the whales consume in water, the smaller species, and the narwhal or the bowhead whales that eat little fish in the ocean. If they are impacted, it will impact the bigger mammals...*"[81] The GN noted that prior to any project proceeding, the impacts related to seismic surveys, exploration and development would have to be thoroughly understood and the related mitigation measures determined.[82]

A Community Representative from Cape Dorset noted concern on the potential impacts of blasting on marine mammals and habitat, and recommended that oil and gas development should not proceed.[83] Additionally, a Community Representative from Iqaluit noted concern on the potential impacts of oil and gas development on wildlife, the importance of Inuit knowledge and that Inuit survive off country foods.[84] In response, the GN noted that this is the purpose of the SEA to determine what the impacts would be on wildlife, the environment and communities.[85]

A Community Representative from Clyde River also noted concerns with respect to impacts to marine mammals from oil and gas activities indicating:

> *Marine mammals are sensitive to noise. They are our food source. With oil and gas activities, our animals would move away further, and we have observed this kind of behaviour as hunters when there is loud activities happening.*[86]

Following the QIA 's presentation at the Final Public Meeting, a Community Representative from Grise Fiord requested that a recommendation be implemented that would stop seismic activity if impacts are observed on marine wildlife.[87] A Community Representative from Resolute discussed reporting mechanisms and commented on the length of time it could take for a negative effect on marine life to when it is observed or addressed:

> *If we found that it was having big time negative impact on all marine animals post-moratorium, if we report Year 1, federal government will only look at it in the next year. Because most of our activities, hunting activities basically are in summertime*

[80] J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 115-116, lines 23-26 and 1-14.
[81] S. Keenainak, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 206-207, lines 25-26 and 1-10.
[82] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 208-209, lines 21-26 and 1-7.
[83] M. Savearjuk Jaw, Cape Dorset, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 839, lines 3-19.
[84] B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 195-196, lines 10-26 and 1-20.
[85] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 197, lines 8-16.
[86] S. Lonsdale, Qikiqtani Inuit Association on behalf of David Iqaqrialu, Clyde River QIA Representative, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 793, lines 1-5.
[87] L. Audlaluk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 345, lines 12-16

*and that's the impact that -- that's when we're going to see it. Then Year 1, we reported; Year 2, they do a study; Year 3, they make a recommendation. So when you really look at it, it would take about three to five years to do something about the negative impact on our marine life.*[88]

*Even though I understand COSEWIC is really slow on listing animals on an endangered list. Hopefully that these kind of scenarios would be looked at.*[89]

In response, the QIA discussed some of the current limitations as a result of the current information gaps and noted that:

> *…one of the reasons why we kind of structured our report and recommendations that had to be completed prior to determining whether to lift the moratorium or not was to allow us to a bit more proactive in trying to determine where those sensitive areas are, where could those no-go zones be, so the scenario that you're talking about is even less likely to occur. Research needs to be done to collect baseline information so that we know if there are changes or not to those conditions. So the more -- the more that we know the easier it will be to determine if there is a change to that kind of standard or status quo and will allow us to develop monitoring plans and to kind of monitor any changes as well.*[90]

A Community Representative from Qikiqtarjuaq requested clarification from DFO on the reasons why whales and narwhals have been coming to their community earlier in the last few years than what has been normal, and wanted to know if this might be due to accidents occurring, spills of gas and oil, or whether the ships going through their breeding grounds are forcing the animals to change their migration route(s).[91] In response, DFO noted that it was not aware of changes to the arrival of narwhals to the area but that any areas that are known to be important for breeding and areas identified of particular concern, would be identified as sensitive and would be given special consideration.[92]

Another Community Representative from Qikiqtarjuaq noted experience with impacts to marine mammals from seismic activities stating "[w]*e had -- didn't have much seal last year. Maybe notice the ship echolocation were watching in the beds of the sea, and for reason maybe the seals have gone somewhere else, and there weren't any seals, hardly.*" The representative requested that the research concerning marine mammal disturbance include consultation with the

[88] J. Amagoalik, Resolute, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 19, 2019, p. 347, lines 5-15.
[89] J. Amagoalik, Resolute, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 19, 2019, p. 347, lines 22-25.
[90] R. D'Orazio, Qikiqtani Inuit Association, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 19, 2019, pp. 349-350, lines 17-26 and 1-7.
[91] J. Keyookta, Qikiqtarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 531-533, lines 24-26, 1-7, 22-24 and 1-7.
[92] . Doherty, Fisheries and Oceans Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 533, lines 12-23.

communities and traditional knowledge as Inuit use the areas for hunting.[93] In response to the comments, Parks Canada noted that it issues restrictions within proponents' permits that restrict vessels from entering areas of special importance by Inuit if mammals such as narwhals are observed.[94]

A Community Representative from Pangnirtung also noted concern with respect to impacts from seismic activities and shipping on marine mammals, noting that the maps presented were outdated.[95] Another Community Representative from Qikiqtarjuaq noted concerns with respect to impacts of development activities on marine mammals stating "*whales, seal, and sea mammals that we consume. These are going to be effected if this should go forward with the oil and gas and production.*"[96]

#### 7.2.1.7. ***Special and Sensitive Areas and Areas of Concern or Importance***

As described in the *Environmental Setting and Potential Effects Report* (see Section 7.2.1.4: Habitat Alteration; Nunami Stantec, 2018a), activities associated with the possible scenarios of oil and gas development in Baffin Bay and Davis Strait may result in habitat alterations on Special and Sensitive Areas and Areas of Concern or Importance and the pathways of effects are the same on these areas so were assessed together. Please refer to this section and report for additional information.

During its Public Scoping Sessions, the NIRB was asked to consider areas including Marine Protected Areas Bird Sanctuaries, National Wildlife Areas, coral reefs, the *Pikialasorsauq* (North Water Polynya), and narwhal wintering areas. Therefore, based on the information collected, it was concluded that Special and Sensitive Areas and Areas of Concern or Importance could be affected by habitat alterations via activities associated with *Scenario A, Scenario B* and *Scenario C*. Special and Sensitive Areas and Areas of Concern or Importance within the Area of Focus that may experience change in habitat which are specific to those areas utilized by waterbirds and marine mammals.

Exploration and development activities located in proximity to waterbird breeding colonies have potential to disturb nesting waterbirds which could cause birds to abandon nests or young or make them vulnerable to predation. However, Special and Sensitive Areas and Areas of Concern or Importance in marine regions in Canada are protected by regulations including the *Migratory Birds Convention Act* and through the creation of protected areas such as Migratory Bird Sanctuaries, National Wildlife Areas, or National Parks which protects waterbirds from harassment and disturbance, including disturbance that may interrupt breeding activities. Additional protections

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[93] J. Metuq, Qiqitarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 586, lines 7-14 and 19-26.
[94] J. Chisholm, Parks Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 587, lines 12-18.
[95] Amagoalik, Resolute, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 724, lines 8-14.
[96] L. Kooneeliusie, Qikiqtarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 730, lines 17-19.

may be afforded under reserves and conservation areas under territorial jurisdiction. The types of activities allowed in these protected areas are strictly regulated to reduce the likelihood of impacts to special and sensitive areas and areas of concern or importance.

Special and Sensitive Areas and Areas of Concern or Importance that are utilized by marine mammals also have the potential for changes in habitat due to icebreaking activities. Changes that may occur include damage to birthing lairs created and maintained by ringed seals and bearded seals or abandonment of overwintering habitat by walrus, narwhal, and polar bear.

Nunami Stantec noted that there was some uncertainty in the assessment of changes in habitat of Special and Sensitive Areas and Areas of Concern or Importance. Overall however, changes in behaviour as a result of habitat alterations from the scenarios were predicted to be short term, lasting only for the duration of activity. Change in habitat effects were expected to be reversible, returning to baseline conditions once activities cease, and to be local in extent. The magnitude of the effect was considered to be moderate, with change from baseline conditions, with no anticipated effect on the viability of the populations within the Area of Focus.

The *QIA Inuit Qaujimajatuqangit Report* outlined that the Inuit Qaujimajatuqangit advisors did discuss protected areas, but rather specific habitat conditions. The floe edge and immediate under ice conditions were considered areas of importance because of their high biodiversity. Inuit travel the floe edge to find seals and whales therefore changes in floe edge conditions are of concern to harvesters.

### Views of Interested Parties

During its presentation at the Final Public Meeting, the Qikiqtani Inuit Association reiterated that no-go zones should be identified where oil and gas development should not occur and that the zoning study be completed using Inuit Qaujimajatuqangit and science to determine where the zones should be.[97]

In its final written submission, the Government of Nunavut (GN) noted Area of Focus has many sensitive habitats and conservation areas, including breeding seabird colonies, areas with large congregations of marine mammals, marine refuge, environmentally sensitive areas, polynyas, etc. The GN noted that there is a lack of understanding of the potential effects with changes to the ice conditions and based on available information, it is unknown if the conditions in sensitive areas would return to natural conditions once oil and gas development ceases. The GN recommended that parties should conduct additional research to improve the understanding of potential effects of oil and gas activities and unplanned events (e.g., ice breaking, vessels, spills) on sensitive areas, as well as how these activities may interact with sensitive areas under changing conditions due to climate change.

In its final written submission, Oceans North Canada (Oceans North) noted that no consideration was given to the potential for the development of new conservations areas in Baffin Bay and Davis

[97] R. D'Orazio, Qikiqtani Inuit Association, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 309, lines 18-26.

Strait. Oceans North also commented on the ongoing initiatives regarding the planning of the *Pikialasoruaq* (North Water Polynya) and highlighted the commitment from the United States-Canada Joint Arctic Leader's statement to include climate change implications of opening Baffin Bay and Davis Strait to oil and gas activities. Oceans North noted that additional areas in Baffin Bay and Davis Strait that may require special management or protected area status should be identified and specific management measures for these areas should be determined through involving the communities in the Qikiqtani region. Oceans North also indicated that recommendations should be made for a future process to determine the areas where the ultimate value of the ecosystem services and traditional lifestyles are equal to the potential value of non-renewable resource development, thereby assisting in risk analysis and decision-making should be considered and the habitat protections required for these areas, including any protections from oil and gas development. Finally, Oceans North indicated that Canada's National Marine Conservation Targets, designed to meet the Convention on Biological Diversity Aichi Target 11, should be considered and 10% target would not be open to oil and gas activity.

Within its public written comments, the Word Wildlife Fund (WWF) noted that commercial shipping should also be tightly managed, and avoided where possible, to minimize the risk of contamination of sensitive areas by an oil spill or other potential shipping impacts, as well as chronic disturbance from increased shipping activity and underwater noise. WWF also indicated that the *Environmental Setting and Potential Effects Report* did not provide enough information to support the claim that impacts to sensitive marine habitats from oil and gas activities would be "short-term" and "reversible". WWF indicated that any oil and gas activities within Ecologically and Biologically Significant Areas may result in long-term impacts, due to the slow recovery of certain species. In addition, the effects on ecologically sensitive habitat and some marine species would almost certainly not be short-term and reversible in the event of a major oil spill. Finally, no information on the scale of the industrial petroleum development was provided, noting that the extent of the cumulative effects of oil and gas activities on a sensitive marine area would vary depending upon the number of drilling rigs in operation in the region.

Following the QIA's presentation at the Final Public Meeting, a Community Representative from Iqaluit discussed the importance of the conservation areas/sanctuary areas are important to communities and noted that oil and gas industry should cease production during part of the year to avoid impacting marine mammals and birds in these areas.[98]

A Community Representative from Resolute noted concern with respect to shipping corridors going through areas that were identified by the communities as sensitive and no-go areas stating that "*[y]ou guys are going through some real sensitive ares[s] for that shipping corrider*", and stressed that this information should be relayed to the federal and territorial governments to ensure these areas are avoided.[99]

[98] B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 342, lines 8-15.
[99] J. Amagoalik, Resolute, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 535, lines 1-15.

During the Final Public Meeting, a Community Representative from Arctic Bay noted concern on the potential effects from offshore oil and gas development and associated spills on protected areas.[100]

In response to a question raised by NIRB staff during the Final Public Meeting on whether there are any legislated setbacks or other restrictions on oil and gas development activities that might be applicable to the areas that are immediately surrounding national marine conservation, Parks Canada noted that under the National Marine Conservation Areas Act there are provisions to work with other agencies on issues of concern outside marine protected areas but potentially there is not much Parks Canada can do.[101]

#### 7.2.1.8. *Identified Gaps*

In general, it was identified that uncertainty surrounding effects characterization for the biological environment results from lack of comprehensive field studies, lack of research on seismic effects on the biological valued ecosystemic components, and lack of studies that characterize species-specific differences in response to noise. It was indicated that uncertainty makes it difficult to conclusively discern between potential project effects and natural variability in behaviour, distribution, abundance, and mortality of plankton, benthic invertebrates, fish species, waterbirds, and marine mammals. In addition, it was identified that the lack of detailed knowledge of fish species, distribution, and abundance in Baffin Bay and Davis Strait created uncertainty in the effects characterization. Finally, there is considerable uncertainty regarding the abundance and distribution of fish species in the Area of Focus.

Some uncertainty of future effect characterization also results from interactions with climate change impacts on the biological environment.

For more detailed discussion on the identified gaps for the effects characterizations of the biological environment, please review each section above.

**Views of Interested Parties**

During the Final Public Meeting, a Community Representative from Iqaluit noted concern with respect to the information gaps identified and indicated that research has been done by other groups such as the Canada-Greenland Commission on the impacts from seismic work on beluga and narwhal and recommended parties review this information before making a decision.[102] The Community Representative further noted concern with respect to the currents in Baffin Bay, how it would affect the movement of ice, and whether the currents are the same as in Greenland or

[100] J. Kango, Arctic Bay, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 764, lines 18-23.
[101] Exchange between R. Barry, NIRB Staff, and J. Chisholm, Parks Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 588-589, lines 21-25 and 2-13.
[102] B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 90-91, lines 24-26 and 1-23.

Norway and identified this as a gap in information.[103] In response, Nunami Stantec acknowledged that there were information gaps for the region, especially related to animals and their habitat, how people are using the region, understanding how oil spills would affect the region and the capacity to respond, and the impacts from climate change.[104] The Qikiqtaaluk Wildlife Board also requested if the information gaps considered cumulative effects at various stages of drilling which was confirmed by Nunami Stantec.[105]

Following Crown-Indigenous and Northern Affairs Canada's (CIRNAC) presentation at the Final Public Meeting, World Wildlife Fund requested confirmation from CIRNAC that there are "*…gaps with respect to impacts of seismic testing, for instance, and impacts of oil on wildlife in the event of an oil spill, how oil behaves in -- in ice, population levels, ecological sensitivity"*[106], noting that it was not identified in the presentation.

#### 7.2.1.9. *Mitigation Measures and Planning Considerations*

Mitigation measures are recommended to avoid or reduce negative effects to the environment from activities associated with the possible oil and gas development scenarios. Many of the mitigation measures are standard to oil and gas development and are part of the usual design of potential projects. The potential effects identified above are what would remain after standard mitigation measures have been applied. Specific measures and commitments by a proponent to decrease potential effects of activities and components would be determined during a project level environmental assessment. During the regulatory process, companies would be responsible for submitting a variety of plans for approval, including, but not limited to: safety, environmental protection, ice management, emergency response, contingencies, and for offshore installations. A company would further have reporting requirements, including those related to spills, incidents, drilling, production, and the environment.

Nunami Stantec identified standard mitigation measures recommended to avoid or reduce potential negative effects or increase the potential for positive effects from oil and gas activities to the biological environment, including but not limited to the following (for additional detail, see Appendix B of the *Environmental Setting and Potential Effects Report;* Nunami Stantec, 2018a):

- Establish habitat protection setbacks (safe distances from marine wildlife) and timing windows to protect sensitive breeding, rearing, or nesting habitat;
- Apply mitigation measures for seismic surveys as specified in the *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment*;
- Project associated vessels should use existing and common travel routes where possible and practical;

[103] B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 93, lines 12-20.
[104] J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 94-96, lines 12-26, 1-4 and 10-11.
[105] J. Price, Qikiqtaaluk Wildlife Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 109, lines 21-26.
[106] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 374, lines 16-19.

- Marine vessels should use existing and common travels routes where possible and practical;
- Marine vessels should maintain a steady course and safe vessel speed whenever possible;
- Implement a Marine Mammal Management Plan that includes marine mammal monitoring for vessel-related activities; and
- Establish safe vessel operation practices to avoid marine mammals and sensitive marine mammal habitat.

### Views of Parties

Following review of the *Environmental Setting and Potential Effects Report,* Natural Resources Canada indicated that the assessment should encourage seismic operators to use newer technologies, such as infrared (heat detection systems) as possibly additional tools to recognize marine mammals within proximity of vessels. During the Final Public Meeting, the Government of Nunavut also recommended the use of infrared heat detection systems as a technology to recognize the presence of marine mammals in the vicinity of seismic testing areas.[107] In response to a question on disturbance to sea mammals from seismic surveys, the Canadian Association of Petroleum Producers indicated that a standard mitigation measure used during seismic programs is to turn off air guns to avoid disturbance of marine mammals until they have moved out of the area.[108]

Within its public written comments, Environment and Climate Change Canada (ECCC), discussed existing information gaps related to waterbirds species composition, abundance, and seasonal distribution in the offshore areas of the Area of Focus and recommended that a comprehensive monitoring strategy for projects and cumulative impacts in the Area of Focus with an adaptive management framework would be necessary to confirm assessment predictions. ECCC further commented on the standard list of mitigation measures and best practices provided and provided reports for consideration (see Appendix C: Recommended Documents).

> *We must also participate in monitoring the impacts of seismic on marine animals.*
>
> [J. Kiguktak, Arctic Bay, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 743, lines 12-13.]

The Environment Agency for Mineral Resources Activities – Government of Greenland (EAMRA, 2018) noted in their public written comments that it is important to know that the mitigating measures generally stipulated by the authorities regarding effects of seismic noise on marine mammals do not reduce the impacts on behavior (displacement) and masking of communication. EAMRA indicated that such impacts can only be mitigated by reducing the over-lap in time of seismic surveys and presence of marine mammals or by reducing the source level of the seismic

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[107] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 174, lines 22-25.
[108] Exchange between E. Panipakoocho, Mittimatalik (Pond Inlet) Hunters and Trappers Organization and P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 641-642, lines 1-4, 6-14 and 6-9.

airguns. EAMRA provided an example of what seismic companies are required to do in Greenland with respect to modelling sound propagation in order to evaluate potential impacts as well as the potential cumulative impacts.

During the Final Public Meeting, a Community Representative from Grise Fiord commented on the QIA's presentation and associated recommendations and recommended that:

> *…it should include that if it look like seismic testing has to happen because the government said so that the recommendation I give include -- should include guidelines spelled out, black and white, very clearly, saying something to the effect: If the seismic activity starts to show negative impact on the wildlife on the environment as per the agreement of the guideline, there will be -- they will stop the seismic activity. That is how I like to see recommendation include.*[109]

### 7.2.2 *Views of the Board*

#### 7.2.2.1. *Plankton*

In reviewing the information and predictions made within the *Environmental Setting and Potential Effects Report*, as well as input by interested parties, the Board recognizes that there is uncertainty surrounding the effects characterization on plankton as a result of the lack of research on seismic effects on plankton generally, and on Arctic plankton in particular. There is also an identified lack of information on the effects of routine discharges on the community structure of plankton, specifically phytoplankton. Further, as noted by Nunami Stantec within the *Environmental Setting and Potential Effects Report*, the potential non-linear feedback loops between climate change and plankton are also not well understood, such as changes in bloom phenology due to sea ice changes, and changes in abundance and species composition due to changes in ocean circulation, surface conditions, and temperatures.

The Board notes that routine discharge and produced water discharge may impact plankton and further studies should be conducted on the possible effects of nutrient pollution from these discharges on plankton in the Area of Focus. Also, concerns were expressed by parties during the Final Public Meeting on the discharge of ballast water which may also be a pathway for the introduction of non-native plankton species to the region.

In addition, as discussed under Chapter 8: Accidents and Malfunctions, accidental oil spills may result in acute effects on plankton which do not have the ability to physically move to avoid an oil spill. Given the importance of lipid rich zooplankton in Arctic food webs, loss of these plankton resources, even for a single season, would adversely affect higher trophic level organisms; such incidents could significantly impact entire food webs as a result and must be protected against through careful planning and preventative approaches.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to plankton, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public

[109] L. Audlaluk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034, March 19, 2019, p.345, lines 7-16.

Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research:

***Recommendations to address irrespective of the current moratorium:***

- Conduct research on the potential for effects on plankton of:
  - nutrient pollution from routine and produced water discharge from oil and gas activities;
  - ballast water discharge from shipping activities; and
  - the potential introduction of non-native plankton species to the region (#47).

***Recommendations to address through future assessments:***

- Project-specific assessments should include the assessment of potential impacts to plankton and benthic flora and fauna:
  - posed by an oil spill or other possible shipping impacts; and
  - due to chronic disturbance from increased shipping activity and underwater noise (#58).

For Board recommendations related to plankton addressing impact modelling, mapping, and predictions see 7.2.2.2 Benthic Flora and Fauna.

#### 7.2.2.2. ***Benthic Flora and Fauna (including soft corals and seaweed)***

In reviewing the information and predictions made within the *Environmental Setting and Potential Effects Report*, as well as input by interested parties, the Board recognizes that depending on the oil and gas development scenario, benthic flora and fauna could be impacted with long term consequences, specifically in changes in habitat due to marine infrastructure development and also to accidental spills. Similar to plankton, the potential non-linear feedback loops between climate change and the benthic environment are not well understood, such as alterations to benthic species composition, biomass and productivity in the Arctic due to sea ice changes, ocean circulation changes, surface conditions, and temperatures.

The Board acknowledges Fisheries and Oceans Canada’s concern with respect to the conclusion that changes in habitat for benthic flora and fauna due to habitat alterations may need to be re-evaluated, as the destruction of even small areas may in fact be significant for the habitat. Further analyses on the potential impacts of such development on the benthic environment would be required by proponents to inform planning for project specific requirements and to assess potential effects of oil and gas developments, if allowed to proceed.

As noted in Volume 2, Chapter 5.2.2, the Board had concerns with the gaps in the biological environment and highlighted in Volume 2, Chapter 5.2.2.2 that information on the current benthic environment (specifically related to corals, sponges and sea pens) and benthic habitats (especially Significant Benthic Areas) in Baffin Bay and Davis Strait would be required to understand the ecological functions of these areas prior to assessing the potential effects of oil and gas developments. This would also require collecting sufficient baseline information for the Area of Focus to discern effects from natural variability, if any.

As discussed under Chapter 8: Accidents and Malfunctions, benthic flora and fauna would be vulnerable to accidental oil spills, with the effect to the intertidal and nearshore benthos potentially being lethal, chronic and/or passed up the food chain to higher trophic levels.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to benthic flora and fauna, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research and impact modelling, mapping, and predictions:

***Recommendations to address irrespective of the current moratorium:***

- Conduct research on the relationship between changes in bloom phenology, abundance, productivity, and species composition of benthic flora and changes in the marine environment (e.g., sea ice distribution, ocean circulation, surface conditions, and temperatures) to better understand the potential non-linear feedback loops between climate change and the benthic marine environment (#48).

- Reflecting updated baseline data, conduct modelling of the different habitats within Baffin Bay and Davis Strait to improve confidence in the assessment of potential effects from oil and gas activities on the habitat supporting:
  - benthic flora and fauna; and
  - plankton.

  Modelling should include consideration of strong currents in the area and the potential for currents to intensify and extend the footprint of the potential impacts of deleterious substances released into the environment (#72).

***Recommendations to address prior to lifting the current moratorium***:

- Conduct research on the effects on benthic filtering organisms resulting from the uptake of suspended solids due to increased turbidity from development activities on/near the seabed (#49).

#### 7.2.2.3. ***Fish and Fish Habitat***

In review of the information and predictions made within the *Environmental Setting and Potential Effects Report* report, as well as input by interested parties, the Board finds that there is still insufficient information with respect to the interactions between fish and fish habitat, potential oil and gas development activities, and approved fisheries in Baffin Bay and Davis Strait. Generally there is insufficient information on fish diversity in the Canadian Arctic and, as noted in Volume 2, Chapter 5.2.2.4: Fish and Fish Habitat there is a need to develop systemic surveys to improve assessments of fish diversity and stocks. Further, it is noted that there is lack of information and understanding of the linkages of the focal fish in the Area of Focus to higher levels in the trophic system which needs to be considered to address the potential consequences of development activities on species or habitats of interest which might be transmitted along ecosystem pathways. The Board also acknowledges the Arctic Fishery Alliance's concern that there is uncertainty in the assessment with respect to the interactions between oil and gas development activities and the current fisheries activities requiring further study.

As noted in the Acoustic Environment Chapter (see Chapter 7.1.1.5 and Chapter 7.1.2.4), parties have noted concerns with respect to the impacts of noise on the marine environment including the potential for adverse impacts to fish and fish habitat noise related to oil and gas development, including seismic activities. During the Final Public Meeting, the Board heard concerns from parties on the potential for fish to avoid certain areas due to increases in noise which may alter the presence, and abundance of marine fish in Baffin Bay and Davis Strait, as well as potentially disturb their movement or migration, feeding reproduction and other important activities.

The Board recognizes that the infrastructure from offshore installations can also serve as a stable substrate and act as an anchor for invertebrates, becoming artificial reefs and biological hotspots. However, consideration should be given to the possible attraction of marine fish to offshore installations and vessels (seismic and supply) that could result in increased potential for injury or mortality through collisions, contamination or other interactions.

Finally, as discussed under Chapter 8: Accidents and Malfunctions, fish and fish habitat would be vulnerable to accidental oil spills. The effects of accidental oil spills for fish may also be lethal, chronic, and/or passed up the food chain to higher trophic levels. Recommendations related to potential accidents and malfunctions can be found in Chapter 8.4.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to fish and fish habitat, waterbirds, marine mammals, and climate change as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research and impact mitigation:

***Recommendations to address prior lifting the current moratorium***:

- Reflecting updated baseline research, assess the potential impacts of oil and gas development on components of the biological, physical, and human environments in the Area of Focus including:
    - sensitive areas,
    - fish and fish habitat (including at different life stages),
    - waterbirds; and
    - marine mammals.

  Assessment should address uncertainty regarding potential physiological and behavioural responses to impacts (such as acoustic and underwater noise) and should indicate how areas impacted by development are expected to change over time and under different climate change conditions/models (#53).

- Reflecting updated baseline and effects assessment data, conduct research to analyze the effectiveness of mitigation measures (including new technologies) designed to reduce potential acoustic impacts associated with oil and gas development and project-related shipping on:
  - fish;
  - waterbirds; and
  - marine mammals.

  Research should include delineation between different species and their various life stages (#62).

***Recommendations to address should the current moratorium be lifted:***

- Conduct research to identify potential risks (including implications for the health and safety of individuals or populations) resulting from attraction to offshore structures and associated vessels for:
  - marine fish;
  - waterbirds; and
  - marine mammals (#43).
- Undertake research to:
  - identify current methods used to monitor for the presence of marine fish, waterbirds, and marine mammals in proximity to offshore oil and gas development infrastructure, and
  - assess the effectiveness of these measures to avoid or reduce adverse interactions or other impacts (#44).

#### 7.2.2.4. ***Waterbirds (Seabirds, Waterfowl, and Shorebirds)***

As acknowledged in the *Environmental Setting and Potential Effects Report* and noted by parties, there remains uncertainty related to the potential effects on waterbirds in Baffin Bay and Davis Strait from oil and gas development proposals. Specifically, additional research is needed to more confidently characterize the effects of underwater noise on waterbirds and to develop more relevant threshold criteria for assessing injury and behavioural disturbance. As noted by ECCC, hearing capabilities of diving waterbirds are complex and poorly understood and insufficient research has been conducted specifically on this issue. The Board also recognizes that there is uncertainty related to potential for changes in habitat, behaviour, health and mortality risks for waterbirds related to oil and gas development. Filling in many of these knowledge gaps for waterbird species composition, abundance and seasonal distribution in the offshore areas of the Area of Focus would improve the confidence in the future assessments of potential development effects.

The Board recognizes that further information is required to understand the risks associated with the potential attraction of birds to offshore structures and potential implications for the health and safety of migratory birds. The effects of light attraction from offshore activities also needs to be better understood, and additional research on methods to detect bird collisions and the effectiveness of associated measures to avoid or reduce such interactions would also help to better predict and manage these issues for future developments.

Further, as discussed under 8.2.2 Biological Environment, marine waterbirds would be vulnerable to accidental oil spills associated with potential development, which would contribute adversely to changes in the presence, abundance, distribution and/or health (such as injury or mortality) of waterbird populations in the Area of Focus. The effects of accidental oil spills for waterbirds may also be lethal, chronic, and/or passed up the food chain to higher trophic levels. Recommendations related to potential accidents and malfunctions can be found in Chapter 8.4. Effects are not limited to accidental oil spills as even thin sheens from routine discharges may adversely affect marine waterbirds, making them more susceptible to health and mortality risks.

Again, the Board emphasizes the importance of collecting sufficient information for the physical, biological and human environments to understand the existing marine environment including the presence and distribution of waterbirds in and near the Area of Focus. Improvements to our understanding of the current state and potential impacts of climate change and pollution levels is also critical to understanding and assessing future offshore oil and gas activities.

For Board recommendations related to waterbirds addressing baseline research and impact mitigation see Chapter 7.2.2.3 Fish and Fish Habitat.

#### 7.2.2.5. ***Marine Mammals***

As acknowledged in the *Environmental Setting and Potential Effects Report*, current data gaps exist with regards to population abundance and distribution of certain marine species and the potential impacts from oil and gas development on marine mammals. In addition, the impact and cumulative effects of underwater noise and potential oil spills on Arctic marine ecosystems are not well understood at present. In the absence of sufficient data, it is difficult to accurately predict the impacts of oil and gas development, critical information for the decision-making process. As noted in Volume 2, Chapter 5.2.1.6, prior to making a decision on potential future offshore oil and gas activities in the region, it is important to understand the existing marine environment including the presence and distribution of marine mammals in and near the Area of Focus.

Numerous comments and concerns were heard by the Board during the Final Public Meeting on the potential impacts to marine mammals from oil and gas development, and the associated potential impacts to Inuit livelihood and food security. Parties also noted concern that marine mammals may avoid certain areas that would otherwise be used, with these behavioural changes altering the presence, abundance, and overall distribution of marine mammals and their movements, feeding, and other activity. This is of key concern if any such areas are especially important or rare habitats and are disturbed repeatedly. Concerns were also raised that noise from oil and gas development/activities may interfere with (and mask) sounds in the marine environment that originate from and/or are used by marine mammals, such as in communication, the identification and detection of prey, reproduction, echolocation, and other essential functions. Further studies are be needed to determine how noise from oil and gas developments would impact marine mammals, which could be used to inform decisions related to the moratorium and when planning project specific requirements, should the moratorium be lifted in future.

As noted in the Fish and Fish Habitat Chapter (Chapter 7.2.2.3), consideration should also be given to the possible attraction of individual marine mammals to offshore installations and vessels (seismic and supply) that could result in increased potential for injury or mortality for marine mammals through collisions, contamination or other interactions. For Board recommendations related to marine mammals addressing baseline research and impact mitigation see 7.2.2.3 Fish and Fish Habitat.

Further, as discussed under 8.2.2 Biological Environment, marine mammals would be vulnerable to accidental oil spills, which could change the presence, abundance, distribution, and/or health of marine mammals (such as injury or mortality). The effects of accidental oil spills for marine mammals may also be lethal, chronic, and/or passed up the food chain to higher trophic levels. Recommendations related to potential accidents and malfunctions can be found in Chapter 8.4.

#### 7.2.2.6. *Special and Sensitive Areas and Areas of Concern or Importance*

The Board heard many times throughout the consultations and at the Final Public Meeting how important ecosystem health is to Nunavummiut. The Board understands that there are many ways to judge and value areas, both from cultural and ecosystemic perspectives. For future generations to understand Inuit culture they must have the ability to experience the same places and things as some parts of culture can not be transferred through pictures or words. As such it is important to protect areas as noted in Volume 2, Chapters 5.2.1.8 and 5.2.1.9. The Board also understands that there are various levels of protection that can be assigned from the federal and territorial levels, but ultimately these protections are meant to ensure that species or places are allowed to be productive, irrespective of activities occurring. The Board acknowledges that there is still much that is not understood regarding the marine environment and therefore more protection may be necessary to ensure that critical areas are protected.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to special and sensitive areas and areas of concern or importance, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research and impact modelling, mapping, and predictions:

***Recommendations to address prior to lifting the moratorium***:

- Conduct additional research to identify the potential effects of oil and gas activities and unplanned events (e.g., ice breaking, vessels, spills) on sensitive areas, including consideration of changing conditions associated with climate change (#33).

***Recommendations to address should the moratorium be lifted***:

- Establish setbacks or other potential development restrictions on the proximity of oil and gas development activities, infrastructure, and other components to the floe edge (#76).

For Board recommendations related to special and sensitive areas and areas of concern and importance addressing impact modelling, mapping, and predictions see Chapter 7.3.2.4 Commercial Harvesting.

#### 7.2.2.7. *Mitigation Measures and Planning Considerations*

As discussed throughout this chapter, the Board shares concerns with parties about the lack of information on the potential effects from offshore oil and gas activities, particularly from seismic sound, on marine wildlife. Without this information, it is difficult to confidently prescribe adequate mitigation measures at this time. The Board agrees with Environment and Climate Change Canada on the importance of developing a comprehensive monitoring strategy for projects and cumulative impacts in the Area of Focus, and that an adaptive management framework would be necessary to confirm assessment predictions. The Board considers the project level assessment process the most applicable stage to assess specific mitigation measures as project level considerations such as location, scale, timing, and intensity would be known. However, given the significant concerns expressed by parties on the potential effects of sound on all aspects of the environment, the Board agrees that an informed decision on lifting the moratorium cannot be made until there is confidence that potential negative effects can be properly mitigated.

The Board further appreciates and acknowledges the mitigation measures provided by the QIA and informed by the Inuit Qaujimajatuqangit Committee. The Board strongly recommends that Inuit Qaujimajatuqangit and Inuit Qaujimaningit and associated traditional rules identified be sought to develop and assess appropriate mitigation measures. The Board has commented on specific recommendations within its views on individual valued components.

## 7.3. Human Environment

As part of the SEA, potential impacts to Valued Socio-Economic Components (VSECs) of the human environment were assessed to gain a better understanding of the nature of the potential effects to the Area of Focus (e.g., economic development and opportunities, traditional activity, and commercial harvesting). The selection of VSECs was informed by public engagement and community scoping meetings conducted by the NIRB in potentially interested communities in the Qikiqtani region in 2017. The full list of VECs considered for the SEA is available in Appendix D: Final SEA Scope List.

The following is a summary of Nunami Stantec's assessment of potential impacts (negative or positive influence from an activity) and effects (change to a valued component) from the hypothetical oil and gas scenarios on VSECs of the human environment. For additional information, see Section 7.3: Human Environment of the *Environmental Setting and Potential Effects Report* (Nunami Stantec, 2018a). The possible scenarios for oil and gas development in

Baffin Bay and Davis Strait are described in detail in Chapter 6: Possible Development Scenarios in Baffin Bay/Davis Strait of this Report.

*Applicable Valued Socio-Economic Components*
The VSECs identified through the NIRB's scoping process that could potentially be affected by the three (3) development scenarios have been grouped together for the description of potential effects as listed in Table 22: Valued Components Groupings for the Human Environment.

**Table 22: Valued Components Groupings for the Human Environment**

| Valued Components Grouping | Valued Components in the SEA Final Scope |
|---|---|
| Economy, Employment and Business | ▪ Economic Development and Opportunities,<br>▪ Employment<br>▪ Contracting and Business Development |
| Community, Infrastructure and Services | ▪ Education and Training<br>▪ Community Infrastructure and Services |
| Community Health and Well-being | ▪ Health and Well-being |
| Commercial Harvesting | ▪ Commercial Harvest |
| Land and Marine Use | ▪ Traditional Use and Practices<br>▪ Traditional Harvest<br>▪ Traditional Foods<br>▪ Non-Traditional Use<br>▪ Marine Transportation |
| Heritage Resources | ▪ Heritage Resources |

### 7.3.1 *Background*

#### 7.3.1.1. *Potential Impacts and Effects*

Based on the assessment by Nunami Stantec, the following possible socio-economic impacts of the three (3) scenarios are identified in Table 23: Summary of Potential Impacts on Selected Valued Socio-Economic Components:

**Table 23: Summary of Potential Impacts on Selected Valued Socio-Economic Components**

| Valued Socio-Economic Component | Potential Environmental Impacts | | | | |
|---|---|---|---|---|---|
| | Ice Disturbance | Employment and Expenditures | Exclusion Zones | Direct Interference | Indirect Interference |
| Economy, Employment and Business | | ✓ | | | |
| Community, Infrastructure and Services | | ✓ | | | |
| Perceived Community Health and Well-being | | ✓ | | | |
| Commercial Harvesting | | | ✓ | ✓ | ✓ |

| Valued Socio-Economic Component | Potential Environmental Impacts | | | | |
|---|---|---|---|---|---|
| | Ice Disturbance | Employment and Expenditures | Exclusion Zones | Direct Interference | Indirect Interference |
| Land and Marine Use | ✓ | | ✓ | ✓ | ✓ |
| Heritage Resources | | | | ✓ | |
| **Note:** "✓" Indicates potential effect from oil and gas activity | | | | | |

- Ice disturbance associated with marine traffic, specifically icebreaking;
- Employment and expenditures associated with use of local or regional services and infrastructure to support oil and gas activities;
- Exclusion zones (safety areas around oil and gas activities restricted to other uses) required to secure a safety radius around seismic vessels, drilling rigs, and production platforms;
- Direct interference of seismic, exploration drilling, or production drilling operations with commercial fishing gear and equipment, causing damage and lost-time and profit from delays;
- Direct interference of seismic or drilling (for both exploration and production) operations with land and marine use (excluding commercial fishing) and changes to harvesting, cultural, and spiritual practices, as well as recreational activities;
- *Indirect interference* with land and marine use mainly related to potential effects on the biological environment that can affect commercial fishing; and
- *Indirect interference* with land and marine use resulting in changes to harvesting, cultural, and spiritual practices, as well as recreational activities.

If no offshore oil and gas activities were to occur (*Scenario D*), it was noted that adverse effects or benefits (such as employment, capacity building, business expansion and development opportunities, and certain infrastructure improvements) to the human environment would not occur from the oil and gas industry. However, adverse effects or benefits to the human environment would still occur from other anthropogenic activities (e.g., increases in shipping and tourism, port and infrastructure development by government) or impacts associated with climate.

#### 7.3.1.2. ***Economic Development and Opportunities, Employment and Contracting and Business Development***

During the Public Engagement Sessions, the NIRB heard many comments and questions from community members on potential employment and training opportunities and potential financial benefits to Nunavut and the Qikiqtani communities from possible offshore oil and gas activities. Multiple community members noted that the potential negative effects from offshore oil and gas development would need to be compared to the potential benefits. The reason most often provided by individuals expressing support for possible offshore oil and gas activity was the potential for employment opportunities.

The following is a summary of the *Environmental Setting and Potential Effects Report* – Section 7.31: Potential Effects from Routine Activities Employment and Expenditures, Economy, Employment, and Business and Section 2.3.3.1: Hypothetical Scenarios (Nunami Stantec, 2018a). Please refer to this section and report for additional information.

> Predicted Effects on Economy, Business, and Employment:
>
> - Generally positive;
> - Low in magnitude;
> - Short term for seismic (Scenario A) and exploration (Scenario B) activities;
> - Long term from production activities (Scenario C);
> - Occur within local communities and regional governments; and
> - Happen throughout the length of the activity
>
> Nunami Stantec, 2018a

Nunami Stantec noted that an increase in direct and indirect employment and expenditures on goods and services from local businesses from oil and gas activities would generally have positive economic effects on local communities and regions. However, the magnitude (size) of potential effects was considered to be low. Potential positive effects could be direct (e.g., job as a Marine Wildlife Observer on a seismic vessel) or indirect (e.g., increased disposable income from oil and gas development in the region being spent in the communities). Local businesses could potentially obtain a steady source of business over a long period if working for large clients, especially during the production life of a hydrocarbon field. Local and regional governments could also experience positive effects from oil and gas production, given royalty and tax payments from the operator.

Potential positive effects on Economy, Employment, and Business from oil and gas activities were considered to be dependant on the ability of local businesses and individuals to take advantage of available opportunities. For example, if there are limited effective management and mitigation measures, such as standard procurement policies, small-to-medium sized businesses may be unable to make competitive bids. Similarly, positive effects could be constrained if residents believe they are not receiving employment opportunities, or available opportunities are minor or of limited duration, which could also affect community health and well-being.

Potential negative effects include: short term Inuit employment opportunities; few employment opportunities; increased local jobs leading to fewer hunters in the communities harvesting country foods; and local businesses losing local clients in favour of oil and gas clients (the latter which could be cyclical or short-term).

*Scenarios A and B – Exploration with Offshore Seismic Surveys and Exploration Drilling:* Nunami Stantec noted that the number of local employment and business opportunities provided by oil and gas activity would depend on the number of trained people and prepared businesses when work starts. Seismic survey (*Scenario A*) and exploration drilling (*Scenario B*) activities are generally of short duration, would happen offshore, have limited interaction with communities, and the ships usually come from another part of the world with all the employees needed. Potential employment and business opportunities were predicted to be short and often uncertain.

*Scenario C – Field Development and Production:* As the entire oil and gas field development and drilling process could be 30-60 years long, with production lasting up to 40 years, there would be more time for local residents and businesses to prepare for opportunities and compete for oil and gas-related contracts. Production activities could also provide opportunities for small business to grow their capabilities, and for local workers to develop skills and knowledge needed to service other oil and gas activities that may take place in the future, or apply transferable skills into other industries (e.g., mining). However, this scenario assumes that vessels (such as Production, Storage and Offloading vessels, Floating Liquefied Natural Gas vessels, or wareships[110]) would be able to provide most, or all, of the required goods and services to support oil and gas activities. This would limit the need for onshore services and infrastructure and may mean fewer economic opportunities for Nunavummiut.

A summary of some of the potential local employment and business opportunities from the oil and gas development scenarios is provided in Table 24: Potential Local Employment and Business Opportunities from Oil and Gas Scenarios in Baffin Bay and Davis Strait.

**Table 24: Potential Local Employment and Business Opportunities from Oil and Gas Scenarios in Baffin Bay and Davis Strait (Created by the NIRB using Nunami Stantec information)**

| Seismic Surveying | Exploration Drilling | Field Development and Production |
|---|---|---|
| Ship comes fully staffed<br><br>Little onshore support needed | Ship comes fully staffed<br><br>Little onshore support needed | More opportunities for employment and business opportunities |
| Marine Wildlife Observers on board vessel | Marine Wildlife Observers on board vessel<br><br>Qualified: engineers, welders, electricians, cooks, support staff, health and safety specialist, environmental specialists, helicopter pilots, technicians, geologists, and healthcare staff | Marine Wildlife Observers on board vessel<br><br>Qualified: engineers, welders, electricians, cooks, support staff, health and safety specialist, environmental specialists, helicopter pilots, technicians, geologists, and healthcare staff |

[110] a vessel anchored for offshore storage and to provide services

| Seismic Surveying | Exploration Drilling | Field Development and Production |
|---|---|---|
| Onshore support: Air based crew transfer from Iqaluit airport or other community if closer to seismic location | Onshore support: Air based crew transfer from Iqaluit airport or other community if closer to seismic location | Onshore support: flight support, supplies, medical services, consulting, legal support, human resources and administration staff, logistics and customs brokers, and catering |
| There may be indirect opportunities with environmental engineering firms hired to conduct environmental studies associated with exploration and production drilling. | | |

## Views of Interested Parties

### *Potential Benefits*

As also noted in the discussions in Volume 2, Chapter 4.1: Applicable Regulatory, Royalty, and Benefits Regime, Nunavut Tunngavik Incorporated (NTI), the Qikiqtani Inuit Association (QIA), Government of Nunavut (GN), Greenpeace Canada, Oceans North Canada (Oceans North), the World Wildlife Fund (WWF), the Ikajutit (Arctic Bay) Hunters and Trappers Organization (Ikajutit HTO), the Nangmautaq (Clyde River) HTO (Nangmautaq HTO), the Resolute Hunters and Trappers Association (Resolute HTA), and community representatives all discussed the uncertainty and lack of information on the level of potential benefits from possible offshore oil and gas activities on Qikiqtani Inuit.

Throughout the SEA, including at the Final Public Meeting, community concerns were expressed that Inuit would not receive real and lasting employment or contracting benefits, including noting that employment opportunities are often limited to entry level positions, with little chance of advancing to management positions. While community members in multiple communities requested that Inuit receive monitoring opportunities, concerns were also raised that structures must be in place to ensure that Inuit staff receive equal pay and equal training and mentorship opportunities.

*When the Baffinland mining project was proposed, Inuit were promised jobs and economic benefit, but we found that most jobs went to white people for the south and not to the locals. Combined with the impact of increased shipping on marine mammals, it wasn't worth it for us. Will this be the case again with oil and gas? How much is -- in direct royalties would come to the community if they were oil and gas?*

[J. Kiuktak, Ikajutit (Arctic Bay) Hunters and Trappers Organization, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p.744, lines 13-21]

The comments from a Community Representative from Clyde River read into the record at the Final Public Meeting stated: "*And the message here is that the North has been exploited before, and there's fears that the exploitation is still going to occur with oil and gas. And so again these benefits associated with oil and gas must -- there must be clearly outlined benefits going to Inuit* *if there's going to be any sort of discussion on even moving forward*.”[111]. During their presentation at the Final Public Meeting, the Mittimatalik (Pond Inlet) HTO discussed past employment opportunities with offshore oil and gas activities in the early 1970s noting that while there were good employment opportunities, there were also difficulties and risks.[112]

During the Final Public Meeting, the GN and the WWF noted the importance of balancing the need for economic development with other needs such as cultural needs and reliance on wildlife as well as potential negative effects.[113,114] NTI also noted that “*any scenario going forward would have to present a maximum net benefit to Inuit for – for NTI to be in agreement with it, which would include that it would not interfere greatly with wildlife, that it would benefit Inuit, there would be economic returns -- but, primarily, to benefit Inuit.*”[115] The QIA similarly noted that “*no oil and gas activities until there are clear benefits and opportunities for Qikiqtani Inuit, and that – those benefits and opportunities need to be weighed with the risk. Inuit need to be able to decide for themselves if the risk is too high or not”.*[116]

***Capacity***

The Ikajutit (Arctic Bay) HTO questioned what training opportunities would be available for the communities and whether royalties would go to the communities. The QIA and the Ikajutit (Arctic Bay) and Nangmautaq (Clyde River) HTOs concluded that individual Inuit are currently not prepared to take full advantage of potential benefits from oil and gas activities.

Within its final written submission and public written comments, the GN noted the potential to develop Nunavut-based support services and a skilled workforce. The GN made recommendations regarding proponent requirements in sharing benefits and improving education and training opportunities for Nunavummiut to access potential employment opportunities.

Within its final written submission, the Canadian Association of Petroleum Producers (CAPP) provided additional information on employment opportunities and associated education levels generally associated with the offshore oil and gas industry. During the Final Public Meeting, the Board heard the following exchange as an acknowledgement that it could take years of developing the industry and providing training to maximize opportunities for Inuit:

> *On the issue of economic benefits, you mentioned that there -- there may be considerable economic benefits. I note that the preliminary findings report stated that the vessels would be able to provide most or all of required goods and services*

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[111] S. Lonsdale, Qikiqtani Inuit Association on behalf of David Iqaqrialu, Clyde River QIA Representative, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 794, lines 11-17.
[112] E. Panipakoocho, Mittimatalik (Pond Inlet) Hunters and Trappers Organization, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 770, lines 9-16.
[113] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 198, lines 1-6.
[114] M. Books, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 238, lines 17-25.
[115] M. Chenier, Nunavut Tunngavik Incorporated, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 266, lines 15-21.
[116] S. Lonsdale, Qikiqtani Inuit Association, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 324-325, lines 23-26 and 1-2.

*to support offshore oil and gas activities. This would limit the need for onshore services and infrastructure and mean fewer economic opportunities for Nunavummiut.*

*…that would probably be the case certainly in the early days where you wouldn't have a supply service community here in Nunavut that would be built up to service the offshore oil and gas industry. But over time, presumably, economic considerations would be such that companies may find opportunities to open up business here in Nunavut to supply an offshore oil and gas industry.*[117]

During its presentation at the Final Public Meeting, CAPP discussed potential benefits from employment, research, and royalties associated with the oil and gas industry. Examples from Newfoundland were provided wherein the Government of Newfoundland used royalties to invest in local infrastructure, including highways, hospitals, and schools. CAPP further discussed the self-worth observed in community members from increases in employment opportunities.[118]

A Community Representative from Cape Dorset further questioned the potential benefits and opportunities that would flow to Inuit from possible offshore oil and gas activities, noting:

*Looking at employment opportunities, I don't think there will be too many Inuit if they don't train them to work in the ships to work on the level -- on the platform or on deck or in the cabin. They can learn about these jobs with -- through fisheries. And the moneys are enough they could work -- it could work.*[119]

***Alternative Development Scenarios***

Within their respective final written submissions and during the Final Public Meeting, NTI, the QIA, Greenpeace Canada, Oceans North, and the WWF discussed the potential for more economic development opportunities for Nunavut through more viable and sustainable development options, such as mining, fishing, and tourism. The WWF concluded that while local communities would bear the majority of the risks and would be affected by impacts of offshore oil and gas development, communities would receive relatively few benefits. The QIA, Greenpeace Canada, and the WWF similarly recommended that prior to decisions being made to lift the Moratorium a cost-benefit-analysis or analysis of economic alternatives be undertaken to provide a realistic understanding of the number of local employment opportunities that could be available and whether job creation from offshore oil and gas activities would be expected to benefit communities.

Oceans North referenced "A New Shared Arctic Leadership Report" and noted that there are currently several serious barriers to Inuit participation in the industrial workforce (see Appendix C: Recommended Documents). Oceans North further noted that the effects assessment did not consider the potential economic benefits associated with the creation of new conservation areas in

[117] Exchange between M. Brooks, World Wildlife Fund and P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 638, lines 7-14 and 17-24.

[118] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 610-612.

[119] A. Nuna, Cape Dorset, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 863, lines 1-7.

Baffin Bay and Davis Strait. It was further noted that each community should be able to weigh the benefits of all potential developments, including oil and gas, shipping, or conservation areas.

A listing of each of the associated recommendations made by the QIA is available in Table 25: QIA Recommendations Regarding Benefits and Opportunities. For additional detail, please refer to the *Uqausirisimajavut Report.*

The QIA made the following related overarching recommendations:

- Complete research into the skills needed to participate in oil and gas activities and include in the study transferable skills gained from mining, tourism, and fisheries; and
- Complete an alternatives assessment including potential benefits from alternative development options (i.e., fisheries, tourism, wind, solar) in comparison to benefits from oil and gas.

> The QIA does not see that there will be immediate Inuit employment or procurement opportunities from the development of offshore oil and gas. Unlike other economic opportunities, it does not offer a mix of jobs and capital investments that are commonly associated with economic growth. In fact, it has the potential to alter the sustainability of some communities by disrupting an important food source and by displacing those currently engaged in its production.
>
> QIA, 2018a

**Table 25: QIA Recommendations Regarding Benefits and Opportunities (content from QIA, 2019)**

| Prior to the lifting of the *Moratorium*: | Post Moratorium Recommendations: |
|---|---|
| 1) Conduct Research:<br>a) More research required on potential benefits from oil and gas.<br>b) An Alternatives Assessment must be included in the impacts/benefits.<br>c) Conduct a skills survey for sector specific skills in Nunavut.<br>d) More detailed analysis of socio- economic effects likely to occur under multiple oil and gas development scenarios, including a survey of Inuit perception of offshore oil and gas development, potential impacts on local spending, investment, and Inuit procurement.<br>e) Different benefits of oil versus gas.<br>f) Implement oil and gas education in communities. | 1) Measures required to increase potential Benefits and Opportunities to Inuit:<br>a) Establish a polluter pays system with proponents.<br>b) Costs for air emissions and noise monitoring should be covered by the proponent.<br>2) Communication strategies and relationship should be developed with communities. |

#### 7.3.1.3. *Community Infrastructure and Services*

The following is a summary of the *Environmental Setting and Potential Effects Report* – Section 7.31: Potential Effects from Routine Activities Employment and Expenditures Community Infrastructure and Services (Nunami Stantec, 2018a). Please refer to this section and report for additional information.

**Predicted Effects on Infrastructure and Services**

- Low in magnitude;
- Limited to a local (community) or regional area (Qikiqtani Region) depending on the communities affected;
- Short-term for seismic (*Scenario A*) and exploration activities (*Scenario B*);
- Long-term for production activities (*Scenario C*);
- Occur frequently during the life of activity; and
- Return to previous levels upon completion of oil and gas activities. Depending on project design and associated components, there could be higher interactions with local infrastructure and services and different actual effects

▪ Nunami Stantec, 2018a

Nunami Stantec noted that potential effects of oil and gas activities on community infrastructure (including ports, airports, health centres, and housing) and services (including but not limited to healthcare, emergency services, water, and wastewater) would depend on their ability to support the industry and more workers in the communities. Potentially affected infrastructure was identified as including permanent and temporary accommodations, grocery stores, recreation centres, hospitals, and roads, airports, and other transportation infrastructure. It was noted that higher levels of economic activity could lead to increases in housing prices and rent levels, which could lead to further negative effects on the local community.

*Scenario A – Exploration with Offshore Seismic Surveys:* Nunami Stantec predicted that seismic surveys would be unlikely to result in a measurable change to local infrastructure or services as vessels are typically based elsewhere in the world, generally remain offshore for the duration of the seismic program, and would only operate in open water. The most common interaction with shore was expected to be for refueling, resupply, maintenance, or a medical emergency.

*Scenario B – Exploration Drilling:* Exploration drilling programs would be of longer duration than seismic surveys (*Scenario A*) and operators could possibly drill wells over a multi-year period. There could be increased traffic in marine ports used as a base and associated service areas, such as for maintenance. Potential negative effects could occur if marine infrastructure in Nunavut is unable to support the increased level of marine activity. However, the use of wareships (vessels for offshore storage and to provide services) would limit the need to use services and infrastructure in the communities. In addition, if workers miss their flights home and need temporary accommodations in a community, this could put pressure on community infrastructure and services such as airports and accommodations.

*Scenario C – Field Development and Production:* It was assumed that all production and shipment of produced oil and gas would occur offshore and have limited contact with the shore, and thus with local infrastructure and services. Although there may be a short peak of activity during installation activities, such as for a platform, most of this would take place offshore with limited expected effects to the onshore. As production activities could last up to 40 years, Nunami Stantec noted this scenario would provide the most potential for interactions with community services and infrastructure. With longer timelines, there could also be potential for non-local workers to move to the region. While this could increase pressure on community infrastructure and services, it was noted that the long time leading up to production could potentially be used to invest in local infrastructure and services. Similar to installation activities, shore-based marine facilities (e.g., existing deep-water port, storage facilities, and airports) could be used to service decommissioning operations and there could be an increase in airport traffic along with temporary accommodations to house workers in transit.

#### Views of Interested Parties

During the Public Engagement Sessions and Final Public Meeting, the NIRB heard that if the communities were to take advantage of the opportunity to support offshore oil and gas activities there would need to be improvements to local infrastructure in the interested communities. During the Final Public Meeting, the Canadian Association of Petroleum Producers noted that while there are concerns for oil and gas development to strain the existing community infrastructure, such as wharfage, that the development could be seen as an opportunity to increase infrastructure capacity.[120]

Within its final written submission the Ikajutit (Arctic Bay) Hunters and Trappers Organization noted the lack of infrastructure plans related to the hypothetical oil and gas scenarios, such as those for airports, ports, and new road construction.

### 7.3.1.4. *Well-being and Health of Coastal Communities*

The following is a summary of the *Environmental Setting and Potential Effects Report* – Section 7.31: Potential Effects from Routine Activities Perceived Community Health and Well-being (Nunami Stantec, 2018a). Please refer to this section and report for additional information.

[120] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Meeting File No. 17SN034 Transcript, March 20, 2019, p. 613, lines 18-25.

Nunami Stantec noted that potential effects on Perceived Community Health and Well-being of communities from possible offshore oil and gas activity was hard to quantify or measure and would be based on multiple factors, including: community composition; existing services and infrastructure; and the level of interaction between the community and the oil and gas activity. Health and well-being are linked to many parts of everyday life, such as: access to healthcare; food security; financial security and comfort; and access to land use for both traditional and non-traditional purposes. As possible oil and gas activity would happen in the offshore environment and outside the range of local communities, it was predicted that there would not be a direct link to the physical human health of local communities in the Qikiqtani region. Nunami Stantec made these predictions with the understanding that the level of effects is dependent on the level of interaction that an oil and gas activity has with a local community or communities, and that perceived health and well-being of a community is based on several external factors that could alter the perception of effects.

**Predicted Effects on Health and Well-being:**

- Low in magnitude;
- Occur only in the communities that would interact with oil and gas activities; and
- Occur continuously throughout the length of the activity.

Nunami Stantec, 2018a

The following potential positive effects on perceived community health and well-being from new economic activity and increased disposable income were identified:

- Improved sense of well-being and higher sense of confidence from the ability to purchase goods and services and providing for families;
- Greater access to food, both store-bought and through harvesting;
- Greater financial flexibility; and
- Potential for government investments in local infrastructure and services through taxes, royalties, and benefits agreements.

Potential negative effects on community health and well-being could occur from:

- Less time participating in traditional hunting activities which could mean less consumption of country food and fewer opportunities to pass on Inuit Qaujimajatuqangit;
- Less engagement in traditional hunting activities leading to increased consumption of non-traditional foods, decreased opportunities for cultural transmission, and disconnection from the land;
- Higher incomes leading to drug or alcohol abuse; or
- Increased housing costs, which could also lead to physical and mental health issues.

Without mitigation plans, the extent of effects on community health and well-being would depend on the type of oil and gas activity and how long it would last. The length of time for seismic and exploration programs (*Scenarios A and B*) is shorter than for production activities, and potential effects on community health and well-being may only happen for the length of the project. As production activities (*Scenario C*) would last for a much longer time, the potential effects on community health and well-being may be felt longer based on the level of interactions activities could have with local communities.

### Views of Interested Parties

Within the *Uqausirisimajavut Report,* the Qikiqtani Inuit Association (QIA) noted that the effects assessment and associated recommendations undertaken with the QIA Advisory Committee was based on the Inuit traditional rules of maligait, piqujait, and tirigusuusiit: show respect to animals; leave animals alone unless hunting them; animals are to be used, not wasted; each animal has its own habitat; and protect animal habitat. Mitigation measures related to these traditional rules were provided within the report to address potential disturbances from offshore oil and gas activities on culture.

> *We strongly recommend that Inuit are the ones that should be interpreting Inuit Qaujimajatuqangit. And Inuit need to be involved in that process, even in these technical processes.*
>
> *… you'll see many of our recommendations are that this IQ advisory committee should continue and that you can't split Inuit Qaujimajatuqangit from Inuit. So if Inuit Qaujimajatuqangit is going to continue to be involved in these assessments, then the knowledge holders have to come with it.*
>
> [R. D'Orazio, Qikiqtani Inuit Association, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 18, 2019, p. 126, lines 11-14 and March 19, 2019, p. 308, lines 9-15.]

The QIA discussed changes to Inuit culture from outside influences and noted difficulties in finding balance between western education, employment, and cultural activities. The following summary of potential effects of offshore oil and gas development on Inuit culture was provided in the *Uqausirisimajavut Report*:

> Qikiqtani Inuit have been subject to external influences for a couple of centuries. Industrial activities and participation in the wage economy are a continuation of that change. Qikiqtani Inuit are constantly evaluating the risk and rewards of another change. It is recognized that the harvesters, who are the knowledge keepers in communities, might be affected by changes in animal behaviour or by involvement in the wage economy. Overall, Inuit culture would also be affected if fewer Inuit went out on the land because of involvement in the wage economy, or if more Inuit are away from home because of the wage economy. In addition, oil and gas development may alter the real and perceived risks and rewards of harvesting from the land, changing the connection to land of Inuit harvesters, and potentially reducing skill-based, place-based, and transportation safety knowledge (IQ), and the continuity of sharing that knowledge between generations. Any reduction in sharing of IQ orally and through observed practice is a risk to Inuit cultural continuity overall (p. 65).

It was further noted that:

> Overall, changes to culture will likely come from multiple sources – reduced or otherwise altered wildlife and wildlife habitat, changing risk perception of

> travelling routes and harvesting routes, changing employment conditions, and altered enjoyment of cultural practices due to signs of industrial activity. The magnitude of these changes cannot be predicted in advance. Therefore, in any future with oil and gas development, it is critical to set up a meaningful human environmental monitoring and management program for oil and gas development impacted Qikiqtani communities, with appropriate indicators defined in advance, collected and reported on at appropriate intervals, and tied to thresholds of acceptable change after which adaptive management measures need to be put in place. Cultural, economic, and social parameters would need to be included. Such a program could be similar to existing project-specific Socio-economic Monitoring Committees in Nunavut, but multi-project in scope (if there are multiple projects) (p. 68).

Based on Inuit Qaujimajangit, the QIA recommended:

- As the last extensive harvester research study was 20 years ago and needs to be updated, a harvester research study needs to be completed with a mandate focused on the marine environment; and
- Provide support for cultural "on the land" programs to ensure that skills are developed among youth, with a strong elder engagement element in order to document how Inuit knowledge is transmitted from elders to youth when out on the land.

A listing of each of the associated recommendations made by the QIA is available in Table 26: QIA Recommendations Regarding Potential Effects on Inuit Culture from Oil and Gas Development in Baffin Bay and Davis Strait. For additional detail, please refer to the *Uqausirisimajavut Report.*

**Table 26: QIA Recommendations Regarding Potential Effects on Inuit Culture from Oil and Gas Development in Baffin Bay and Davis Strait (Source: QIA, 2019)**

| Prior to lifting the *Moratorium*: | Post Moratorium Recommendations: |
|---|---|
| ▪ Additional research to understand potential cultural changes to Inuit.<br>▪ Conduct research on Inuit harvesting of country food and food sharing.<br>▪ Collect more Inuit Qaujimajatuqangit on important harvesting areas.<br>▪ Develop monitoring programs and no-go zones that reflect Inuit cultural values.<br>▪ A new impact and benefit that includes all potential project scenarios.<br>▪ Honourably engage with all consultation and accommodation requirements. | ▪ Food security research and outcomes should be used in monitoring and assessments.<br>▪ Include country food sharing research and data in assessment moving forward.<br>▪ IQ and scientific monitoring programs established at priority harvesting areas.<br>▪ Develop cultural training programs to transmit and maintain traditional knowledge.<br>▪ Develop on the land programs.<br>▪ Create Inuit culture mentorship program.<br>▪ Management of activities should be based on community priorities and values.<br>▪ Communication strategies and relationship should be developed with communities. |

| Prior to lifting the *Moratorium*: | Post Moratorium Recommendations: |
|---|---|
| | ▪ Restrictions put in place on how close oil and gas development could occur from the floe edge.<br>▪ Individual projects should be required to pay into development of human environment monitoring and management program. |

The Government of Nunavut (GN) recommended that the Government of Canada, the GN, and Inuit organizations collaborate in creating a cultural awareness program for future proponents that would provide education on the history of Nunavut, the *Nunavut Agreement,* and Inuit Qaujimajatuqangit principles.

Within its final written submission, the Canadian Association of Petroleum Producers (CAPP) submitted a link to the report "An Assessment of Predicted Socio-Economic Impacts of Labrador Shelf and Gas Activity on Labrador Communities and Individuals" providing information on effects of offshore oil and gas activities off the Labrador Shelf on culture. Components that were assessed included sustainable development, social, resilience, benefits and capacity building, autonomy for Aboriginal People and Communities, economic, cultural, gender, and communications. Findings included that "communities and people who demonstrate resilience adapt to change better and are more able to moderate negative effects. The factors that contribute to resilience include the degree to which people and communities are well informed about jobs, business opportunities and processes; can pace development; are engaged in respectful decision-making; and can maintain cultural and traditions" (Sikumiut Environmental Management Ltd., 2011).

#### 7.3.1.5. *Commercial Harvesting*

The following is a summary of the *Environmental Setting and Potential Effects Report* – 7.3.1: Potential Effects from Routine Activities on Perceived Health and Well-being (Nunami Stantec, 2018a). Please refer to this section and report for additional information.

*Exclusion zones:* During seismic surveys, exploration drilling, and production activities, exclusion zones would be set around drilling rigs and production platforms when activity is occurring to provide safety to commercial fishers, other marine users, and oil and gas personnel to reduce potential accidents such as a collision or spill. Within these safety zones, ships or other activities, such as commercial fishing, would not be permitted. This could mean that fish harvesters could experience a loss of economic returns.

Nunami Stantec predicted that overall effects on commercial fishing from oil and gas activities would be: low in magnitude; short to long term as production activities have a long life-span; localized to the area surrounding the drill rig or production platform; and would continue the entire time the drill rig or production platform was active. Recovery was considered to be rapid and occur once the safety zone was removed (weeks or as long as the next fishing season commences).

The potential effects of being restricted from certain fishing areas would likely be during the summer months, when there are lower ice levels and fishing activity is at its highest. Mitigation measures include industry best practices of ongoing communication with the fishing industry, and the use of a Fisheries Liaison Officer onboard drilling and production facilities.

**Predicted Effects on Commercial Harvesting from Exclusion Zones:**

- Low in magnitude;
- Short to long term;
- Localized to the area surrounding the drill rig or production platform; and
- Continue the entire time the drill rig or production platform was active.

Nunami Stantec, 2018a

*Direct Interference:* Seismic vessels, as well as supply vessels, could contact and damage fishing equipment and other vessels. As a result, commercial fishers could lose time fishing, and potentially an entire season. Nunami Stantec expected that seismic operations would have an established compensation policy to deal with such incidents. The scenarios limit the use of transits to shore and exploration drilling (*Scenario B*) and field development and production (*Scenario C*) would use wareships, which would reduce the distance supply vessels would need to travel and therefore the potential for an interaction.

*Indirect Interference:* As mentioned in Chapter 7.2 Biological Environment, without mitigation measures to avoid or reduce potential impacts, oil and gas activities could have negative effects on fish species that could decrease the quantity or quality of fish harvested, particularly shrimp or turbot, which could negatively affect fish sales. Potential impacts include fish avoiding a usually productive fishing area, which could result in lower catch rates for harvesters or commercial fishers losing time fishing. Also, fish could absorb oil and store it in their fat (fish taint) which could affect the ability of fish being sold on the market. However, oil discharge during routine operations is not permitted and the potential for taint was considered negligible.

### Views of Interested Parties

During the Public Engagement Scoping Sessions, the NIRB heard concerns that commercial fisheries could be negatively affected by offshore oil and gas activities and as a result, the livelihood of community members who work for the fisheries could be negatively affected. Concerns were also raised that fish sales may go down if consumers perceive that the quality of Nunavut fish had decreased because of oil and gas activities, even if the quality did not change.

The Qikiqtani Inuit Association (QIA), Nunavut Fisheries Association (NFA), Arctic Fishery Alliance (AFA), the Qikiqtani Wildlife Board (QWB), the World Wildlife Fund, and Community Representatives all discussed the potential negative, and unknown, effects of possible offshore oil and gas development on commercial fisheries. Within its final written submission, the QWB noted the importance of commercial fisheries to the communities and organizations in the Area of Focus and that it was desirable to not have undue stress placed on this developing industry. Within the *Uqausirisimajavut Report,* the QIA noted the potential for oil and gas activities to "interfere with commercial harvesting by changing fish habitat, interfering with harvesting operations, increasing navigation risks, or impacting the markets for ‘clean’ arctic commercial fish (especially in a spill event)” (p. 77).

Within their respective final written submissions, the NFA and AFA noted that the commercial fishery in Nunavut is a sustainable, renewable natural resource sector already providing significant benefits to the territory. The potential for significant future growth was highlighted. The NFA questioned whether the risk of potential impacts on the Nunavut fishery from oil and gas development activities was worth the potential, and unknown, benefits. The NFA and the AFA raised the following concerns and associated recommendations with possible offshore oil and gas development in the Development Scenarios Area:

- *Lack of information:* The NFA and AFA noted that existing information gaps make it difficult to undertake a quantitative analysis and identify the extent of potential effects of oil and gas development and potential oil spills on Nunavut’s existing and future commercial fishery. It was recommended that studies be conducted to address the knowledge gaps.
- *Limited operating offshore fishing season:* The NFA and AFA raised as a major concern the potential for any activity to further limit the already short fishing season. The NFA noted that a loss of one (1) or two (2) weeks of turbot or shrimp stocks could result in several hundred tonnes of fish not being harvested, which could equal millions of lost dollars in lost revenue. The potential for exclusion zones around oil and gas activity to threaten the viability of the industry was also identified. It was recommended that seismic activities be restricted from areas where fishing takes place during the limited open water season.
- *Activity in closed fishing areas:* The NFA raised concerns that the three (3) areas currently closed to fishing to protect sensitive benthic areas or narwhal overwintering areas (see Volume 2, Figure 29: Nunavut Fishery Footprint, Current and Proposed Closure Areas and Significant Benthic Areas) could be exempted from closure to possible oil and gas activities. It was noted that this could impact these areas from being recognized internationally as marine conservation targets and also potentially threaten important sensitive benthic areas. It was recommended that all oil and gas activities be excluded from areas identified as closed to fishing, both for current and potential future areas.
- *Potential expansion of fisheries:* The AFA noted that emerging fisheries are expected to be developed in the coming years and that, as the climate changes, existing commercial species may shift their distribution northward to Nunavut’s waters. The Mittimatalik (Pond Inlet Hunters) and Trappers Organization (Mittimatalik HTO) also commented on potential new fishing opportunities in the future and questioned whether these would be impacted by offshore oil and gas activities. The Mittimatalik HTO noted that the HTOs and communities could lose income if the fisheries are negatively impacted. During the Final Public Meeting, the Ikajutit (Arctic Bay) HTO further commented on the potential effects from offshore oil and gas development on the expansion of fisheries.[121] The AFA recommended that there should be no limits placed on the northward expansion of the fishery to accommodated oil and gas activities.

[121] J. Kango, Arctic Bay, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 764, lines 12-16.

The WWF noted that little study has been done on the potential impacts of oil and gas activity on the most important species for fisheries in Baffin Bay and Davis Strait, including Arctic char and Greenland halibut. It recommended that the precautionary approach be taken when deciding if oil and gas activities should be allowed within areas known to be of significance to important fish species.

During the Final Public Meeting, Community Representatives from Iqaluit,[122] Pangnirtung,[123] and Resolute[124] discussed the importance of the commercial fishery to the community and the reliance that many families have on income from the Fisheries. In response to whether families would be compensated if wildlife were disrupted, irrespective of a spill, the NEB noted that in the past companies have been asked to consult with potentially affected parties, including fishermen and harvesters, to develop compensation plans in the even harvest is reduced due to a project activity.[125]

##### 7.3.1.6. *Land and Marine Use (Traditional and Non-traditional)*

The following is a summary of the *Environmental Setting and Potential Effects Report* – Section 7.3.1: Potential Effects from Routine Activities: Perceived Health and Well-being (Nunami Stantec, 2018a). Please refer to these sections for additional information on potential effects of oil and gas activities on traditional and non-traditional land and marine use from ice disturbance, exclusion zones, and direct and indirect interference.

*Ice Disturbance:* Through the literature review, Nunami Stantec identified community concerns that the use of marine vessels and icebreakers could result in changes to the quality and extent of sea ice, which might have an impact on marine mammals and their habitats. Nunami Stantec determined that disturbances from ice-breaking activities would be local and unlikely to result in appreciable change to the physical environment in the Area of Focus. It was further clarified that the reduced interaction with shore-based infrastructure during *Scenarios A* and *B* and the use of wareships for production activities (*Scenario C*) would reduce the potential for ice-breakers to enter coastal waters.

**Predicted Effects on Land and Marine Use from Ice Disturbance:**

- Low in magnitude;
- Short-term;
- Localized to the vessel's route; and
- Occur as multiple regular events as vessels transit to shore.

Nunami Stantec, 2018a

[122] B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 807-808, lines 1-13, 23-26, and 1-10.
[123] S. Keenainak, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 526, lines 11-26.
[124] J. Amagoalik, Resolute, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 825, lines 4-10.
[125] Exchange between S. Keenainak, Pangnirtung and C. Wickenheiser, National Energy Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 526-527, lines 20-26 and 1-8.

*Scenarios A and B – Exploration with Offshore Seismic Surveys and Exploration Drilling:* Activities associated with the scenarios are predominantly located offshore with limited shore and nearshore interaction. Seismic surveys (*Scenario A*) and exploration drilling activities (*Scenario B*) were anticipated to occur primarily in open water, and it was considered unlikely that ice-breaking activities would occur to support activities. However, icebreakers would be available to assist vessels if needed.

*Scenario C – Field Development and Production:* Ice breaking could be used during production activities (*Scenario C*) to protect marine-based oil and gas development facilities from sea ice and to support any ships travelling to shore. Nunami Stantec noted that icebreaking in areas used by Inuit and Nunavummiut could also impact over-ice travel for traditional harvesting and other activities. Potential negative effects could include: more travel time; fuel used; and wear and tear on equipment, as well as reduced access to preferred hunting areas. Any resulting changes to traditional use and practices, changes in access to harvesting sites, changes in harvesting site locations, and changes in quality of harvest could also lead to changes to perceived community health and well-being. If there was a project, discussions would need to occur between operators and harvesters, hunting and trapping organizations, and the QIA about potential effects and recommended mitigation plans or actions to assist in planning to avoid or reduce potential negative effects on traditional use and practices, including traditional harvesting and over-ice travel.

*Exclusion Zones:* Nunami Stantec predicted that there would be limited or no effects from exclusion zones on traditional harvesters and other coastal marine users as the scenarios would be located in the offshore and do not include development of onshore infrastructure. Exclusion zones would also apply to other offshore marine users such as freighters, tankers, military vessels, coast guard, and research vessels. Potential effects include vessels changing their routes or delaying activity to avoid the exclusion zone. Mitigation measures would include ongoing communication with other users to reduce the potential for interaction and resulting effects.

**Predicted Effects on Land and Marine Use from Exclusion Zones:**

- Low to moderate in magnitude;
- Short to long-term;
- Localized to the area surrounding the drill rig or production platform;
- Occur continuously while the drill rig or platform is active; and
- Would recover quickly once the safety zone was removed.

Nunami Stantec, 2018a

*Direct Interference:* Vessels moving between a shore base and offshore infrastructure have the potential to increase risks of human injury (e.g., breaking though newly formed ice) or cause damage to coastal harvesters and their equipment and other marine users resulting in lost time and equipment or potential injuries. A communication procedure between operators and community organizations would reduce the potential for direct interference between oil and gas activities and other marine users.

*Indirect Interference:* Nunami Stantec identified that contamination of species (real or thought to occur) or changes to species distribution, could result in less harvesting or consumption of country foods and could affect other activities such as wildlife focused marine tourism. These potential effects could also impact the economy, food security, and perceived well-being.

**Predicted Effects on Land and Marine Use from Direct Interference:**

- Low to moderate in magnitude;
- Short to long term;
- Localized to where the interference occurred; and
- Occur infrequently.

**Potential Effects on Land and Marine Use from Indirect Interference:**

- Low to moderate in magnitude;
- Short to long term;
- Localized to where the interreference occurred; and
- Happen infrequently.

Nunami Stantec, 2018a

### Views of Interested Parties

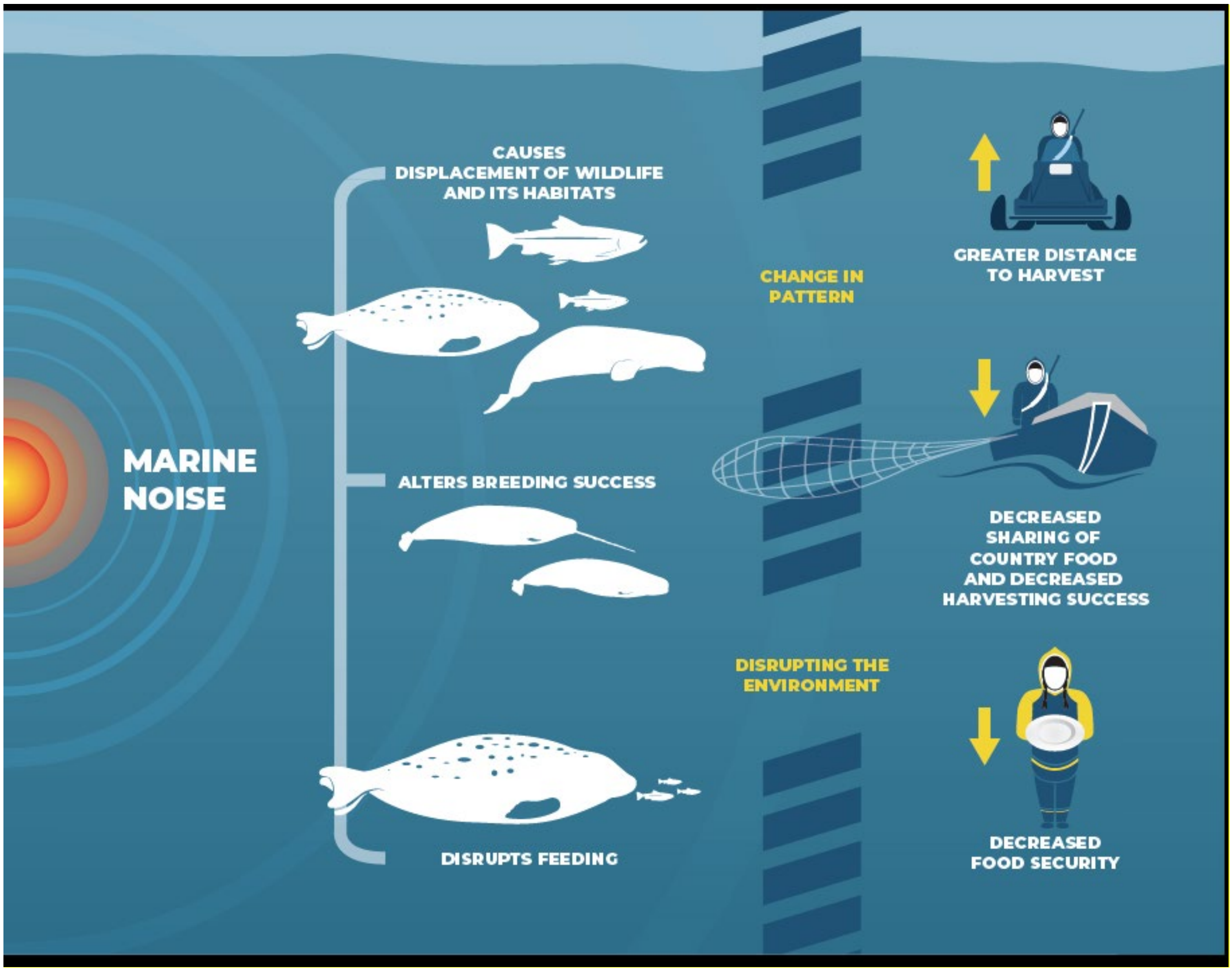
Within the *Uqausirisimajavut Report*, the QIA identified potential negative effects on marine-based harvesting from possible offshore oil and gas activities and noted that "currently, the Canadian Arctic is perceived to be pristine. The NIRB heard similar concerns from communities throughout the SEA. The presence of oil and gas activities could change that perspective" (p. 77). The World Wildlife Fund (WWF) similarly discussed the growing potential to develop a northern tourism industry as Arctic sea ice declines. The NIRB also heard this from communities throughout the public engagement sessions, particularly at the scoping phase. The WWF further provided models for successful Indigenous-led tourism from across Canada and around the world. It was stated that government funds invested in oil and gas infrastructure and in building response capacity could total billions of dollars, which could instead be invested in creating full-service destinations for northern lights and ice floe tours, polar bear watching, fishing and hunting outfitters, and camping tours.

> *... there are some of us that hold knowledge but some not as much. But we know a great deal about animals. They talk -- they almost speak to us when there are impacts.*
>
> [E. Panipakoocho, Pond Inlet, NIRB Final Public Meeting File No. 17SN034 Transcript, March 22, 2019, p. 889, lines 3-6.]

The Qikiqtani Inuit Association (QIA) provided Figure 39: Example of Direct and Indirect Effects from a Project Interaction: Marine Noise to visually represent the potential effects of an activity and associated indirect effects on Inuit and food security, focusing on effects from marine noise.

For additional discussion on observations shared by harvesters regarding changes in marine mammal behaviour when subjected to noise, please see Chapter 7.2.1.6 - Noise.

**Figure 39: Example of Direct and Indirect Effects from a Project Interaction: Marine Noise (QIA, 2019)**



Within their respective final written submissions and during the Final Public Meeting, the QIA, and the Ikajutit (Arctic Bay) Hunters and Trappers Organization, and community representatives commented on the importance of food security. Within the *Uqausirisimajavut Report,* the QIA concluded that as wildlife and wildlife habitat and Inuit culture are inter-related with food security, there was the possibility that access to country food could be decreased by the effects of oil and gas development on wildlife and wildlife habitat. The QIA identified the following potential adverse/negative effects from disrupting country food access and food security by: changing quality; changing the location where animals will be found; and changing the number of skilled hunters. Potential positive/beneficial effects were identified as making it easier to hunt by providing wages to be able to go out on the land. Mitigation measures related to adopting the traditional rules were provided within the report to address potential disturbances from offshore oil and gas activities on food security.

> *Based on Inuit Qaujimajatuqangit*:
>
> Loss of access to marine-based country food could result in higher household food costs, reduced dietary health for Inuit families, reduced sharing of foods between families (a central value for Inuit), increased food insecurity of households living in poverty, alongside a variety of cultural losses discussed previously in Section 6.2. Without food security, Inuit population health is at high risk.
>
> QIA, 2019, p. 72
>
> … the true value of marine-based harvesting is greater than the substitute value of the food. Inuit distribute country food in a way that ensures no one in the community starves. It is akin to social assistance in the wage economy, yet appears to be far more effective.
>
> QIA, 2018a, p. 48

During the Final Public Meeting, the QIA further discussed concerns raised from changes, such as access of country food or time on the land and noted:

> *… a lot of the knowledge transfer comes from harvesting or harvesting-related activities. When you have hunters going out with young people and teaching, it's not only about the actual hunt. A lot of stories are told; a lot of old words that aren't necessarily used in an office setting are used and passed on. So it improves language; it improves harvesting. And on top of that, things like fur preparation, food preparation, all that is done communally; so it's not just harvesting but also the related activities that -- that really foster the knowledge transfer, that really foster that positive environment for Inuit interaction.*[126]

It was recommended that the Nunavut Wildlife Harvester Study be updated to include quantity of country food in diet, harvest location, as well as the transfer of knowledge and skills. It was further specified that the unique conditions and realities of individual communities be taken into account when conducting such studies.[127]

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[126] S. Lonsdale, Qikiqtani Inuit Association, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 314-315, lines 23-26 and 1-9.
[127] R. D'Orazio, Qikiqtani Inuit Association, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 320, lines 4-26.

A listing of each of the associated recommendations made by the QIA is available in Table 27: Recommendations Regarding Potential Effects on Food Security. For additional detail, please refer to the *Uqausirisimajavut Report.*

**Table 27: Recommendations Regarding Potential Effects on Food Security (Source: QIA, 2019)**

| Prior to lifting the Moratorium: | Post Moratorium Recommendations: |
|---|---|
| ▪ Additional Research is required to understand potential impacts on country food access, sharing and food security.<br>○ The Nunavut Wildlife Harvest Study should be updated and scope expanded to include country food considerations.<br>○ Develop an understanding of community-specific food security vulnerability.<br>▪ Wildlife Compensation framework should include impacts to food security. | ▪ Develop more community driven management strategies<br>○ Develop provisions for harvesters and community members to report impacts to quality of country food.<br>○ Prior communication of planned oil and gas shipping and other activity zones to affected communities. |

Key associated recommendations identified in the *Uqausirisimajavut Report* were:

- Conduct current research into the sharing and harvesting of country food and maintain the currency of the research throughout any oil and gas development activities; and
- Ensure appropriate wildlife compensation provisions are in place to apply to offshore oil and gas development.

Within its final written submission, the Ikajutit (Arctic Bay) HTO stated that 'no amount of jobs or money is worth losing our source of food'. During the Final Public Meeting, the Ikajutit HTO noted during its presentation that:

> *Inuit rely on a healthy environment to survive. This is why oil drilling is so risky for us. Even if the risks of an incident is small, the impacts will be too much for us. There -- if there is an oil spill in the Arctic, will there be loss of compensation for our loss of food? And would this compensation account for all terms impacts if the environment is polluted? This should be in place before any exploration happens. If there is no compensation, we want to see the moratorium stay for another 30 years.*[128]

Within their respective final written submissions and during the Final Public Meeting, the Government of Nunavut (GN) and the WWF also commented on the relationship between wildlife and Inuit community food security and community well-being and identified information gaps. The GN made recommendations regarding additional data collection on the potential impacts of oil and gas activities, such as oil spills and noise, on food security and community well-being. The

[128] J. Kiguktak, Ikajutit (Arctic Bay) Hunters and Trappers Organization, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, page 743, lines 16-26.

GN made further recommendations for project components to mitigate effects, including the need for a defined compensation in place.

Within its final written submission, the Arctic Fishery Alliance noted that food insecurity is a well-documented challenge in Nunavut and that many families rely on country food to survive. It was further stated that ensuring continued access to uncontaminated sources of seafood is critical for many Inuit and Nunavummiut in the Qikiqtani region and that these same species, such as clams, have the potential for small inshore commercial fisheries development. Recommendations were made regarding the preservation of local, sustainable food sources and potential commercial opportunities, even if it results in a prohibition on oil and gas development in Nunavut.

A community representative from Iqaluit also commented on the importance of Inuit Qaujimajatuqangit and the importance of the marine environment to Inuit:

> *The most important one, I guess, is Inuit Qaujimajatuqangit, Inuit knowledge. It's crucial in this particular planning period for NIRB that it's a must to have Inuit knowledge, an understanding, because what they want to do in our ocean, in our bay, is our daily bread. Our daily bread. So be careful. You know, is it more important to pump out oil than to kill 2 off all your narwhale, your seal, you know. And then we have food crisis in Nunavut. You know, it's very important that when -- when NIRB decides or whoever -- I know the federal government has the last say. But -- but, you know, it's very important that Inuit are number one on the list. Not two. One.*[129]

When discussing potential accident and malfunctions, a community member from Pangnirtung discussed food security and the importance of the marine environment and uncertainty of potential impacts and effects:

> *The water is our survival. The store-bought groceries are very expensive. We cannot survive on them alone. When we -- when we see -- [audio drop] the exploration starts and won't be able to work. There's a catch there that we saw. There will be jobs, opportunities for the Nunavummiut. Yeah, good enough. Our life will be disturbed if -- there is always if. If there's an oil spill, what will we do? And there isn't any mention at all of compensation if anything like that happened in the future.*[130]

Community Representatives further discussed the importance of community-based harvesting, potential effects from offshore oil and gas development, and compensation for harvesters:

> *…we have many ways on how we try to survive off the land, and sometimes we're able to make a little bit of money with what we harvest. We have many ways to – to grow our economy. There are -- there's a fishing – a fisheries in -- turbot fisheries in our community of Pangnirtung. And then further north, we have many*

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[129] B. Kovic, Iqlauit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 93-94, lines 21-26 and 1-7.

[130] H. Oshutapik, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 107-108, lines 18-26 and 1.

*whales, walrus, anything, all types of sea mammals that we harvest in our jurisdiction. My question is who is going to be responsible for royalties or trade for the harvesters and for members of our community?*[131]

*We are really against seismic testing or oil production or whatever around our area. Right now Resolute has some serious country food issues. Like I said in the last couple days that we haven't seen a narwhal, beluga pass through our area now. We have two older muqtuq or whale skin from Grise Fiord. We have to order Arctic char from Arctic Bay just by the fact that Northwest Passage is always ice-free now where we can't go to our fishing grounds. And every once in a while, we can't go to our caribou hunting grounds because too much open water, and we have to order reindeer from Greenland. And the only reason why we're able to do this is because we're in cooperation with three other communities that form the -- the fishing company, Arctic Fisheries Alliance with Grise Fiord, Arctic Bay, and Qikiqtarjuaq, using the profits from there, we've been able to at least order country food. And when there's some serious country food shortage, the ones that get affected the most are the income support people, the poor people, because sometime the income support only goes up to three weeks.*[132]

*And the Inuit consume traditional foods in our area -- from our area. I think we would lose all our people if they deplete. And what one of the person -- elders I asked, and he was working at the drilling site. There were harmful chemicals were being used with the drilling purposes, and this would be very bad for our wildlife. And second elder was -- he grew in the outpost camp, and he only survived with country food. He said no as well. They're not going to say go ahead. For those that want to do drilling in the oil and gas development. And the elders thinking of them, of their concerns. If we deplete the country food. Where would we go? What would they -- they wouldn't be able to eat the kinds of things they desire, and it's -- and we -- and sometimes when we're sick when we eat country food we get better. And if we lose our country food and mammals -- animals, what do we do?*[133]

*And today, we're getting less and less country food. And the country food that we consume will be impacted. If they should be -- will be impacted, this will be not good for us and it will not good for the people.*[134]

[131] H. Oshutapik, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 200, lines 19-26.
[132] J. Amagoalik, Resolute, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 824, lines 4-25.
[133] M. Idlout, Resolute, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 833, lines 1-13.
[134] M. Savearjuk Jaw, Cape Dorset, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 839, lines 20-24.

During the public engagement sessions, communities expressed concerns about the impacts of ice breaking, which may affect marine mammals wintering in the area, and indirectly affect Inuit harvesting attempts. There was also discussion of the use of ice as haul outs and dens for seals and walrus.

> *The Inuit Qaujimajatuqangit is valuable. How can we use this in this area? This is a good question to ask ourselves. And to use the Inuk-thinking process it's different from the white man thinking process. And to hear the voices around the table, they would rather see a delay. That is what I wanted to mention to the Board. We -- myself would like more opportunity. I think we're just starting to learn about this. And I'm impressed by the young people that are continuing the work that we have done.*
>
> [L. Kooneeliusie, Qikiqtarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, lines 2-11.]

During the Final Public Meeting, a Community Representative and member of the Inuit Qaujimajatuqangit Committee established through the QIA's Inuit Qaujimajatuqangit studies for the SEA described the value and knowledge of Committee members and made recommendations to have a long-standing committee.[135]

#### 7.3.1.7. *Heritage Resources*

The following is a summary of the *Environmental Setting and Potential Effects Report* – Section 7.31: Potential Effects from Routine Activities Heritage Resources (Nunami Stantec, 2018a). Please refer to this section and report for additional information.

Nunami Stantec noted that current and past Inuit land and marine use is greatest within the land-fast ice zone and next to onshore areas. Direct effects on heritage resources from oil and gas activities were predicted to be low in magnitude, short to long term, localized to where interference occurred, and happen infrequently.

Although any potential destruction of a heritage resource would be long-term and permanent, the potential for an interaction was predicted to be low as the activities for possible scenarios would primarily take place far offshore. Heritage Resources are protected under the *Nunavut Act* and any onshore development would be subject to the heritage resource permitting and environmental assessment processes. Implementation of mitigative measures and best practices would further reduce potential interactions.

#### 7.3.1.8. *Mitigation and Planning Considerations*

Mitigation measures are recommended to avoid or reduce negative effects to the environment from activities associated with the possible oil and gas development scenarios. Many of the mitigation measures are standard to oil and gas development and are part of the usual design of potential projects. The potential effects identified above are what would remain after standard mitigation measures have been applied. Specific measures and commitments by a proponent to decrease potential effects of activities and components would be determined during a project level environmental assessment. During the regulatory process, companies would be responsible for

[135] L. Kooneeliusie, Qikiqtarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 817, lines 8-26.

submitting a variety of plans for approval, including, but not limited to: safety, environmental protection, ice management, emergency response, contingencies, and for offshore installations. A company would further have reporting requirements, including those related to spills, incidents, drilling, production, and the environment.

Nunami Stantec identified standard mitigation measures recommended to avoid or reduce potential negative effects or increase the potential for positive effects from oil and gas activities to the human environment, including the following (for additional detail, see Appendix B of the *Environmental Setting and Potential Effects Report;* Nunami Stantec, 2018a):

- Early discussions with stakeholders and rights holders to notify and discuss potential employment and business opportunities;
- Partnerships with educational institutions to train and develop local capacity for potential employment opportunities;
- Assist local businesses to prepare for potential contract opportunities;
- Develop a benefits plan, approved by the relevant government, outlining initiatives and programs to enhance benefits to local residents, communities, and businesses;
- Use a Fisheries Liaison Officer and/or fisheries guide vessels during certain activities (such as on seismic vessels, and during movement of a drilling rig);
- Notify shippers of planned oil and gas activity through the Canadian Coast Guard; and
- Develop a compensation program for loss or damages to commercial fishers from an accidental release of oil or other contaminants, or debris, or expenses incurred in taking remedial action.

Nunami Stantec further outlined planning considerations used when undertaking the assessment of potential effects from oil and gas activities on the human environment, including (for additional detail, see Section 7.3.5 and Appendix B of the *Environmental Setting and Potential Effects Report*):

- The location of the possible development scenarios in the offshore waters;
- Timing of activities (i.e., seismic and exploration drilling activities to occur during the open water period, with production activities to occur year-round);
- Federal regulation of activities and likely requirements of a Benefits Agreement;
- Onshore components including supply and servicing work would use existing infrastructure; and
- Timelines vary for specific activities (see Volume 2, Chapter 2.6: Objectives and Scope of the Assessment).

### Views of Parties

Within its *Uqausirisimajavut Report*, the Qikiqtani Inuit Association (QIA) provided recommended mitigation measures of potential negative effects on culture and food security according to the traditional rules of *leave animals alone unless hunting them* and *animals are to* *be used, not wasted.* These are reflected in the recommendations described in the preceding sections.

Many parties, including the QIA, the Government of Nunavut, the World Wildlife Fund, and community representatives raised questions and concerns about whether communities would be compensated if affected by offshore oil and gad development, particularly in the event of an oil spill. A general recommendation was that proponents be required to have a defined compensation plan in place that specifically includes effects on food security. For more detailed discussions on compensation, please see Chapter 4: Governance and Lifecycle.

During its presentation at the Final Public Meeting, the Canadian Association of Petroleum Producers (CAPP), discussed mitigation measures undertaken by operators during seismic surveys to reduce potential impacts to the commercial fisheries. For example, seismic operators in offshore Newfoundland meet with the fishing industry at the beginning of the year to determine the location of their respective activities during the summer seasons so that the seismic operator avoids fishing activity and potential impacts. CAPP further discussed the use of fishery liaison officers onboard the vessels to identify any commercial fishing operations in the area of the survey. It was also noted that Inuit representatives from Northern Labrador Inuit communities have been hired to assist with ship operations and to identify commercial fishing operations taking place and/or the presence of mammals or species.[136]

### 7.3.2 *Views of the Board*

#### 7.3.2.1. *Economic Development and Opportunities, Employment, and Contracting and Business Development*

In reviewing the information and predictions made within the *Environmental Setting and Potential Effects Report*, as well as input by interested parties, the Board finds it unclear whether, and to what extent, employment opportunities associated with oil and gas development would be available to Inuit in the Area of Focus. Based on the hypothetical offshore oil and gas development scenarios and input by industry (including the Canadian Association of Petroleum Producers (CAPP) during the Final Public Meeting), it was clear that there would not be many economic opportunities to local communities, particularly at the earlier stages of development. However, the Board also heard from Nunavut Tunngavik Incorporated and the Government of Nunavut that the construction and use of onshore infrastructure could bring more direct and indirect economic benefits to the region. CAPP provided evidence on the potential for development and growth over time, citing the development of the oil industry in Newfoundland as a relevant example. As discussed in Chapter 6: Possible Development Scenarios in Baffin Bay/Davis Strait, the Board further heard from parties that to comprehensively weigh the potential risks and benefits of possible oil and gas development, an analysis of other development opportunities would need to be considered. For example, the Board understands from the respective final written submissions of the Arctic Fisheries Alliance and the Nunavut Fisheries Association that there is a focus on providing job opportunities and learning opportunities for Inuit with the commercial fisheries as well as the potential for future growth.

[136] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 604-605.

The Board agrees that, prior to decisions being made on whether offshore oil and gas development should proceed in the Area of Focus, additional clarity is necessary on whether and how Inuit would stand to benefit. If the moratorium were to be lifted and oil and gas development went ahead, further studies and preparation would need to be undertaken to maximize Inuit participation and benefits. The Board notes that if the Moratorium should be lifted and offshore oil and gas development proceeds in the Area of Focus, any future proponent would need to clearly identify and address barriers to employment and contracting opportunities in Nunavut communities to show how developers would ensure benefits would be accessible and maximized for Inuit and Nunavummiut. Examples of work that could support that approach might include conducting labour market analyses well in advance of project developers entering the regulatory system, supporting work readiness training, and supporting local small business development.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to economic development and opportunities, employment, and contracting and business development, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research and consultation, co-ordination, and public engagement:

***Recommendations to address prior to lifting the current moratorium***:

- Conduct a comparative analysis of oil and gas developments and alternative forms of economic development in the Area of Focus (e.g., commercial fishing, shipping, mining, and tourism) to include:
    - a labour market analysis
    - cost-benefit-analysis;
    - identification of education and training opportunities and ability to gain transferable skills;
    - identification of types and numbers of local employment opportunities and other benefits; and
    - discussion of potential limitations on the ability of Inuit communities to effectively participate in job, training, or other economic opportunities associated with a given type of economic development (#40).

***Recommendations to address should the moratorium be lifted***:

- The oil and gas development industry should establish communication strategies and foster working relationships with communities prior to the presentation of specific development proposals (#9).

### 7.3.2.2. *Community Infrastructure and Public Services*

As discussed in greater detail in Chapter 8: Accidents and Malfunctions, the lack of infrastructure in the communities, particularly related to marine infrastructure such as deep water ports, was repeatedly raised by parties as a concern and factor that would limit the ability of communities to take advantage of economic opportunities that may be presented by the development of oil and gas activities in the region.

For Board recommendations related to infrastructure addressing baseline research see Volume 2, Chapter 5.3.1.7: Community Infrastructure.

### 7.3.2.3. *Well-being and Health*

The health and well-being of residents in the Area of Focus, as well as Nunavut as a whole, is extremely important. As noted throughout this report and exemplified by the work conducted by the Qikiqtani Inuit Association (QIA) as well as comments by Community Representatives, the mental and physical health of Inuit is dependent on a healthy ecosystem. The Board acknowledges and agrees that not only is health and well-being subjective, but it is comprised of multiple factors, including, but certainly not limited to: a heathy environment and connection to the environment; food security; sharing; using and transmitting Inuit Qaujimajatuqangit and skills; expressions of culture; and being able to provide for one's family. Current issues related to food security are a particular concern at present and the Board agrees that focused attention on addressing these concerns through different avenues, including the impact assessment process, needs to be taken. The Board also agrees with the conclusions presented by the QIA that Inuit Qaujimajatuqangit needs to be collected for a particular need and should not extrapolated for unintended purposes or separated from the context within which it is shared. The Board also agrees with parties, including the QIA, on the need for additional information related to well-being, health, harvesting, and cultural changes and tracking information and for these processes to be properly informed by communities and Inuit Qaujimajatuqangit and Inuit Qaujimaningit.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to well-being and health, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research:

***Recommendations to address irrespective of the current moratorium:***

- With the direction and participation of the Qikiqtani Inuit Association and the 10 communities in the region, support further research into the role of harvesting in the marine environment, including:
  - the importance of harvesting on food security in communities;
  - community-specific food security vulnerability
  - the costs of harvesting; and
  - importance of country food sharing in communities (#26).

***Recommendations to address should the moratorium be lifted***:

- Based on the results of the research conducted under #3, opportunities should be identified to support programs to limit negative impacts on Inuit culture, heritage, and rights (e.g., cultural training programs, including "On the Land Programs" for youth, Elder engagement, Inuit mentorship programs, etc.) (#10).

For Board recommendations related to well-being and health addressing impact modelling, mapping, and predictions see Chapter 7.2.2.6 Special and Sensitive Areas and Areas of Concern or Importance.

#### 7.3.2.4. ***Commercial Harvesting***

The Board heard concerns from a number of parties, including the Qikiqtani Inuit Association (QIA), Nunavut Fisheries Association (NFA), Arctic Fishery Alliance (AFA), and the Qikiqtani Wildlife Board (QWB), on the potential direct and indirect effects on commercial fisheries that could result from oil and gas activities; such effects might include: loss of time of catch, diminished quality of catch, and potential restrictions to expansion of both the inshore and offshore fisheries. It is evident that the commercial fisheries in the Area of Focus are an important direct and indirect contributor to the Nunavut economy and well-being. The Board finds that concerns are justified that the commercial fisheries in the region could be impacted if the moratorium were to be lifted now. In addition to information gaps and associated recommendations identified in Volume 2, Chapter 5.3.1.10: Commercial Harvesting regarding fish stocks, movement, and stock connectivity, additional information is required on the potential quantitative effects of oil and gas development on the fisheries, including from potential spills.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to commercial harvesting, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research and impact modelling, mapping, and predictions:

***Recommendations to address should the moratorium be lifted***:

- Building on updated baseline information about commercial harvesting collected under Recommendation #27, identify the potential for oil and gas development (including resulting from associated spills or other incidents) to have adverse economic effects on Nunavut's existing and future commercial fisheries (#57).
- Establish setbacks or other potential development restrictions on the proximity of oil and gas development activities, infrastructure, and other components (particularly seismic surveying activities) in areas, and during seasons, where commercial harvesting takes place currently, or in areas where expansion of commercial harvesting is expected to take place in the future (#77).
- Consider establishing setbacks or other development restrictions on the proximity of oil and gas development activities, infrastructure and other components (particularly seismic

surveying activities) in areas, and during seasons, that are currently closed to fishing in order to protect sensitive benthic areas and Narwhal overwintering habitats (#78).

#### 7.3.2.5. *Land and Marine Use*

This SEA has illustrated how important the offshore is to Inuit and Nunavummiut in general, and how important it is to involve Nunavummiut in decision-making. Inuit rely on marine resources for many well-established reasons; food security for example, is incredibly important in fulfilling both nutritional and cultural requirements. Yet there are significant gaps in information available on these marine resources, particularly in the offshore areas where oil and gas development would take place (which have been discussed throughout this report). Many parties commented on the potential effects of offshore oil and gas development on traditional activities, and the Board heard from the Qikiqtani Inuit Association (QIA) and others about their concerns for potential negative effects on food security, such as changing resources, locations, quality, and number of skilled hunters if less time is being spent on the land due to employment opportunities. The QIA and community members described how the local food sharing network and use of resources extends far beyond just producing food, and evidence was provided describing marine harvesting as a holistic or circular economy, where all parts of the wildlife are used.

Based on the importance of traditional activities and marine-based harvesting and the identification of multiple related information gaps throughout this assessment, it is clear to the Board that there is a need for more comprehensive data regarding the use of wildlife in the region. The Board again notes that it agrees with the conclusions presented by the QIA that Inuit Qaujimajatuqangit needs to be collected for a particular need and should not extrapolated for unintended purposes or separated from the context within which it is shared. Shared Inuit Qaujimajatuqangit and Inuit Qaujimaningit should also be further guided in its interpretation and use by the knowledge holders.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to land and marine use, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing consultation, co-ordination, and public engagement and regulatory, royalty, and benefits regimes and processes:

***Recommendations to address irrespective of lifting the current moratorium***:

- The Government of Nunavut, Nunavut Tunngavik Incorporated, the Qikiqtani Inuit Association, marine users (including commercial and traditional harvesters), and the communities in the Area of Focus should be included as active participants in all marine planning with the potential to affect the Canadian offshore waters of Baffin Bay and Davis Strait (#4).
- Develop an Inuit-led process to establish an accessible and central holding place in Nunavut to support the gathering and sharing of Inuit Qaujimajatuqangit and Inuit Qaujimaningit studies (#12).

***Recommendations to address prior to lifting the current moratorium:***

- Potential impacts to Inuit harvesting and Inuit rights (including threats to food security) should be considered when developing and implementing compensation frameworks for impacts on marine fish, waterbirds, and marine mammals (#14).

For Board recommendations related to land and marine use addressing baseline research see Volume 2, Chapter 5.3.2.2: Well-being and Health.

#### 7.3.2.6. *Mitigation and Monitoring*

As indicated throughout this chapter and report, there is an inherent and interdependent relationship between Inuit and the environment. Though located beyond the boarders of the Nunavut Settlement Area, the SEA process and the resulting information and knowledge has illustrated the importance of the offshore to Nunavut and the importance of Inuit being involved in decision-making regarding the use of that area. The Board agrees with the Qikiqtani Inuit Association regarding the importance of having communities and Inuit Qaujimajatuqangit and Inuit Qaujimaningit as a foundation in establishing effective mitigation measures and having a key role in monitoring. The mitigation measures provided by the QIA and informed by the Inuit Qaujimajatuqangit Committee have been greatly appreciated and carefully considered by the Board. Should the current moratorium be lifted in future, it will be essential that Inuit Qaujimajatuqangit and Inuit Qaujimaningit and associated traditional rules identified be sought to develop and assess appropriate mitigation measures.

The Board further acknowledges the information and experiences shared by the Canadian Association of Petroleum Producers regarding the oil industry in offshore Newfoundland and Labrador and coordination with commercial fisheries. The Board cannot stress enough the importance of communicating and collaborating with local users for decisions around marine use. The Board has commented on specific recommendations within its views on individual valued components:

The Board has carefully considered the identified information gaps and areas of uncertainty relating to mitigation and monitoring, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing monitoring:

***Recommendations to address irrespective of the current moratorium:***

- Establish a mechanism for harvesters and community members to report:
    - any observed issues with the quality of country food; and
    - any other observed changes or concerns regarding impacts associated with development activities in the Area of Focus (#64).

***Recommendations to address should the current moratorium be lifted:***

- Develop and implement programs to involve Inuit and nearby communities in local monitoring programs in Baffin Bay/Davis Strait (particularly including monitoring of priority harvesting areas) (#66).
- With the involvement of the Qikiqtani Inuit Association and communities, use food security research conducted under Recommendation #26 to inform project-specific impact assessments and monitoring programs (#67).

## 7.4. CLIMATE CHANGE

### 7.4.1 *Background Information*

The following is a summary of Nunami Stantec's *Environmental Setting and Potential Effects Report* – Section 6.0: Climate Change, and Sections 7.1.1, 7.2.1, and 7.3.1 on the Potential Effects from Routine Activities and the QIA *Inuit Qaujimajatuqangit Report.* Please refer to these reports for additional information.

Climate change is characterized by the change in meteorological elements or variables such as surface temperature, precipitation, or frost-free days averaged over a period of decades. The average global temperature is increasing, and climate change is already very noticeable in the Arctic. Signs of climate change observed in the Arctic and in the Area of Focus include changes to temperature, precipitation, and sea ice extent. Climate change is expected to continue to affect the biophysical and human environments into the future. Based on public comment and feedback from the potentially interested communities during the scoping phase for the SEA, climate change was added as a separate component and given specific focus to highlight the importance and concerns regarding changing climatic conditions, particularly in the Arctic. Key to these concerns was to consider how an already rapidly changing climate would affect both the offshore oil and gas industry as well as the prediction of potential effects and the extent commitments to counteract climate change might limit the feasibility of developing Arctic oil and gas in future.

The *Environmental Setting and Potential Effects Report* highlighted recorded observations that Inuit have made regarding climate change, including changing sea ice conditions, water levels, temperatures, and species observed. During the Public Scoping Sessions, community members also shared their observations and concerns about the changing climate, including warmer winter temperatures and shorter winters. For example, it was noted in Pangnirtung that the Arctic is more impacted by climate change than other parts of the world and that hunters need to be listened to as they have observed the impacts of climate change and industry on the land and animals. A community member in Iqaluit noted changing ice conditions and associated safety risks. The QIA noted in the Preliminary Findings Report that the Inuit Qaujimajatuqangit demonstrated changing freeze-up times and difficulties with getting onto the ice as early as in the past, and also that fall freeze-up is occurring a month later than was historically observed. Harvesters were also heard to say that landfast ice does not extend as far from shore as in the past and its condition is less secure.

> The seasonal calendar links the knowledge of animal species with the climate.
>
> QIA, 2018a

Changes to sea ice and glaciers have also been observed with glaciers in some areas having grown noticeably smaller, causing lower water levels in associated rivers. Community members in Grise Fiord have observed less run-off from glaciers in the summer and glaciers breaking off. They also reported a longer open-water season, with sea ice melting sooner and breaking up faster than before, and less summer ice. Inuit in Qikiqtarjuaq, Iqaluit, and Pangnirtung have also noticed thinner sea ice and ice forming later and breaking up or melting earlier in the season.

Climate models are used to predict what could happen to the climate in the future and are developed by considering Representative Concentration Pathways (RCP). RCP represent different sets of input data and were developed by considering a wide range of possible futures that relate to: expected emissions and concentrations of greenhouse gases, sulphur dioxide, future economic conditions, land use changes, de-forestation, re-forestation, air pollution control, and government policy. The various RCPs reflect uncertainty about future conditions that could lead to different concentrations of greenhouse gases in the atmosphere and are used as a basis for modelling potential changes in global air temperature, precipitation, ice conditions, and other climate variables.

The Intergovernmental Panel for Climate Change (IPCC) has made projections based on four (4) RCP scenarios. Nunami Stantec reviewed the latest ICPP projections for the Arctic and provided projections of future climate change more specific to the Area of Focus. The following ICPP scenarios were considered for the SEA:

1) maximum projections where no action is taken to reduce carbon emissions (global GHG emissions would continue to rise beyond 2100); and
2) intermediate projection if countries take actions to reduce carbon emissions (global GHG emissions are projected to peak around 2040).

The two (2) scenarios were selected for use in the SEA as they provide a reasonable intermediate and maximum scenario. Overall, scientific models predict that the Arctic will warm considerably more than other regions of the globe. More information on the following components from the IPCC assessment are available in Section 6.2 of the *Environmental Setting and Potential Effects Report:* surface temperature, precipitation, runoff, extreme precipitation, storms, sea ice cover, waves, snow cover and frozen ground, and weather forecasting and climate change.

Nunami Stantec ran climate change models specifically for the SEA using the IPCC projections and climate data from a Clyde River weather station collected between 1999 and 2013 to provide a projection of future climate change specific to the Baffin Bay and Davis Strait region. Clyde River was selected because there was a good dataset available and Nunami Stantec determined that it provided a good representation for the Area of Focus for this phase of an assessment.[137] However, there was insufficient data available for all the elements; temperature, precipitation, and daily frost statistics were taken from a database prepared and maintained by ECCC. Summaries

[137] J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 52, lines 15-21.

of the climate model results are available in Table 28: Regional Climate Change Projections. The models run predict that in the 2080s, the average temperature during the winter in the Area of Focus could be as much as 12.1 degrees Celsius (ºC), or 53.8 degrees Fahrenheit (ºF) higher than the average from 1981-2010. An intermediate projection is that it could be 5.5 ºC (42 ºF) higher. Precipitation could change by as much as 60% in the winter and sea level pressures are likely to change with variation in the frequency of storms over the region. Snow cover may decrease by 9% to 33%. Changes to the average temperature and precipitation levels will not be as large in the summer as in the winter. Another potential future change predicted is an increase in the number of frost-free days.

Sea ice extent is lower earlier in the year than in the past, with freeze-up starting later and break-up starting earlier. The models also predict that compared to 1986-2005, the sea ice extent is expected to decrease across the Arctic by 34% in February and 94% in September between 2081-2100. The waters are already nearly ice-free in September in Baffin Bay and Davis Strait. As temperatures increase and glaciers melt, more icebergs are expected to occur in the Area of Focus in the short-term, and the number may decrease in the long-term. There will be longer open water periods and a greater frequency and severity of open water storms and fog is expected. Populations of marine species such as seals and polar bears that rely on sea ice as part of their habitat are likely to be adversely affected as the climate warms and levels of ice continue to decrease.

*Climate change is a major factor in this region that needs to be considered.*

J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 54-55, lines 126 and 1.

**Table 28: Regional Climate Change Projections (Source: Nunami Stantec, 2018a)**

| Component | Maximum Predicted Change by 2100 |
|---|---|
| Air temperature | Rise by approximately 9-12 ºC |
| Number of days no frost | Increase from 68 to 100-131 days |
| Sea water temperature | Increase by 1.5 to 2.5 º |
| Precipitation (rain and snow) | Increase by 40-60 % |
| Snow cover | Decrease by 9-33 % |
| Sea ice | Decrease by 34 % (February) and 94 % (September). Open water could last longer |
| Extreme Storms | Amount of storms likely to stay the same. Intensity of storm may increase. |

#### 7.4.1.1. *Oil and Gas Activity Effects Assessment – Physical Environment*

Through the work completed by Nunami Stantec it was recognized that climate change may increase the duration and spatial extent of the open water season, with longer periods of open water potentially creating conditions that support a longer operating season for specific offshore oil and gas development activities (e.g. marine seismic surveys). Changes to natural ocean conditions from climate change were not expected to change predictions of the potential effects to water quality or sediment quality from routine discharges associated with oil and gas development in Baffin Bay and Davis Strait. While the longer operating seasons which could result from climate change might extend the frequency or duration of an effect, Nunami Stantec predicted that residual effects of routine discharge on water quality and sediment quality would still be localized to the vicinity of the discharge and magnitude would be characterized as low. Potential effects of climate change on water quality could include changes in water temperature and the amount of freshwater present in the water column.

#### 7.4.1.2. *Oil and Gas Activity Effects Assessment – Biological Environment*

Recognizing the potential for climate change to allow seismic operations to cover larger spatial areas for longer periods of time, the frequency and geographic extent of impacts associated with these activities could similarly be enhanced. However, effects of seismic operations on plankton and on benthic flora and fauna are not expected to change magnitude or duration. Reduced future ice cover and duration as a result of climate change may alter habitat as it could be expected to result in a change in ice-algae abundance and distribution. There is little uncertainty in this aspect of the effects assessment as it is restricted to ice breaking activities only, which are well understood.

It was also noted that climate change could alter the magnitude of the effect of specific constituents from drill and mud cuttings on benthic flora and fauna if increased water temperature or chemistry change the bioavailability of constituents in the areas of deposition. Small changes in pH balances may also take place from the ocean absorbing carbon dioxide due to climate change. This is likely to decrease the ability of Arctic coral reefs to incorporate carbonate into their habitats and for carbonate to be incorporated into the shells of other species, threatening their continued existence. As coral structures serve as important habitats for benthic flora, fauna, and associated predators, loss of reefs from climate change would further reduce the availability of benthic habitat.

Reductions in sea ice associated with climate change may increase the spatial and temporal range of seismic explorations, drilling activities and associated ship traffic. Although this may create noise for longer periods and over a potentially wider area, these changes are not expected to substantially alter the characterization of potential effects of underwater noise on marine fish in the Area of Focus. Climate change could also alter the magnitude of the effect of specific constituents if increased water temperature or chemistry changes the bioavailability of constituents in the areas of deposition, as well as altering the quality of available prey. Some of these effects are expected to be reduced given the ability of fish to move to other habitats.

Some of the uncertainty identified within the effects assessment originates from the limited available knowledge on the ecology and specific habitat needs of the marine fish species present in the Area of Focus. Climate change may create additional uncertainty for the future, as it may contribute to changes in future fish and fish prey species assemblages, some of which may have different habitat needs and associations. While climate change would not be expected to significantly alter fish habitat, indirect impacts could include changes in water temperature or chemistry and associated changes in the marine ecosystem, including changes in species composition and community structure if fish species migrate into the region from adjacent habitats.

As a result of extended operating seasons associated with climate change effects, waterbirds and marine mammals also have the potential to be exposed to longer periods of in-air and underwater noise associated activities in *Scenarios A-C*. Climate change may also cause changes in waterbird species distribution, abundance and phenology. Waterbird populations adversely affected by climate change influences on the availability and quality of foraging and nesting habitat are likely to be more susceptible to the effects of increased oil and gas activity, including increased risk of injury or mortality.

It was noted that climate change may alter some of the characterizations of effects related to marine mammal habitat alterations. It was further noted that with increasing extent and duration of the open water season as well as thinner ice, there may be a reduced need for icebreaking and ice-management associated with oil and gas activities in the future. Although a decrease in required icebreaking would reduce direct ice habitat alteration from oil and gas activities, ice dependent or ice-associated animals may be subject to increased stress as a result of habitat loss. If stressed, these animals may have an increased mortality risk and be more susceptible to the same, or lesser degree of, habitat alterations and disruptions from ice-breaking and ice-management activities.

As was identified for other wildlife groups, it was recognized that climate change may also create additional uncertainty for marine mammals in the future, through changes to physical and chemical ocean conditions (mainly sea ice, temperature, and nutrients) which may alter species composition, productivity, prey, habitats, and distribution and abundance throughout the Area of Focus. Special and Sensitive Areas and Areas of Concern or Importance are also expected to be impacted by climate change, and changes in atmospheric and ocean conditions will likely simultaneously alter the conditions and locations of these special areas and the abundance, distribution and species composition that use and depend on them. How these simultaneous effects may interact is currently unknown.

#### 7.4.1.3. ***Oil and Gas Activity Effects Assessment – Human Environment***

Changes to the physical extent, thickness, quality, and predictability of sea ice resulting from climate change could affect the ability of local residents to travel over sea ice and access fishing or hunting grounds, as well as conduct other types of traditional use and practices. However, the potential reduced extent of sea ice could also reduce the need for ice-breaking activities. Changes in sea ice was discussed extensively in the *Inuit Qaujimajatuqangit Report* and during the NIRB's Public Scoping Sessions.

Both the *Environmental Setting and Potential Effects Report* and the *Inuit Qaujimajatuqangit Report* identified that climate change has already impacted traditional practices such as hunting and fishing. Changes in snow, ice, and water conditions, and generally less predictable weather make travel and time spent out on the land more difficult and dangerous. Some hunters have reportedly stopped narwhal hunting at the floe-edge owing to the unpredictability of the local climate and associated dangers, and community members from Pangnirtung have experienced changes in the consistency and quality of snow, which has made it harder to make igloos. Climate change is also affecting the timing of traditional activities. For example, warmer temperatures affect the ability to cache food in the summer and some Inuit have noted that community freezers must be used until traditional caching (without freezers) can be done in the late fall. New species of birds and wildlife have also been observed.

> Seasonal travel was part of life ... [Inuit] followed a specific seasonal pattern, taking advantage of seasonal conditions, animal migrations, and cultural exchanges. In order to survive, an intimate knowledge of the land and seasons was needed.
>
> QIA, 2018a

Employment and expenditures related to oil and gas activities was not expected to be affected by climate change in a way that would result in a measurable change on the local economy, employment, and business. However, climate change was predicted to affect the ability of traditional harvesters to participate in the local economy. The local economy could also be affected by changes to infrastructure conditions from changes to permafrost, precipitation, and wind. A measurable effect on economy, employment, and business could be anticipated to continue depending on the degree of climate change in the future. If warming trends continue and there is more open water and access to areas of Nunavut, there could be more vessel traffic in and out of available ports and harbours. Oil and gas activity has the potential to further increase vessel activity out of these ports and harbours, which may negatively affect the quality of marine infrastructure and ability to service all vessels.

### 7.4.2 *Views of Interested Parties*

Within the *Uqausirisimajavut Report*, the Qikiqtani Inuit Association (QIA) considered climate change to be a form of 'cumulative change' and recommended that modeling of any future with oil and gas development should include multiple climate change scenarios. The QIA noted the need for climate change to be a major emphasis of research given its impact on the Arctic environment, and that additional research would be required to determine the influence of climate change on marine mammals specifically. The QIA stressed that climate change would impact both industrial oil and gas activities that could occur in the Area of Focus as well as the valued components (e.g., marine mammals) that may interact with these activities. It was considered that climate change is likely the primary risk factor to wildlife and Inuit well-being and way of life. The QIA recommended that future research include studies focused on the influence of climate change in the Development Scenario Area, including what influence climate change is having on marine animals in the region.

Within its final written submission, the Government of Nunavut (GN) highlighted the need for additional information on specific aspects of climate change. For example, it was suggested that there is currently insufficient information available regarding the potential effects of climate change on various ecological components in the Arctic, including how migration patterns may be impacted. The GN recommended that following the SEA, the Government of Canada, in conjunction with stakeholders including the GN, undertake research on climate change in the Arctic, including: ongoing assessment of climate changes; impacts of climate change on the physical environment, including marine currents, fog, and precipitation; and impacts of climate change on the biological environment, including for wildlife migration patterns and for changes to sea ice levels and their association with wildlife behaviors.

Nunami Stantec questioned ECCC on whether it had undertaken any climate change projection modelling for the region, and if not, whether it had any plans to do so.[138] In response, ECCC noted that some modelling has been undertaken, with plans to conduct more. In a deferred response, ECCC provided supplementary information on representative concentration pathways and on climate change models, which was placed on the public record (see Appendix C: Recommended Documents; Public Registry 324048).

Fisheries and Oceans Canada (DFO) recommended four (4) publications produced by the Arctic Council and the Arctic Monitoring and Assessment Programme (AMAP) be reviewed for any future work conducted (see Appendix C:). The AMAP publications provide information on the current state of the Arctic marine environment and the impacts of climate change and pollution. DFO noted that many of these reports provide specific information related to the Baffin Bay and Davis Strait region and that the conclusions and recommendations presented in the reports could be used to fill information gaps and inform policy development, including mitigation, related to oil and gas or other industrial activities in the area.

> *Significant changes [are] coming as climate change affects land, ice, and water. And we've heard substantially on our community visits how this is affecting conditions on the land, how it is affecting wildlife. These are changes that are also, as we have heard, opening new transportation routes, creating new opportunities, such as tourism, but then which also bring risks and hazards, such as other sources of pollution, potentially.*
>
> M. Hopkins, Crown-Indigenous Relations and Northern Affairs Canada, NIRB Final Public Meeting File No. 17SN034, March 29, 2019, p. 364, lines 6-14.

Within its public written comments, the Inuit Circumpolar Council – Canada (ICC) discussed the importance of polynyas, and specifically the *Pikialasorsuaq* (Northern Water Polynya) shared by Greenland and Canada. As noted in other sections throughout this report (which also speaks to the importance of polynyas and interconnectedness to other components of the environment), polynyas are open water that remain ice free throughout winter. Polynyas are high in biodiversity and can act as critical resources and habitat for seal life and can be essentially wintertime harvesting areas. ICC noted that the *Pikialasorsuaq* is being threatened by rapid and large-scale changes, notably climate change. As an example, ICC identified that in recent years, the northern ice bridge in Kane Basin that influences the formation of the polynya has become less stable and as a result, the *Pikialasorsuaq* polynya less defined. The urgent need to understand, monitor, and manage these changes to safeguard the health of the *Pikialasorsuaq* for future generations was highlighted. Furthermore, the Inuit Circumpolar Canada initiated the Pikialasorsuaq Commission as a "collaborative action to build resilience of Arctic communities in a region where global dynamics have caused immense change to a marine ecosystem that is integrally linked with culture, health, local economies, infrastructure, and Inuit lives overall".

Within its final written submission, the World Wildlife Fund discussed climate change within the Arctic context, noting that its impacts on Arctic people, plants, and animals are considered

[138] Exchange between J. Beckett, Nunami Stantec, and B. Summerfield, Environment and Climate Change Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 399, lines 6-20.

extreme, life-altering, and in some cases, including to existing infrastructure, devastating. WWF further commented on the conclusion within the *Environmental Setting and Potential Effects Report* that effects from seismic operations on benthic flora and fauna were not expected to change with the potential for seismic operations to cover larger areas for longer periods of time if climate change leads to a greater open water season. WWF recommended that the precautionary principle be adopted where it is not yet conclusively known what the potential impacts may be.

As discussed in Chapter 7.3.1.5 – Views of Interested Parties, the Arctic Fisheries Association discussed potential emerging fisheries in the future as climate changes, which could lead to commercial species migrating to Nunavut's waters.

During the Final Public Meeting, many Community Representatives shared their concerns with respect to climate change:

> *As Inuit, we are also saying that we are noticing that the ocean temperature is – is changing.*[139]
>
> *Regarding climate change. Oil and gas activities should not be allowed until the government considers how it might drive climate change.*[140]
>
> *I really don't understand how this problem with the climate change -- it is a problem with climate change when you, like, think about the ship traffic that has been increasing. And I'm still not getting any answers when I asked about what's going to happen when the ice recedes in Northwest Passage, when all the world starts going to China that -- in that Northwest Passage route. And here we are. Just listening the couple of days, I haven't had any assurances, as someone who lives up in High Arctic, in Grise Fiord, in Jones Sound. But it is connected to Baffin Bay, because we get a lot of our food from there.*[141]
>
> *We know in our land everywhere the wildlife are impacted. And they are impacted and change, and some of the different animals are coming up now from south because they change with the climate change.*[142]
>
> *And remember too climate change our waters are getting warmer. The Northwest Passage only flows up to halfway this year; and last year, it was about 60 percent frozen. Now, it's only 50. So what we're saying -- what we're thinking maybe three to five years Northwest Passage will be ice free. And I think it's -- while we have a chance to look at what's there, I think it would be good to record it, just to say that*

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[139] J. Kango, Arctic Bay, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 114, lines 20-21.
[140] J. Price, Qikiqtaaluk Wildlife Board, on behalf of the Nangmautaq (Clyde River) Hunters and Trappers Organization, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 21, 2019 p. 789, lines 20-22.
[141] L. Auglalk, Grise Fiord, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 18, 2019, p.281-283, lines 25-26, 1-26, and 1-3.
[142] L. Ningiuk, Grise Fiord, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 19, 2019 p. 542, lines 4-7.

> *maybe way in the future, "Oh, the High Arctic used to have these animals." Maybe for the legacy of the grandchildren where there were recording of animals where they used to be and where they are now needs to be done.*[143]

A Community Representative from Pond Inlet reported a more variable and unpredictable climate, including colder temperatures than expected. It was further indicated that additional research to be conducted:

> *Now, we are being told that there's climate change and our -- the Arctic is getting warmer, but I don't see that. I would like to negotiate probably with governments. I am pleased that the government departments were able to come up. They're here to help us. The topic of global warming is not really happening. I find that our land is getting even colder in some parts. As hunters, we are noticing the air that we breathe, it seems to be falling. It's starting to cool. There's -- it's -- there's a cooling period right now, and the -- the marine areas, sea mammals, zooplankton also are able to hold their breath. And people are saying that the ocean currents or ocean is getting warmer. Surveys such -- surveys should be conducted so that we'll find out if that's factual. That was one of the concerns that was raised by some of my members of the community.*[144]

A Community Representative from Cape Dorset also shared their experience with the movement of the ocean [*currents*] and ice, noting that ice movement has changed due to climate change.[145]

In response to observations from a Community Representative from Grise Fiord who described increased vessel traffic from increasingly open water due to climate change, NTI noted that "*And as for the changing ice conditions in the Northwest Passage, from my reading, two things are happening: The seasonal ice is getting less; but multiyear ice is getting greater, is getter more because -- and that's because the seasonal ice is melting in the Arctic Islands and is letting the multiyear ice coming through from the Arctic Ocean*".[146]

### 7.4.3 *Views of the Board*

Climate change is affecting the Arctic environment at a rapid rate and is a major factor requiring consideration when making decisions regarding possible offshore oil and gas development in Baffin Bay and Davis Strait. As indicated in the preceding sections of this chapter, a large amount of information has been collected throughout the SEA. This includes reports assembled and modelling produced for the Nunami Stantec *Environmental Setting and Potential Effects Report*, as well as the multitude of studies and literature provided by parties. The Board further wants to highlight the invaluable information and knowledge shared by community members and

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[143] J.Amagoalik, Resolute Bay, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 21, 2019 p. 725, lines 3-14.

[144] E. Panipakoocho, Pond Inlet, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 21, 2019 p. 854, lines 4-20.

[145] A. Alasuaq, Cape Dorset, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 204, lines 10-20.

[146] Exchange between L. Audlaluk, Grise Fiord, and W. Johnson, Nunavut Tunngavik Incorporated, NIRB Final Public Meeting File No. 17SN-34 Transcript, March 19, 2019, p. 282, lines 1-6 and p. 284, lines 1-4.

Community Representatives throughout the SEA, specifically during the public engagement sessions and the Final Public Meeting. The Board believes this has truly illustrated how Inuit are both on the front line of experience effects of climate change as well as calling for more information to be conducted to both understand and adapt to changing climate conditions. Recommendations related to effects on air quality and greenhouse gases are available in Chapter 7.1.2.1 Air Quality and Greenhouse Gas Emissions.

As noted in Chapter 6.6.2 Views of Interested Parties, the Board heard from both Nunavut Tunngavik Incorporated (NTI) and the World Wildlife Fund (WWF) that the development of oil and gas resources in the Arctic appear to be incompatible with efforts of the *Paris Agreement* to limit the average global warming to 2 degrees Celsius. They note that for the world to meet this goal, scientific studies indicate that 60-80 percent of existing global fossil fuel reserves must stay in the ground. It was further noted that if countries do reduce their use of fossil fuels in order to cut greenhouse gas emissions and mitigate climate changes, there will be reduced demand for oil and gas which may make Nunavut oil and gas production uneconomic. Please refer to 6.6.2 Views of Interested Parties for associated discussion.

The Board acknowledges the information brought forward by DFO in its submission of the AMAP publications to fill information gaps and inform policy development, including mitigation, related to oil and gas or other industrial activities in the area. The Board believes this exemplifies the value of strategic environmental processes in general for not only identifying knowledge needs but also for filling them.

As the lifecycle for oil and gas from exploration to abandonment is long (ranging from 45-80 years), it is important to improve our understanding of how climate change will affect both potential offshore oil and gas development and the prediction of associated effects. The Board heard how the prediction of the effects of climate change is complex; for example, air temperatures, water temperatures, currents, behavior of ice, and behavior of wildlife and how they would interact to create a complicated set of conditions under which oil and gas development would need to operate. Associated with the effects of climate change there is a need to consider what the changes to sea ice might be in future and how that might influence the accuracy of effects predictions for development proposals. In addition, melting glaciers and calving icebergs resulting from climate change could further increase the need for ice management and its associated effects on marine wildlife. A longer open water season would increase the use of the area, resulting in more shipping and a longer time period for shipping which would potentially increase emissions and disruption to wildlife and wildlife habitat. Specific wildlife species may also adjust the way they use habitat and migrate in or out of the area in future related to the changing climate, further complicating the assessments required for development.

Through discussions at the Final Public Meeting the Board benefitted from many community members sharing their experiences related to current observations of climate changes in their local environments. Many Community Representatives also shared their concerns regarding the many unknowns about future environmental conditions including the magnitude and rate of change and the need to undertake more research on climate change in the Arctic environment. The Board shares these concerns and agrees with comments from the Qikiqtani Inuit Association, the Government of Nunavut, the World Wildlife Fund, and Community Representatives on the need for further research on the impacts of climate change on various aspects of the environment such as currents, fog, precipitation, water and ice levels, and wildlife migration. There are many reasons that climate change needs to be a priority consideration for future decision making in the Area of Focus irrespective of the consideration of offshore oil and gas activities, including the interdependence and reliance of ecosystem components and of Inuit with those components in the Arctic. The Board is also of the understanding that as part of the review of the Moratorium on offshore oil and gas there will be further review and consideration of climate change knowledge independent of this SEA.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to climate change, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research:

***Recommendations to address irrespective of the current moratorium:***

- Collect baseline information and undertake assessments of the current and predicted effects of climate change in the Arctic, including direct and indirect impacts:
    - on the physical environment (e.g., marine currents, fog, and precipitation),
    - on the biological environment (e.g., wildlife migration patterns); and
    - on the human environment (e.g., changes to wildlife availability and effects on harvesting, changes to ranges and availability of fish species and effects on commercial harvesting, etc.) (#19).

For Board recommendations related to climate change addressing impact modelling, mapping, and predictions see Volume 2, Chapter 5.1.2.2: Air Quality; Chapter 7.2.2.6 Special and Sensitive Areas and Areas of Concern or Importance; Chapter 7.2.2.3 Fish and Fish Habitat.

## 7.5. Cumulative Effects

### 7.5.1 *Background Information*

During the NIRB's Public Engagement Sessions, community members noted concerns and asked questions about the potential for offshore oil and gas activities, particularly vessels, to interact with other activities to have a negative effect on the environment. Community members discussed effects, particularly on marine mammals, already being observed and concerns about any increases to those as a result of oil and gas related activities.

The assessment of cumulative effects addresses how potential effects from one (1) project or activity may interact cumulatively with residual effects from other projects and activities conducted or expected to be conducted in or adjacent to the Area of Focus. A list of applicable past, present, and reasonably foreseeable activities identified by Nunami Stantec and used to assess potential cumulative effects was identified in Volume 2, Chapter 5.3.1.12.: Other Reasonably Foreseeable Future Activities. The following is a summary of Nunami Stantec's *Environmental*

*Setting and Potential Effects Report* – Sections 7.1.2, 7.2.2, and 7.3.3. Please refer to these sections for additional information.

#### 7.5.1.1. *Physical Environment*

A summary of potential cumulative effects predicted by Nunami Stantec on the physical environment that may occur in Baffin Bay and Davis Strait from activities associated with the three (3) hypothetical oil and gas development scenarios (seismic surveying, exploration drilling, and filed development and production drilling) and other past, present, and future activities in the region is presented in Table 29: Summary of Potential Cumulative Effects on the Physical Environment. For Scenario D: No Offshore Oil and Gas Activity, there would be no project effects and, as a result, no contribution to cumulative effects. However, it was noted that cumulative changes to valued components may still occur as a result of other past, present, or future activities. For additional information, please refer to Section 7.1.2: Cumulative Effects of the *Environmental Settings and Potential Effects Report*.

**Table 29: Summary of Potential Cumulative Effects on the Physical Environment**

| Other Projects and Physical Activities with Potential for Cumulative Impacts | Potential Cumulative Effects | | | | | |
|---|---|---|---|---|---|---|
| | Air Quality | Greenhouse Gas Emissions | Change in Sea Ice Quality and Extent | Change in Noise Levels | Change in Water Quality | Change in Sediment Quality |
| **Past and Present Physical Activities and Resource Use** | | | | | | |
| Mining—Baffinland Mary River Iron Ore Mine (marine transportation) | ✓ | ✓ | ✓ | ✓ | | |
| Commercial Shipping | ✓ | ✓ | ✓ | ✓ | | |
| Commercial Fishing | ✓ | ✓ | | ✓ | | |
| Tourism (cruise ships) | ✓ | ✓ | | ✓ | | |
| Research (Military, Academic) | ✓ | ✓ | ✓ | ✓ | | |
| Traditional Use and Practices, Traditional Harvest, Traditional Foods | X | X | | ✓ | | |
| Oil and Gas—Greenland | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Oil and Gas—Atlantic Canada | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Future Physical Activities** | | | | | | |
| Mining (marine transportation) | ✓ | ✓ | ✓ | ✓ | | |
| Deepwater Port (Iqaluit) | ✓ | ✓ | | ✓ | | |
| Commercial Shipping | ✓ | ✓ | ✓ | ✓ | | |
| Commercial Fishing | ✓ | ✓ | | ✓ | | |
| Tourism (cruise ships) | ✓ | ✓ | ✓ | ✓ | | |

| Other Projects and Physical Activities with Potential for Cumulative Impacts | Potential Cumulative Effects | | | | | |
|---|---|---|---|---|---|---|
| | Air Quality | Greenhouse Gas Emissions | Change in Sea Ice Quality and Extent | Change in Noise Levels | Change in Water Quality | Change in Sediment Quality |
| Research (Military, Academic) | ✓ | ✓ | ✓ | ✓ | | |
| Traditional Use and Practices, Traditional Harvest, Traditional Foods | X | X | | ✓ | | |
| Oil and Gas—Greenland | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Oil and Gas—Atlantic Canada | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Oil and Gas – Baffin Bay and Davis Strait | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Notes:** ✓ = those "projects and physical activities" whose effects are likely to interact cumulatively with effects associated with oil and gas activities in Baffin Bay and Davis Strait.

X = 'Air Quality' and 'Greenhouse Gas Emissions' checked off by the NIRB and the QIA for Traditional Use and Practices; Traditional Harvest, and Traditional Foods due to the use of boats with outboard motors for associated activities.

Nunami Stantec expected the potential effects to the physical environment from activities associated with the possible scenarios of oil and gas development in the Area of Focus to be generally localized around the source of the impact or dissipate to background levels within a small radius of the source.

The potential effects to the physical environment from oil and gas development were expected to be generally localized around the source of the impact or dissipate to background levels within a small radius of the source. Given the offshore location of oil and gas activities associated with the scenarios and the small scale of potential effects, it was not anticipated that residual effects from oil and gas activities would interact with other activities to result in cumulative effects. Exceptions include scenario activities that would contribute to global greenhouse gas (GHG) emissions and those contributing to underwater noise.

*Greenhouse Gas Emissions and Noise*

While representing a small contribution when compared to global emissions, it was noted that scenario activities that contribute to GHG emissions would require mitigation. This includes meeting best available technologies to maintain efficiency for the activities that burn fuels such as diesel fuel, aviation fuel or fuel gas. Additional and specific mitigation measures are available in Appendix B of the *Environmental Setting and Potential Effects Report.*

Underwater noise can affect a large area and has been identified as an impact of concern for the sustainability of marine organisms. Potential cumulative effects of underwater noise on Biological Environment valued ecosystemic components are discussed in Chapter 7.5.1.2 Biological Environment.

### 7.5.1.2. *Biological Environment*

A summary of potential cumulative effects predicted by Nunami Stantec on the biological environment that may occur in Baffin Bay and Davis Strait from activities associated with the three (3) hypothetical oil and gas development scenarios (seismic surveying, exploration drilling, and filed development and production drilling) and other past, present, and future activities in the region is presented in Table 30: Summary of Potential Cumulative Effects on the Biological Environment. For Scenario D: No Offshore Oil and Gas Activity, there would be no project effects and, as a result, no contribution to cumulative effects. However, it was noted that cumulative changes in habitat, behaviour, health, and mortality risk may still occur as a result of other past, present, or future activities. For additional information, please refer to Section 7.1.2: Cumulative Effects of the *Environmental Settings and Potential Effects Report*.

**Table 30: Summary of Potential Cumulative Effects on the Biological Environment**

| Other Projects and Physical Activities with Potential for Cumulative Effects | Potential Cumulative Effects | | | |
|---|---|---|---|---|
| | Change in Habitat | Change in Behaviour | Change in Physical Health | Change in Mortality Risk |
| **Past and Present Physical Activities and Resource Use** | | | | |
| Mining – Baffinland Mary River Iron Ore Mine (Marine Transportation) | ✓ | ✓ | | X |
| Commercial Shipping | ✓ | ✓ | | X |
| Commercial Fishing | ✓ | ✓ | | ✓ |
| Tourism (cruise ships) | ✓ | ✓ | | |
| Research (Military, Academic) | ✓ | ✓ | | ✓ |
| Traditional Use and Practices, Traditional Harvest, Traditional Foods | | ✓ | | ✓ |
| Oil and Gas – Greenland | ✓ | ✓ | ✓ | ✓ |
| Oil and Gas – Atlantic Canada | ✓ | ✓ | ✓ | ✓ |
| **Future Physical Activities** | | | | |
| Mining (marine transportation, air traffic) | ✓ | ✓ | | X |
| Deepwater Port (Iqaluit) | ✓ | ✓ | | X |
| Commercial Shipping | ✓ | ✓ | | X |
| Commercial Fishing | ✓ | ✓ | | ✓ |
| Tourism (cruise ships) | ✓ | ✓ | | |
| Research (Military, Academic) | ✓ | ✓ | | ✓ |
| Traditional Use and Practices, Traditional Harvest, Traditional Foods | | ✓ | | ✓ |
| Oil and Gas – Greenland | ✓ | ✓ | ✓ | ✓ |
| Oil and Gas – Atlantic Canada | ✓ | ✓ | ✓ | ✓ |
| Oil and Gas – Baffin Bay and Davis Strait | ✓ | ✓ | ✓ | ✓ |

**Note:** ✓ = those "projects and physical activities" whose effects are likely to interact cumulatively with effects associated with oil and gas activities in Baffin Bay and Davis Strait.
X = Additional potential cumulative effects identified by Fisheries and Oceans Canada in its final written submission.

As noted in 7.2 Biological Environment, the predicted potential effects to the biological environment from activities associated with the possible oil and gas development scenarios would generally be localized around the source of the impact or dissipate to background levels within a small radius of the source. The effects to the biological environment from oil and gas development are also expected to lessen to natural or background conditions within a small area from the source. However, there is potential for cumulative changes in habitat, behaviour, health, and mortality risk which may occur to components of the biological environment in Baffin Bay and Davis Strait as summarized below.

*Plankton*

Routine discharges (bilge and ballast water) from commercial shipping, fishing, research, mining, and tourism vessels entering the water column could degrade habitat quality for plankton. The creation of deepwater ports and future marine-based oil and gas development(s) could further increase the potential for cumulative effects as oil and gas development would increase shipping in the area. These activities could also introduce invasive species that could be harmful to arctic plankton. Overall, the cumulative effects associated with more ship traffic on plankton is expected to be negligible or low, and local. If effects do occur, they would likely result from multiple irregular events and be short-term in duration.

*Benthic Flora and Fauna*

Cumulative effects in Baffin Bay and Davis Strait may result from current or future commercial fishing activities if gear types that include bottom contact is used. Potential cumulative effects from the development and operation of a future deepwater port was considered likely to cause changes to intertidal and subtidal habitats, behaviour, and mortality risk of benthic flora and fauna. Sessile benthic flora and fauna may be smothered, mobile species may be temporarily or permanently displaced. Overall, the cumulative effects associated with deepwater ports and fishing were expected to be negligible or low, local, and medium to long-term, allowing for the local benthic community to recover from the disturbance.

*Fish and Fish Habitat*

Potential cumulative effects on fish and fish habitat may occur from current and future commercial fishing, potentially changing fish habitat and increasing mortality risk to fish. Commercial fisheries can control fish populations throughout the Area of Focus; however, it was noted that management of fish and fish habitat will become increasingly uncertain as commercial fisheries expand further into the Arctic and possible extend their fishing season. Depending on gear types used, commercial fishing can disturb the benthic environment and thus affect important fish habitat. In addition, future marine-based oil and gas development(s) could also disturb the benthic environment with the development of marine infrastructure that comes into contact with the seabed. Overall, the cumulative effects are expected to be low to moderate and local, and medium to long-term, allowing for the fish populations and their benthic prey and habitats to recover from the disturbance.

*Waterbirds*

Potential cumulative effects to waterbirds are expected to include changes in habitat and behaviour associated with increased physical or sensory disturbance, and changes in health and mortality risk associated with habitat alteration, increased collision risk, discharges of cuttings and other waste materials, and indirect effects from air emissions. An increase in regional oil and gas activities was expected to result in an increase in exposure of waterbirds to in-air and underwater noise associated with seismic exploration, marine infrastructure or activities (e.g., in-water drilling), shipping (e.g., vessel engines), and air traffic. Increased vessel traffic from commercial shipping, fishing, tourism, research and mining, as well as aircraft use will add to these disturbances. Nunami Stantec referenced research concluding that depending on the frequency, intensity, and duration of noise, and species-specific sensitivities, potential cumulative effects on waterbirds could include displacement from suitable breeding, foraging, staging, or roosting habitats, or direct physiological effects (i.e., injury or mortality). Higher concentrations of lighting sourced from marine infrastructure or seismic and drilling vessels can disrupt seasonal migration patterns of waterbirds by impairing visibility of the stars used for navigation; this may increase the risk of injury or mortality from collisions with lit infrastructures to which they are attracted.

Cumulative effects on waterbirds from change in habitat and behaviour associated with increased physical or sensory disturbance, and change in health and mortality risk associated with cumulative habitat alteration, increased collision risk, discharges of waste materials, and indirect effects from air emissions, have the potential to be long-term in duration and regional in extent. Cumulative effects may result from be multiple irregular or regular events. The magnitude of cumulative effects was expected to be moderate as changes were not anticipated to adversely affect the viability of waterbirds present within the Area of Focus.

*Marine Mammals*

Potential cumulative effects to marine mammals may include changes in behaviour and in mortality risk associated with underwater noise and habitat alteration. Overlap in oil and gas exploration and commercial shipping and tourism activities may raise the probability of exposure to underwater noise events (e.g., generated by seismic surveys, vessel engines, and icebreaking activity), and increase the ensonified area (area filled with sound) in the Area of Focus. This may affect the feeding, breeding, or migratory behaviours of marine mammal species, resulting in changes in behaviour. Increases in underwater noise may also result in changes in mortality risk due to the potential of increased birthing lair abandonment by ringed seals and/or a lack of alternative birthing lairs that are not disturbed by noise. Furthermore, a greater number of icebreakers in the Area of Focus could cause localized habitat alterations and affect the availability of suitable reproduction, molting, resting, migrating or feeding habitat for ice-dependent (ice-obligate) marine mammals (polar bear, walrus, bearded seal, and ringed seal) resulting in additional potential changes in behaviour and mortality risk.

Overall, Nunami Stantec noted that potential cumulative effects on marine mammals could extend across the region and be long-term in duration. Effects were predicted to be multiple irregular events and, although could be adverse, were anticipated to be moderate in magnitude. It was stated that potential cumulative effects were not expected to affect the viability of species in the Area of Focus.

*Special and Sensitive Areas and Areas of Concern or Importance*

Similar to the effects assessment discussed in Chapter 7.2 that changes in habitat was anticipated only for areas utilized by waterbirds and marine mammals, this was anticipated to be the case for cumulative changes in habitat for Special and Sensitive Areas and Areas of Concern or Importance in the Area of Focus. Change in habitat (i.e., disturbance by vessels) near Special and Sensitive Areas and Areas of Concern or Importance may result from oil and gas exploration activities, and other past, present, and future activities including mining, commercial shipping, tourism, military and academic research vessels, and marine vessels used for traditional harvesting. Vessel activity in proximity to waterbird breeding colonies could potentially disturb nesting waterbirds. Special and Sensitive Areas and Areas of Concern or Importance that are utilized by marine mammals also have the potential for changes in habitat due to icebreaking activities associated with oil and gas exploration, and other past, present, and future activities.

It was noted that cumulative effects on Special and Sensitive Areas and Areas of Concern or Importance may be long term and region wide. While the magnitude of the effect was anticipated to be moderate, it was not anticipated to affect the viability of the populations within the Area of Focus.

#### 7.5.1.3. *Human Environment*

A summary of potential cumulative effects predicted by Nunami Stantec on the human environment in Baffin Bay and Davis Strait from activities associated with marine-based oil and gas development in Baffin Bay and Davis Strait and other past, present, and future activities in the region is presented in Table 31: Potential Cumulative Effects - Human Environment. For Scenario D: No Offshore Oil and Gas Activity, there would be no project effects and, as a result, no contribution to cumulative effects. However, it was noted that cumulative changes to valued components may still occur as a result of other past, present, or future activities. Please refer Section: 7.3.2 of the *Environmental Settings and Potential Effects Report* for additional information.

**Table 31: Potential Cumulative Effects - Human Environment**

| Other Projects and Physical Activities with Potential for Cumulative Environmental Effects | Potential Cumulative Environmental Effects-Routine Activities | | | | | |
|---|---|---|---|---|---|---|
| | Change in Economy, Employment, and Business. | Change in Capacity of Infrastructure and Services | Change in Access to Resources | Change in Quality of Harvest | Change in Heritage Resources | Change in Perceived Community Health and Well-being |
| **Past and Present Physical Activities and Resource Use** | | | | | | |
| Mining—Baffinland Mary River Iron Ore Mine (marine transportation) | ✓ | ✓ | ✓ | | | ✓ |
| Commercial Shipping | ✓ | | ✓ | ✓ | | |
| Commercial Fishing | ✓ | ✓ | ✓ | | | ✓ |
| Tourism (cruise ships) | | ✓ | ✓ | | | ✓ |
| Research (Military, Academic) | | ✓ | ✓ | | | |

| Other Projects and Physical Activities with Potential for Cumulative Environmental Effects | Potential Cumulative Environmental Effects-Routine Activities | | | | | |
|---|---|---|---|---|---|---|
| | Change in Economy, Employment, and Business. | Change in Capacity of Infrastructure and Services | Change in Access to Resources | Change in Quality of Harvest | Change in Heritage Resources | Change in Perceived Community Health and Well-being |
| Traditional Use and Practices, Traditional Harvest, Traditional Foods | ✓ | | ✓ | ✓ | | ✓ |
| Oil and Gas—Greenland | | | ✓ | | | |
| Oil and Gas—Atlantic Canada | | | | | | |
| **Future Physical Activities** | | | | | | |
| Mining (marine transportation) | ✓ | ✓ | ✓ | | | ✓ |
| Deepwater Port (Iqaluit) | ✓ | ✓ | ✓ | | | ✓ |
| Commercial Shipping | ✓ | | | ✓ | ✓ | |
| Commercial Fishing | ✓ | | ✓ | ✓ | | ✓ |
| Tourism (cruise ships) | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Research (Military, Academic) | ✓ | ✓ | | ✓ | | |
| Traditional Use and Practices, Traditional Harvest, Traditional Foods | ✓ | | ✓ | ✓ | | ✓ |
| Oil and Gas—Greenland | | | | ✓ | | |
| Oil and Gas—Atlantic Canada | | | | | | |
| Oil and Gas – Baffin Bay and Davis Strait (Scenario A, B, and C) | ✓ | ✓ | ✓ | ✓ | | ✓ |
| **Note:** ✓ = those "other projects and physical activities" whose residual effects are likely to interact cumulatively with residual environmental effects associated with oil and gas activities in the Area of Focus. | | | | | | |

As discussed in 7.3 Human Environment, the potential effects to the human environment from activities associated with the possible oil and gas scenarios in Baffin Bay and Davis Strait would generally be localized to the communities interacting with the activities. However, there is potential for cumulative effects to components of the human environment in Baffin Bay and Davis Strait.

*Economy, Employment, and Business Opportunities*

Change in economy, employment, and business opportunities could occur if the demand for oil and gas companies as well as companies in other industries (e.g., mining activity or increases in shipping and tourism) lead to a shortage of local trained and entry-level workers and potential wage inflation; businesses having difficulties serving multiple projects; or individuals are no longer being able to participate in traditional hunting activities (which could lead to a loss of passing on Inuit Qaujimajatuqangit or consuming country food). Nunami Stantec noted that the Government of Nunavut could benefit if it receives royalties or taxes from multiple projects.

*Capacity of Infrastructure and Services*

Change in capacity of infrastructure and services to support multiple industries may occur from oil and gas activities in combination to other future projects, including increases to shipping and tourism from declining sea ice and new mining activities. However, it was considered likely that increases in the use of marine infrastructure in most potentially interested communities would be limited due to the lack of current harbour infrastructure to support such increases and that future mining developments are likely to be in remote locations away from communities. While the construction of the deepwater port in Iqaluit, as well as improvements to the port in Pond Inlet, would improve marine infrastructure in the Area of Focus, it could also attract more use by the oil and gas industry and other sectors. Depending on the pace of development, there still could be an effect on marine infrastructure if the demand for service outpaces the capacity to provide service.

*Access to Resources*
Change in access to resources by commercial and traditional fish harvesters as well as to traditional uses and practices from limited access to grounds at certain times of the year may occur from vessels, equipment, and safety zones associated with new, and multiple, oil and gas development activities in combination with multiple projects or activities taking place offshore (e.g., shipping, tourism, and research activities). Any increase in marine traffic in the nearshore and land-fast ice zone could potentially increase the cumulative effect on traditional travel routes and access to harvesting locations, which could result in difficulties hunting and consuming country foods, and therefore, food security.

*Quality of Resources*
Change in quality of resources may occur from emissions from multiple offshore projects or activities in combination with any oil and gas development and could have negative effects on both traditional and non-traditional harvests.

*Perceived Community Health and Well-Being*
Change in perceived community health and well-being could be affected both positively and negatively from oil and activities in combination with other activities. Changes in economy, employment, and business opportunities; capacity of infrastructure and services; access to resources; and quality of harvest can negatively affect traditional use and practices, traditional harvest, and the consumption of traditional foods. Positive effects could also occur (e.g., increased disposable income from employment opportunities). Nunami-Stantec noted that perceptions of health and well-being would be intangible and difficult to mitigate.

### 7.5.2 *Views of Interested Parties*

Within the *Uqausirisimajavut Report,* the Qikiqtani Inuit Association (QIA) indicated that it considers climate change a form of cumulative change. The QIA stated that cumulative effect assessments must be conducted for all oil and gas related projects and recommended that all operational decisions (e.g., issuance of permits and licenses) must be made only after detailed consideration of cumulative effects, including a central focus on climate change scenarios as they impact on the environment and on any proposed projects.

In response to questions raised by the Board at the Final Public Meeting on whether the QIA had discussions with the local hunters and trappers organizations on whether future country food sources would be able to support Inuit, the QIA noted:

> *So we know that, you know, there's enough resources out there. But it needs to be done in a sustainable way. And I think part of that is our larger discussion on visiting Inuit management systems and Inuit decision-making when it comes to wildlife and things like quotas and -- and whatnot. So I think it encompasses that within those recommendations that we would like to see these things come -- come to light and -- and on -- with the understanding that the impacts are beyond just the harvesting now. So we must take into account other pressures, the cumulative effects. And so with this larger study on those cumulative effects, we're hoping to just spark more discussion and have those informed decisions on – on management and to make these practices sustainable.*[147]

Within its final written submission, Environment and Climate Change Canada (ECCC) commented that commercial marine vessels are a significant source of air pollution and greenhouse gas (GHG) emissions. It was noted that growth in ship traffic is expected to be driven by community re-supply, tourism, and industrial activity and that cumulative effects of air pollutants from Arctic marine shipping should be considered. The World Wildlife Fund (WWF) shared these concerns that cumulative effects of GHGs need to be considered. The WWF noted in its final written submission that "project by project consideration of GHG and air emissions at the impact assessment stage will not give the whole picture" of cumulative GHG emissions and that "cumulative GHG emissions under various feasible scale of development will be an important factor in the Government's decision on the oil and gas moratorium". The WWF further noted that GHG emissions would significantly increase the total carbon footprint if downstream emissions were included in the assessment.

Fisheries and Oceans Canada (DFO) noted within its public written comments that fish habitats are not homogenous and that consequently, habitat destruction in small areas may be very significant. The importance of the amount of each given habitat type within the larger study area and percentage that is affects, along with species affected, was discussed. It was noted that the first pass of equipment would be the most damaging for vulnerable corals, sponges, and sea pens and that they may not recover from the disturbance. DFO added that the existing fishing closures do not protect all Significant Benthic Areas identified in Baffin Bay and Davis Strait. DFO also noted that complete habitat loss can occur for marine mammals when there is extended disturbance such as underwater noise and habitat alteration (i.e., walrus haul outs can be abandoned due to repeated disturbance) that can contribute to cumulative effects.

During the Final Public Meeting, ECCC noted its recommendations that additional studies and knowledge are needed to understand potential cumulative impacts on Arctic birds and that there is an increased need for a monitoring strategy before moving forward.[148] Transport Canada (TC)

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[147] S. Lonsdale, Qikiqtani Inuit Association, NIRB Final Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 358-359, lines 14-26 and 1-2.

[148] B. Summerfield, Environment and Climate Change Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 388, lines 14-16.

noted during the Final Public Meeting that it has commenced processes to undertake a cumulative effects assessment, irrespective of offshore oil and gas development activities, on the impacts of shipping to marine mammals.[149] While the study is currently being conducted in Cambridge Bay and the timing may not align with the SEA process, TC was hopefully that the information learned could inform future decision-making processes.

Within its final written submission, the Canadian Association of Petroleum Producers (CAPP) provided additional information on cumulative effects mechanism associated with the offshore oil and gas industry by providing four (4) website links to other effects monitoring programs or studies that have been conducted in the East Coast of Canada (see Appendix C: Recommended Documents). The Danish Centre for Environment and Energy recommended within their public written comments two (2) reports and that ecosystemic based management be consideration in future work conducted for cumulative effects (see Appendix C).

P. Croal provided comments on the SEA noting that the report prepared by Nunami Stantec did not adequately assess the cumulative effects of potential oil and gas activities in the Arctic. It was further noted that no decisions on oil and gas operations can be made until data gaps are addressed and confidence in the findings and recommendations are "high" or "acceptable".

The WWF noted in its final written submission that the development of offshore oil and gas related activities in Baffin Bay and Davis Strait would also add another stressor into the environment through additional noise and pollution, as well as an increase in vessel traffic due to the offshore support vessels that are used to carry out different operations necessary for floating drilling rigs, as well as moored or fixed production platforms. The WWF stated that if not properly managed, these new stressors could put northern ecosystems and cultures at risk. Conflicts with marine mammals, underwater noise, chronic leaks from platforms, seismic blasting, disturbance of ice habitat, heavy fuel oil, sewage and grey water, and oil spills were noted to be part of the existing complex risk profile upon which oil and gas activities will be layered in the Arctic. It was further stated that it was unclear how the conclusions were made in the *Environmental Setting and Potential Effects Report* that cumulative effects to marine habitat would be small to moderate and short-term. The WWF further indicated that direct studies of natural recovery from drilling in deep water are lacking and that cumulative effects of multiple drilling wells are not well-studied. Particular concern was further expressed that potential cumulative effects from cumulative underwater noise impacts on fish was not accurately captured. The WWF recommended that more research is needed on the cumulative effects of multiple drilling wells on marine environments and recommended three (3) reports for review on management practices, chronic pollution, and cumulative effects from oil and gas activities (see Appendix C: Recommended Documents).

Within its public written comments, the Nangmautaq (Clyde River) Hunters and Trappers Organization (Nangmautaq HTO) recommended that research be conducted for several subject areas. It was noted that any oil and gas activities in the future would result in increases in shipping and ocean noise in addition to other activities already taking place such as tourism, cruise ships, cargo shipping, and fishing. The Nangmautaq HTO noted that it is currently observing impacts from these activities on the marine environment and recommended that more research be required

[149] A. Gudmundson, Transport Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 330, lines 4-18.

to validate the conclusions made by Nunami Stantec within the *Environmental Setting and Potential Effects Report* that "it is generally not expected that the effects to the physical environment from the possible oil and gas activities included in the Oil and Gas Scenarios would interact with other activities to cause cumulative effects".

A Community Representative from Resolute expressed concern with respect to potential cumulative effects of oil and gas operations and the opening of conservation areas, in particular the proposed Tallurutiup Imanga (Lancaster Sound) National Marine Conservation Area, and stressed that care needs to be taken with the possible activities as effects to the environment have already been observed in the community (e.g., have not caught a narwhal in several years).[150]

During the Final Public Meeting, a Community Representative from Arctic Bay further identified effects from past mining activities and also commented on the potential for cumulative effects from offshore oil and gas activities, if allowed to proceed:

> *We have been effected mostly by Nanisivik which had a mine going and the ships going through. We're the same. When the caps -- caps were born, the ice was broken by the ice -- by the ship. And us hunters, we saw this firsthand. Imagine if there's more activity what's going to happen.*[151]

Further discussion on observed mine-related impacts and effects were discussed by community members.[152] In response to questions raised by the Board, the Mittimatalik (Pond Inlet) HTO noted observed effects from the Mary River Iron Ore Mine. In particular, the Mittimatalik HTO discussed observed increases in mine and tourism related vessel transits and resulting impacts as well as on-going community monitoring:

> *We monitor those -- we monitor those transits. It was getting in the way of hunters, especially the ones that were trying to go out whale hunting. We have been told -- we have said numerous times that we've been impacted, especially in the summertime, when there are many ships that are transiting through.*[153]

Other comments from Community Representatives during the Final Public Meeting on observed cumulative effects include:

> *Now, if there's oil and gas development, we are expecting probably the number of vessels to increase in the Lancaster Sound conservation area. It's very difficulty to know right now and to predict as to what may happen. If there is the total amount*

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[150] J. Amagoalik, Resolute, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 103-104, lines 25-26 and 1-9.
[151] Q. Oyukuluk, Arctic Bay, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 765, lines 6-12.
[152] Exchange between E. Panipakoocho, Mittimatalik (Pond Inlet) Hunters and Trappers Organization, J. Kango, Arctic Bay, and B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript March 21, 2019, pp. 775-777.
[153] E. Panipakoocho, Mittimatalik (Pond Inlet) Hunters and Trappers Organization, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 774-775, lines 22-26 and 1-2.

*of vessels that are going to transfer -- transit through our ocean, it'll be have a big impact on us.*[154]

*But the ships, huge ships, are too many now coming through. I've seen a ship that -- I seen -- I have cabin outside of Pangnirtung. When it was passing by and this ship was in the area where there's seals. After they were in that area, the ship -- these ships; they disappeared, the seals. And -- and the ships have impacted the population of the seals once they come.*[155]

### 7.5.3 *Views of the Board*

As communicated to the Board by parties, it is recognized that growth in commercial shipping (e.g., from increased community re-supply, tourism, industrial activities) is expected as sea ice diminishes and shipping routes remain ice-free longer. There is a need to consider the potential cumulative impacts of air pollutants from current marine shipping and forecasted future emissions against the emissions associated with the potential scenarios to help determine the possible future concentrations for ambient pollutant levels in the Arctic.

The Board heard significant concerns from parties regarding the potential for effects from oil and gas activities to act cumulatively with those resulting from other existing and potential activities. The Board also acknowledges that individually effects may be manageable or easily mitigated, but that when compounded, many small changes can result in significant effects. Many Community Representatives also shared concerns of effects already resulting from past and current projects such as the now-closed Nanisivik Mine and currently operational Mary River Iron Ore Mine. The Board agrees with the Qikiqtani Inuit Association (QIA) on the importance of conducting cumulative effects assessments during the regulatory process for proposed oil and gas projects, which the Board expects would continue to occur through the applicable regime in future.

Again, the Board emphasizes the importance of collecting information for the physical, biological, and human environments to support future planning and establish clear baselines against which future monitoring can reference. The Board agrees that cumulative effects are occurring at present related to the changing climate, and the increase in shipping and mining activities currently happening in Nunavut has potential to exacerbate this further. The Board appreciates the information provided on current cumulative effects mechanisms in place for the Area of Focus; while the Board understands that various agencies are responsible for tracking cumulative effects in some form, it was also obvious that there could be more collaboration between parties in sharing results and making them accessible. Improved collaboration would further assist in reducing duplication of efforts and resources. The Board agrees with recommendations by parties including the QIA, Government of Nunavut, and Environment and Climate Change Canada regarding the need for not only tracking cumulative effects but developing a comprehensive monitoring strategy. As highlighted in the QIA's *Uqausirisimajavut Report*, the Board agrees there is a need to include

[154] B. Kovic, Iqlauit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 776-777, lines 23-26 and 1-3.
[155] L. Ishulutaq, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 783, lines 13-19.

Inuit marine users and Inuit Qaujimajatuqangit and Inuit Qaujimaningit in both the development and fulfillment of monitoring programs moving forward.

The Board recognizes that greenhouse gases (GHG) are known to contribute to global warming which causes changes in the world's atmosphere, land, and oceans and could impact Inuit health and well-being, plants, and animals. The potential GHG emissions from the scenarios (seismic surveys, exploration drilling, and field development and production drilling) are less than 0.08% of the current GHG emissions for Canada (Nunami Stantec, 2018a), however, even small GHG contributions contribute to climate change cumulatively. As expressed in the comments of parties including the QIA, GN, CIRNAC, ECCC, P. Croal, and the WWF on the potential scale of development, there is a vast difference in emissions between one (1) drilling platform (average 500,000 megatonnes of GHG annually (Nunami Stantec, 2018a)) and the development and operation of many such platforms. If the scale of offshore petroleum activities was to be extensive, this could constitute an important contribution to Canada's overall GHG emissions.

The Board acknowledges the concerns expressed by P. Croal and the WWF that the magnitude of predicted effects as identified in the *Environmental Setting and Potential Effects Report* may not be reflective of actual effects. However, it is the Board's understanding that these predictions were based on identified effects from other projects to provide an indication of potential effects of hypothetical future development in Baffin Bay and Davis Strait. At this level of assessment, the focus was necessarily on identifying the types of effects, while a more focused effects assessment could be undertaken to more thoroughly consider details for project specific components such as size, depth, timing, including predictions related to magnitude.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to cumulative effects, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research:

***Recommendations to address should the moratorium be lifted***:

- Conduct research regarding the potential for cumulative effects on marine fish, waterbirds, and marine mammals with consideration of:
    - associated oil and gas activities combined with existing and potential future activities, including mining, marine transportation, commercial fishing, Inuit harvesting and traditional land use, and practices;
    - direct project interactions;
    - changes to water quality;
    - habitat alteration or loss including disturbance of ice habitat;
    - underwater noise;
    - oil spills, including chronic leaks from platforms; and
    - the release of sewage and grey water (#45).

***Recommendations to address through future assessments***:

- The scope of future assessments and marine planning must include comprehensive cumulative effects assessments for valued ecosystemic and socio-economic components, including food security. Collaboration and input should be sought from all relevant parties and be informed by community-based monitoring programs (#17).

# 7.6. TRANSBOUNDARY EFFECTS

## 7.6.1 *Background Information*

Transboundary effects may occur when residual effects extend from one (1) country or jurisdiction to another, or when affected Valued Ecosystem or Socio-Economic Components (VEC, VSEC) move between jurisdictions (i.e., seasonal migration) where the initial effects are compounded (i.e., by additional impacts), or result in effects on other VECs and/or VSECs in the other jurisdiction. Examples of transboundary effects may include a fuel spill within Canadian federal waters which is then carried into Greenland waters via currents and exposes VECs in that jurisdiction to potential effects.

During its Public Engagement Sessions, the NIRB heard questions about the potential for negative effects from offshore oil and gas activities in Canadian waters to marine areas under Greenlandic jurisdiction, as well as effects to Canadian waters from oil and gas development in Greenland's marine waters.

For each of the VECs and VSECs where transboundary effects could occur, Nunami Stantec described effects mechanisms based on the review of potential effects from oil and gas activities and described additional planning and mitigation measures that address potential transboundary effects when applicable. The following is a summary of Nunami Stantec's *Environmental Setting and Potential Effects Report* – Sections 7.1.3, 7.2.3, and 7.3.3. Please refer to these sections for additional information.

### 7.6.1.1. *Physical Environment*

Nunami Stantec provided and described the transboundary effects to the physical environment in Baffin Bay and Davis Strait in Section 7.1.3 of the *Environmental Setting and Potential Effects Report* and the following provides a summary of this description. Please refer to this section and report for additional information.

Activities associated with the possible scenarios (s*eismic surveying, exploration drilling, and field development and production drilling*) may result in the long-range transport of air pollutants from the Development Scenario Area (Canadian federal waters) into the NSA and result in environmental effects on air quality and human health. The extent of potential effects would depend on factors such as the source strength (quantities of emissions) and weather conditions, including prevailing winds. As the prevailing winds in Baffin Bay and Davis Strait are mostly from the North and Northwest, Nunami Stantec considered that the probability of air contaminants from each of the scenarios leaving the Area of Focus in any appreciable quantities would be quite low. In cases where the location of the activity would be close to the border on federal waters, the probability would be higher. In those cases, it was recommended that a more detailed study be done to assess the potential effects. The potential for transboundary effects to the physical environment from oil and gas development in Baffin and Davis Strait was expected to be limited to potential changes to air quality. There would be no transboundary effects on VECs associated with oil and gas activities from Scenario D: No Offshore Oil and Gas Activity.

#### 7.6.1.2. *Biological Environment*

Nunami Stantec provided and described the transboundary effects to the biological environment in Baffin Bay and Davis Strait in Section 7.2.3 of the *Environmental Setting and Potential Effects Report* and the following provides a summary of this description. Please refer to this for additional information. Fish, waterbird, and marine mammal populations range over larger geographic areas and, in some cases, migrate over provincial and international boundaries. If oil and gas activities in the Area of Focus result in population level effects, those effects could be compounded by effects from other jurisdictions, or aspects of the human environment that value biological VECs (e.g., traditional harvest, commercial fishing) may be affected.

*Plankton and Benthic Flora and Fauna*
Given the localized nature of the anticipated residual effects on plankton and benthic flora and fauna described in Chapter 7.2, Nunami Stantec did not expect associated transboundary effects.

*Fish and Fish Habitat*
Migratory fish species that migrate through, or occur in, more than one (1) exclusive economic zone applicable to the Area of Focus include: Atlantic cod, Arctic cod, Atlantic salmon, Atlantic herring, Atlantic halibut, capelin, and several skate and grenadier species.

Nunami Stantec noted that transboundary effects may be present for fish species in the Area of Focus if the effect is substantial enough to affect their long-term health or population density, seasonal migration, or their general distribution extends outside the region, and they are an important ecological, subsistence, or commercial resource in that jurisdiction. As discussed in Chapter 7.2.1.4, most residuals effects from Scenarios A (*seismic surveying)*, B (*exploration drilling*), and C (*field development and production drilling*) on fish and fish habitat were expected to be local, and thus transboundary effects were currently considered to be negligible. Future changes in fish species distribution and abundance and associated fisheries may alter such an interpretation.

*Waterbirds*
The Area of Focus is located along the Atlantic Flyway, which extends from Nunavut and parts of the Northwest Territories south through eastern Canada and the United States and across the Caribbean Sea. The coastal and offshore areas of Baffin Bay and Davis Strait serve as important breeding grounds and staging area for millions of waterfowl, seabirds, and shorebirds on their way to and from Arctic breeding grounds, with approximately 500 species migrating along the Atlantic Flyway.

Based on the distribution of waterbird species which require multiple locally specific habitats for different life stages and processes, as well as the ecology and life history of species migrating across provincial and international boundaries, residual effects of oil and gas activities (including from artificial light sources and discharge of contaminants) and environmental effects have the potential to result in transboundary effects to waterbirds. Transboundary effects to waterbirds were expected to include: change in migratory patterns associated with alteration of staging habitat; change in health associated with increased contaminant load; and change in risk of injury or mortality associated with hunting pressure across jurisdictional boundaries. To the extent that the residual effects, alone or in combination, would affect the health and mortality risk of species that are of ecological or subsistence in other jurisdictions (e.g., the thick-billed murre hunt in Newfoundland, Labrador, and western Greenland), transboundary effects may occur. However, as most of the potential residual effects from the scenarios considered on waterbirds were of low to moderate magnitude and not threatening to the long-term viability of these populations, transboundary effects were currently considered to be negligible.

*Marine Mammals*
The distributions of individual populations for various species of marine mammal in Baffin Bay and Davis Strait cross international waters between Canada and Greenland. These species include ringed seal, Atlantic bearded seal, Northwest Atlantic harp seal, Atlantic walrus, beluga, Baffin Bay narwhal, Davis Strait-Baffin Bay-Labrador Sea northern bottlenose whale, Eastern Canada-West Greenland bowhead whale, fin whale, and Baffin Bay polar bear. Seasonal migrations of the Western North Atlantic population of humpback whale occur between summer feeding grounds in Canadian waters passing through waters of the United States down to breeding and calving grounds surrounding various island nations of the Caribbean (e.g., Western North Atlantic humpback population). Individual marine mammal populations (e.g., pinnipeds, beluga, bowhead whale, and polar bear) are in some cases subject to hunting in both Canada and Greenland. The Baffin Bay polar bear population has been the subject of co-management discussions regarding abundance and hunting between Nunavut and Greenland.

Transboundary effects may occur for changes in marine mammal behaviour and changes in mortality risk as a result of hunting and habitat disturbance associated with a variety of industrial activities, including oil and gas, fishing, tourism, and shipping operations within the Area of Focus. Habitat disturbance is possible from a variety of industrial activities, including oil and gas, fishing, tourism, and shipping operations. These may introduce direct and indirect impacts that can cause population distribution and abundance to shift to other transboundary habitats. Inconsistent commercial fishing management across a marine mammal population's range could also change prey abundance, shifting marine mammals to areas of greater prey abundance. Aquaculture can locally deplete prey's food supply while increasing metabolic waste in the ecosystem, shifting food webs to different taxonomic groups. Underwater noise generated by various activities (e.g., seismic survey or vessel movements) may result in changes to population distribution through avoidance of disturbed habitats.

It is possible that changes in behaviour or changes in mortality risk that may affect the viability of species present in Baffin Bay and Davis Strait could cause transboundary effects. However, as summarized in Chapter 7.2.1.6 Marine Mammals of this report, most residual effects on marine mammals from activities under the scenarios considered were of low to moderate magnitude and were not expected to threaten the long-term viability of these populations. As such, the *Environmental Setting and Potential Effects Report* noted that transboundary effects are currently considered to be negligible for marine mammals.

#### 7.6.1.3. ***Human Environment***

Nunami Stantec did not anticipate that transboundary effects from routine oil and gas activities would occur on VSECs, other than inter-provincial/territorial migration of workers and the economic effects such as the purchase of goods and services outside of Nunavut.

### 7.6.2 ***Views of Interested Parties***

During the Final Public Meeting, the Qikiqtani Inuit Association (QIA) questioned the Canadian Association of Petroleum Products (CAPP) on potential transboundary impacts that could be anticipated for Baffin Island from proposed projects in Labrador. In response, CAPP noted that it was still early in the assessment process and projected that potential spills would likely travel south away from Nunavut waters and that "*if there's any risk at all for potential impacts to Nunavut, it would likely be migratory species that travel north into the Nunavut offshore areas*".[156]

Following the QIA's presentation at the Final Public Meeting, a Community Representative from Iqaluit discussed the importance of information sharing, noting "*I think there's some information sharing that we could get from the Northwest Territories on how their studies were conducted. I know that there was -- perhaps we could also get some information from the Inuit of Labrador because there's offshore -- there's the offshore industry just outside their front door, and -- and we can maybe learn from what they've learned or have experienced*."[157] In response, the QIA noted multiple recommendations it made for increasing communication and collaboration with organizations and Inuit, in Greenland.[158]

Community representatives further noted the importance of learning from the experiences that other communities, particularly Inuit, have had with offshore oil and gas development, especially with activities undertaken in Arctic waters and in the presence of ice:

> "*I want to hear from them -- the Greenland, Norway, Alaska, even Mexican -- how it affected their lifestyle. It doesn't necessarily have to be a spill. It could be just the operation itself*."[159]

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[156] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 623, lines 4-7.
[157] B. Kovic, Iqaluit, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 19, 2019, pp. 340-341, lines 26 and 1-8.
[158] S. Lonsdale, Qikiqtani Inuit Association, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 19, 2019, pp. 342-343.
[159] B. Kovic, Iqaluit, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 20, 2019, p. 510, lines 6-10.

> *… I have a question to you people from Greenland, Qaanaq area, can't they come while they're working with the oil development in their area to speak on some of the issues.*[160]
>
> *… have some delegates from Beaufort Sea communities, Inuvialuit people, Labradormiut people where they have exposure to activities from Newfoundland, Greenland. I think Mr. Kokvik has mentioned few times the North West Greenland Inuit have already have information. I want to hear what they have to say. Make sure these delegates come to meet with us. And we all meet somewhere together, and we come out with a report to -- to get powers that be when it comes time to make the decision on moratorium.*[161]

Within its final written submission, the Government of Nunavut (GN) discussed the need for more comprehensive transboundary effects assessments and recommended that the Government of Canada identify opportunities for regional and transboundary management of the Arctic. It was further noted that an offshore co-management board for the area of focus could help in understanding the thresholds of the region in terms of oil and gas development, as well as to establish opportunities for regional management and monitoring. During the Final Public Meeting, the GN stressed the need for a more comprehensive cumulative and transboundary effects assessment in consideration of recommended revised scenarios (see Chapter 6.4.1 Views of Parties for additional details).[162]

Fisheries and Oceans Canada (DFO) indicated within its public written comments that summaries of specific information were lacking regarding marine fauna, including: movements of adult fishes seasonally and/or interannually; inshore-offshore seasonal movements of the 'population' in general; and movement patterns of adult fishes such as Greenland halibut or Greenland sharks. DFO further noted that information on linkages and exposure scenarios to development activities were also lacking and that the life history of the species should be considered in the exposure scenarios. It was recommended that detailed and focused examination of migratory patterns and associated complexities for Greenland halibut be required for effective decision making and risk analysis of possible oil and gas development. Recommendations were further made regarding Atlantic walrus crossing international waters between Canada and Greenland.

[160] Q. Oyukuluk, Arctic Bay, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 786, lines 11-14.
[161] L. Audlaluk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 813, lines 14-24.
[162] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 178-179, lines 22-26 and 1-19.

> *So we have to think of the impacts that may occur to the marine areas between Baffin and Greenland and the Nunavut Settlement Area as well. We need to ensure that our areas are protected.*
>
> [H. Oshutapik, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 22, 2019, p. 892, lines 5-8.]

The Resolute Hunters and Trappers Association wanted clarification on potential effects from oil and gas activities within Greenland and how spills and accidents in Greenland would impact Nunavut. Within its public written comments, the Danish Centre for Environment and Energy similarly indicated the need to focus on the transboundary effects of drifting oil spills and long-range propagation of seismic noise. Within its final written submission, the Ministry of Fisheries, Hunting and Agriculture – Government of Greenland commented on the potential risk of an oil or gas spill from oil and gas activities to the surrounding nature and wildlife. Noting that Greenland's most important occupation is fishing and that both fishing and hunting contribute to subsistence use of marine resources in the country, the Ministry noted that it was of significant importance to Greenland that security precautions are considered highly important.

In response to a question raised by the Board on whether the GN has agreements in place in the event of a spill from an oil and gas project in the Labrador seas, the GN noted that it has a Memorandum of Understanding with the Government of Newfoundland and will reach out to the Nunatsiavut Government.[163] For additional information regarding spills, see Chapter 8: Accidents and Malfunctions.

### 7.6.3 *Views of the Board*

Throughout the assessment the Board heard concerns from many parties, including the Government of Nunavut (GN), Fisheries and Oceans Canada, the Government of Greenland's Ministry of Fisheries, Hunting and Agriculture, and Community Representatives on the potential for effects from offshore oil and gas activities to result in transboundary impacts to jurisdictions outside of Nunavut. The Board also heard concerns about potential effects within the Area of Focus from offshore oil and gas activities occurring in other jurisdictions, including in Greenland and Labrador and Newfoundland. The Board feels that more information is necessary on migratory patterns of marine life between jurisdictions specifically, while a greater emphasis should also be placed on thoroughly understanding the whole of the marine ecosystem regardless of where political borders, jurisdictions and responsibilities begin and end.

The Board agrees with the recommendations made by the GN regarding the need for more comprehensive transboundary effects assessments and for identifying opportunities for regional and transboundary management of the Arctic. Further, recognizing the unique nature of the offshore area in Baffin Bay and Davis Strait, the Board supports the pursuit of cooperative transboundary management mechanisms should the moratorium be lifted in future. As suggested by the GN, these mechanisms could be relied upon to establish thresholds for oil and gas development and identify opportunities for regional management and monitoring. Recognizing

[163] Exchange between M. Qumuatuq, NIRB Board, and A. Cyr-Parent, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 685-686, lines 1-26 and 1-5.

that there are many ways to facilitate the kind of transboundary collaboration required at an international, national, and provincial/territorial level, the Board has stopped short of adopting the GN's recommendation that the form this cooperation should take is a specific offshore co-management board. The Board agrees that this may be an appropriate mechanism, but there may also be other ways of facilitating the necessary cooperation and shared management.

The Board also wants to emphasize that this assessment and the general recommendations of the Board in respect of the approach to Inuit Qaujimajatuqangit and Inuit Qaujimaningit and regulatory regimes (as discussed in Volume 2, Chapters 2.9 and 4.1) has made clear the need for Inuit to be well represented on any such co-management structure in the future. These regimes should be structured to ensure that Inuit Qaujimajatuqangit and Inuit Qaujimaningit are reflected in associated management and decision-making for the marine region that is essential to Nunavut's nearby communities.

Also as noted throughout this Report and during the Final Public Meeting, Community Representatives also expressed their interest in hearing directly from Inuit from other jurisdictions with experiences with offshore oil and gas activities. The Board agrees that establishing relationships between governments, organizations, and communities in the Area of Focus and those in other Arctic jurisdictions with relevant experience with oil and gas development would facilitate knowledge sharing and improve decision-making within the region. The Board also highlighted the importance of this kind of transboundary sharing of experience and cooperation in the discussion of emergency response capability in Volume 2, Chapter 4.2 and in Chapter 8.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to transboundary effects, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing consultation, co-ordination, and public engagement:

***Recommendations to address prior to lifting the current moratorium***:

- Opportunities should be pursued to establish relationships and develop decision-making processes with neighboring jurisdictions and the Government of Nunavut, Inuit Organizations, and communities, in support of developing common thresholds to assess effects from oil and gas development, to develop appropriate regulatory oversight of the industry, and to establish co-management mechanisms to address transboundary effects (#7).

***Recommendations to address through future assessments***:

- Future assessments and marine planning should include comprehensive transboundary effects assessments of valued environmental components and collaboration with Inuit residents in transboundary areas outside the Nunavut Settlement Area (e.g., Nunavik, Greenland, etc.) should occur whenever practical (#11).

For Board recommendations related to transboundary effects addressing consultation, co-ordination, and public engagement and regulatory and benefits regimes, see Chapter 8.4 Views of the Board and Volume 2, Chapter 4: Governance and Lifecycle.

## 7.7. Effects of the Environment On Possible Offshore Oil and Gas Projects/Activities

### 7.7.1 *Background Information*

There are long timelines for all the steps needed to undertake the oil and gas scenarios. If new oil and gas activities were allowed and went ahead, some of the activities, like production drilling, would likely not happen for decades. Changes to climate are happening very fast in the Arctic. As part of the study of possible future oil and gas scenarios in Baffin Bay and Davis Strait, potential impacts of the natural environment on marine-based oil and gas activities in the region were assessed. Components that may cause impacts to marine-based oil and gas activities in Baffin Bay and Davis Strait as identified in the *Environmental Setting and Potential Effects Report* (Nunami Stantec, 2018a) include:

- Current climate and climate change (for example, winds, visibility or icing);
- Seismic activity (for example, earthquakes, and resulting tsunamis); and
- Bathymetry (water depth or distance of the seabed from the water surface).

Please refer to Section 7.4: Effects of the Environment on Oil and Gas Activities of the *Report* for additional information.

#### 7.7.1.1. *Climate and Climate Change*

Current climate and future climate change may result in extreme temperatures, fog, high winds, icing and floating ice, and other extreme weather events (for example, storms, and waves) that may cause negative effects on marine-based oil and gas activities in Baffin Bay and Davis Strait, including:

- Less visibility for operation of equipment such as marine vessels;
- Delays in oil and gas development activities;
- Workers not being able to get to work sites;
- Damage to oil and gas facilities and equipment; and
- Build-up of ice on marine-based facilities.

Nunami Stantec noted that negative effects of current climate and climate change on possible oil and gas development in Baffin Bay and Davis Strait can be avoided or mitigated by carrying out the following measures:

- Careful and considered design in accordance with factors of safety, best engineering practice, and adherence with standards and codes;
- Engineering design practices that will consider predictions for climate and climate change;

- Inspection and maintenance programs that will reduce the deterioration of the infrastructure and will help to maintain compliance with applicable design criteria and reliability of the transmission system; and
- Establish ice management systems to reduce ice loads and associated risks.

During the Public Engagement Sessions, community members noted concerns and asked questions about the potential for offshore oil and gas activities, particularly the use of vessels, to interact with other activities to have a negative effect on the environment. Observations of climate change and resulting effects were shared throughout the engagement sessions.

#### 7.7.1.2. *Seismic Activity*

Baffin Bay and Davis Strait is considered as a marine region prone to seismic activity (e.g., earthquakes, tsunamis, and slope failures). Large earthquakes could result in damage to marine-based facilities and disruption of activities associated with oil and gas development in the region.

To mitigate or prevent negative effects of seismic activities, such as earthquakes and tsunamis, facilities and equipment related to the various possible scenarios of oil and gas development in Baffin Bay and Davis Strait would need to be designed according to the Canadian Standards Association and other applicable standards and guidelines.

#### 7.7.1.3. *Bathymetry*

Due to the unique bathymetry of Baffin Bay, bathymetric barriers (i.e., shallow sills in the north and south) must be considered in oil and gas equipment and facilities. For example, exploration and production drilling equipment and marine vessels could accidentally contact the seabed during transport and result in damage to these human-made structures. It was noted that Davis Strait does not have obvious bathymetric barriers.

To mitigate or prevent negative effects to oil and gas equipment and facilities, additional studies of the bathymetry of the region, proper design of facilities, and some dredging of the ocean floor may be required to reduce the likelihood of damage to oil and gas facilities and equipment during transport to project sites.

#### 7.7.1.4. *Accidents and Malfunctions*

Accidents or malfunctions that may result from effects of the environment on oil and gas activities would need to be managed through environmental management plans developed by each proponent and approved by applicable regulators. Environmental management plans would include emergency response measures and project personnel training requirements. For additional information, please see Chapter 8: Accidents and Malfunctions.

#### 7.7.1.5. *Identified Gaps*

As noted in the *Environmental Setting and Potential Effects Report*, confidence in the conclusions for potential effects of the environment on oil and gas activities are based on future climate projections reported by the Intergovernmental Panel on Climate Change, the climate projections made as part of this assessment, and from the existing climate data specific to Baffin Bay and Davis Strait where available. Confidence in many of these projections was considered to be medium or high (e.g., increase in surface temperature, reduction in sea ice extent as the climate warms). However, confidence in projections on iceberg prevalence and distribution, storm tracks, and the strength and frequency of storms, and on height of surface waves was considered to be low. This uncertainty may hinder the design of equipment with specifications and strengths needed to withstand the variability in future weather and storms in the Area of Focus.

### 7.7.2 *Views of Interested Parties*

Within its final written submission, the Government of Nunavut (GN) noted that in addition to undertaking research on climate change, the Government of Canada should undertake analysis to understand the risks of climate change on oil and gas safety, and, in consultation with the GN, develop safety guidelines, emergency preparedness and response requirements, and standard operating procedures for industry to proactively address impacts of climate change on their operations over the long-term.

The Board also heard from the community of Clyde River that "*regarding climate change. Oil and gas activities should not be allowed until the government considers how it might drive climate change."*[164]

### 7.7.3 *Views of the Board*

As noted in the introduction of this chapter, there are extensive timelines associated with development of the oil and gas scenarios and changes to the climate in the Arctic are happening very fast at present; further consideration for the impact of the environment, particularly climate change, on the feasibility and safety of future offshore oil and gas development activities in Baffin Bay and Davis Strait is necessary. The Board notes that the potential effects of the environment on *Scenarios A, B* and *C* should be considered in future infrastructure decisions. The equipment used for oil and gas development activities in future would also need to be designed, constructed, and operated to maintain safety, integrity, and reliability in consideration of existing and reasonably projected environmental forces that may occur in the Arctic, specifically in Baffin Bay and Davis Strait.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to effects of the environment on possible oil and gas activities, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed

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[164] J. Price, Qikiqtaaluk Wildlife Board, on behalf of the Nangmautaq (Clyde River) Hunters and Trappers Organization, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 21, 2019 p. 789, lines 20-22.

what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing impact modelling, mapping, and predictions and regulatory, royalty, and benefits regimes and processes:

***Recommendations to address prior to lifting the current moratorium:***

- Investments should be made to improve ice monitoring and management services in the region to increase the accuracy of predictions in relation to sea ice extent, iceberg locations and trajectories, and the potential for extreme weather events (#73).

***Recommendations to address through future assessments***:

- All specific oil and gas development proposals should demonstrate that:
  - adaptive management approaches are incorporated into the project; and
  - the project design and equipment used will maintain safety, integrity, and reliability even in the harsh and rapidly-changing environmental conditions of Baffin Bay and Davis Strait (#18).

# CHAPTER 8: ACCIDENTS AND MALFUNCTIONS

## 8.1. BACKGROUND INFORMATION

Accidents and malfunctions are considered non-routine events and require contingency planning to reduce or avoid negative effects to workers, public safety, and the environment, as well as bring any incidents under control as quickly and effectively as possible. The following is a summary based on the *Oil and Gas Hypothetical Scenarios* provided to the NIRB by Nunami Stantec (Nunami Stantec, 2018b). Additional information is available in *Oil and Gas Hypothetical Scenarios* – Section 10: Non-Routine Aspects of Oil and Gas Exploration and Development.

Potential accidents and malfunctions associated with routine activities include

- Uncontrolled release of oil and gas
- Fire and explosions
- Impacts to drilling platforms
- Loss of life
- Vessel collisions
- Vessel strike with marine mammals;
- Downed aircraft
- Medical evacuations
- Terrorist threats
- Major weather and sea
- Ice conditions

Proponents would be required to evaluate the potential risks of all proposed activities and have response plans in place for all potential accidents. Effectiveness of response measures for the Area of Focus would depend on multiple factors such as environmental conditions, technology, infrastructure, and capacity. Nunami Stantec recommended that spill response planning consider the variables unique to the region, such as environment, cultural values, local infrastructure, current technology and best practices, and capacity.

### 8.1.1 *Types and Likelihood of Spills*

The two (2) types of spills identified were:

- *Batch spill*: A spill of small volume (a few litres) that are instantaneous and often of short duration. Batch spills can happen during routine use, storage, and transfer of the rig, production platform, or supply vessels and can include: diesel oil, hydraulic and lubricating fluids, synthetic or water-based drilling fluids, chemicals, and cleaning agents.
- *Blowouts*: A continuous spill of large volumes of crude oil into the ocean and associated gas into the atmosphere that can last for hours, days, or weeks if not controlled. Potential blowouts can occur above or under the water, including at the wellhead and points along the pipe and drill string.

There are many statistical reports and trend analyses available worldwide as well as scenario-based models for certain conditions or regions of the world.[165] There have been two (2) blowout events

[165] As identified in the Final SEA Section 4(b): Assess the potential impacts and benefits, spill modelling was excluded as a criterion of the SEA.

rated as extremely large (greater than 150,000 barrels): the Ixtoc I blowout in the Gulf of Mexico in 1979 (3 million barrels), and the Macondo (Deepwater Horizon) blowout in 2010 (4 million barrels). Nunami Stantec noted that regulators have developed large-scale and hypothetical worst-case scenarios to assess the likelihood of a blowout event happening over the life of an area (e.g., the US Bureau of Ocean Energy Management for the Outer Continental Shelf of Alaska).

Determining the probability of a blowout varies depending on many factors including: collection, interpretation, and analysis of historical data; data from countries with differing levels of regulations; characteristics of the well; well pressure; water depth; operating conditions (for example, weather); and whether it is an exploration, appraisal, or development well. It was noted that the risk of a blowout is typically reduced as drilling moves from the exploration to development phase, as there is an increase in knowledge of the area and the reservoir properties.

As noted in the *Oil and Gas Hypothetical Scenarios Report*, while the risk of medium or large oil spills or blowouts would be low given the types of safeguards used in modern oil and gas exploration and development, the effects of oil spills on the environment would be extremely adverse.

### 8.1.2 ***Worst-Case Scenario***

Proponents would be required to develop a project-specific spill response plan and associated risk assessment based on a worst-case scenario or an event or set of events that may occur and would have major consequences. The National Energy Board (NEB) Filing Requirements for Offshore Drilling in the Canadian Arctic stipulate that proponents "describe the worst-case oil spill scenario for a major loss of containment of oil from a well" (NEB, 2014; as cited in Nunami Stantec, 2018a, p. 3.6). Nunami Stantec stated that the NEB has taken a goal-based approach wherein the operator provides a credible worst-case scenario based on the work that is being undertaken and multiple performance parameters.

Multiple performance parameters include, but not limited to[166]:

- Representative crude oil types
- Well flow rate(s)
- Duration of flow
- Reservoir characteristics
- In a scenario for a subsea blowout, probability of hydrates forming
- Specific drilling locations
- Specific wellbore geometry
- Specific drilling event
- Iterative process requiring flow rate over time
- Met ocean data for the time of occurence

It was noted that developing an accurate and credible worst-case scenario is a very detailed undertaking for a specific set of circumstances and some of this information was not available for this assessment. Therefore, Nunami Stantec concluded that preparing a hypothetical worst-case

[166] For a more comprehensive listing of criterion as well as assumptions, see Section 10.2 of the *Oil and Gas Hypothetical Scenarios* Report.

scenario in this case would have limited value as it may not be indicative of a credible situation based on an actual project.

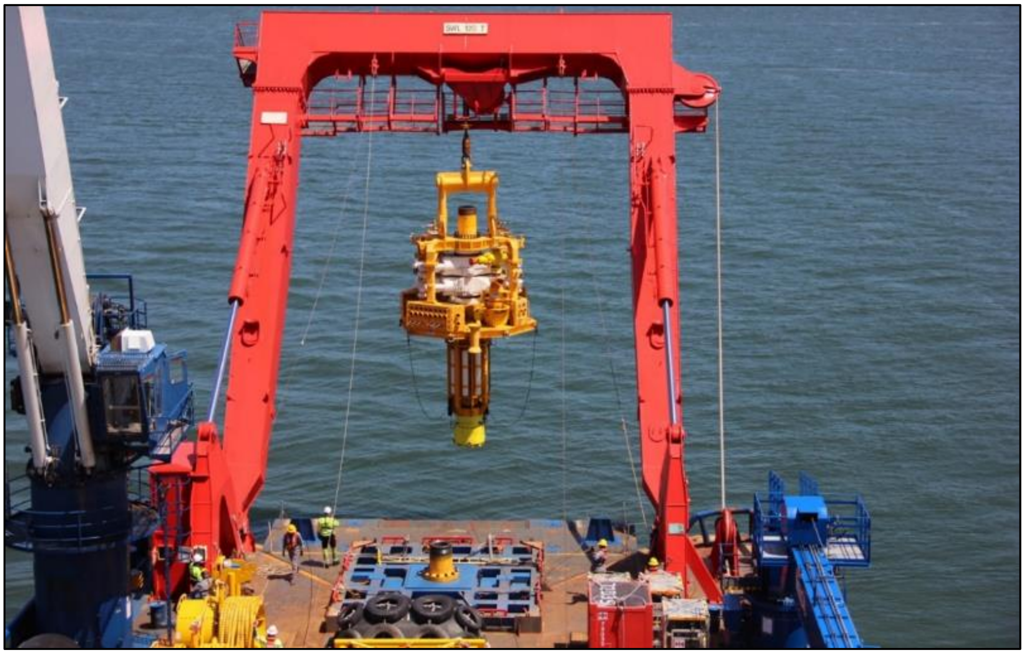
### 8.1.3 *Measures to Regain Well Control*

The National Energy Board (NEB) has multiple policy and regulatory requirements in place in order to ensure that the proponent can respond to and stop a blowout, including:

- *Same Season Relief Well (SSRW):* Unless an alternative has been identified and approved by the NEB, a company must demonstrate the capability to drill a relief well to kill an out-of-control well during the same drilling season.[167] This is intended to reduce the risk that a blowout would continue into the winter months. It was further noted that spill response measures in the presence of ice would have limited success in securing a well and/or cleaning a spill in or under ice. The NEB undertook a review of the SSRW policy in 2010-2011 as part of its Arctic Offshore Drilling Review.
- *Surface intervention equipment and response techniques:* Surface intervention (also called a 'dynamic kill') includes re-establishing the primary barrier of a well to stop the uncontrolled flow of oil or gas above the seabed. Measures include circulating differently weighted drilling fluids and/or the use of a secondary blowout prevention barrier, also called a capping stack. If required, a capping stack can be brought to a site and installed within a few weeks (See Figure 40). A potential timeline for securing a well could be:
    - One to two (1-2) days to assess the damage using a remote operated vehicle;
    - Up to seven (7) days to pump in sea-water to the well and plug with cement (if required);
    - Between 14-21 days to move and deploy a capping stack and secure well; and
    - Possibly conducting a final well kill by filling the wellbore with heavy fluid after the flow has stopped and the well has been secured (can occur in a subsequent year).

[167] A relief well would be drilled to intersect a well experiencing a blowout above the flow. Heavy drilling fluids then cement could be pumped down the relief well to stop the flow from the reservoir in the damaged well.

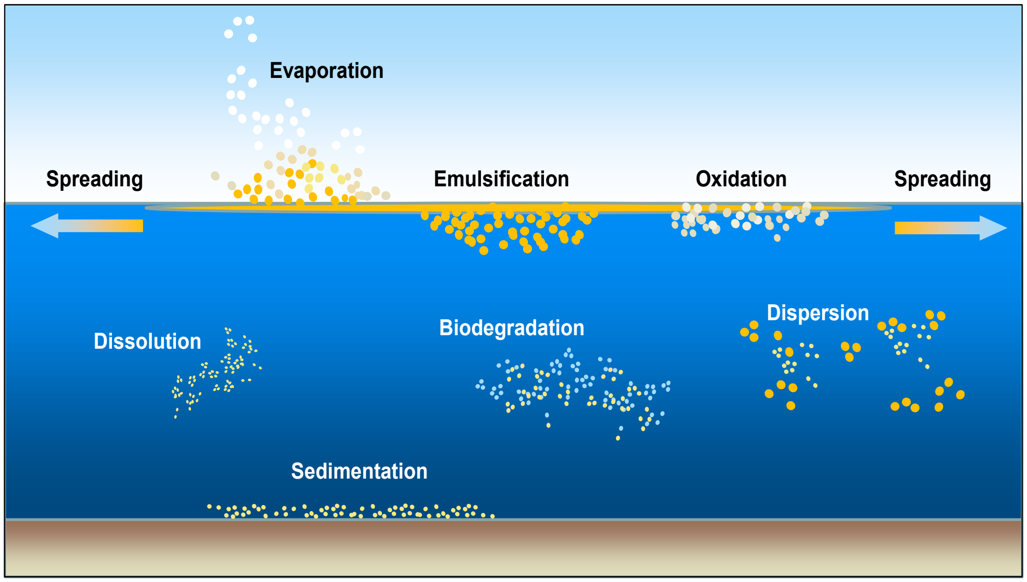
**Figure 40: Deploying a Capping Stack onto the Blowout Preventer on the Seabed (Source: OSRL, n.d., as cited in Nunami Stantec, 2018b)**



### 8.1.4 *Oil Spill Behaviour*

In Section 10.4 of the *Oil and Gas Hypothetical Scenarios*, Nunami Stantec described the behaviour of oil in the environment. In the case of an oil spill from underground or underwater through a well, most of the oil (and accompanying gas) would rise to the surface. Natural gas would evaporate, the oil would be left on the water's surface, and wind, waves, and currents would mix the oil and cause it to naturally disperse over a larger area. Over time some oil droplets would evaporate into the air and some would eventually mix with water (emulsify). Over the longer term, some components of the surface oil could be combined with oxygen in the air (oxidized) by sunlight, while others could break down (dissolve) in the seawater. Oil on the surface could also be broken down (biodegraded) with the help of microbes in the water. The remainder of the oil that does not make it to the surface could be transported long distances by underwater currents. Over time (potentially decades or longer), some would be broken down by bacteria or other living organisms (biodegrade), and some would dissolve into the water. This behaviour is demonstrated in Figure 41: Oil Spill Fate and Behavior in Open Water.

**Figure 41: Oil Spill Fate and Behavior in Open Water (Source: ExxonMobil, n.d., as cited in Nunami Stantec, 2018b)**




It is predicted that over the duration of a subsea blowout, 40-50 percent of the oil droplets released would typically evaporate and that over time there would be less oil between the water's surface and the seabed. The maximum amount of oil on the water surface in the form of a slick would be approximately 15-20 percent of the oil released, and a small amount of oil would continually move between the water surface and the upper part of the water column due to winds and waves.

Modeling the trajectory and fate of oil or gas is an important planning tool when developing an oil spill contingency plan for a specific project. The challenge with running such models for the SEA is that it requires site-specific data and historical data on weather and sea conditions. This data is unavailable given the limited drilling in the region, and there are few examples of wells to use as a basis for predicting the properties of oil and gas from the study region. As there was limited information available and this was not a project specific exercise, Nunavut Stantec predicted that the slick or layer of oil could move south by the Baffin Island and Labrador currents, then potentially get caught in the northward moving West Greenland, North Atlantic, and Hudson Strait currents while spreading, evaporating, and dispersing in the water column.

### 8.1.5 *Offshore Oil Spill Response*

Accidents and malfunctions which could introduce hydrocarbons into the environment are considered to be the biggest risk to biophysical and socio-cultural receptors. The effectiveness of oil spill response measures and the ability to reduce damage to the environment would depend on multiple factors, including:

- Exposure
- Seasonal and environmental conditions
- Oceanographic conditions such as currents, water temperature, extent and type of ice cover

- Distance between a spill and the shoreline
- Vulnerability of shorelines to spills and likelihood shoreline would be exposed to oil
- Shoreline types
- Biological communities supported by shorelines
- Use of these areas by traditional harvesters, communities, and others.

Response to oil spills in an Arctic environment due to remote location, limited available infrastructure, and environmental variables such as limited daylight hours in winter, extreme cold, sea ice, icebergs, communication, and required equipment locations all introduce additional operational and logistical challenges. Recent research has focused on methods and technologies for effectively responding to oil spills in the Arctic environment, however more research is required in order to address mitigate issues.

Table 32 describes some of the tools available for oil spill response and are outlined in further detail in *Oil and Gas Hypothetical Scenarios* section 10.5. The techniques described may be used in combination and depending on the environment and the circumstance of the spill, these methods have been demonstrated to be effective in open water and coastal environments. Where sea ice is present, some techniques may be more effective than others. Further, it is be important to be aware of the regulations and systems that are applicable to the Arctic.

**Table 32: Table of Common Technologies and Responses to Oil Spills**

<table>
<tr><th>Response Type</th><th>Details</th></tr>
<tr><td><u>Mechanical Containment and Recovery</u>: Oil is contained by a boom and a device called a skimmer is used to remove the oil.</td><td>1. Most commonly used strategy but has limitations in effectiveness when waves are higher than one (1) metre.<br>2. Performance of containment and recovery is typically low.</td></tr>
<tr><td colspan="2"><br>Figure 42: Boom and Ocean Skimmer (Source: SL Ross, n.d., as cited in Nunami Stantec, 2018b)</td></tr>
<tr><td><u>Controlled In-Situ Burning*</u>: Spilled oil is burned.</td><td>1. Effective method of removing oil from the environment based on large Arctic ice trials in Norway and actual oil spills from tanker accidents.<br>2. Generally accepted as an effective way of removing oil from the environment.</td></tr>
</table>

| Response Type | Details |
| --- | --- |
|  **Figure 43: Controlled In-Situ Burning (Source: SL Ross, n.d., as cited in Nunami Stantec, 2018b)** | |
| *Oil Spill Dispersants**: Products added to the oil to quickly break up oil slicks on the surface and disperse oil below the surface using the mixing energy of waves. | 1. Breaking oil up into micron-sized droplets allows oil to mix with water column below the surface and increase exposure to oil-consuming bacteria, which is expected to be present in the Area of Focus due to natural oil seeps. Could take decades to break down.<br>2. While potential contact with seabirds and shoreline is lessened, potential contact with fish and marine mammals is increased. Could stay in the water column for decades. |
| *Shoreline Response Program*: Considering coastal sensitivity, details how a spill that reached the shore would be addressed and typically includes the removal and treatment of oil. | 1. Planning would incorporate traditional knowledge and current resource harvesting practices to identify important coastal areas and identification of the treatment endpoints.[168] |
| *Tracking and Surveillance*: detection, monitoring, and tracking of oil on water and in ice conditions through airborne remote sensing technologies or trained observers. | 1. Considered the most effective way to identify the presence of oil on water and in some situations to detect oil among ice.<br>2. Transport Canada, along with Environment and Climate Change Canada, has a number of aircrafts across Canada and one (1) based out of Iqaluit from July to October for the National Aerial Surveillance Program for Canadian Waters and monitor shipping activities, ice conditions, marine safety, and pollution.<br>3. Additional research is ongoing to evaluate and test next new technologies that could be used. |
| **Note:** *Fisheries and Oceans Canada stated that these measures are not currently authorized in the Arctic environment for ship-source or other types of oil spills; however, work is currently being undertaken to expand the options for oil spill response.[169] | |

For discussion related to the Government of Canada's Tiered Oil Spill Response please see Volume 2, Chapter 4.2: Spill Response Regime of this report.

[168] Guides for cleanup in Environment and Climate Change Canada's *The Field Guide to Oil Spill Response on Marine Shorelines* (2006).

[169] www.tc.gc.ca/media/documents/communications-eng/OPPFactsheet_ARMS_E_FINAL.pdf

## 8.2. ACCIDENTS AND MALFUNCTIONS ON THE PHYSICAL, BIOLOGICAL AND HUMAN ENVIRONMENTS

The following sections summarizes the potential effects accidents and malfunctions may have on the physical, biological and human environments. For further details, please refer to the *Environmental Setting and Potential Effects Report*: Sections 7.1.4, 7.2.4 and 7.3.4).

### 8.2.1 *Physical Environment*

The primary concern with effects of accidents and malfunctions on the physical environment is associated with the effects of an oil spill on water quality, sediment quality, and sea ice. While the likelihood of an oil spill occurring is small, the effects would be adverse. The level of impacts to the physical environment from the accidental release of oils would largely depend on physical conditions in the marine environment, the duration of the spill, the oil type, and the methods used to contain and treat the oil spill. Effects could include increased concentrations of the more toxic components of the oil in the water column, flocculation and sinking events associated with plankton and microbial pathways to marine sediments, and contamination of sea ice. An oil spill on sea ice may change ice conditions by reducing the ability of sea ice to reflect sunlight, which could increase the rate of melting of sea ice. The ice may help contain the hydrocarbons to some extent initially, but in time, the contaminants would be released to the water column. In addition, a major oil spill may impact coastlines in the region. Also, an accidental release of natural gas (a gas associated with oil) into the marine environment could form ice-like solids which may settle on the seabed and impact marine sediment quality.

One of the predominant concerns the NIRB heard from community members in the potentially interested communities was about the potential effects from an oil spill. Community members from Clyde River, Arctic Bay, Pond Inlet, Grise Fiord and Kimmirut noted concern with respect to the spill response, capacity, and availability in spill response equipment. Community members Grise Fiord also noted that additional marine traffic would increase the risk of spills.

### 8.2.2 *Biological Environment*

Activities associated with the possible oil and gas development scenarios in Baffin Bay and Davis Strait may result in accidents and malfunctions such as collisions of marine vessels with marine mammals, including whales. However, although vessel strikes with marine mammals are adverse, it was noted that they are not expected to be a common occurrence and would not likely affect the viability of species within the Area of Focus.

The primary concern with effects of accidents and malfunctions from oil and gas development, such as marine vessel accidents and oil pipeline or well damage, may also cause oil spills or release of other chemicals that may affect the biological environment. Such accidents could impact marine water and sediment quality and sea ice conditions and cause effects to components of the biological environment. The extent and magnitude of these effects can range from moderate to high depending on the type and volume of hydrocarbons released, the sensitivity of the receptor to crude oil exposure, seasonal and environmental conditions, and oceanographic conditions (e.g., currents, water temperature, extent and type of ice cover).

In addition, oil spills may impact coastlines and shorelines in the region and cause direct effects, such as death, to marine wildlife including fish, waterbirds, and marine mammals. The proximity of the spill to shorelines, and the vulnerability of shorelines to spills is also important. Effects from oil spills on plankton were predicted to be moderate to high, local to regional, restricted to the single event, and be medium to long-term in duration depending on the type of oil and time of year. An oil spill would likely result in mortalities for benthic fauna, fish, waterbird and marine mammal mortalities and reduced health affecting regional populations, and changes in the local abundance of prey and predator species. Potential effects from a small spill could result in localized effects on marine organisms similar to those described above. The *Environmental Setting and Potential Effects Report* indicated that impacts to the biological environment from oils spills would depend on physical conditions in the marine environment, the distance of the spill from marine wildlife habitat, the length of time the spill lasts, the oil type, and the methods used to contain and treat the oil spill.

Overall, impacts of oil spills to components of the biological environment could be regional (limited to Baffin Bay and Davis Strait) or transboundary and have long-term effects. There is potential for a large oil spill to have wide-spread negative impacts to marine species in Baffin Bay and Davis Strait. Nunami Stantec did not expect that an oil spill would substantially affect the long-term sustainability of regional fish, waterbird, or mammal populations, unless those populations are otherwise compromised prior to the incident, or large portions of their range or habitat are affected by the incident. However, since such oil spills occur through an accident or malfunction, they are predicted to be irregular in occurrence with appropriate safeguards in place. Spill response and clean-up activities would also help to reduce the effects of small spills. Effects from a prolonged spill would be experienced across large areas (potentially with the product travelling hundreds of kilometres).

As noted in the *Environmental Setting and Potential Effects Report* and as heard during the NIRB Scoping Sessions, community members from Arctic Bay and Grise Fiord expressed concern regarding spills of oil and gas near sea ice that could affect animals and their habitat, as well as harvesting areas. Community members from Pond Inlet indicated that Lancaster Sound is home to many animal species and expressed concern regarding oil and gas development in that region and the loss of marine mammals as a food source. Community members from Pangnirtung also noted concern with respect to impacts to marine mammals from oil spills.

### 8.2.3 *Human Environment*

Most of the possible accidents and malfunctions identified above could negatively affect the capacity of infrastructure and services for days or months and may even provide short-term employment opportunities. Oil and other chemical spills have the greatest potential to negatively affect the human environment as discussed further below, including small accidental spills from ships, spills during equipment failure or platforms or blowouts (large spills).

*Commercial Harvesting*

A spill of oil or other contaminants in or near popular fishing grounds or when fishing activity is high could lead to direct interference with commercial fishing activities. Commercial fishers could experience lost time and income due to a spill of oil or other contaminants for multiple reasons, including: fishery closures; having to move to alternant fishing grounds; damaged fishing gear and equipment from fouling (accumulation of oil on equipment such as fishing gear or vessels); fish avoiding an area and resulting reduced catch; contaminated fish through fish taint; or consumers believing the quality of fish has been affected, which could directly affect the marketability and value of commercial fish landings. The significance of potential effects would depend on various factors, including the size of an area closed, time of year, and length of closure.

*Perceived Community Health and Well-being and Land and Marine Use*

A spill of oil or other contaminants into the marine environment could negatively affect community physical and mental health and well-being if it prevents residents from undertaking traditional or recreational activities such as fishing, hunting, and consuming sea-ice or icebergs. A spill could also directly interfere with marine based tourism, traditional use and practices, traditional harvest and the consumption of traditional foods, and therefore, food security. Depending on its location and magnitude, an accidental spill could result in actual or perceived effects on the availability or quality of the marine environment and result in loss of access to areas that may be used for both traditional and non-traditional harvesting activities.

## 8.3. VIEWS OF INTERESTED PARTIES

> *In case there's a oil spill, we're not prepared. We don't have any infrastructure in Nunavut communities and nearby communities to do emergency work if they should go with the oil and gas. And we know that our communities and Inuit would be very sensitive and [it would] impact them. And I don't mind if the moratorium goes forward and continues, because we're Inuit in this homeland, in our homeland, and we consume the wildlife [a] great deal. What would happen? There's many oil spills in the -- globally. And the first time this would happen, I don't know any -- ice freezing is a big factor if there should be a spill. And it would be hard if the water – [if oil] should go in the water and down below the ice and also the -- the depth of the sea.*
>
> [J. Eetoolook, Nunavut Tunngavik Inc., NIRB Final Public Meeting File. 17SN034, Transcript, March 22, 2019, p. 906, lines 11-24]

Within the *Uqausirisimajavut Report,* the Qikiqtani Inuit Association (QIA, 2019) noted that technology does not exist to clean up from spills and blowouts in ice conditions; the risks to these locations is too high for Inuit and the resources they rely upon. The QIA noted that the anticipated effects on marine wildlife may come from a variety of different causes such as from boat strikes or tissue damage from seismic air guns, oil spills from blowouts or spills during oil transportation or from fuel spills from ships themselves. QIA provided recommendations on a number of topics related to spills and research.

Within the *Uqausirisimajavut Report,* the QIA concluded that: "…a catastrophic accident with large-scale hydrocarbon release, while rare in occurrence, would have high magnitude and potentially long-term impacts on wildlife and wildlife habitat, and by extension on Inuit cultural practices, especially related to harvesting." A member of the public during a community meeting where compensation was discussed commented that, in the event of a major oil spill, "You cannot put a price on my culture", acknowledging that damage to the marine environment that prevents Inuit from living their culture through harvesting, or other activities in the marine environment or shoreline cannot be adequately compensated. These likely unmitigable risks must be considered when contemplating whether to lift the current moratorium on oil and gas development (QIA, 2019, p. 65).

The QIA provided a number of recommendations in relation to accidents and malfunctions as summarized in Table 33: QIA Recommendations Regarding Accidents and Malfunctions from Oil and Gas Development in Davis Strait and Baffin Bay. For additional details, please refer to the *Uqausirisimajavut Report*.

**Table 33: QIA Recommendations Regarding Accidents and Malfunctions from Oil and Gas Development in Davis Strait and Baffin Bay (Source: QIA, 2019)**

| Prior to lifting the moratorium: | Post Moratorium Recommendations: |
|---|---|
| 1. Research to prove effective management of oil spills in ice.<br>2. Research on how the arctic environment will impacts the ability to mitigate and clean up oil spills.<br>3. Confirmation and use of proven oil spill cleanup technologies. | 1. Research the movement of contaminants (oil spills) under ice. |

*What effect does the Arctic environment have on the ability to clean up an oil spill? We don't know how to clean up oil spills under ice; and until that technology is proven, there's a great risk to an oil spill in this area.*

[R. D'Orazio, Qikiqtani Inuit Association, Final Public Meeting, March 19, 2019, p. 307, lines 17-21]

Within its final written submission and during the Final Public Meeting, the Government of Nunavut (GN) noted that there is limited specific information available regarding the behaviour of oil and gas in Arctic conditions, especially under-ice conditions. The GN highlighted that this is a critical issue that must be understood to support effective spill response planning and to ensure adequate spill response capacity is developed before oil and gas development proceeds. The GN observed that the Nunami Stantec reports did not distinguish between requirements of emergency preparedness and response for oil versus gas projects (methane, sour gas, and heavy and light crude oil), acknowledging that community capacity, infrastructure and planning is needed to manage any spill. Further, the GN commented that the reports did not provide sufficient detail regarding regulatory oversight of emergency preparedness and response in the Arctic, recommending that other similar jurisdictions should be researched to identify lessons learned, standard operating procedures, and mitigation measures. Oceans North Canada (Oceans North) also supported the consideration of "lessons learned" from other federal and Inuit jurisdictions, including from the Grand Banks and recommendations from the National Energy Board (NEB)'s Arctic Offshore Drilling Review.

The GN recommended that additional studies be undertaken to understand the potential effects of an oil or gas spill/release on wildlife, including migratory species in the Area of Focus, with consideration for the potential effects of oil or gas spill/release during the under ice and open water season. Based on the results of these studies, an assessment of socio-economic effects should be completed to understand the potential effects of an oil or gas spill/release on the Inuit way of life and food security, as well as on the northern economy, including tourism and fisheries.

At the Final Public Meeting, the GN questioned Nunami Stantec on the mitigation of spills and the difference between oil spills and gas spills in terms of potential impacts, requesting clarification on the frequency of major malfunctions and accidents within the oil and gas industry (i.e., are these types of incidents rare).[170] The Canadian Association of Petroleum Producers (CAPP) responded to these questions stating that a natural gas spill would be expected to evaporate, with little residual effect, compared to an oil spill which would be largely on the surface with dissipation likely to occur due to wave and current actions.[171] Nunami Stantec noted that "*…"rare" is a relative term*" and effects would be dependent on the scenario and type of operation.[172]

Crown-Indigenous Relations and Northern Affairs Canada observed in its final written submission that oils spills could be dangerous to wildlife, the environment, the coasts and other important and sensitive areas, noting that communities have expressed concerned about strong and changing currents and the spread of oil in the event of a spill. Communities would like to be assured that impacts to their way of life, the environment, and wildlife would be prevented. On this same topic, Environment and Climate Change Canada (ECCC, 2019) stated that the magnitude, geographic extent and duration of a worst-case scenario spill or blow out was understated in the Nunami Stantec Reports, especially for incidents that could occur in the vicinity of any key habitats. Although the geographic extent of the effect could be characterized as local or regional, the impact of the effect would be transboundary, as migratory birds are a resource shared among several jurisdictions. The duration of the effect, in many cases, would be long-term to permanent. As such, ECCC supported the requirement for worst-case scenario spill modelling and requiring the highest standards of spill response and preparedness to assess risks and protect the important populations within the Area of Focus. Within their public written comments, Fisheries and Ocean Canada (DFO), Natural Resources Canada (NRCan) and Oceans North Canada also emphasized the importance of modelling the fate, behaviour and effects of an accident/spill and/or the probability of sub-surface blow-outs to properly assess the risks to the Arctic environment.

Further within their public written comments, DFO recommended three (3) weblinks related to information on oil spills with some emphasis on spills in the Arctic be reviewed for any future work conducted. DFO also highlighted the lack of discussion within the Nunami Stantec reports related to capacity and/or capability of communities to respond to a spill within the Area of Focus and consideration for potential impacts on the coasts and shorelines resulting from these accidents. During the Final Public Meeting, several parties highlighted the limited resources for spill response

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[170] A. Cyr-Parent, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 80-82, lines 15-22, 25-26 and 1.
[171] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 81, lines 15-23.
[172] J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 82, lines 4-8.

in the North , but DFO noted that the Canadian Coast Guard currently does have some assets at strategic locations that could be mobilized in the event of a spill.

Within its final written submission, NRCan noted that development in Baffin Bay and Davis Strait would increase the likelihood of an oil spill to the sensitive Arctic ecosystem, and stressed that modeling how oil or gas would react if there was a spill would be an important tool when developing an oil spill contingency plan for a specific project. NRCan agreed with the conclusions within Nunami Stantec's *Oil and Gas Hypothetical Scenarios Report* that site-specific data and historical data would be needed to develop an accurate oil spill model and that several environmental factors affect the fate and trajectory of oil during a spill. Further, the physical and chemical properties of the specific oil released must be included in the model to determine how specific oil types would behave in the environment, impact aquatic wildlife, and potentially degrade.

During its presentation at the Final Public Meeting, CAPP explained that oil spill response is an area of significant focus for the oil and gas industry, noting that there are "*a variety of a different ways that if an oil spill occurs our industry can use to help respond and clean up that oil spill.*" CAPP further stated that "*[f]or the Arctic environment, natural dispersion and in situ burning is likely the best tools, the most effective tools for the Arctic environment together with an activity called remote sensing.*[173]

Within its final written submission, the Arctic Fishery Alliance (AFA) indicated that while potential mitigation measures in the event of any oil-related disasters were outlined in the *Oil and Gas Hypothetical Scenarios*, it appeared that these only considered the best-case scenario. In AFA's opinion, Nunavut's waters are among the most pristine in the world, and as such, an oil spill in this region would be catastrophic. AFA also noted that, at present, there are no deep-water ports or search and rescue capabilities in Nunavut; therefore any potential spill or blow-out would have a longer response period than anywhere else in Canada. In addition, there is no environmental remediation capacity. AFA stressed that permitting oil and gas development in a region with no existing response network or infrastructure would be ill-advised.

The Environment Agency for Mineral Resources Activity (EAMRA) noted within its public written comments that spills into the environment are considered to be the biggest risk to valued ecosystemic components associated with oil and gas development. In EAMRA's opinion, oil spills should have been given more attention within the *Oil and Gas Hypothetical Scenarios Report* and the *Environmental Setting and Potential Effects Report,* specifically noting limitations in response and recover in an Arctic environment. EAMRA also stressed that no recovery methods have been proven to be effective in removing oil from ice-covered waters. EAMRA also recommended four (4) publications on this topic be reviewed for any future work on this topic and provided an updated reference to their oil spill sensitivity atlas for the west coast of Greenland (see Appendix C: Recommended Documents). They also identified current data gaps in oil spill response, including a lack of studies on oil fate and behaviour in ice-covered waters. EAMRA also outlined the information requirements associated with Greenland's Net Environmental Benefit Analysis (NEBA) or Spill Impact Mitigation Assessment, which is a part of their project approval process,

[173] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting No. 17SN034 Transcript, March 20, 2019, pp. 608-60, lines 24-26 and 1-11.

including who should perform the assessment. EAMRA provided recommendations related to future assessments and planning in relation to potential oil spills as follows:

- There should be a strong focus on further study of oil spills given the risk, limited ability to respond, and specific limitations to these activities in an Arctic environment, and there should be a focus on the fate and behavior of oil in ice-covered waters and the associated oil spill response.
- Realistic oil spill scenarios should be included to assess oil spill response capacity/technology requirements and to assess transboundary implications.
- Weathering process and environmental consequences of response technologies should be considered when assessing potential for effects of an oil spill and the fate of spilled oil.
- Experience gathered from the large Exxon Valdez and Deepwater Horizon oil spills, especially with respect to long-term effects to wildlife population from large spills should be considered.
- Studies should be undertaken on the effect and degradation of the toxic components of drilling chemicals under Arctic conditions and these results should be considered.
- Information on spill impact mitigation assessments should be included, including specifying who should be conducting the assessment and what information should be included.
- A strategic Net Environmental Benefits Analysis should be performed to identify what oil spill response technologies could be required in the event of a spill.

In its public written comments, Greenpeace Canada (Greenpeace) noted that it would be important to include the details of how a Same Season Relief Well (SSRW) works in the Arctic environment and how effective an SSRW may be in preventing a blowout. Further, Greenpeace suggested that consideration should be paid to how spills would be addressed at or near the end of drilling season when wells are abandoned. Greenpeace also expressed concern that freezing waters and temperatures, darkness for many months, and the remoteness of drilling operations in Baffin Bay and Davis Strait would present many challenges in addressing a spill, and should be considered further.

Greenpeace also indicated in its submission that the Nunami Stantec report did not provide information regarding the types of challenges (accidents large and small) that can occur during oil and gas operations. Greenpeace suggested that consideration for lessons learned from spills that occurred at other oil and gas developments (e.g., Exxon Valdez oil spill of 1989 and the Deepwater Horizon oil spill of 2010) would be useful. A summary of costs associated with oil spills and blowouts that could occur in the Area of Focus is also needed to provide a clear understanding of the risks involved as well as the long-term impacts on communities, including impacts on food security and sovereignty.

Greenpeace and World Wildlife Fund (WWF) provided their shared view that in the development of the SEA, relying on the oil industry does not provide the objective perspective required to assess the full benefits and risks of potential projects. Greenpeace suggested that the SEA should include more examples from academic sources and independent research institutions to avoid the perception of conflict of interest. Finally, Greenpeace noted that the Nunami Stantec report did not take into account the challenges in transporting specialized equipment to remote areas for Arctic offshore oil and gas operations.

Oceans North noted concerns within its final written submission that spills in the region may have detrimental effects on spawning fish, larval survival, and juvenile survival. In addition, oil spills could immediately settle and impact coral, sponges and seapens in the area.

In its public written comments and final written submissions, WWF stressed that a large oil spill in the Canadian Arctic could have devastating impacts on the marine environment and communities in the North as it would be almost impossible to clean up given current infrastructure and response capacity. Despite the low risks of a blowout, the consequences of a major spill in sensitive Arctic ecosystems would be severe, which was further emphasized at the Final Public Meeting.[174] In addition to improved clean-up technologies for oil spills in icy waters, WWF noted that Canada needs an enhanced presence and performance capacity in the Arctic, including area-specific training, icebreaking capability, infrastructure to support oil spill response, improved international coordination for transboundary spills, improved availability of vessels for responding to oil spills or other emergency situations, and aircraft and helicopter support facilities.

WWF indicated that chronic low-level pollution from oil platforms is an ongoing problem in the offshore oil sector, and that industry has thus far been unable to give assurances about preventing or containing chronic leaks. WWF highlighted that in some cases, such as the North Sea, these types of ongoing releases may have been ongoing for decades, indicating that: "while the environmental impacts of a single small spill or leak are likely to be minimal, the cumulative impacts of many small spills or an ongoing, chronic leak can be significant." WWF also indicated that in its experience, the average offshore installation or supply vessel has insufficient room for filters, cyclones, and settling tanks large enough to reduce the oil in produced water to a level where there is no sheen prior to disposal. Moreover, WWF stated that equipment sometimes breaks down and there is rarely any independent inspection of overboard discharges from offshore facilities and vessels, by remote sensing or unannounced visits by the authorities. WWF also noted that most offshore operators' monitoring of the oil to water ratios of their overboard discharges is typically intermittent.

WWF also stressed that among the various phases of offshore operations, exploration drilling entails the highest risk of blowout; and while the chances of a blowout may be low, any calculation of risk must also include a discussion of the potential consequences of a blowout. WWF noted that in the Canadian Arctic, there is very little infrastructure and response capacity, weather and environmental conditions can be extreme; and ecosystems are extremely sensitive to pollution. As a result, the consequences of a major oil spill in the Canadian Arctic are potentially catastrophic. WWF also stressed that it would be unrealistic to expect northern communities to provide adequate and timely oil spill response infrastructure and capacity to respond to spills from oil and gas operations in the high Arctic.

[174] M. Brooks, Word Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 113, lines 11-22.

As noted by other SEA participants, WWF identified that there are significant differences between oil spill response capabilities in open water and in ice-covered waters. Significant challenges also exist for spills occurring within different sea ice types, concentrations and seasons, and these changing conditions are all strongly impacted by climate change. WWF identified that a key challenge of accurately quantifying the potential damage resulting from an Arctic oil spill is that the baseline knowledge of the Arctic system is presently limited. While WWF acknowledged there is some research into how oil responds in ice, WWF also indicated that fully understanding how oil behaves in an Arctic environment is challenging at best. WWF stated its concern with respect to the limited technologies available during the Final Public Meeting for effectively "*…cleaning up an oil spill in Arctic conditions; remote locations*"; stressing that everyone is dealing "*…with ice, darkness, extreme weather, and in an environment where response capacity is extremely limited in the Eastern Canadian Arctic.*"[175] WWF also noted that the impacts of a spill "*...would be potentially catastrophic; and in some cases, it would be very difficult to compensate.*"[176]

WWF commissioned research confirming that major weaknesses in response preparedness currently exist in the Canadian Arctic. WWF also modeled possible oil spill trajectories in Baffin Bay and Davis Strait. WWF's research identified major issues with the state and availability of oil-spill response equipment, training resources, and communications infrastructure including:

- Only a small number of communities have access to the most basic oil-spill response equipment from the Canadian Coast Guard;
- The communities that do have equipment say it is irregularly maintained, too few community members are trained to use it, and that some communities don't have a key to access the storage containers;
- Harsh weather conditions, periods of prolonged darkness and the presence of sea ice make most standard oil-spill response equipment ineffective;
- Remote locations mean long response times for large-scale clean up and equipment or limit the availability of contracted response capacity in the Arctic;
- Lack of reliable communications infrastructure makes it difficult for communities to call for assistance, and for responders to communicate with those on land during an oil spill response;
- In the Canadian Arctic, there are no legal requirements to ensure that sufficient people and equipment could respond to a spill from a ship, nor any requirements that such a response would occur within a certain amount of time. Given limitations on the availability of equipment and contractor response capability, spill response can take more than 10 times longer than in waters south of 60 degrees' latitude; and
- Ships are not required under Canadian law to carry their own spill response.

WWF recommended the following based on the commissioned research:

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[175] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 110-111, lines 22-26 and 1-3.
[176] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 711, lines 15-17.

- As the people who know the environment and its resources best and who have the most to lose from damages caused by a spill, community members should have a greater role in decision-making that shapes the future of shipping. By consulting with communities and Indigenous organizations and by using both scientific and traditional knowledge, preferred shipping routes and areas to be avoided can be identified to reduce as much as possible conflicts with wildlife and important habitats.
- Phase out the use and carriage by ships of heavy fuel oil, the most hazardous, persistent, and difficult to clean up of any marine fuel in the Arctic.
- Develop community-based response plans.
- Local knowledge and engagement is essential for effective response, and in the Arctic, community members often act as first responders because of remoteness and weather.
- Increase funding for training of community responders.
- Invest in equipment and capacity in the North to align standards with the south. Permanent assistance vessels along shipping routes could be deployed in the shipping season and more equipment could be stockpiled along these corridors.
- Require ships transiting the Arctic to carry adequate response equipment on board.
- Ship crews should be trained to provide effective damage control and minor hull repairs.

*… who monitors once it gets going? As an Inuk, as a beneficiary of Nunavut, I am very worried that federal government and others might just sit back and let -- just let it go until something happens like Mexico. You have [an] oil spill, you know, and everybody jumps and gets moving and all that stuff.*

[B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p.92, lines 13-18.]

WWF also recommended that three (3) publications related to oil spill response research be reviewed for any future work conducted (see Appendix C: Recommended Documents). When describing its views, WWF noted the importance of effective spill response techniques and capacity and referenced many documents that supported its view. The Canadian Association of Petroleum Producers (CAPP) also recommended two (2) publications related to emergency preparedness and response be reviewed for future work conducted (see Appendix C).

WWF also indicated that Norway does not allow oil operations within the boundaries of the maximum annual sea ice extent in the Barents and Norwegian Seas, citing that there is currently no known technology or method that can recover oil from Arctic ice. WWF stressed that until oil recovery and cleanup technologies in icy waters have improved and the interaction of oil and ice is better understood, drilling in the eastern Canadian Arctic should not proceed. WWF urged that more knowledge is needed on the long-term behavior of oil in ice, on ice and under ice.

WWF also noted that the application of chemical dispersants can be toxic, sometimes more so than oil, and cold weather and the presence of ice can make it difficult to apply dispersants to oil slicks in the Arctic, as dispersants rely on ocean waves to mix the oil and chemicals together. As one of several response techniques, WWF acknowledged that the use of chemical dispersants may be necessary in certain circumstances; however, it should be remembered that effectiveness may be limited and dispersants may not produce a net environmental benefit. WWF also stressed that the potential ecological consequences of the physical and toxicological properties of dispersed oil are far from fully understood and more research is required to inform response plans in future oil spills. WWF therefore believes that the use of dispersants in the Arctic marine environment would only be possible in the summer, should never be used in sensitive environments and, in any case, would be limited in its effectiveness even when it is used.

WWF noted in its final written that vessel traffic in the Canadian Arctic is on the rise, which is increasing the risk to marine habitats. Conflicts with marine mammals, underwater noise, disturbance of ice habitat, heavy fuel oil, sewage and grey water, and oil spills are all part of the complex risk profile which shipping brings to the Arctic. WWF also noted that though the chances of shipping in the Arctic to result in a large-scale oil spill, the consequences of such a spill could be significant and potentially devastating, resulting in: contamination of important habitat for wildlife such as polar bears, walrus, seabirds and seals, as well as narwhals, belugas and bowhead whales; long-term destruction of fish habitat, a staple of the Arctic community and Indigenous diet; and wide-reaching contamination if oil gets trapped under sea ice and travels to communities hundreds of kilometres away.

WWF recommended that before proceeding with oil exploration in the Canadian Arctic, a comprehensive, collaborative, long-term Arctic oil spill research and development program needs to be established. The program should focus on understanding oil spill behavior in the Arctic marine environment, including the relationship between oil and sea ice formation and transport. It should also include an assessment of oil spill response technologies and logistics, improvements to forecasting models and associated data needs, and controlled field releases under realistic conditions for research purposes. Industry, academia, governments, NGOs and Indigenous organizations should be integrated into the program, with a focus on peer review and transparency.

WWF also noted that more knowledge of ice thickness, concentration and extent is essential for anticipating the likely behavior of oil in, under, and on ice and determining applicable response strategies, while high-quality bathymetry, nautical charting, and shoreline mapping data are needed for marine traffic management and oil spill response. From a biological perspective, understanding population dynamics and interconnections within the Arctic food web will enable the determination of key species that are most important to monitor if an oil spill occurs. WWF noted that additional research and development is needed to include meteorological-ocean-ice forecast model systems at high temporal and spatial resolutions, and to ensure better assimilation of traditional knowledge of sea state and ice behavior into forecasting models.

*…we can all agree that we prefer not to see an accident happen in the first place and not go down this road of liability and compensation. And, of course, compensating for the loss of livelihood or country food is very difficult to do, if not impossible to compensate for somebody's way of life.*

[M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 492, lines 8-13]

In response to WWF's request for clarification on what needs to be done in order to prepare communities to respond to oils spills (both minor and major), the NEB noted companies are required to have an emergency response plan prepared, and these plans must take into account possible damages to Inuit communities. For projects in the North. NEB noted that "*it would be expected that companies consult with the Inuit communities and develop those emergency response plans with those communities. So if there's a need for training, preparedness, equipment, anything that's required of a emergency response plan, that could be done in consultation with communities.*[177] CAPP was also questioned by WWF the capacity of individual operators to clean up oil spills in the Arctic, and CAPP responded by stating that the "*industry 's ability to clean up oil spills anywhere in the world is not going to be 100 percent effective, despite all of the potential recovery mechanisms available ... It's virtually impossible to clean up 100 percent of the oil spill.*"[178]

In response to questions about why having a second rig on hand in the event of a well blowout or the requirement to have capping stacks be onsite are not prescribed requirements for all operators, NEB noted that the requirements are not mandated under regulations applicable across the industry, but can be included as project-specific requirements. The NEB noted that in the Arctic, based on the timelines required to mobilize a rig to get a relief well drilled, "*in a practical sense* [there would] *have to be a second rig in the field*" and based on the intervention requirements and commitments by an operator, "*a capping stack would be required one way or another, if deemed necessary in that instance…*"[179]

In response to WWF's questions about whether Canada currently has the response capacity to deal with a major oil spill in the Canadian Arctic and who would be responsible, the NEB noted that that "[*w*]*ith respect to an offshore blowout in the Arctic, no, we're not ready*". The NEB also noted that if an operator were to be given an authorization, the operator would have to put in place significant financial assurances, response plans and immediate response capacity prior to drilling occurring. The Canadian Coast Guard (CCG), in response, indicated that "*if such a project will happen, of course, we expect the risk generator* [operator] *to do investment to make sure that there's enough response equipment. And as you described, this equipment could -- this capacity could not only be used for the offshore rig but could also be used for the transit vessel.*[180]

WWF also requested clarification whether the CCG believes that Arctic-specific regulations would be required given that the operating conditions in the Arctic are unique and presents a unique set of challenges. The NEB responded noting that the regulations are performance-based and that "*it is a[n] all-applicable-hazards approach to whatever the scenario is so -- and whatever the unique*

[177] Exchange between M. Brooks, World Wildlife Fund, and C. Wickenheiser, National Energy Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 493.
[178] P. Barnes, Canadian Association of Petroleum Producers, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp.635-636, lines 25-26 and 1-7.
[179] Exchange between M. Brooks, World Wildlife Fund, and K. Landra, National Energy Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 494-497.
[180] Exchange between M. Brooks, World Wildlife Fund, K. Landra, National Energy Board and M. Blouin, Canadian Coast Guard, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 497-500.

*environmental conditions are of the operating area.*"[181] The NIRB Board also requested clarification on preparedness and emergency response that needs to be ready once a company vessel is out on the water.[182]

Questions were also asked about responses to a well blow out, including:

- how the flow from a blow out would be stopped if it could not be capped;
- what would be required to repair the well and stop the leak;
- how long would it take to repair the well and stop the leak; and
- how fast could support arrive.

In response, NEB noted that there would be a requirement for a same-season relief well (second rig drilling down beside the wellbore) to be onsite and that it can take "*roughly, two to six weeks with kind of four weeks being the median*" for a relief well to stop the source of leak from a blowout. In addition, NEB noted "*if the capping stack is in the field and the vessel to actually place it is available and if it is safe to actually deploy a capping stack in that scenario, it could be installed within days of the -- of the incident. But we can't rely on the capping stack, because there are several scenarios in which it cannot be deployed in which the relief well is the only way to actually stop the source.*[183]

*It can take "roughly, two to six weeks" for a relief well to stop the source of leak from a blowout.*

[K. Landra, National Energy Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 505, lines 3-5.]

During the Final Public Meeting, in response to questions by parties on the minimum or best-practice time for a spill response, the NEB noted that there are various tiers of ability to respond depending on the type of spill, the sea state and other restraints. NEB noted that Tier 1 would be that immediate response capability is available at the scene of the activity. Any standby vessels and support vessels would be required to respond within 20 minutes and would be required to deploy absorbent booms, side-sweep type of spill response, etc. Tier 2 would bring additional national response capabilities, such as organizations like the East Coast Response Corporation, and Coast Guard. Tier 3 triggers a global response, where the global network of spill response organizations such as Oil Spill Response Limited out of the United Kingdom would respond to the spill.[184]

The Ikajutit (Arctic Bay) Hunters and Trappers Organization (Ikajutit HTO) indicated in its final written submission that, in their view oil drilling is too risky and the impacts from potential spills would be too great. The Ikajutit HTO questioned whether there would be compensation for loss

[181] Exchange between M. Brooks, World Wildlife Fund, and K. Landra, National Energy Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 501-502, lines 2-6, 15-26 and 1-4.
[182] E. Copland, NIRB Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 502, lines 22-25.
[183] Exchange between J. Kango, Arctic Bay, E. Copland, NIRB Board and K. Landra, National Energy Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 503-505.
[184] Exchange between S. Lonsdale, Qikiqtani Inuit Association, A. Cyr-Parent, Government of Nunavut, and K. Landra, National Energy Board, NIRB Final Public Meeting File. 17SN034, Transcript, March 20, 2019, pp. 475-478.

of food in the event of a spill and asked whether the compensation would account for long term impacts. The HTO also noted that the Canadian Coast Guard is not prepared to handle major oil spills and that oil spills are difficult to clean in ice, which would require an ice-specific response plan(s).

The Mittimatalik (Pond Inlet) HTO (Mitimatalik HTO) noted in its final written submissions that there was a study on oil spill impacts completed near Cape Hatt that indicated that the sensitive benthic areas never recovered following the spill, and questioned whether the NIRB will be including the information from this study in the report. The HTO also stressed that there are other areas that have never been studied but should be assessed before any oil and gas development proceeds.

The Nangmautaq (Clyde River) HTO (Nagmautaq HTO) noted in its public written comments that more information would be required on the effectiveness of oil spill response in the Arctic and spill response capacity, particularly when sea ice is involved. The HTO stressed that there is always a possibility of major incidents in the form of oil well blowouts and shipping accidents. Extreme weather, winds, and icebergs make the Arctic an extremely challenging environment to effectively respond to and clean up oil spills. The HTO indicated that it did not feel that spill response capacity in the Arctic is adequate to handle any serious spills or accidents and noted that the community does not currently have the resources, equipment and training to respond to a major spill. The HTO recommended that a robust and effective spill response regime should be developed and put in place before oil and gas exploration and drilling activities take place that includes notification to communities, implementation of spill prevention measures, establishing spill response capacity, related infrastructure, equipment and technology.

*We all take risk. This oil exploration is a risk. I'm taking risk as Inuk, as a beneficiary to the land claim. I'm going to have to weigh the balance for my great-great-grandchildren whether it's right or wrong, and I need the support of -- excuse me -- Energy Board to accommodate my lifestyle and also the way that we live. And also, NGOs and everyone in this room need to -- even though there's money in the top end of the whole thing for the companies, but it's my lifestyle that we're playing with. It's my daily life. It's my children's country food that we're playing with.*

[B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 511, lines 2-13.]

The Resolute Hunters and Trappers Association (Resolute HTA) expressed concern in its public written comments with respect to the potential for oil spills to occur and the impacts a spill would have on marine animals. The HTO noted concern with the lack of research conducted on spill prevention, especially for major spills or blowouts, noting that it would be very difficult, and maybe impossible, to clean up a major oil spill in the Arctic.

During the Final Public Meeting, a Community Representative from Iqaluit noted concern about who would be responsible for monitoring oil and gas development activities, and identified that there is a lack of capacity for the federal government to respond to spills and a lack of monitoring of icebreakers and spills.[185] In response to a question on whether the Canadian Coast Guard has requested response assistance from outside Canada or support for studies related to oil spills, it was noted

[185] B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 92, lines 5-18.

that DFO has international agreements to obtain support from other countries and all available scientific or emergency response capability is available if ever required.[186]

A Community Representative from Pangnirtung questioned Nunami Stantec regarding whether an oil spill or leak could spread from the north and mix with multi-year ice that converges in specific areas where migrating marine mammals may also be converging.[187] Nunami Stantec, Environment and Climate Change Canada, and Fisheries and Oceans Canada did not have a response to this question. Another Representative form Pangnirtung asked whether or not studies have been done to determine if capping stacks would be strong enough to prevent a huge spill and blowout and whether they can be used in the Arctic; referencing the accident in the Gulf of Mexico as an example.[188] In response, Nunami Stantec noted that the capping stacks are meant to be used as a last resort, and was unsure whether these have been tested in the Arctic.[189]

During the Final Public Meeting, many Community Representatives noted concern with respect to the potential impacts from oil spills and had questions on who would be responsible for the cleanup:

> *While we're here, we would like to get more information before the gas or if -- before the accidents do happen or cause oil spill. Like, for example, these things could happen, then our responsibility for cleaning. We won't -- we have no access, but if something should happen, everyone's going to be impacted, especially Inuit…If there is an oil spill, what will we do?*[190]
>
> *…if there were to be an oil spill how emergency response would come into play, who would do it. No one has said that we are going to be responsible for the cleanup. Yesterday we heard that there isn't too -- too much funding available to help with the cleanup should there be a spill to occur around -- around our region.*[191]
>
> *And if I have to inform -- knowing -- and that there should be an oil spill now or explosion in the ocean with the oil and gas, this is urgent. This is emergency, and there's explosion underneath the ocean…Have to ask you now, there's explosion; it's emergency; who will get going in the dealing with the explosion? … we -- these*

[186] Exchange between J. Metuq, Qikiqtarjuaq and M. Blouin, Canadian Coast Guard, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 423-424, lines 24-26 and 1.
[187] S. Keenainak, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 75, lines 17-25.
[188] H. Oshutapik, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 108, lines 2-18.
[189] J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 108-109, lines 20-26 and 1-6.
[190] H. Oshutapik, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 107, lines 11-17, 25.
[191] J. Kango, Arctic Bay, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 192, lines 11-17.

*have to be prepared well ahead of time for emergency cases, and they need to be dealt with as soon as possible.*[192]

*If there's drilling, so far, to date, there's no assurance that there's going to be safety concerns met if there's a blowout.*[193]

*…there was an oil spill by a company -- by BP Oil. And, later on, there was an impact to the tiger fish -- or the tiger shrimp with no eyes.*[194]

*…if there was a blowout, it would probably take a long time to do a proper cleanup, especially in the wintertime. I'm thinking about my children and grandchildren and my great-grandchildren. Now, if there was an impact to our wildlife, how long would -- how would -- how long would it take to restore the habitat and the environment? How long can it be restored after oil spills? I'm looking at least over a hundred years,… We don't want our grandchildren, their grandchildren to wait 100, 200 years before it comes back to normal. Will it come back to normal? We don't know that. It's a gamble.*[195]

*If there were to be an accident or malfunction, the CIRNAC and the emergency measures would be -- will not be able to act quick enough to respond to any accidents or malfunctions*.[196]

*How will the Coast Guard and the government prepare for oil and gas activity? What needs to be done to ensure that it can be safe? We know that oil spills in ice are difficult to clean up. Booms won't work; so there is a need for ice-specific response plan…*[197]

The NIRB Board asked a clarification question on what a spill of natural gas would look like, i.e. whether it would be visible and distinguishable like an oil spill.[198] The NIRB Board also requested clarification about whether a company could continue to hold a licence for up to 20 years if there

[192] S. Keenainak, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 208, lines 5-9, 10-12, 14-16.
[193] L. Audlaluk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 282, lines 10-13.
[194] J. Metuq, Qiqitarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 423, lines 11-14.
[195] B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 509, lines 5-13 and 16-18.
[196] L. Audlaluk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 812, lines 4-7.
[197] J. Kiuktak, Ikajutit (Arctic Bay), NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p.744, lines 6-11.
[198] K. Kaluraq, NIRB Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 82, lines 22-26.

has been spills or the company is not in compliance.[199] Nunami Stantec noted that there would be constant regulation by the regulatory authority, to ensure safety.[200]

The NIRB Board also requested clarification on whether compensation for wildlife loss from vessel strikes or other accidents has been discussed.[201]

> *It's a different environment than what you saw in Mexico or any other warm place. This is totally different. We don't need to have other eastern side of Canada regulation fits in the Arctic. It's not -- it's not like that. It's different….There has to be a separate regulation. And I'm sure Energy Board will work on a new regulation before two years is up.*
>
> [B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 511-512, lines 17-21, 26 and 1-2.]

Following the GN's presentation, the NIRB Board requested clarification on how the GN would ensure that infrastructure necessary to respond to accidents and malfunctions would be built in advance of oil and gas development activities proceeding.[202] In response, the GN noted that all infrastructure, including emergency response infrastructure would require a thorough review of the infrastructure to determine the impacts to both the land and the ocean.[203] In response to the NIRB Board's questioning about whether the current spill response regime is built on the existing infrastructure in communities, or whether steps would be required to identify infrastructure to handle spills, the NEB noted that the spill response regime is built on the existing infrastructure and that the company proposing the project would be responsible to develop spill response plans which would include consideration of the existing infrastructures.[204]

In response to the NIRB Board's question on the hypothetical spill model presented by WWF during its presentation at the Final Public Meeting, WWF indicated that the model was based on an oil spill that resulted from a major accident or major blowout that would release oil continuously for 34 days with no response and would be considered a basically worst-case scenario.[205]

[199] G. Alikut, NIRB Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, p. 88, lines 6-12.
[200] J. Beckett, Nunami Stantec, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 88-89, lines 24-26 and 1-2.
[201] P. (Omingmakyok) Kadlun, NIRB Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 18, 2019, pp. 104-105, lines 22-26 and 1.
[202] A. Maghagak, NIRB Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 227-228, lines 25-26 and 1-5.
[203] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 19, 2019, p. 228, lines 9-24.
[204] Exchange between P. Omingmakyok (Kadlun), NIRB Board and K. Landra, National Energy Board, NIRB Final Public Meeting File. 17SN034, Transcript, March 20, 2019, pp. 554-556, lines 17-22 and 25-26, 1-8.
[205] M. Brooks, World Wildlife Fund, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 737, lines 17-25.

## 8.4. VIEWS OF THE BOARD

As was expressed through many of the comments provided by parties, the Board is similarly concerned with the potential for accidents and malfunctions that may occur from the development of oil and gas in Baffin Bay and Davis Strait. Many commenters referenced well-known international disasters associated with oil and gas development, including the Exxon Valdez oil spill of 1989 in Alaska and the Deepwater Horizon oil spill of 2010 in the Gulf of Mexico; these incidents continue to contribute significantly to public awareness and concern about the risks associated with production and transport of oil in the marine environment.

Commenting parties frequently stressed how the unique operating environment of Baffin Bay and Davis Strait would further exacerbate the risks of oil and gas development. The Board recognizes the limitations inherent in assessing risks and impacts associated with accidents and malfunctions such as oil spills or well blow outs based on hypothetical development scenarios. In contrast to project-specific assessments, there are many high-level assumptions associated with identifying and assessing potential effects. The Board rejects the assertion of Greenpeace Canada (Greenpeace) and the World Wildlife Fund (WWF) that the development scenarios and associated effects assessment by Nunami Stantec were not objective because the reports were informed by consultations with the oil and gas development industry and the current industry regulator to identify current industry practices, technology, and experience. The assessment of potential effects associated with the development scenarios was completed independently of the industry engagement required to identify the development scenarios used for this assessment, and industry did not "color" or otherwise shape the conclusions expressed within assessment of effects. The Board is confident that the Nunami Stantec reports were based on objective and reasonable assumptions required to assess the benefits and risks of a range of oil and gas development activities.

In addition, many participants in the SEA provided feedback providing their views about the limitations of the reports, and this feedback has been considered by the Board to develop the recommendations contained in this report. For example, the Board agrees that building in consideration of additional academic sources and the work of independent research institutions and developing understanding of the challenges in transporting specialized equipment to remote areas would be helpful for future assessments. The Board also echoes the observations of many participants in the SEA that although oil and gas development itself is not new to the Arctic, there are unique challenges associated with the environment in Baffin Bay and Davis Strait specifically, including ice conditions, the harsh climate, the species present, and the way of life of surrounding communities, which warrant careful consideration.

Accidents or malfunctions may occur owing to many factors including equipment malfunctions, extreme weather or human error. The risks of accidents and malfunctions associated with oil and gas development may be addressed through various instruments such as regulatory requirements, operating procedures, management and mitigation plans and regulatory oversight. However, the assessment of the significance and acceptability of these risks can only be fully understood when evaluated against the values of the potentially-affected communities. As also discussed in Volume 2, Chapter 4.2 Spill Response Regime the Board recognizes that several key areas of deficiency in terms of information gaps, uncertainty, and a lack of readiness that must be addressed before the potential for, extent of, and acceptability of adverse effects associated with accidents and malfunctions resulting from oil and gas development activities in the region can be understood.

Specifically, the Board finds that:

- further research is required to demonstrate that oil spilled in icy conditions can be recovered successfully with existing technologies prior to environmental damage occurring;
- significant investments in infrastructure and spill response capacity in the region are required before the region would have capacity to respond to accidents and malfunctions associated with oil and gas development even at the preliminary initial exploration and development stages; and
- baseline research is needed before the effects of oil spills can be meaningfully described and understood.

The Board heard numerous times throughout the assessment and at the Final Public Meeting that community members feel under-equipped and unprepared to implement the emergency preparedness and response measures necessary to respond effectively to an accident in their local marine environment. Community Representatives commented on the need for additional support, supplies, and training programs for communities to assist them as a first line of defence in emergency response, in addition to the requirements to construct the additional infrastructure necessary to mount a rapid. During the Final Public Meeting, a Board Member noted there are no emergency measures in place in the communities to assist with cleanups and that the available technologies may not be right for the North considering the extreme cold and weather. The Board Member emphasized that studies should be conducted on accidents and malfunctions in extreme, cold weather.[206] The Board is intimately aware of the current infrastructure deficit in Nunavut communities and has, in the course of other assessments, recommended that more effort is necessary to better address risks associated with current (and increasing) levels of shipping in the Area of Focus. The Board is concerned that without significant improvements to the emergency response capability in the region, allowing oil and gas production activities to proceed could exponentially increase the magnitude of risk and potential effects associated with an accident or malfunction in the marine environment.

The Board recognizes, as identified by several participants, that there are other areas in Canada and internationally that have considerable experience with emergency response planning, prevention, response and mitigation in the oil and gas development industry and in the offshore environment. The Board endorses the recommendations of parties during the SEA that the parties responsible for emergency response in the Area of Focus, including the potentially affected communities, should seek out contact with the emergency response agencies in other areas to assess the effectiveness of approaches employed in other regions.

With respect to the potential for impacts and effects from accidents and malfunctions on the environment, the Board heard significant concerns expressed by parties and community members

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[206] U. Puqiqnak, NIRB Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 234-236, lines 26. 1-26, and 1.

throughout the SEA and during the Final Public Meeting. As a reflection of the breadth of these concerns and the interconnectedness of issues and environmental components, the subject of accidents and malfunctions have been discussed throughout this Report. For further discussions on compensation, see Volume 2, Chapter 4.1: Applicable Regulatory, Royalty and Benefit Regimes; Volume 2, Chapter 4.2 Spill Response Regime and for potential effects on the physical, biological and human environment see Chapter 7.1, Chapter 7.2 and Chapter 7.3, respectively.

Preservation of the ecological integrity of Baffin Bay and Davis Strait is vital not only to a myriad of terrestrial and marine wildlife species, but also to the health of the people of the region, their culture, and economies. The Board heard clearly how Inuit culture throughout the Area of Focus is fundamentally rooted and interconnected in relationships with the marine environment; a loss of access to the marine environment resulting from accidents associated caused by oil and gas development would be catastrophic for both current and future generations of Inuit. The Board agrees that Inuit could not be effectively compensated for such losses by <u>any mechanism</u>. Commercial fisheries and tourism are important facets of Nunavut's economy at present, with recognized potential to increase through time, and the effects of accidents and malfunctions from oil and gas development on these sectors warrants further consideration. Finally, in the Board's view, the intrinsic value of the natural environment, including the many areas with recognized importance as wildlife habitat within the Area of Focus, require assessment, identification and the imposition of sufficient protections to ensure their continuance. The Board believes that what has been learned through this assessment regarding the uncertainties and lack of readiness to respond to potential accidents and malfunctions from oil and gas development only highlights how much more remains to be learned and how much more remains to be done. As has been emphasized throughout this report, the Board strongly encourages responsible parties to invest in research to improve both the understanding of the ecosystem of Baffin Bay and Davis Strait and the capacity of the region to respond to changes in the environment moving forward.

The Board has carefully considered the identified information gaps and areas of uncertainty relating to accidents and malfunctions, as well as the recommendations of participants and the comments, concerns, and knowledge shared by community members throughout the SEA, including at the Final Public Meeting. Having assessed what feasible and practical actions can be taken over time, the Board offers the following recommendations addressing baseline research; consultation, co-ordination, and public engagement; and impact modelling, mapping, and predictions:

***Recommendations to address irrespective of the current moratorium***:

- Assemble available information on emergency preparedness and response, including:
    - current regulatory oversight and responsibilities;
    - current and required response capabilities for the Area of Focus;
    - spill response technologies applicable to the Arctic (in both ice and open water);
    - emergency response infrastructure; and
    - best practices and measures for emergency prevention and response (#29).

- All parties with responsibilities for emergency response in the Area of Focus, including the communities in the region, should establish relationships with other circumpolar nations and transboundary groups to support active and timely coordination with these groups to enhance transboundary emergency preparedness and response capabilities (#5).

***Recommendations to address prior to lifting the current moratorium:***

- Conduct baseline research to assess the capacity and infrastructure required to manage and respond to a well blowout or major spill in the Arctic and to determine whether an effective response can be mounted in remote locations under harsh weather conditions with periods of prolonged darkness and in the presence of ice (#32).
- Conduct baseline studies to understand potential effects of an oil or gas spill/release on:
    - the Arctic environment and wildlife (including migratory species of marine fish, waterbirds and marine mammals),
    - the Inuit way of life, and northern economy, including tourism and fisheries, and food security; and
    - preparedness for handling any spills that could occur.

  Studies should consider potential effects of oil or gas spill/release under-ice and during the open water season (#54).

***Recommendations to address should the current moratorium be lifted***:

- In consultation with community members and Inuit knowledge holders, oil and gas developers should identify sensitive or important shorelines that could be impacted by spills, accidents, or other malfunctions associated with proposed oil and gas developments and project-shipping. When areas have been identified, oil and gas developers should ensure that spill plans incorporate this information and address community concerns, including items such as shipping restrictions during critical life cycle processes for marine wildlife (such as marine fish, waterbirds, and marine mammals) (#79).
- In the development of emergency response plans, spill contingency and prevention plans, standard operating procedures, etc. and in the design of impact mitigation measures, oil and gas developers should incorporate lessons learned from accidents and malfunctions in similar jurisdictions, including associated standard operating procedures and impact mitigation measures (#63).

In addition, as identified in the Board's recommendations described under Volume 2, Chapter 4.2 Spill Response Regime, the Board has recommended the development of a research and evaluation program that can include evaluating the effectiveness of spill response methods, equipment and technology in the Arctic environment (#55).

# CHAPTER 9: OTHER MATTERS

## 9.1. OTHER MATTERS CONSIDERED BY THE BOARD

In addition to the environmental and socio-economic matters typically considered by the Board during an assessment, and presented in the preceding sections of the Report, there were also several questions and comments provided to the Board about the processes and procedures that will follow the NIRB's submission of the Final SEA Report. As summarized below, the Board heard questions about next steps following the conclusion of the SEA and also received recommendations from participants, particularly community members, regarding improvements to the approaches of regulatory authorities to consultation and reporting back to communities. This Chapter outlines these other matters and provides the basis for the Board's recommendations in relation to communication and consultation and suggested improvements to regulatory processes.

### 9.1.1 *Next Steps*

Throughout the SEA and during the Final Public Meeting, many parties had questions regarding the steps that would occur following the completion of the SEA, including how the Board's Final SEA Report and recommendations would be considered by the Minister of Crown-Indigenous Relations and Northern Affairs. Within its final written submission and during the Final Public Meeting, the Government of Nunavut (GN) noted that "it would be useful for the Final SEA Report to recommend next steps of the 5-year moratorium review process, including roles and responsibilities for governments (federal and Nunavut), Inuit organizations, and other relevant stakeholders during this review, and opportunities for community engagement and/or involvement in decision-making". The GN made recommendations to the Government of Canada regarding the development of a plan for undertaking research required to fill knowledge gaps associated with oil and gas development in the Arctic. The GN further recommended additional information be provided about regulatory and community involvement and engagement in the 5-year moratorium review process.

> *In terms of some of these other bodies of information or datasets that you're talking about, we see this as kind of a living process that as more information is generated and collected and analyzed that it actually becomes part of this record somehow. And we talked earlier about -- and I might be getting this wrong -- but an atlas of some sort.*
>
> [B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 225, lines 15-21.]

In response to questions raised by the World Wildlife Fund and NIRB staff during the Final Public Meeting, the GN commented on the need to fill identified information gaps, noting:

> *Obviously – obviously, the more information we have and the quicker we have it, the -- the better it's going to be. But we have no illusions that we're not going to -- that we're going to be able to fill all the gaps as quickly as we want. But I think a concerted effort by -- by everybody to understand what these gaps are and to work towards filling them is important here. And -- and probably that's one of the main benefits, I think, of this whole process, has been the collaboration between all the -*

*- all the stakeholders that have participated in this -- in this process. And -- and we're hopeful that that collaboration will continue in -- in filling some of these science gaps or, whatever, socioeconomic gaps, understanding as we move forward.* [207]

*In terms of some of these other bodies of information or datasets that you're talking about, we see this as kind of a living process that as more information is generated and collected and analyzed that it actually becomes part of this record somehow. And we talked earlier about -- and I might be getting this wrong -- but an atlas of some sort. But there's also the process issues and et cetera. So this is the start, and -- and we have to be able to adapt and to be able to collect all the information, all the process material that we need, to continue this to be meaningful process for everybody concerned.*[208]

With regards to steps that should be taken following the Board's issuance of the Final SEA Report and recommendations, the Qikiqtani Inuit Association similarly noted during the Final Public Meeting:

*…once this report is put forward and these recommendations are made by the Board, then the next step would be to decide, okay, then how do we go -- how do we follow through with actually conducting this research or following through with these recommendations. And at that point, I think that's when that conversation will start.*[209]

*the Qikiqtani Inuit Association just really wants Inuit to be involved, directly involved, in any decisions that may affect Inuit wildlife, Inuit cultural values, any opportunities. And at the moment, it does not seem like the benefits from oil and gas would outweigh the potential impacts. And that's kind of the message that we wanted to leave with.*[210]

At the Final Public Meeting, community representatives also noted that significant follow up work would need to be done to address gaps in information both related to offshore oil and gas development and the environmental and socio-economic baseline conditions in the region in general:

*I'm just bringing up the fact that many parties have identified a lot of gaps in information, even those few parties that have expressed that they could conditionally support oil and gas development have only done so recognizing that there would be many -- much more research and much information still to be supplied. And many more parties that have expressed they would not like to see oil*

[207] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 19, 2019, p. 191, lines 10-24.
[208] B. MacIsaac, Government of Nunavut, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 19, 2019, p. 225, lines 15-26.
[209] R. D'Orazio, Qikiqtani Inuit Association, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 19, 2019, pp. 337-338, lines 24-26 and 1-4.
[210] R. D'Orazio, Qikiqtani Inuit Association, NIRB Final Public Meeting File No.: 17SN034 Transcript, March 22, 2019, pp. 911-912, lines 25-26 and 1-5.

> *and gas development proceed have also identified a lot of information gaps and areas where research conducted by the Government of Canada could be improved or focused in a way that benefits Nunavut and Inuit communities. So I think the Board's been receiving this feedback, taking a lot of notes, and we'll be able to bring these recommendations forward to the government for consideration in any future decision-making. And I think much of that might be broader than just decisions around oil and gas development. It could be research priorities and agendas and areas where further work is needed, regardless of oil and gas as well.*[211]

The Board also noted that communities should play a significant role in setting future priorities for research in the region. As observed by a Community Representative from Resolute, this approach is not typical of research previously conducted in the region:

> *…I'm saying make sure these researchers listen to us, because it's been too long that, the researchers, they only want PhD, to come up and learn and using our environment as learning technique. Thank you for all the things we heard. And the things we want to be researched, they should be prioritized.*[212]

A Community Representative from Qikiqtarjuaq and member of the Inuit Qaujimajatuqangit Committee established through the QIA's Inuit Qaujimajatuqangit study also questioned the extent to which regulators, such as the NEB intends to use Inuit Qaujimajatuqangit and Inuit Qaujimaningit in the regulatory process going forward:

> *There's a disconnect between IQ committee and you. How is -- how are you going to include IQ as part of your regime? IQ, and I'm in that committee, but I don't feel you. So -- and because of that, as the IQ committee, if it's going to be included in part of the overall regime while there's -- during cleanups, will you be working closely with the IQ committees? Even though it's written on paper, we are voiceless. So in order for us to have a voice, you need to work with us. And, also, you say you have plans for our future. Are you willing to work with us? Are you willing to listen to us? Are you willing to try and understand where we are coming from? Or are you just going to make us voiceless like we have been voiceless for so long? We tend to think that our title is up there, but then it's just for show.*[213]

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[211] J. Amagoalik, Resolute, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p.830, lines 5-25.
[212] J. Amagoalik, Resolute, NIRB Final Public Meeting File No. 17SN034 Transcript, March 22, 2019, p. 886, lines 19-25.
[213] L. Kooneeliusie, Qikiqtarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, p. 520, lines 1-16.

*...prior to the oil and gas development your willingness to engage with the natural guardians of the land with issues that needs to be resolved such as environmental impacts and to ensure safety of marine species and how our elders/leaders could offer great wealth by collaborating with -- ... what we have to offer through Inuit knowledge.*

[ J. Metuq, Qikiqtarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 802, lines 11-19..]

*I'd like to see -- anyone else in here, for that matter, I'd like to see more communications between us. The question that I had to you, you did not answer my question. But you spoke in generalities. But for all of us, we would like you to speak to all of us and not just to -- to different – different departments. Or we are -- you are speaking in terms like we're from other planets.*

[L. Kooneeliusie, Qikiqtarjuaq, NIRB Final Public Meeting Transcript, File No. 17SN034, p. 522, lines 13-20.]

The NEB noted in response that it has established an enhanced Indigenous engagement program to collect input for decision-making and provided examples of working with local Indigenous communities and First Nations in the Northwest Territories.[214]

Recommendations from a Clyde River Community Representative read into the record at the Final Public Meeting suggested the following:

> *... an office set up by the oil and gas industry in the community and the other impacted communities to have a physical office and a coordinator. ... we need to directly talk to the industry, and David would like to see them coming into communities to hear concerns and views and questions from all community members to have a better, a bigger holistic understanding of how the Inuit population feels about the oil and gas industry and about job opportunities and for the cultural identity to not have that be put in a dangerous situation.*[215]

Community Representatives also noted the importance of ensuring that Inuit knowledge holders are consulted and involved directly in subsequent regulatory processes, as follows:

> *... before there are any -- before there any decisions made, please harness our elders, because they have a lot of knowledge. Go to our elders and have meetings with them, because they have a vast pool of knowledge. They're wise.*[216]

In response to questions raised by the QIA during the Final Public Meeting, CIRNAC identified the next steps following the receipt of the NIRB's Final SEA Report and recommendations:

- the Minister will issue an initial response;

[214] B. Chambers, National Energy Board, NIRB Final Public Meeting File No. 17SN034 Transcript, March 20, 2019, pp. 520-521.
[215] S. Lonsdale, Qikiqtani Inuit Association on behalf of D. Iqaqrialu, Clyde River, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 794-795, lines 25-26, 1, and 10-17.
[216] J. Keeyookta, Qiqiktarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 22, 2019, p. 889, lines 18-22.

- the Board's recommendations will be used to support the next steps in the government's five (5) year review of the moratorium; and
- the government will consider the recommendations to identify additional work that is to be done.[217]

In response to a question from NIRB staff related to specific recommendations that the GN identified as necessary to be fulfilled prior to any decisions being made, CIRNAC noted that while it would be unlikely that all of the recommendations provided could be addressed, the implementation of each recommendation would be considered by CIRNAC on an individual basis.[218]

### 9.1.2 *Reporting Mechanisms*

Throughout the Final Public Meeting, many agencies were asked about if, and how, they report research findings/decisions back to the communities, with a particular focus on the types of engagement undertaken, and materials used to support these activities. There was a general acknowledgment of the importance of keeping community members informed of activities and research being conducted in their areas and also making the results of those studies available and accessible. In general, there was a clear acknowledgment of the need to improve the reporting mechanisms back to communities:

> *I know there is always evolving and ongoing efforts from scientists, you know, with the wildlife researchers, with the -- there's the area co-management committees for all of the migratory bird protected areas that engages with the HTOs and the community members, but I think we -- we could always do a better job, and there's always ongoing discussions. And I will bring that message back with me to my colleagues for -- look for ways for improved communication.*[219]

> *I think we have been trying to improve communication -- based on your comment, clearly not sufficiently. So we will continue to endeavor to do that. A lot of the way we bring information back depends on how it's gathered and why it's gathered.*[220]

The NIRB Board similarly asked how information and feedback provided by communities during the SEA would be used to inform program delivery through the newly established Arctic Region for Fisheries and Oceans Canada (DFO) and the Canadian Coast Guard. DFO noted that it was important that the priorities of the new regional office align and reflect the priorities of the

[217] M. Hopkins, Crown-Indigenous Relations and Northern Affairs Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 370-372.
[218] M. Hopkins, Crown-Indigenous Relations and Northern Affairs Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 376-377.
[219] B. Summerfield, Environment and Climate Change Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, page 418, lines 14-23.
[220] A. Doherty, Fisheries and Oceans Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, p. 419, lines 1-6.

communities.[221] The Canadian Coast Guard echoed similar sentiments and noted that public engagement with local governments and communities is being used to identify regional needs of marine users and determine how to provide better services.[222]

### 9.1.3 *Overall Conclusions from Communities Regarding the Moratorium*

At the Board's request, Community Representatives at the Final Public Meeting shared their concluding thoughts with the Board about the moratorium:

> *I will not regret that we oppose the -- we don't apologize to the oil industry. We have rights in terms of the waters between here and Greenland, Baffin Bay. We know and feel that there needs to be a moratorium. I think in two years it will still, once again, not fully be closed. I think there's too many risks …*[223]

> *It's -- it's our farm out there. We got beautiful habitat. We've got nurseries in this area for all species, coastal areas. For us and I hope most of you in this room, it's a no go.*[224]

> *However, overall, if we had our say, there would be no seismic testing in all – in Baffin Bay.*[225]

> *They say that their community needs jobs, and they are not opposed to development; however, oil and gas activities pose significant risk to our community. Therefore, certain conditions must be met before the Clyde River HTO can support oil and gas activities in Baffin Bay and Davis Strait. The HTO states that until these conditions are met they can not support offshore oil and gas in the Arctic, and they believe the government moratorium should remain in place. … More research is needed on the following subjects and the delegates are well aware of those areas. It includes marine wildlife population and location, the impact of seismic testing and oil spills on marine marine wildlife, and the effectiveness of oil spill response in the Arctic, particularly when sea ice is involved.* [226]

> *Elders have noticed that previous seismic program had impacts on marine animals such as seals, who couldn't get into the water through breathing holes because of the sound were too loud for them to be in the water. Even when people approached*

[221] A. Doherty, Fisheries and Oceans Canada, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 419-420.
[222] M. Blouin, Canadian Coast Guard, NIRB Final Public Meeting File No. 17SN034 Transcript, March 19, 2019, pp. 419-421.
[223] L. Audlaluk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 732, lines 11-16.
[224] B. Kovic, Iqaluit, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 717, lines 20-24.
[225] J. Kiguktak, Arctic Bay, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 734, lines 12-13.
[226] J. Price, Qikiqtaaluk Wildlife Board, reading the submissions of the Nangmautaq (Clyde River) Hunters and Trappers Organization into the record at the Final Public Meeting, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 787-788, lines 5-13 and 14-20.

*the seals on the ice, they would stay where they were if there were ships and noise in the area. For these reasons, we cannot support seismic blasting program in our area.*[227]

*If there is no compensation, we want to see the moratorium stay for another 30 years.*[228]

*And we don't want to see the exploration open up. So I think we should proceed cautiously and not proceed fast.*[229]

*And based on Inuit Qaujimajatuqangit committee work that I'm doing, I too have learnt. I too don't mind a delay in this process that we're talking. I think from the biggest to the smallest wildlife in the water, we have discuss. And if this was to proceed, it wouldn't be right.*[230]

*I don't think we're ready for oil and gas development right now.*[231]

*With that, I would also like to add our state of economics in the readiness in the communities. I can say for certain this is too early. As I mentioned in some of -- as was mentioned in some of the presentation, we have no infrastructure going back to hierarchy law the presenters stating the economic benefits. I would like to respond and say that this is not economic development.*[232]

*From what I heard during these meetings, I think we're not prepared enough and we haven't planned well in advance yet. Right now, the regulators have to look for ways to mitigate any potential risks that may occur.*[233]

*So just to make a short statement, no, we are not prepared. I don't think anyone is prepared right now to sacrifice an area in the name of industry.*[234]

[227] J. Kiguktak, Ikajutit (Arctic Bay) HTO, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 742, lines 18-25.
[228] J. Kiguktak, Ikajutit (Arctic Bay) Hunters and Trappers Organization, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 743, lines 24-25.
[229] L. Ningiuk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 763, lines 24-26.
[230] Q. Oyukuluk, Arctic Bay, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 765, lines 12-17.
[231] S. Keenainak, Pangnirtung, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 799-800, lines 26 and 1.
[232] J. Metuq, Qikiqtarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 805, lines 1-8.
[233] L. Audlaluk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 811-812, lines 26 and 1-4.
[234] L. Audlaluk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 814, lines 18-20.

*Let's think about the environment because it's tangible. The marine areas are more important. They are -- we need to ensure that there are -- are no impacts to the marine areas. I think we should say no to development right now in regards to oil and gas development. And I think for those of us sitting around here I hear more people saying no. Let's not hurry. I think we should deal with this sort of development … From what we see and about climate change, it's -- it's -- it's too early. I think there -- the moratorium, five-year moratorium should stand as is.*[235]

*The Inuit Qaujimajatuqangit is valuable. How can we use this in this area? This is a good question to ask ourselves. And to use the Inuk-thinking process it's different from the white man thinking process. And to hear the voices around the table, they would rather see a delay. That is what I wanted to mention to the Board. We -- myself would like more opportunity. I think we're just starting to learn about this.*[236]

*And I'm representing the hamlet council, and I went to ask people locally and they said no to this oil and gas development because we're going to be impacted greatly.*[237]

*Let it be known all of the communities are saying no to lifting the moratorium. I think that's pretty clear right now.*[238]

*I'm representing the people, and I want to relay to you the hunters, especially. I went to ask them as to what they think about this issue. And our area is going to be impacted a great deal and the water is going back and forth through this strait. And – and there's old ice and also icebergs move around, and they said it -- it's going to impact not only the marine mammals but also other animals will be impacted on the land. They will be impacted greatly, and we want to say no to the development.*[239]

*It's understandable now for the people that are here for the meeting that they want to delay the moratorium. I'm also agreeable with them because I'm an Inuk as well.*[240]

[235] L. Ningiuk, Grise Fiord, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 816, lines 11-19 and 23-26.
[236] L. Kooneeliusie, Qikiqtarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 818, lines 2-10.
[237] M. Idlout, Resolute, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 833, lines 14-17.
[238] J. Keyookta, Qikiqtarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 865, lines 1-3.
[239] M. Idlout, Resolute, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 832, lines 3-22.
[240] M. Savearjuk Jaw, Cape Dorset, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, p. 834, lines 7-10.

*If there's an oil spill in the fall, while the currents are moving, it would be disastrous for the new seal pups to survive. Everything, all sea mammals, all the communities would be impacted, and we wouldn't be able to help to clean up. So I'm saying no to lifting the moratorium. We don't live like our southern counterparts. We have no way of helping.*[241]

## 9.2. VIEWS OF THE BOARD

Throughout the SEA it was clear that the communities in Baffin Bay and Davis Strait did not feel they had been adequately consulted about:

- research that was previously conducted, or that is on-going in the Area of Focus;
- previous decision-making processes that led to the approval of oil and gas development activities in the Area of Focus; and
- the decision-making processes leading up to the placement of the moratorium in 2016.

The Board also heard that previous regulatory and research processes have not generally involved Inuit knowledge and rights holders or meaningfully considered Inuit Qaujimajatuqangit and Inuit Qaujimaningit. The Board also considered that there are other Arctic and offshore regions within Canada and internationally that may have greater knowledge and experience with the effects of offshore oil and gas developments that may be willing to share their knowledge, experience, and best practices with potentially affected communities.

In the design and conduct of the SEA the Board received and incorporated ongoing feedback from the SEA working group, the communities, and other participants in the process about the need to include more opportunities for community engagement and advances in the treatment of Inuit Qaujimajatuqangit and Inuit Qaujimaningit, as advocated by the Qikiqtani Inuit Association. The Board commits to applying the lessons learned throughout the SEA to improve the Board's assessments and processes in future. In respect of the SEA specifically, the feedback from communities resulted in the NIRB adding an additional consultation step to the SEA process involving the Board returning to the 10 interested communities to share the NIRB's findings and recommendations as provided to the Minister in the NIRB's Final SEA Report.

The Board urges the regulatory participants in the SEA process to modify their processes and procedures to reflect the feedback heard throughout the SEA regarding ensuring that Inuit knowledge and rights holders and potentially affected communities have a central role in the research and regulatory processes that will come after this SEA process concludes. To capitalize on the momentum gained during the SEA the Board has incorporated requirements for community involvement and the gathering, sharing, and consideration of Inuit Qaujimajatuqangit and Inuit Qaujimaningit into more than 20 of the Board's 80 recommendations.

Key highlights include the following recommendations:

[241] J. Keyookta, Qikiqtarjuaq, NIRB Final Public Meeting File No. 17SN034 Transcript, March 21, 2019, pp. 865-866, lines 19-26 and 1.

- Building on the data collected in regard to emergency response capability, develop accessible public guidance on the roles and responsibilities of Nunavut stakeholders (Federal agencies, Government of Nunavut, Inuit organizations, and communities) for oil and gas spill response within the Nunavut Settlement Area and in the Canadian offshore adjacent to the Nunavut Settlement Area (#1);
- The Government of Nunavut, Nunavut Tunngavik Incorporated, the Qikiqtani Inuit Association, marine users (including commercial and traditional harvesters), and the communities in the Area of Focus should be included as active participants in all marine planning with the potential to affect the Canadian offshore waters of Baffin Bay and Davis Strait (#4).
- All parties with responsibilities for emergency response in the Area of Focus, including the communities in the region, should establish relationships with other circumpolar nations and transboundary groups to support active and timely coordination with these groups to enhance transboundary emergency preparedness and response capabilities (#5).
- Timely, predictable and adequate participant funding should be provided for all future Strategic Environmental Assessments and project-specific assessments to facilitate active participation by Nunavut communities, Inuit organizations, local hunters and trappers organizations, interested individuals and other interested groups (#6).
- Develop an Inuit-led process to establish an accessible and central holding place in Nunavut to support the gathering and sharing of Inuit Qaujimajatuqangit studies (#12).
- Ensure that all baseline research, data collection, effects assessment and updating conducted in the Area of Focus includes consultations with Inuit knowledge and rights holders and consideration of Inuit Qaujimajatuqangit and Inuit Qaujimaningit (#20).
- In consultation with the Qikiqtani Inuit Organization and communities in the Area of Focus, ongoing research programs should be prioritized to continue the gathering of Inuit Qaujimajatuqangit and Inuit Qaujimaningit regarding the marine environment and offshore areas in Baffin Bay and Davis Strait from Inuit knowledge holders in the communities in the Area of Focus (#21)
- In collaboration with communities and responsible parties, update statistical data for key socio-economic indicators in the Area of Focus, including business investment data and contributions of economic sectors at the community level (#38).
- Establish a mechanism for harvesters and community members to report:
    - any observed issues with the quality of country food; and
    - any other observed changes or concerns regarding impacts associated with development activities in the Area of Focus. (#64).
- Develop and implement programs to involve Inuit and nearby communities in local monitoring programs in Baffin Bay/Davis Strait (specifically including monitoring of priority harvesting areas) (#66).

# CHAPTER 10: SUMMARY OF BOARD RECOMMENDATIONS

In the preceding Chapters of the Report, the Board has made numerous recommendations designed to address the comments, concerns and recommendations of the participants in the SEA. In developing these recommendations the Board recognizes that there may be many parties with shared responsibility for implementing these recommendations over time, and notes that the applicable regulatory authorities and processes associated with the assessment and regulation of oil and gas developments in Baffin Bay and Davis Strait are currently in a state of flux. Consequently, rather than issuing stale dated recommendations to authorities that may not exist in future regulatory structures, the Board has not prescribed which authorities may be responsible for implementation. Similarly, recognizing that there may be many different ways to meet the objectives of the recommendations in terms of structures and approaches, the NIRB's recommendations have focused on what the recommendation needs to accomplish, with much less emphasis prescribing how the objectives should be met. It is hoped that this flexibility will mean that parties having responsibility for the implementation of the recommendations will not be limited in their ability to complete the consultations, research, modelling, assessment and regulatory decision-making necessary to implement the recommendations in a meaningful and practical way.

For convenience, the Board's recommendations contained within the Report are summarized into the seven (7) tables that follow:

1. Recommendations Addressing Consultation, Coordination, and Public Engagement
2. Recommendations Addressing Regulatory, Royalty, and Benefits Regimes and Processes
3. Recommendations Addressing Baseline Research
4. Recommendations Addressing Assessment of Ecosystemic and Socio-Economic Impacts
5. Recommendations Addressing Impact Mitigation
6. Recommendations Addressing Monitoring
7. Recommendations Addressing Impact Modelling, Mapping, and Prediction

The Board has organized the tables on the basis of the type of recommendations offered (e.g., establishing baseline, assessing effects, etc.) and the Board's expected timing of the implementation of the recommendation:

- Recommendations to address irrespective of the current moratorium;
- Recommendations to address prior to lifting the current moratorium;
- Recommendations to address should the current moratorium be lifted; and
- Recommendations to address through future assessments.

For parties wishing to understand more fully the basis for specific recommendations, the tables include a reference to the relevant section(s) of this Report where the Board summarizes the views of parties and the Board's views that provide the basis for the specific recommendation.

## 10.1. Recommendations Addressing Consultation, Co-ordination and Public Engagement

Throughout the SEA, and as discussed in Chapter 9: Other Matters, it was clear that, in the past, the communities in Baffin Bay and Davis Strait did not feel they had been adequately consulted, nor that Inuit Qaujimajatuqangit and Inuit Qaujimaningit had been shared or considered in the approval of historical oil and gas development activities in the Area of Focus. The Board also noted that there are other Arctic and offshore regions within Canada and internationally that may have greater knowledge and experience with the effects of offshore oil and gas developments that may be willing to share their knowledge, experience, and best practices. On this basis, the Board made the following recommendations.

**Table 34: Summary of Board Recommendations Addressing Consultation, Co-ordination, and Public Engagement**

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| **Recommendations to address irrespective of the current moratorium** | | | | | |
| 1. | 4.2 Spill Response Regime<br>8.9 Accidents and Malfunctions<br>9.0 Other Matters Considered by the Board | #29 | Spill Response Regime; Accidents and Malfunctions | Gaps and Uncertainty | Building on the data collected in Recommendation #29, develop accessible public guidance on the roles and responsibilities of Nunavut stakeholders (Federal agencies, Government of Nunavut, Inuit organizations, and communities) for oil and gas spill response within the Nunavut Settlement Area and in the Canadian offshore adjacent to the Nunavut Settlement Area. |
| 2. | 5.3 Human Environment<br>9.0 Other Matters Considered by the Board | #38 | Well-being and Health | Inuit Qaujimajatuqangit | Work with communities to develop the criteria and indicators that should be relied upon to assess community health and well-being, which respect Inuit Qaujimajatuqangit and Inuit Qaujimaningit. |
| 3. | 7.3 Human Environment | | Well-being and Health | Inuit Qaujimajatuqangit | Conduct research in consultation with the Qikiqtani Inuit Association, Government of Nunavut and communities in the Area of Focus to identify the |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| | 9.0 Other Matters Considered by the Board | | | | potential for oil and gas development to have impacts on Inuit culture, heritage, and rights. |
| 4. | 7.3 Human Environment<br>9.0 Other Matters Considered by the Board | | Land and Marine Use | Marine Planning | The Government of Nunavut, Nunavut Tunngavik Incorporated, the Qikiqtani Inuit Association, marine users (including commercial and traditional harvesters), and the communities in the Area of Focus should be included as active participants in all marine planning with the potential to affect the Canadian offshore waters of Baffin Bay and Davis Strait. |
| 5. | 8.9 Accidents and Malfunctions<br>9.0 Other Matters Considered by the Board | | Accidents and Malfunctions | Marine Planning | All parties with responsibilities for emergency response in the Area of Focus, including the communities in the region, should establish relationships with other circumpolar nations and transboundary groups to support active and timely coordination with these groups to enhance transboundary emergency preparedness and response capabilities. |
| **Recommendations to address prior to lifting the current moratorium** | | | | | |
| 6. | 2.11 Community Engagement<br>9.0 Other Matters Considered by the Board | #8 | Public Engagement | Inuit Qaujimajatuqangit | Timely, predictable, and adequate participant funding should be provided for all future Strategic Environmental Assessments and project-specific assessments to facilitate active participation by Nunavut communities, Inuit organizations, local hunters and trappers organizations, interested individuals, and other interested groups. |
| 7. | 7.6 Transboundary Effects | | Transboundary Effects | Marine planning | Opportunities should be pursued to establish relationships and develop decision-making processes with neighboring jurisdictions and the Government of Nunavut, Inuit Organizations, and communities, in |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| | 9.0 Other Matters Considered by the Board | | | | support of developing common thresholds to assess effects from oil and gas development, to develop appropriate regulatory oversight of the industry, and to establish co-management mechanisms to address transboundary effects. |
| **Recommendations to address should the current moratorium be lifted** | | | | | |
| 8. | 2.11 Community Engagement<br>9.0 Other Matters Considered by the Board | #6 | Public Engagement | Inuit Qaujimajatuqangit<br>Marine Planning | In consultation with communities, relevant regulatory authorities should prepare community "toolkit" materials in plain language and general terms, which support community members becoming involved in research conducted in the Area of Focus and in the regulatory and marine planning processes associated with potential future oil and gas development in the Area of Focus. |
| 9. | 7.3 Human Environment<br>9.0 Other Matters Considered by the Board | | Human Environment | Inuit Qaujimajatuqangit | The oil and gas development industry should establish communication strategies and foster working relationships with communities prior to the presentation of specific development proposals. |
| 10. | 7.3 Human Environment<br>9.0 Other Matters Considered by the Board | #3 | Well-being and Health | Inuit Qaujimajatuqangit | Based on the results of the research conducted under #3, opportunities should be identified to support programs to limit negative impacts on Inuit culture, heritage, and rights (e.g., cultural training programs, including "On the Land Programs" for youth, Elder engagement, Inuit mentorship programs, etc.) |
| **Recommendations to address through future assessments** | | | | | |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| 11. | 7.6 Transboundary Effects<br>9.0 Other Matters Considered by the Board | #7 | Transboundary Effects | Marine Planning | Future assessments and marine planning should include comprehensive transboundary effects assessments of valued environmental components and collaboration with Inuit residents in transboundary areas outside the Nunavut Settlement Area (e.g., Nunavik, Greenland, etc.) should occur whenever practical. |

## 10.2 Recommendations Addressing Regulatory, Royalty, and Benefits Regimes and Processes

During the SEA, the Board heard that there was considerable uncertainty regarding the regulatory regime and the royalties and benefits that could accrue in Nunavut. In addition, the Board heard from communities and the SEA Working Group regarding the importance of ensuring that the gathering and consideration of Inuit Qaujimajatuqangit and participation of Inuit knowledge and rights holders is central to the regulatory and benefits regimes that would be responsible for assessing and regulating future oil and gas developments in Baffin Bay and Davis Strait. On this basis, the Board made the following recommendations.

**Table 35: Summary of Board Recommendations Addressing Regulatory and Benefits Regimes**

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| **Recommendations to address irrespective of the current moratorium** | | | | | |
| 12. | 7.3 Human Environment<br>9.0 Other Matters Considered by the Board | | Land and Marine Use | Inuit Qaujimajatuqangit | Develop an Inuit-led process to establish an accessible and central holding place in Nunavut to support the gathering and sharing of Inuit Qaujimajatuqangit and Inuit Qaujimaningit studies. |
| **Recommendations to address prior to lifting the current moratorium** | | | | | |
| 13. | 4.1 Regulatory Regime<br>9.0 Other Matters Considered by the Board | | Regulatory, Royalty, and Benefits Regimes | Gaps and Uncertainty | Clear descriptions should be developed to explain the royalties and benefits regime applicable to:<br>▪ oil and gas developments occurring exclusively in the Canadian offshore adjacent to the Nunavut Settlement Area; and<br>▪ oil and gas developments occurring in the Canadian offshore adjacent to the Nunavut Settlement Area which are |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| | | | | | supported by land-based infrastructure within the Nunavut Settlement Area.<br><br>This analysis should clarify the extent to which *Canada Oil and Gas Operations Act* benefits can be accrued in Nunavut and specify the framework that would apply to compensation for interference with Inuit harvesting or damage to marine wildlife or wildlife habitat (within the Canadian offshore and the Nunavut Settlement Area). |
| 14. | 4.1 Regulatory Regime 7.3 Human Environment 9.0 Other Matters Considered by the Board | | Land and Marine Use Royalty and Benefits Regimes | Gaps and Uncertainty | Potential impacts to Inuit harvesting and Inuit rights (including threats to food security) should be considered when developing and implementing compensation frameworks for impacts on marine fish, waterbirds, and marine mammals. |
| **Recommendations to address through future assessments** | | | | | |
| 15. | 4.1 Regulatory Regime 9.0 Other Matters Considered by the Board | | Regulatory, Royalty, and Benefits Regimes | Marine Planning; Gaps and Uncertainty | Assessments of proposed oil and gas projects should clearly identify the predicted benefits and potential compensation accruing to the region and potentially affected communities |
| 16. | 4.1 Regulatory Regime | #6 and # | Regulatory, Royalty, and Benefits Regimes | Inuit Qaujimajatuqangit | Structure future assessments conducted in, or adjacent to, the Nunavut Settlement Area and associated decision-making processes with the express |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| | 9.0 Other Matters Considered by the Board | | | | recognition of Inuit rights, Inuit Qaujimajatuqangit and Inuit Qaujimaningit, and the requirement to actively engage with Inuit knowledge holders and Nunavut communities. |
| 17. | 7.5 Cumulative effects<br>9.0 Other Matters Considered by the Board | | Cumulative Effects | Marine Planning | The scope of future assessments and marine planning must include comprehensive cumulative effects assessments for valued ecosystemic and socio-economic components, including food security. Collaboration and input should be sought from all relevant parties and be informed by community-based monitoring programs. |
| 18. | 7.7 Effects of the Environment<br>9.0 Other Matters Considered by the Board | | Effects of the Environment on Possible Offshore Oil and Gas Projects/Activities | Lack of Readiness | All specific oil and gas development proposals should demonstrate that:<br>▪ adaptive management approaches are incorporated into the project;<br>▪ the project design and equipment used will maintain safety, integrity, and reliability even in the harsh and rapidly-changing environmental conditions of Baffin Bay and Davis Strait. |

## 10.3. Recommendations Addressing Baseline Research And Impact Assessment

In several of the sections of the Report (e.g. Sections 5.1-5.3 and Sections 7.1-7.7) the Board's consideration of the potential ecosystemic and socio-economic effects for oil and gas development was limited by significant information gaps, uncertainty, and a lack of up to date information establishing baseline conditions, and assessing effects in the context of the unique environmental and socio-economic conditions of Baffin Bay and Davis Strait. In addition, the Board noted that very little of the baseline research and impact assessment information that does exist includes meaningful gathering or consideration of Inuit Qaujimajatuqangit and Inuit Qaujimaningit or consultation with Inuit knowledge and rights holders.

To address these gaps in the available baseline and impact assessment information in the Area of Focus, the Board has made the recommendations listed below.

**TABLE 36: SUMMARY OF BOARD RECOMMENDATIONS ADDRESSING BASELINE RESEARCH**

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| **Recommendations to address irrespective of the current moratorium** | | | | | |
| 19. | 5.4 Climate Change | | Climate Change | Gaps and Uncertainty | Collect baseline information and undertake assessments of the current and predicted effects of climate change in the Arctic, including direct and indirect impacts:<br>▪ on the physical environment (e.g., marine currents, fog, and precipitation),<br>▪ on the biological environment (e.g., wildlife migration patterns); and<br>▪ on the human environment (e.g., changes to wildlife availability and effects on harvesting, changes to ranges and availability of fish species and effects on commercial harvesting, etc.). |
| 20. | 5.3 Human Environment 9.0 Other Matters Considered by the Board | #12, #19, #21-#79 | Traditional Activity and Knowledge | Inuit Qaujimajatuqangit Gaps and Uncertainty | Ensure that all baseline research, data collection, effects assessment, and updating conducted in the Area of Focus includes consultations with Inuit knowledge and rights holders and consideration of Inuit Qaujimajatuqangit and Inuit Qaujimaningit. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| 21. | 5.3 Human Environment 9.0 Other Matters Considered by the Board | #12, #19, #20, #22-#79 | Traditional Activity and Knowledge | Inuit Qaujimajatuqangit; Gaps and Uncertainty | In consultation with the Qikiqtani Inuit Organization and communities in the Area of Focus, ongoing research programs should be prioritized to continue the gathering of Inuit Qaujimajatuqangit and Inuit Qaujimaningit regarding the marine environment and offshore areas in Baffin Bay and Davis Strait from Inuit knowledge holders in the communities in the Area of Focus. |
| 22. | 5.1 Physical Environment | | Bathymetry | Gaps and Uncertainty | Conduct additional bathymetry research to identify navigational hazards in the Area of Focus and to improve the safety of shipping in the region. |
| 23. | 5.1 Physical Environment | | Naturally Occurring Seeps | Gaps and Uncertainty | Conduct research to:<br>▪ identify naturally occurring oil and gas seep locations in the Area of Focus; and<br>▪ determine flow rates and other relevant characteristics. |
| 24. | 5.2 Biological Environment; | <Fish and Fish Habitat #25, Marine Environment and Sediment and Effects Assessment (#47 and #48)> | Plankton; Benthic Fauna; | Gaps and Uncertainty | Conduct research in the Area of Focus to improve understanding of:<br>▪ marine plankton, including abundance, diversity and biomass; and<br>▪ benthic flora and fauna, including their respective biologies and ecologies. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| 25. | 5.2 Biological Environment | | Fish and Fish Habitat; Marine Mammals; Waterbirds | Gaps and Uncertainty | Collect additional baseline data and undertake research in Baffin Bay and Davis Strait on:<br>▪ fish and fish habitat (including spawning grounds, nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly to carry out their life processes);<br>▪ waterbirds; and<br>▪ marine mammals.<br><br>This research should be designed to improve the understanding of current status and potential for development activities to impact important populations and sensitive habitats. Research efforts should also include consideration for the effects of climate change and pollution and should focus on: population densities, distribution, abundance, and breeding success; monitoring of seasonal migration patterns and key habitat use; sensitive breeding and foraging habitat, including habitat used during winter conditions (e.g., polynyas); productivity; and prey abundance and distribution, include connections between species and other trophic levels (e.g., connections between plankton, fish, water birds, and marine mammals) . |
| 26. | 5.3 Human Environment; 7.3 Effects on the Human Environment | #3 | Well-being and Health | Gaps and Uncertainty Inuit Qaujimajatuqangit | With the direction and participation of the Qikiqtani Inuit Association and the 10 communities in the region, support further research into the role of harvesting in the marine environment, including: |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| | | | | | ▪ the importance of harvesting on food security in communities;<br>▪ community-specific food security vulnerability<br>▪ the costs of harvesting; and<br>▪ importance of country food sharing in communities. |
| 27. | 5.3 Human Environment | | Fish and Fish Habitat Commercial Harvesting | Gaps and Uncertainty; Alternatives | Collect baseline fisheries and ecosystem data to assess the commercial and ecosystemic viability of existing and potential expansions to the commercial fisheries in Baffin Bay and Davis Strait, including consideration of:<br>▪ turbot migratory patterns, spawning grounds, and stock connectivity with inshore waters in Nunavut and Greenlandic waters;<br>▪ the viability of harvesting additional species (e.g., clams, Porcupine crab, redfish, etc.);<br>▪ required investments in technology; and<br>▪ increases to local quotas. |
| 28. | 5.3 Human Environment | | Heritage Resources | Gaps and Uncertainty | Conduct a baseline assessment of heritage resources along the coastlines of eastern Baffin Island, Ellesmere Island, and associated islands to identify archaeological and paleontological resources that could be impacted by potential effects from offshore development activities. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| 29. | 8.9 Accidents and Malfunctions; 4.2 Spill Response Regime | <#6, #7,#32> | Accidents and Malfunctions | Marine Planning | Assemble available information on emergency preparedness and response, including:<br>▪ current regulatory oversight and responsibilities;<br>▪ current and required response capabilities for the Area of Focus;<br>▪ spill response technologies applicable to the Arctic (in both ice and open water);<br>▪ emergency response infrastructure; and<br>▪ best practices and measures for emergency prevention and response. |
| 30. | 5.1 Physical Environment | #70 | Sea Ice and Iceberg Conditions | Marine Planning | Conduct baseline research on sea ice conditions, including sea ice characteristics, iceberg presence and distribution and the effects of climate change on sea ice distribution. |
| **Recommendations to address prior to lifting the current moratorium** | | | | | |
| 31. | 4.2 Spill Response Regime 8.9 Accidents and Malfunctions | #29 and #32 | Spill Response Regime Accidents and Malfunctions | Lack of Readiness; Marine Planning | Building on the data collected in Recommendation #29, initiate a formal review of the existing capacity to respond effectively to a major spill of oil in the Area of Focus, highlighting the expected role of communities and community capacity in responding to emergencies. The Government of Nunavut, Designated Inuit Organizations, and Nunavut communities should be actively engaged through the review process. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| 32. | 4.2 Spill Response Regime<br>8.9 Accidents and Malfunctions | #31 and #29 | Accidents and Malfunctions | Gaps and Uncertainty;<br>Lack of Readiness | Conduct baseline research to assess the capacity and infrastructure required to manage and respond to a well blowout or major spill in the Arctic and to determine whether an effective response can be mounted in remote locations under harsh weather conditions with periods of prolonged darkness and in the presence of ice. |
| 33. | 4.2 Spill Response Regime<br>8.9 Accidents and Malfunction<br>7.2 Effects to Biological Environment | Climate Change | Special and Sensitive Areas and Areas of Concern and Importance<br>Climate Change | Gaps and Uncertainty | Conduct additional research to identify the potential effects of oil and gas activities and unplanned events (e.g., ice breaking, vessels, spills) on sensitive areas, including consideration of changing conditions associated with climate change. |
| 34. | 5.1 Physical Environment | #29, #1 #31 | Oceanography<br>Spill Response Regime Accidents and Malfunctions | Gaps and Uncertainty | Conduct baseline research to improve understanding of oceanographic processes in Baffin Bay and Davis Strait during ice-covered and open-water conditions. This baseline information should be used to inform analysis of potential environmental effects and oil spill modeling. |
| 35. | 5.1 Physical Environment | #70 | Coastal Landforms;<br>Marine Sediment;<br>Marine Wildlife | Gaps and Uncertainty | Undertake research to establish baseline information on coastal habitat features such as:<br>▪ shoreline form, substrate, and vegetation type;<br>▪ biological resources, presence of sensitive species;<br>▪ life stages; |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| | | | | | ▪ sensitive human use resources; and<br>▪ the potential oil residency in different shoreline/substrate types. |
| 36. | 5.1 Physical Environment | | Marine Sediment | Gaps and Uncertainty | Establish baseline information for water and sediment quality in the Area of Focus to include:<br>▪ water sampling conducted during both open water and ice covered conditions;<br>▪ water sampling from multiple depths chosen to reflect variances in temperature and salinity; and<br>▪ comparison of local and regional water and sediment quality data to all applicable guidelines for the protection of marine life water and sediment quality sampling (e.g., Canadian Council of Ministers of the Environment guidelines). |
| 37. | 5.2 Biological Environment | #24-#27 | Species at Risk | Gaps and Uncertainty; Marine Planning | Baseline data should be used to identify sensitive (or critical) habitat for Species at Risk for incorporation into marine planning for the Area of Focus. |
| 38. | 5.3 Human Environment 9.0 Other Matters Considered by the Board | #2 | Economy, Development and Employment | Gaps and Uncertainty | In collaboration with communities and responsible parties, update statistical data for key socio-economic indicators in the Area of Focus, including business investment data and contributions of economic sectors at the community level. |
| 39. | 5.3 Human Environment | | Community Infrastructure | Lack of Readiness Gaps and Uncertainty | Prepare an inventory of the existing communication and transportation infrastructure in the Area of Focus. Assess the adequacy of the current inventory and determine requirements for additional capacity that |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| | | | | | would be necessary to serve the development of the offshore oil and gas industry. |
| 40. | 7.3 Human Environment | | Economy, Development and Employment | Gaps and Uncertainty | Conduct a comparative analysis of oil and gas developments and alternative forms of economic development in the Area of Focus (e.g., commercial fishing, shipping, mining, and tourism) to include:<br>▪ a labour market analysis<br>▪ cost-benefit-analysis;<br>▪ identification of education and training opportunities and ability to gain transferable skills;<br>▪ identification of types and numbers of local employment opportunities and other benefits; and<br>▪ discussion of potential limitations on the ability of Inuit communities to effectively participate in job, training, or other economic opportunities associated with a given type of economic development. |
| **Recommendations to address should the current moratorium be lifted** | | | | | |
| 41. | 5.1 Physical Environment<br>7.1 Effects to Physical Environment | #75 | Acoustic Environment<br>Plankton<br>Benthic Flora and Fauna<br>Fish and Fish Habitat | Gaps and Uncertainty & Marine Planning | Conduct baseline research to:<br>▪ establish baseline atmospheric and underwater sound levels in Baffin Bay and Davis Strait;<br>▪ improve understanding of the potential effects of underwater noise and seismic |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| | | | Waterbirds<br>Marine Mammals | | activities on plankton, benthic organisms and invertebrates (including shellfish and arthropods), fish, waterbirds, and marine mammals; and<br>▪ apply research to develop threshold criteria for assessing injury and behavioural disturbance. |
| 42. | 5.1 Physical Environment | | Geology | Gaps and Uncertainty | Conduct research, in consultation with industry leaders in petroleum exploration and production and other Arctic regions with oil and gas developments, to improve understanding of geohazards in the Area of Focus (e.g., glacial feature distribution, ice scour analyses, and seabed and underwater slope stability assessments) and geotechnical properties of marine sediment relevant to exploratory drilling and placement of structures on the seabed. |
| 43. | 7.2 Effects to Biological Environment | | Fish and Fish Habitat<br>Waterbirds<br>Marine Mammals | Gaps and Uncertainty | Conduct research to identify potential risks (including implications for the health and safety of individuals or populations) resulting from attraction to offshore structures and associated vessels for:<br>▪ marine fish;<br>▪ waterbirds; and<br>▪ marine mammals. |
| 44. | 7.2 Effects to Biological Environment | | Fish and Fish Habitat<br>Waterbirds<br>Marine Mammals | Gaps and Uncertainty | Undertake research to:<br>▪ identify current methods used to monitor for the presence of marine fish, waterbirds, and marine mammals in proximity to offshore oil and gas development infrastructure, and |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| | | | | | ▪ assess the effectiveness of these measures to avoid or reduce adverse interactions or other impacts. |
| 45. | 7.5 Cumulative effects | | Fish and Fish Habitat<br>Waterbirds<br>Marine Mammals<br>Cumulative Effects | Gaps and Uncertainty | Conduct research regarding the potential for cumulative effects on marine fish, waterbirds, and marine mammals with consideration of:<br>▪ associated oil and gas activities combined with existing and potential future activities, including mining, marine transportation, commercial fishing, Inuit harvesting and traditional land use, and practices;<br>▪ direct project interactions;<br>▪ changes to water quality;<br>▪ habitat alteration or loss including disturbance of ice habitat;<br>▪ underwater noise;<br>▪ oil spills, including chronic leaks from platforms; and<br>▪ the release of sewage and grey water. |
| **Recommendations to address through future assessments** | | | | | |
| 46. | 7.1 Effects to Physical Environment | #65 and #74 | Air Quality and Greenhouse Gas Emissions | Gaps and Uncertainty | Conduct research to:<br>▪ assess upstream and downstream greenhouse gas emissions at various scales |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| | | | | | of offshore oil and gas development in Baffin Bay and Davis Strait; and<br>▪ determine if, and to what extent, oil and gas resources can be developed in the Area of Focus within the limits imposed under national and international carbon reduction targets. |

The Board recognizes that one of the central purposes of the completion of the baseline research recommended by the Board is to inform the assessment of potential ecosystemic and socio-economic impacts. Consequently, the Board has noted where there are links between the recommendations regarding baseline research and the recommendations in relation to ecosystemic and socio-economic impacts below.

**TABLE 37: SUMMARY OF BOARD RECOMMENDATIONS ADDRESSING ASSESSMENT OF ECOSYSTEMIC AND SOCIO-ECONOMIC IMPACTS**

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| **Recommendations to address irrespective of the current moratorium** | | | | | |
| 47. | 7.2 Effects to Biological Environment | #24 | Plankton | Gaps and Uncertainty | Conduct research on the potential for effects on plankton of:<br>▪ nutrient pollution from routine and produced water discharge from oil and gas activities;<br>▪ ballast water discharge from shipping activities; and<br>▪ the potential introduction of non-native plankton species to the region. |
| 48. | 7.2 Effects to Biological Environment | <#24, #19, #72 and ##49 | Benthic Flora and Fauna | Gaps and Uncertainty | Conduct research on the relationship between changes in bloom phenology, abundance, productivity, and species composition of benthic flora and changes in the marine environment (e.g., sea ice distribution, ocean circulation, surface conditions, and temperatures) to better understand the potential non-linear feedback loops between climate change and the benthic marine environment. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| **Recommendations to address prior to lifting the current moratorium** | | | | | |
| 49. | 7.2 Effects to Biological Environment | #48 and #72 | Benthic Flora and Fauna | Gaps and Uncertainty | Conduct research on the effects on benthic filtering organisms resulting from the uptake of suspended solids due to increased turbidity from development activities on/near the seabed. |
| 50. | 5.2 Biological Environment | #37, #69 and #71 | Special and Sensitive Areas and Areas of Concern and Importance | Gaps and Uncertainty | Conduct further research to assess:<br>▪ the resiliency of sensitive areas; and<br>▪ whether these areas would return to natural conditions following cessation of oil and gas development. |
| 51. | 6.6 Additional Factors | #19-#46 | Alternative Development Options and Hypothetical Oil and Gas Development Scenarios | Marine planning | Incorporating all relevant updated baseline data (including Inuit Qaujimajatuqangit and Inuit Qaujimaningit) and in collaboration with the Nunavut government, Inuit organizations, and local communities, initiate marine-based regional planning throughout the Area of Focus, including the development of regional priorities |
| 52. | 6.6 Additional Factors | #38, #2, #27 and #51 | Alternative Development Options and Hypothetical Oil and Gas Development Scenarios | Alternatives | Reflecting updated baseline information and regional priorities identified in #51, conduct an analysis of the risks and benefits of:<br>▪ alternative economic development options (e.g., commercial fishing, renewable energy, and tourism) for the Area of Focus; and<br>▪ development of alternative energy sources which could support domestic energy consumption in Nunavut. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| 53. | 7.2 Effects to Biological Environment | #25 and #27 | Fish and Fish Habitat; Waterbirds; Marine Mammals Climate Change | Gaps and Uncertainty | Reflecting updated baseline research, assess the potential impacts of oil and gas development on components of the biological, physical, and human environments in the Area of Focus including:<br>▪ sensitive areas;<br>▪ fish and fish habitat (including at different life stages);<br>▪ waterbirds; and<br>▪ marine mammals.<br><br>Assessment should address uncertainty regarding potential physiological and behavioural responses to impacts (such as acoustic and underwater noise) and should indicate how areas impacted by development are expected to change over time and under different climate change conditions/models. |
| 54. | 8.9 Accidents and Malfunctions | | Accidents and Malfunctions | Gaps and uncertainty | Conduct baseline studies to understand potential effects of an oil or gas spill/release on:<br>▪ the Arctic environment and wildlife (including migratory species of marine fish, waterbirds and marine mammals);<br>▪ the Inuit way of life, and northern economy, including tourism and fisheries, and food security; and<br>▪ preparedness for handling any spills that could occur. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| | | | | | Studies should consider potential effects of oil or gas spill/release under-ice and during the open water season. |
| **Recommendations to address should the current moratorium be lifted** | | | | | |
| 55. | 4.2 Spill Response Regime | #29, #1 and #31 | Spill Response Regime | Lack of Readiness | Establish a long-term, comprehensive Arctic spill prevention, response, and evaluation research program to:<br>▪ predict and evaluate the effects of spills on the Arctic biological, physical, and human environments; and<br>▪ identify and evaluate effective spill prevention and response methods, equipment, and technology in the Arctic environment. |
| 56. | 7.2 Effects to Biological Environment | | Special and Sensitive Areas and Areas of Concern and Importance | Marine Planning | Conduct research to improve understanding of the potential for oil and gas development to have impacts on sensitive areas in the Area of Focus, including for polynyas and areas with ice cover. This research should address how these areas may change over time, based on which types of oil and gas development activities occur, and which climate change conditions/models are used. |
| 57. | 7.3 Human Environment 8.9 Accidents and Malfunctions | 27 | Commercial Harvesting Accidents and Malfunctions | Gaps and Uncertainty | Building on updated baseline information about commercial harvesting collected under Recommendation #27, identify the potential for oil and gas development (including resulting from associated spills or other incidents) to have adverse economic effects on Nunavut's existing and future commercial fisheries. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| **Recommendations to address through future assessments** | | | | | |
| 58. | 7.2 Effects to Biological Environment | #24 and #47 | Plankton | Gaps and Uncertainty | Project-specific assessments should include the assessment of potential impacts to plankton and benthic flora and fauna:<br>▪ posed by an oil spill or other possible shipping impacts; and<br>▪ due to chronic disturbance from increased shipping activity and underwater noise. |
| 59. | 6.6 Additional Factors | | Alternative Development Options and Hypothetical Oil and Gas Development Scenarios | Alternatives | Strategic environmental assessments on offshore oil and gas activities in specific areas of known resources, such as the Saglek Basin and the Sverdrup Basin should be undertaken prior to project-specific assessment. Future SEAs should:<br>▪ analyze different configurations and phases of potential oil and gas activities; and<br>▪ choose locations, environmental conditions, and study objectives in collaboration with the Nunavut government, Designated Inuit Organizations, and local communities. |
| 60. | 6.6 Additional Factors | #59 | Alternative Development Options and Hypothetical Oil and Gas Development Scenarios | Alternatives | Any future SEAs or project-specific assessments should include consideration of alternative technologies, particularly for marine seismic surveys. |

## 10.4. Recommendations Addressing Mitigation, Monitoring, Modelling, Mapping And Prediction

Although the significant gaps in baseline data and the associated effects predictions have limited the recommendations that the Board can make in respect of these areas, the Board has included the following general recommendations with respect to measures designed to mitigate/limit and monitor for the potential for impacts and also requiring that impact modelling, mapping, and predictions are updated to reflect the baseline and effects assessment research recommended by the Board..

**Table 38: Summary of Board Recommendations In Relation to Impact Mitigation**

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| **Recommendations to address prior to lifting the current moratorium** | | | | | |
| 61. | 7.1 Effects to Physical Environment | #19-#60 | Mitigation | Gaps and Uncertainty; Marine Planning | Reflecting updated baseline and effects assessment data, and the experience of the National Energy Board, Canada-Newfoundland and Labrador Offshore Petroleum Board, Canada-Nova Scotia Offshore Petroleum Board, and other relevant parties, and in collaboration with the Government of Nunavut, Inuit Organizations, and local communities and informed by Inuit Qaujimajatuqangit and Inuit Qaujimaningit conduct research to:<br>▪ identify standard impact mitigation measures associated with offshore oil and gas development; and<br>▪ assess the effectiveness (or limitations) of these standard impact mitigation measures in the Arctic environment; and develop standard mitigation measures for potential impacts associated with oil and gas developments in the Area of Focus. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| 62. | 7.2 Effects to Biological Environment | #25, #27 and #53 | Fish and Fish Habitat<br>Waterbirds<br>Marine Mammals<br>Acoustics<br>Mitigation | Gaps and Uncertainty | Reflecting updated baseline and effects assessment data, conduct research to analyze the effectiveness of mitigation measures (including new technologies) designed to reduce potential acoustic impacts associated with oil and gas development and project-related shipping on:<br>▪ fish;<br>▪ waterbirds; and<br>▪ marine mammals.<br><br>Research should include delineation between different species and their various life stages. |
| **Recommendations to address should the current moratorium be lifted** | | | | | |
| 63. | 8.9 Accidents and Malfunctions | | Accidents and Malfunctions | Lack of Readiness | In the development of emergency response plans, spill contingency and prevention plans, standard operating procedures, etc. and in the design of impact mitigation measures, oil and gas developers should incorporate lessons learned from accidents and malfunctions in similar jurisdictions, including associated standard operating procedures and impact mitigation measures. |

**Table 39: Summary of Board Recommendations Regarding Monitoring**

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| **Recommendations to address irrespective of the current moratorium** | | | | | |
| 64. | 7.3 Human Environment<br>9.0 Other Matters Considered by the Board | | Mitigation<br>Monitoring | Marine Planning<br>Inuit Qaujimajatuqangit | Establish a mechanism for harvesters and community members to report:<br>▪ any observed issues with the quality of country food; and<br>▪ any other observed changes or concerns regarding impacts associated with development activities in the Area of Focus. |
| **Recommendations to address prior to lifting the current moratorium** | | | | | |
| 65. | 5.1 Physical Environment | | Climate and Meteorology | Gaps and Uncertainty | Develop an improved surface weather monitoring network for the Area of Focus designed to increase the accuracy of weather forecasting throughout the region, including mechanisms for taking into account rapidly changing climate conditions. |
| **Recommendations to address should the current moratorium be lifted** | | | | | |
| 66. | 7.3 Human Environment<br>9.0 Other Matters Considered by the Board | | Mitigation<br>Monitoring | Marine Planning<br>Inuit Qaujimajatuqangit | Develop and implement programs to involve Inuit and nearby communities in local monitoring programs in Baffin Bay/Davis Strait (particularly including monitoring of priority harvesting areas). |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| 67. | 7.3 Human Environment | #26 | Mitigation | Inuit Qaujimajatuqangit | With the involvement of the Qikiqtani Inuit Association and communities, use food security research conducted under Recommendation #26 to inform project-specific impact assessments and monitoring programs |

**Table 40: Summary of Board Recommendations Addressing Impact Modelling, Mapping and Predictions**

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| **Recommendations to address irrespective of the current moratorium** | | | | | |
| 68. | 5.1 Physical Environment | #30# | Sea Ice and Iceberg Conditions | Marine Planning | Based on updated baseline information generated in Recommendation #30, model the temporal and spatial occurrence of sea ice in the Area of Focus. |
| 69. | 5.2 Biological Environment | #27, #50 and #71 | Special and Sensitive Areas and Areas of Concern and Importance | Gaps and Uncertainty | Reflecting up to date information, including additional baseline gathered under Recommendations #27and #50, produce up-to-date online maps of sensitive habitats for the Area of Focus with layers of information for relevant species and factors considered to identify sensitive habitats. |
| **Recommendations to address prior to lifting the current moratorium** | | | | | |
| 70. | 5.1 Physical Environment | #35 | Coastal Landforms | Gaps and Uncertainty | Based on additional baseline research on coastal habitat features conducted in accordance with Recommendation #35, develop a coastal/shoreline sensitivity atlas. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| 71. | 5.2 Biological Environment | #50 and #69 | Special and Sensitive Areas and Areas of Concern and Importance | Marine Planning | Identify sensitive/critical habitat for Species at Risk where oil and gas activities should be limited, restricted, or prevented from occurring and/or where establishment of Marine Protected Areas may be appropriate. |
| 72. | 7.2 Effects to Biological Environment | #24, #39, #48 and #49 | Benthic Flora and Fauna<br>Plankton | Gaps and Uncertainty | Reflecting updated baseline data, conduct modelling of the different habitats within Baffin Bay and Davis Strait to improve confidence in the assessment of potential effects from oil and gas activities on the habitat supporting:<br>▪ benthic flora and fauna; and<br>▪ plankton.<br><br>Modelling should include consideration of strong currents in the area and the potential for currents to intensify and extend the footprint of the potential impacts of deleterious substances released into the environment. |
| 73. | 7.7 Effects of the Environment | | Effects of the Environment on Possible Offshore Oil and Gas Projects/Activities | Lack of Readiness | Investments should be made to improve ice monitoring and management services in the region to increase the accuracy of predictions in relation to sea ice extent, iceberg locations and trajectories, and the potential for extreme weather events. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| **Recommendations to address should the current moratorium be lifted** | | | | | |
| 74. | 5.1 Physical Environment | #19 | Air Quality, Greenhouse Gas Emissions<br>Climate Change | Gaps and Uncertainty | Shipping emissions associated with proposed oil and gas development should be modelled to understand the potential direct, indirect, and cumulative effects on air quality and contributions of greenhouse gas emissions |
| 75. | 5.1 Physical Environment | 41 | Acoustic Environment | Gaps and Uncertainty & Marine Planning | Based on baseline research conducted under Recommendation #41 to establish baseline atmospheric and underwater sound levels in Baffin Bay and Davis Strait, complete updated modeling of the dispersion of sound from anthropogenic sources and the potential direct, and cumulative effects, of noise from oil and gas development activities on wildlife receptors (including marine fish, waterbirds and marine mammals). |
| 76. | 7.3 Biological Environment | #50, #69, #71 | Special and Sensitive Areas and Areas of Concern and Importance | Marine Planning | Establish setbacks or other potential development restrictions on the proximity of oil and gas development activities, infrastructure, and other components to the floe edge. |
| 77. | 7.3 Human Environment | | Commercial Harvesting<br>Special and Sensitive Areas and Areas of Concern and Importance | Marine Planning | Establish setbacks or other potential development restrictions on the proximity of oil and gas development activities, infrastructure, and other components (particularly seismic surveying activities) in areas, and during seasons, where commercial harvesting takes place currently, or in areas where expansion of commercial harvesting is expected to take place in the future. |

| No. | Report Sections | Related Recs. | Topic | Key Themes | Board Recommendation |
|---|---|---|---|---|---|
| 78. | 7.3 Human Environment | #77 | Commercial Harvesting | Marine Planning | Consider establishing setbacks or other development restrictions on the proximity of oil and gas development activities, infrastructure and other components (particularly seismic surveying activities) in areas, and during seasons, that are currently closed to fishing in order to protect sensitive benthic areas and Narwhal overwintering habitats. |
| 79. | 8.9 Accidents and Malfunctions | #63 | Accidents and Malfunctions | Marine Planning, Inuit Qaujimajatuqangit | In consultation with community members and Inuit knowledge holders, oil and gas developers should identify sensitive or important shorelines that could be impacted by spills, accidents, or other malfunctions associated with proposed oil and gas developments and project-shipping. When areas have been identified, oil and gas developers should ensure that spill plans incorporate this information and address community concerns, including items such as shipping restrictions during critical life cycle processes for marine wildlife (such as marine fish, waterbirds, and marine mammals). |

# APPENDIX A: REFERENCE LIST


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# APPENDIX B: FIGURES REFERENCE LIST

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# APPENDIX C: RECOMMENDED DOCUMENTS

| Table of Recommended Documents<br>Documents as recommended by parties in written comment submissions to the Nunavut Impact Review Board for the Strategic Environmental Assessment in Baffin Bay and Davis Strait.<br>Additional reports may be available within individual comment submissions. | | | | |
|---|---|---|---|---|
| **Volume** | **Chapter** | **Party Recommending Publication** | **Topic** | **Publication (Abstract, Report, Paper, Article)** |
| 2.0 | 4.2.0 | Canadian Association of Petroleum Producers (CAPP) | Spill Response Regime | CAPP. (n.d.a). Emergency Planning and Response. Canadian Association of Petroleum Producers. Retrieved from http://atlanticcanadaoffshore.ca/emergency-planning-and-response/. |
| 2.0 | 4.2.0 | Fisheries and Oceans Canada (DFO) | Spill Response Regime | DFO (2018b). Marine Spills Contingency Plan - National Chapter. Fisheries and Oceans Canada and Canadian Coast Guard. (EKME# 3044777). Retrieved from http://www.ccg-gcc.gc.ca/folios/01230/docs/MSCP2018-eng.pdf. |
| 2.0 | 4.2.0 | CAPP | Spill Response Regime | CAPP (n.d.b). Spill Prevention and Response. Canadian Association of Petroleum Producers. Retrieved from http://atlanticcanadaoffshore.ca/spill-prevention-and-response/ |
| 2.0 | 5.1.1.1 | Environment and Climate Change Canada (ECCC) | Climate and Meteorology - Baseline | ECCC. (2017). Environment Canada and Climate Change. National Marine Weather Guide – Arctic Regional Guide Part 7: Baffin Bay and Davis Strait. (Cat. No. En56-240/5-2017E-PDF978-0-660-07238-8). Retrieved from http://publications.gc.ca/collections/collection_2017/eccc/En56-240-5-2017-eng.pdf. |
| 2.0 | 5.1.1.1 | ECCC | Climate and Meteorology - Baseline | ECCC. (2019a). Canadian Climate Normals. Online Database. Government of Canada. Retrieved from http://climate.weather.gc.ca/climate_normals/index_e.html |
| 2.0 | 5.1.1.2 | ECCC | Air quality - Baseline | Gong, W., Beagley, S.R., Cousineau, S., Sassi, M., Munoz-Alpizar, R., Ménard, S., Racine, J., Zhang, J., Chen, J., Morrison, H., Sharma, S., Huang, L., Bellavance, P., Ly, J., Izdebski, P., Lyons, L., & Holt, R. (2018). Assessing the impact of shipping emissions on air pollution in the Canadian Arctic and northern regions: Current and Future Modelled Scenarios. Atmospheric Chemistry and Physics, 18(22), pp. 16653-16687. Retrieved from https://www.atmos-chem-phys-discuss.net/acp-2018-125. |
| 2.0 | 5.1.1.4 | ECCC | Oceanography - Baseline | Hannah, C. G., Dupont, F., Dunphy, M. (2009). Polynyas and tidal currents in the Canadian Arctic Archipelago.*Arctic* , 62(1), pp. 83-95. |
| 2.0 | 5.1.1.4 | ECCC | Oceanography - Baseline | NSIDC. (n.d.a). National Snow and Ice Data Center – Sea Ice Features: Polynyas. Retrieved from https://nsidc.org/cryosphere/seaice/characteristics/polynyas.html. |
| 2.0 | 5.1.1.4 | ECCC | Oceanography - Baseline | NOAA. (n.d.a). National Weather Service. Fog Safety Overview. Retrieved from https://www.weather.gov/safety/fog. |
| 2.0 | 5.1.1.5 | ECCC | Sea Ice and Iceberg Conditions - Baseline | NSIDC. (n.d.a). National Snow and Ice Data Center – Frequently Asked Questions on Arctic sea ice. Retrieved from http://nsidc.org/arcticseaicenews/faq/#area_extent. |
| 2.0 | 5.1.1.5 | ECCC | Sea Ice and Iceberg Conditions - Baseline | Barber, D.G., Babb, D.G., Ehn, J.K., Chan, W., Matthes, L., Dalman, L.A., Campbell, Y., Harasyn, M.L., Firoozy, N., Theriault, N., & Lukovich, J.V. (2018). Increasing mobility of high Arctic Sea ice increases marine hazards off the east coast of Newfoundland. *Geophysical Research Letters* , 45(5), pp. 2370-2379. |
| 2.0 | 5.1.1.5 | ECCC | Sea Ice and Iceberg Conditions - Baseline | Howell, S.E.L., Duguay, C.R., & Markus, T. (2009). Sea ice conditions and melt season duration variability in the Canadian Arctic Archipelago: 1979-2008. Geophysical Research Letters, 36 (10). Retrieved from https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2009GL037681. |
| 2.0 | 5.1.1.5 | ECCC | Sea Ice and Iceberg Conditions - Baseline | Howell, S. E. L., Wohlleben, T., Dabboor, M., Derksen, C., Komarov, A., & Pizzolato, L. (2013). Recent changes in the exchange of sea ice between the Arctic Ocean and the Canadian Arctic Archipelago. Journal of Geophysical Research Oceans, 118(7), pp. 3595–3607. Retrieved from https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/jgrc.20265. |
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| 2.0 | 5.1.1.5 | ECCC | Sea Ice and Iceberg Conditions - Baseline | Mudryk, L. R., Derksen, C., Howell, S., Laliberté, F., Thackeray, C., Sospedra-Alfonso, R., Vionnet, V., Kushner, P. J., & Brown, R. (2018). Canadian snow and sea ice: historical trends and projections. The Cryosphere, 12, pp. 1157-1176. Retrieved from https://www.the-cryosphere.net/12/1157/2018/. |
| 2.0 | 5.1.1.5 | ECCC | Sea Ice and Iceberg Conditions - Baseline | Stroeve, J. C., Markus, T., Boisvert, L., Miller, J., & Barrett, A. (2014). Changes in Arctic melt season and implications for sea ice loss. Geophysical Research Letters, 41(4), pp. 1216–1225. Retrieved from https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2013GL058951. |
| 2.0 | 5.1.1.5 | DFO | Sea Ice and Iceberg Conditions - Baseline | AMAP. (2017). Snow, Water, Ice and Permafrost in the Arctic (SWIPA) 2017. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. xiv + 269 pp. Retrieved from https://www.amap.no/documents/doc/snow-water-ice-and-permafrost-in-the-arctic-swipa-2017/1610. |
| 2.0 | 5.1.1.6 | DFO | Acoustic Environment - Baseline | Au, W.W.L & Hastings, M.C. (2008). *Principles of Marine Bioacoustics* . Springer, New York. |
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| 2.0 | 5.1.1.7 | NRCan | Geology (Bedrock and subsurface geology) - Baseline | Skipton, D.R., Saumur, B.M., St-Onge, M.R., Wodicka, N., Bros, E.R., Currie, L.D., Weller, O.M., & Haggart, J.W. (2018). Bedrock geology, Pond Inlet, Nunavut, part of NTS 38-B. Geological Survey of Canada, Canadian Geoscience Map 347, 1 sheet. Retrieved from https://doi.org/10.4095/306578. |
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| 2.0 | 5.1.1.7 | NRCan | Geology (Bedrock and subsurface geology) - Baseline | Haggart, J.W., Burden, E.T., Clark, K., Currie, L.D., Dafoe, L.T., Enoogo, J., Herrle, J.O., Schröder-Adams, C.J., Sweet, A.R., Williams, G.L., Fensome, R.A. (2017). *Report of activities 2017, GEM-2 Baffin Project: onshore Cretaceous-Paleogene stratigraphic studies, northern Baffin Bay region, Nunavut.* (Geological Survey of Canada, Open File 8324). Retrieved from https://doi.org/10.4095/306084. |
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| 2.0 | 5.2.1.6 | DFO | Marine Mammals - Baseline | Davidson, E. (2016). Exploring the characteristics of spatial distribution for Sperm whales (Physeter macrocephalus) and Northern bottlenose whales (Hyperoodon ampullatus) in the Arctic: a preliminary study to inform conservation management. (Doctoral dissertation). Iceland University, Reykjavik, Iceland. Retrieved from https://www.semanticscholar.org/paper/Exploring-the-characteristics-of-spatial-for-Sperm-Davidson/d822ebe8a149790a13f5a0265aee947e23527bbb. |
| 2.0 | 5.2.1.8 | ECCC | Special and Sensitive Areas - Key Habitat Sites - Baseline | ECCC. (2016). Environment and Climate Change Canada's input to the Nunavut Planning Commission regarding Key Habitat Sites for Migratory Birds in the Nunavut Settlement Area. Revised May 2016. Retrieved from http://www.nunavut.ca/files/2016-05-31%20ECCC%20Key%20habitat%20sites%20for%20migratory%20birds %20in%20the%20NSA.pdf |
| 2.0 | 5.2.1.8 | ECCC | Special and Sensitive Areas - Key Habitat Sites - Baseline | Mallory, M.L, & Fontaine, A.J. (2004). Key marine habitat sites for migratory birds in Nunavut and the Northwest Territories. (Occasional Paper No. 109 Canadian Wildlife Service). Retrieved from http://publications.gc.ca/collections/collection_2011/ec/CW69-1-109-eng.pdf. |
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# APPENDIX D: FINAL SEA SCOPE LIST

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NUNAVUT IMPACT REVIEW BOARD
NUNAVUMI AVATILIKIYIN KATIMAYIN

**NIRB File No.: 17SN034**

March 9, 2018

To: Distribution list

Re: Final Scope List for the NIRB's Strategic Environmental Assessment in Baffin Bay and Davis Strait

Dear Parties:

As you are aware, the Nunavut Impact Review Board (NIRB or Board) has initiated a comprehensive public process to identify the scope for the Strategic Environmental Assessment in Baffin Bay and Davis Strait (the SEA). The NIRB's scoping process is designed to collect feedback from government departments, industry, academia, non-governmental organizations, communities, and the general public. Using the feedback provided, the NIRB has identified the full range of possible offshore oil and gas activities, ecosystemic, and socio-economic factors, and questions and concerns to consider throughout the SEA.

The purpose of this correspondence is to circulate the Final Scope List for information.

## FILE HISTORY

On February 9, 2017 the NIRB received a referral from Indigenous and Northern Affairs Canada (INAC) to initiate the SEA pursuant to Section 12.2.4 of the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada* (*Nunavut Agreement*).[1] The NIRB is responsible for coordinating the SEA, including considering previously-collected information and Inuit Qaujimajatuqangit and Inuit Qaujimaningit, facilitating public engagement, and submitting a final report to the Minister of Crown-Indigenous Relations and Northern Affairs by March 2019.

Between April 20, 2017 and May 15, 2017, public engagement sessions were held in support of the SEA in the communities of Clyde River, Arctic Bay, Resolute Bay, Grise Fiord, Pond Inlet, Qikiqtarjuaq, Cape Dorset, Kimmirut, Iqaluit, and Pangnirtung. The engagement sessions were organized and facilitated by the NIRB, with participation and support by representatives of the SEA working group: Indigenous and Northern Affairs Canada, Nunavut Tunngavik Incorporated, the Qikiqtani Inuit Association, and the Government of Nunavut. During these

[1] The NIRB's jurisdiction as expressed within the *Nunavut Agreement* continues to apply for the SEA in Baffin Bay and Davis Strait.

engagement sessions, the NIRB provided the public with information on the SEA process and next steps and received valuable information to inform the SEA process. On June 26, 2017 the NIRB circulated a summary report to its public distribution list detailing comments and questions from each community.

On September 11, 2017 the NIRB released a *Draft* Scope List for a period of public review and comment. Between October 18, 2017 and November 16, 2017, the NIRB, accompanied by representatives of the SEA working group, conducted public scoping sessions throughout the communities of the Qikiqtani Region listed above. Following the conclusion of public scoping meetings and the receipt of written comment submissions regarding the *Draft* Scope List, on December 20, 2018 the NIRB released a summary report detailing comments and questions received from each community, as well as a Revised *Draft* Scope List. Parties were invited to review the Revised *Draft* Scope List and provide written comments to the NIRB for consideration on or before February 5, 2018. Following the close of the commenting period, submissions were received by the following parties:

- Government of Nunavut,
- World Wildlife Fund Canada,
- Greenpeace Canada,
- Peter Croal, and
- Danish Centre for Environment and Energy / Greenland Institute for Natural Resources.

Following the public commenting period on the Revised *Draft* Scope List, the NIRB has produced the attached Final Scope List (Appendix C) for information. A summary table has also been enclosed to demonstrate how various suggested revisions offered through written comment submissions have been addressed, with an indication of where edits have either been incorporated into the Final Scope List, or if edits were not incorporated, a corresponding rationale. The NIRB sincerely appreciates the substantial time and effort that parties invested in developing their comment submissions.

All information relating to the NIRB's Strategic Environmental Assessment in Baffin Bay and Davis Strait can be accessed online from the NIRB's online public registry at www.nirb.ca by using any of the following search criteria:

- Project Name: Strategic Environmental Assessment in Baffin Bay and Davis Strait
- NIRB File No.: 17SN034
- Application No.: 125087

## NEXT STEPS

For the information and planning of parties, the NIRB has enclosed the current Process Map and anticipated timeline for the NIRB's SEA in Baffin Bay and Davis Strait. Based on the feedback received by parties, the NIRB has provided a revised Appendix A, which provides additional background information on the SEA, as well as the Final Scope List (Appendix C). Following the release of the Final SEA Scope, the NIRB will release the *Draft* Possible Development Scenarios for public commenting period in April 2018.

If you have any questions regarding the Strategic Environmental Assessment in Baffin Bay and Davis Strait, please contact Heather Rasmussen, Policy Advisor, at (867) 983-4606 or via email at hrasmussen@nirb.ca.

Sincerely,

Ryan Barry
Executive Director
Nunavut Impact Review Board

cc: SEA Distribution List
Daniel VanVliet, Indigenous and Northern Affairs Canada
Filip Petrovic, Indigenous and Northern Affairs Canada
Jorgan Aitaok, Nunavut Tunngavik Incorporated
Rosanne D'Orazio, Qikiqtani Inuit Association
Steven Lonsdale, Qikiqtani Inuit Association
Annie Cyr-Parent, Government of Nunavut

Attached: Appendix A: Background Information on the Strategic Environmental Assessment in Baffin Bay and Davis Strait
Appendix B: Maps
Appendix C: Final Scope List for the Strategic Environmental Assessment in Baffin Bay and Davis Strait

Enclosed: Process Map for NIRB's Strategic Environmental Assessment in Baffin Bay and Davis Strait
SEA Baffin Bay and Davis Strait Draft Scope Comment Table

## APPENDIX A: BACKGROUND INFORMATION

### PURPOSE OF THE ASSESSMENT

The focus of the Strategic Environmental Assessment in Baffin Bay and Davis Strait (the SEA) is to develop an improved understanding of potential types of oil and gas related development activities[2] that could one day be proposed within the Canadian waters of Baffin Bay and Davis Strait outside of the Nunavut Settlement Area (NSA), along with their associated adverse effects, benefits, and management strategies. The SEA will incorporate available scientific information, Inuit Qaujimajatuqangit and Inuit Qaujimaningit[3] and other types of traditional knowledge, and public feedback. An essential component of the SEA is to reflect Inuit concerns and traditional use of the associated marine areas. The NIRB is responsible for producing a final report at the conclusion of the SEA outlining the information collected throughout the assessment and providing recommendations to the Minister of Crown-Indigenous Relations and Northern Affairs for consideration. The Final SEA Report will inform the five (5)-year review of the Government of Canada decision to designate Canadian Arctic waters as off limits to future oil and gas licences. The decision to designate Canadian Arctic waters as off limits to future oil and gas licences was made through a joint statement by the President of the United States and the Prime Minister of Canada in December, 2016.[4]

Strategic environmental assessments can be used as beneficial planning and decision-making tools that can be applied to assess the potential outcomes and environmental effects of a policy, plan, or program in a defined geographical area or for a specific industrial sector. Strategic environmental assessments are well suited to undertaking a high-level and comprehensive analysis of alternatives, cumulative effects, and policy issues with regards to the potential for offshore oil and gas activities and components prior to individual projects being proposed and assessed. Unlike project-specific assessments undertaken by the NIRB, the SEA will not be focused on a proposed project. Instead, the SEA will identify the types of oil and gas activities that could potentially be proposed for Canadian waters in Baffin Bay and Davis Strait outside of the NSA, evaluate existing information, and examine issues, potential impacts and benefits, and management structures associated with possible activities.

The SEA will include an overview of how some of the applicable Strategic Environmental Assessment Guidelines have been incorporated into the assessment.

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[2] For the purpose of the SEA, 'oil and gas development' will refer to the discovery and exploitation of oil and gas deposits and encompasses exploration, production, and decommissioning activities.

[3] Inuit Qaujimajatuqangit refers to traditional values, beliefs, and principles while Inuit Qaujimaningit encompasses Inuit traditional knowledge (and variations thereof) as well as Inuit epistemology as it relates to Inuit Societal Values and Inuit Knowledge (both contemporary and traditional).

[4] United States-Canada Joint Arctic Leader's Statement. December 20, 2016. Retrieved from https://pm.gc.ca/eng/news/2016/12/20/united-states-canada-joint-arctic-leaders-statement

## SEA Phases

The SEA will consist of the following three (3) general phases:

*Issues Scoping:* The scope of the SEA will outline the factors to be considered within the assessment, including the full range of possible offshore oil and gas activities; physical, biological, and socio-economic components; and questions and concerns to consider throughout the SEA.

*Analyze Possible Development Scenarios:* The various possible oil and gas development scenarios (including a 'no oil and gas development' scenario) will be identified in combination with other ongoing or planned activities (e.g., development projects, fisheries, conservation initiatives, traditional uses, etc.) and within the context of the unique biophysical, socio-economic, and regulatory environment of the area. The potential impacts and benefits of the possible development scenarios identified by the Board for inclusion in the SEA will be considered by the Board.

*Develop Final SEA Report:* During the final phase of the SEA, the NIRB will hold a final public meeting, with opportunities for representatives of the 10 selected Qikiqtani communities to attend and share their views and concerns with the Board. The Board will then prepare and issue the Final SEA Report to the Minister of Crown-Indigenous Relations and Northern Affairs. The Final SEA Report will be available to the public for information.

## Area of Focus

As noted above, the SEA will consider possible types of oil and gas related development activities that could one day be proposed within the Canadian waters of Baffin Bay and Davis Strait outside of the Nunavut Settlement Area (NSA), along with their associated adverse effects, benefits, and management strategies. The Area of Focus established for the SEA is illustrated in Figure 1: Strategic Environmental Assessment Area of Focus in Baffin Bay and Davis Strait (see Appendix B). This broader Area of Focus will be used when developing descriptions of the existing environment, investigating available knowledge, and analyzing potential effects of development activities.

The study of the possible development scenarios will include possible oil and gas exploration and production in the area illustrated in Figure 2: Strategic Environmental Assessment Development Scenarios (see Appendix B). The possible development scenarios will not exclude the potential for coastal based infrastructure and activities and components to be established in support of offshore oil and gas development activities and components.

## Guiding Legislation and Jurisdiction

The SEA will describe the current regulatory and royalty framework for oil and gas development in the Canadian offshore waters[5] of Baffin Bay and Davis Strait, identifying existing and proposed legislation, regulations, protected areas, etc., that may be relevant or applicable.

All marine areas of the NSA and the adjacent continental shelf are subject to federal jurisdiction with respect to oil and gas development. Any potential oil and gas development activities that could be undertaken in the Canadian offshore waters of Baffin Bay and Davis Strait would necessarily occur in waters currently under federal jurisdiction and would be subject to the *Canada Petroleum Resources Act* (CPRA) and the *Canada Oil and Gas Operations Act* (COGOA). The CPRA authorizes the issuance of exploration licences, significant discovery licences, and production licences. Offshore oil and gas operations occurring within these areas would be subject to the environmental assessment and regulatory regime of the National Energy Board under the COGOA. Regulations related to the exploration and drilling, production, conservation, processing, and transportation of oil and gas in Canada's frontier and offshore areas and associated changes under consideration through the Frontier and Offshore Regulatory Renewal Initiative will also be discussed.

Any land-based support and staging infrastructure and activities for offshore oil and gas activities and components that would be established along the coastal areas of Baffin Bay and Davis Strait – whether on land or in the water – within the boundaries of the NSA would generally be subject to all of the requirements described above as well as the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada* (the *Nunavut Agreement*) and applicable Territorial legislation. Pursuant to the *Nunavut Agreement*, the NIRB assesses proposed development within the NSA and may also have a role in assessing project proposals located outside of the NSA if there was the potential for project-induced significant adverse ecosystemic or socio-economic effects within the NSA (i.e., potential transboundary effects).

The SEA will further identify and consider existing and proposed management and conservation areas within the Area of Focus (such as the recently established Tallurutiup Imanga (Lancaster Sound) National Marine Conservation Area), their associated management measures and regulations, and implications for the possible development scenarios that will be assessed through the SEA.

## Objectives

The primary objectives of the SEA are to:

1. **Provide background information.** This will include a description of:
    a. The geology and the identification of areas with any currently known, estimated, or speculated reserves, including their potential value and their ease/difficulty of exploitation, and areas with the greatest oil and gas potential;

[5] The Canadian offshore waters refer to waters of Canadian jurisdiction extending beyond the NSA.

b. Historic oil and gas activities within Nunavut and the Canadian waters of Baffin Bay and Davis Strait, including current status and state of any installations and ongoing monitoring measures;
c. Overview of the existing biological, physical, and human environments within Baffin Bay and Davis Strait, including bathymetry and physiography, prevailing currents, winds, tides, and any species at risk and special or sensitive areas, including areas of importance to Inuit, that could interact with potential activities;
d. Description of the current regulatory and royalty regimes and known future changes that may apply to the offshore oil and gas industry in the study area; and
e. High level and brief overview of relevant global factors that would determine demand for oil and gas and associated issues, including climate policies which influence the feasibility of oil and gas development in the Arctic and issues related to climate change.

2. **Describe potential challenges, obstacles, and other factors relevant to possible oil and gas development:**
    a. Potential technical challenges related to sea ice and icebergs, water depth, and lack of harbours and other infrastructure, etc.;
    b. General consideration of policy and regulatory frameworks and requirements and potential challenges, such as human and institutional capacity, and the implications of jurisdiction on environmental assessments;
    c. Collection of sufficient information on known and applicable royalty regimes in other jurisdictions to understand how royalties are applied under other regimes;
    d. General consideration of potential economic challenges related to the financial feasibility of developing oil and gas resources within the Canadian offshore waters of Baffin Bay and Davis Strait;
    e. Potential implications of public opinion on oil and gas development; and
    f. Possible future biological, physical, and human environments within Baffin Bay and Davis Strait.

3. **Describe possible oil and gas development scenarios, including:**
    a. Overview of typical offshore oil and gas activities encompassing exploration, appraisal, production, and decommissioning activities;
    b. An overview and analysis of possible offshore oil and gas development scenarios that could occur in Baffin Bay and Davis Strait will be prepared, including the circumstances and assumptions that may reasonably drive these scenarios. The scenarios will take into account timelines, activities, and equipment based on known factors such as infrastructure, technology, financial feasibility, domestic policy/regulations, including general requirements for benefits plans, and climate;
    c. The possible oil and gas development scenarios will be presented as a technical document and will outline typical offshore oil and gas lifecycle activities. Hypothetical development scenarios will be used to discuss in detail how these activities could reasonably be expected to be carried out based on current technology and the unique environment of Baffin Bay and Davis Strait – this would include examples of equipment and infrastructure that could be used.

Information presented in the technical document will be used to describe hypothetical scenarios that will provide a context for the review of potential effects on the physical, biological, and human environments. While the scenarios will not be associated with specific locations of activities, equipment, and/or infrastructure, it is expected they will generally identify areas where possible activities and infrastructure could be feasible or not;

d. The potential offshore oil and gas scenarios will include a 'no oil and gas development' scenario;

e. Description of alternative means to carrying out each scenario, including alternatives to individual components/activities, alternate timing, and development options; and

f. Identification of existing and potential reasonably foreseeable future marine activities in Baffin Bay and Davis Strait associated with communities as well as with mineral exploration and mining, coastal and marine tourism, and community port facilities.

4. **Assess the potential impacts and benefits:**

a. For each scenario, the potential for positive and negative ecosystemic and socio-economic effects to identified Valued Ecosystem Components and Valued Socio-Economic Components will be discussed;

b. The SEA will speak to the types of effects that could occur and the potential characteristics of these effects. The description of environmental effects will not be as detailed as that for a project level assessment and site specific effects will not be quantified as is typical of project level assessment. The SEA will not include significance determinations or modelling of spills or noise emissions;

c. While the assessment of effects of each scenario on the valued components will include the potential for greenhouse gas emissions resulting from activities associated with the oil and gas development scenarios, particularly the extraction and production of petroleum resources, potential greenhouse gas emissions from the end use of oil and gas products are excluded from the Scope of the SEA;

d. Identification of potential cumulative effects within the Area of Focus of offshore oil and gas activities and components, occurring both within Canadian and Greenlandic waters, with existing and reasonably foreseeable, marine activities in the Canadian and Greenlandic waters of Baffin Bay and Davis Strait;

e. Identification of potential transboundary impacts, including oil and gas development and associated activities in Greenlandic waters which could contribute to cumulative effects and the potential for accidents and malfunctions;

f. Identification of potential mechanisms for carrying out cumulative effects and transboundary assessments that could be undertaken at the project level (e.g., creation of a repository for regional data);

g. Identification and recommendations for general mitigative and monitoring measures (e.g., collection of baseline information) that could be employed during any potential offshore oil and gas activities in the region;

h. Identification, where appropriate, of activities and/or areas that may require additional or enhanced levels of mitigation, and identification, if feasible, of the type and level of enhanced mitigation required;

i. Identification of potential accidents and malfunctions that could occur as a result of offshore oil and gas activities in Baffin Bay and Davis Strait – such as accidental oil spills or sub-sea blow-outs or leaks – will be considered, as well as whether they could obviously be mitigated or not. For impacts that the Board considers to be mitigable, the Board may also recommend appropriate mitigation measures;

j. Credible worst case accident and malfunctions scenario; and

k. Identify the level of uncertainty in the assessment of each scenario for each VEC/VSEC.

5. **Identify knowledge and data gaps, including areas of concern.**

6. **Develop Final SEA Report with recommendations.** The final report will assist Indigenous and Northern Affairs Canada in its responsibilities for the administration of exploration rights in the offshore areas Baffin Bay and Davis Strait, and will inform the five (5) year review of the Government of Canada decision to designate Canadian Arctic waters as off limits to future oil and gas licences. The report will address the matters described above and there is nothing precluding the Board from considering views of parties regarding topics such as:

   a. Specific needs for additional information, including identification of knowledge gaps that should be addressed to inform future decision-making, with associated recommendations where possible;
   b. Processes, where possible, to fill information and data gaps;
   c. Location and timing of potential oil and gas activity;
   d. Actions to prevent or reduce potential adverse effects from offshore oil and gas activities;
   e. Emergency preparedness and response;
   f. Options to maximize benefits for Nunavummiut;
   g. Approaches to oil and gas development, if applicable;
   h. Potential alternative development activities that could be given further consideration;
   i. Potential needs to review and update the Strategic Environmental Assessment in Baffin Bay and Davis Strait; and
   j. Ongoing and reporting opportunities to support future decision-making.

## Collection and Use of Information

Throughout each of its phases, the SEA will gather and consider available scientific information, Inuit Qaujimajatuqangit and Inuit Qaujimaningit, and public feedback, with the information gathered made publically available through an online public registry, in-person community meetings, and periodic distribution of notices, reports, and other items.[6] Numerous

[6] Privileged, confidential, or proprietary information excepted.

opportunities will allow for interested parties and members of the public to participate in the SEA by providing oral and written comments, through community meetings, workshops, public commenting periods, and a final public meeting. Inuit Qaujimaningit shared with the Board by the public and Inuit organizations will be considered essential to shaping and influencing the SEA process and will be given equal weight to scientific information. The NIRB will work closely with the Qikiqtani Inuit Association, who will be collecting Inuit Qaujimajatuqangit to inform the SEA, to ensure community knowledge and Inuit Qaujimajatuqangit is appropriately used to inform the SEA. The feedback provided will assist the Board in developing the scope of the SEA, the consideration of possible development scenarios, and recommendations regarding possible oil and gas development activities in Baffin Bay and Davis Strait and associated issues.

Through an independent consultant, the NIRB will engage with technical experts within the oil and gas industry to assist in developing the possible offshore oil and gas development scenarios. Engagement is also planned to occur with transboundary groups, organizations, and Inuit from outside Nunavut, with the objective of understanding perspectives and learning lessons from other Arctic areas which have had experience with oil and gas development to date.

## SEA MANAGEMENT

The NIRB will carry out the SEA as an independent body, providing a report with associated recommendations to the Minister of Crown-Indigenous Relations and Northern Affairs at the conclusion of the SEA. While the NIRB is responsible for coordinating the SEA, project support will be provided through the Northern Affairs Organization at Indigenous and Northern Affairs Canada (INAC) and a working-level advisory group with representation from:

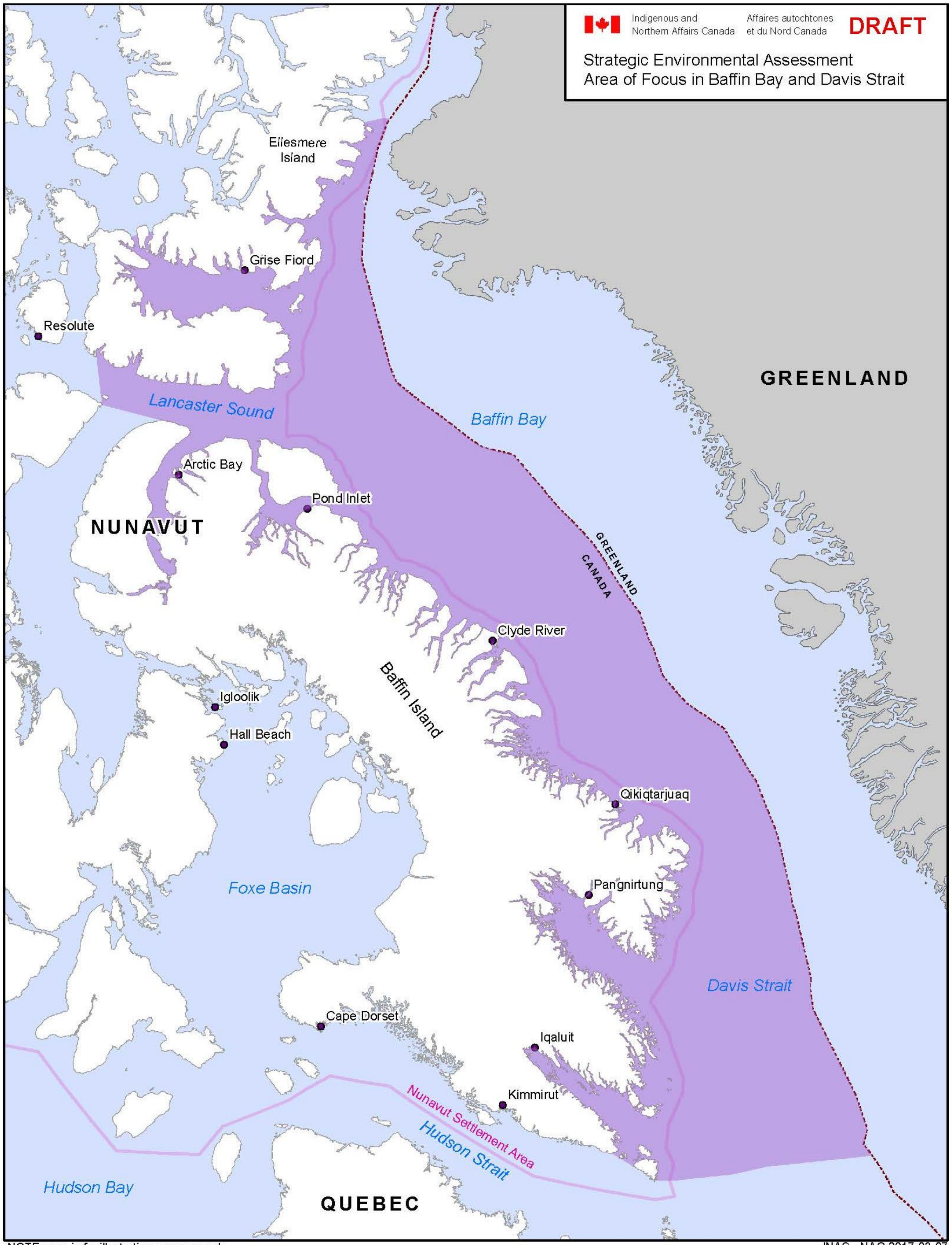
- Nunavut Impact Review Board
- Indigenous and Northern Affairs Canada
- Nunavut Tunngavik Incorporated
- Qikiqtani Inuit Association
- Government of Nunavut

The working group will inform and guide the NIRB throughout the SEA, with opportunities for direct participation on community tours and at other key steps, including but not limited to:

- Development of the *Draft*, Revised *Draft*, and Final Scope List;
- Input into the scope and presentations for community meetings;
- Feedback on the *Draft* development scenarios and proposed effects mechanisms; and
- Input into the Final Public Meeting.

## APPENDIX B: MAPS

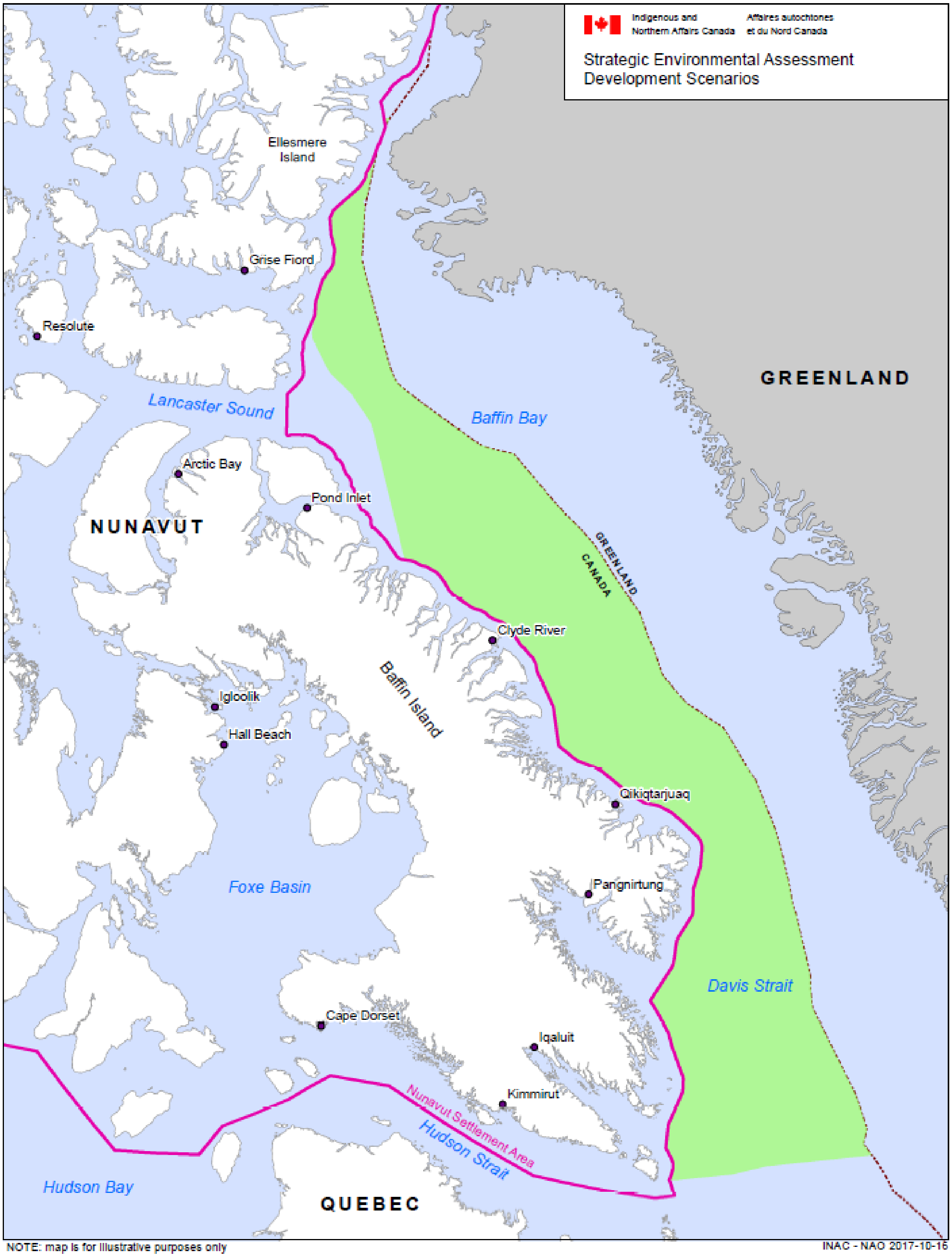
Figure 1: Strategic Environmental Assessment Area of Focus in Baffin Bay and Davis Strait




NOTE: map is for illustrative purposes only

INAC - NAO 2017-03-07

Figure 2: Strategic Environmental Assessment Development Scenarios



## APPENDIX C: *DRAFT* SCOPE LIST

### PAST OIL AND GAS ACTIVITIES

No new oil and gas rights have been issued in the Eastern Canadian Arctic since the 1980s and there are no active authorizations for offshore drilling in Canada's Arctic, including Baffin Bay and Davis Strait.

The SEA will be informed by available information (including exploration, production, and reclamation activities) regarding past oil and gas activities undertaken within Nunavut (and/or previously the Northwest Territories). Where information is available, marine seismic programs, including those used for research purposes, such as those undertaken by the Geological Survey of Canada, will be included.

The SEA will further consider the experiences of other Arctic jurisdictions with oil and gas development, including the Inuvialuit Settlement Region, Eastern Canada, Greenland, and Alaska.

### ACTIVITIES AND COMPONENTS

The scope of the SEA will encompass the full range of possible offshore oil and gas activities throughout the complete life cycle of development, while focusing on possible scenarios deemed more likely to be applicable in Baffin Bay and Davis Strait. Activities and components that may be considered include:

- Exploration and Appraisal Activities
    - Initial scouting activities;
    - Preliminary seismic surveying of the potential resource (2D, 3D, and 4D marine seismic surveys and vertical seismic profiling);
    - Well site, geotechnical, and geohazard surveys;
    - Exploratory and delineation drilling; and
    - Transportation (support/supply vessels, seismic vessels, and air transportation).
- Development and Production Activities
    - Associated coastal infrastructure and staging activities;
    - Pipeline routing, rig installation, and drilling;
    - Transportation of the extracted resource (oil or natural gas);
    - Seismic and geohazard surveying throughout production;
    - Operations and maintenance; and
    - Decommissioning and reclamation.

### SPATIAL AND TEMPORAL BOUNDARIES

The Area of Focus of the SEA encompasses the Canadian waters of Baffin Bay and Davis Strait and adjoining bays, sounds, and inlets west of the Canada/Greenland border and extending from the latitude of Resolution Island in the south to Nares Strait in the north (see Figure 1, Appendix B).

The study of the possible development scenarios will include potential oil and gas exploration and production in the Canadian waters beyond the NSA and in the evaluation of scenarios the Board will consider limits imposed by existing and potential special and sensitive areas as well as management and conservation areas (see Figure 2, Appendix B). The Tallurutiup Imanga (Lancaster Sound) National Marine Conservation Area will be excluded from the scope of possible development scenarios.

The analysis of potential interactions would be undertaken throughout the entire SEA Area of Focus.

The SEA will consider the typical lifecycle of the various oil and gas scenarios, and the implications for short, medium, and long term time frames as applicable. The temporal scope will be further determined during the development of the potential oil and gas development scenarios.

## COMPONENTS TO BE CONSIDERED

*Valued Components*

Using available information and input from stakeholders, the NIRB will identify the existing biological, physical, and human environments within the SEA Area of Focus. To do so, the following preliminary Valued Ecosystem Components (VECs), and Valued Socio-Economic Components (VSECs), including subjects of note, have been identified and shall take into account the temporal and spatial boundaries established for the SEA while drawing upon relevant information from scientific sources, Inuit Qaujimajatuqangit and Inuit Qaujimaningit,[3] traditional and community knowledge.

Physical Environment

| Valued Ecosystem Components | Considerations To Include |
|---|---|
| **a.** Climate and meteorology (weather and storm conditions)<br>**b.** Oceanography (including wind, waves, tides, currents, sea level, storm surge, and upwelling)<br>**c.** Sea ice and iceberg conditions | • Trends, extreme events, and seasonal variations;<br>• Climate change and greenhouse gas emissions;<br>• Air quality;<br>• Sea water temperature and salinity;<br>• Polynyas; and<br>• Marine weather forecast. |
| **d.** Air quality | • Identification of existing greenhouse gas (GHG) emission sources;<br>• Identification of potential pollutants that would need to be assessed at the project specific level; and<br>• Potential contributions of each |

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| | development scenario to Territorial/National GHG emission levels. |
| **e.** Acoustic environment (atmospheric and under water noise) | • Baseline sound and vibration levels and variability;<br>• Potential relationship between these parameters and local weather conditions, seasonal variations, etc.; and<br>• Review of available studies/research on potential impacts of noise and vibration on marine wildlife behaviours and fish in comparable climate and geographical location. |
| **f.** Geology (coastal and submarine) | • Potential for seismicity and geohazard events (e.g., earthquakes, landslides, and mudslides). |
| **g.** Coastal landforms<br>**h.** Marine sediment | • General description of coastal landforms.<br>For water bodies that could potentially be impacted by activities/components:<br>• Physical and chemical characteristics; and<br>• Description of sedimentation rates and dispersion patterns of waterbodies. |

Biological Environment

| Valued Ecosystem Components | Considerations |
|---|---|
| **i.** Coast and shoreline environment (including coastal and marine plants) | • Species distribution, life stages, and important areas;<br>• Unique habitats;<br>• Protected areas or parks; and<br>• Fish spawning habitat. |
| **j.** Plankton<br>**k.** Benthic flora and fauna (including soft corals and seaweed)<br>**l.** Fish and fish habitat (including water quality)<br>**m.** Waterbirds (seabirds, waterfowl, and shorebirds)<br>**n.** Marine mammals | • Species distribution, migratory routes, life stages, behaviour/lifestyle, and important areas;<br>• Unique and vulnerable habitats;<br>• Polynyas; and<br>• Biodiversity among species. |

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| **o.** Species at Risk | • *Species at Risk Act*, *Migratory Birds Convention Act*, Committee on the Status of Endangered Wildlife in Canada (COSEWIC);<br>• Species and associated habitat[7];<br>• Associated monitoring of species at risk and/or associated habitat[8]; and<br>• Biodiversity among species. |
| **p.** Special and Sensitive Areas | • Areas identified and/or designated under Territorial and/or Federal legislation, processes, and frameworks (e.g., Ecologically and Biologically Significant Areas, Marine Protected Areas, National Marine Conservation Areas, Migratory Bird Sanctuaries, and National Wildlife Areas);<br>• Rare or unique habitats (e.g., North Water Polynya); and<br>• Important migration routes or spawning, breeding, or calving areas. |
| **q.** Areas of Concerns/Importance | • Areas identified by government departments, academia, non-governmental organizations, potentially interested communities; and<br>• Areas identified through Inuit Qaujimajatuqangit and Inuit Qaujimaningit will be highlighted. |

Human Environment

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| **r.** Potentially interested communities | • Clyde River, Arctic Bay, Resolute Bay, Grise Fiord, Pond Inlet, Qikiqtarjuaq, Cape Dorset, Kimmirut, Iqaluit, and Pangnirtung. |
| **s.** Economic development and opportunities[9] | For the Qikiqtani region, with focus on the |

[7] Associated habitat to include: seasonal movements, movement corridors, habitat requirements, key habitat areas, and potential critical habitat which include consideration of important biophysical attributes related to any of its general life history states (e.g., breeding, foraging, etc.,).
[8] A review of available and relevant literature on whether potential or future critical habitat, listed wildlife species or species assessed as "at risk" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) occur or are expected to occur within the study area and zone of influence.

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| | potentially interested communities:<br>• The traditional economy, current economic structure including the interaction between the wage and traditional economy, development trends and variability, as well as in Nunavut as a whole;<br>• The roles of renewable resource development (e.g., subsistence and commercial hunting and fishing) in the local, regional, and territorial economy; and<br>• Community and resident self-reliance. |
| **t.** Employment | For the Qikiqtani region, with focus on the potentially interested communities:<br>• Labour supply statistics in terms of relative genders, ages, and other demographic categories;<br>• Local household incomes, income sources, and composition of income;<br>• Sector specific breakdown of employment within the NSA;<br>• Existing local employment opportunities and labour supply status; and<br>• For each possible development scenario, discussion of the requirements for employment (e.g., education levels) and the potentials of needs to be met by local recruitment. |
| **u.** Contracting and business development | For the Qikiqtani region, with focus on the interested communities:<br>• Current data available as it relates to types of contracting and business opportunities from socio-economic studies associated with the possible development scenarios;<br>• For each possible development scenario, |

[9]This component will consider, at a high-level, economic development and opportunities in addition to, or as alternatives to oil and gas development, but will not be assessed or analyzed in depth.

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| | types of potential goods and services to be supplied, including procurement, services contracting, and other business opportunities; and<br>• Economic structure and characteristics of local and regional economies, existing business types, and potential capacity to meet needs through the possible development scenarios. |
| **v.** Education and training | For the Qikiqtani region, with focus on the interested communities:<br>• Overview of the existing education system and training opportunities and programs (early childhood through post-secondary), with a focus on opportunities and programs relevant to the possible development scenarios; and<br>• Education and skill levels of residents and experience of the local labour force in different demographic categories based on available data. |
| **w.** Population demographics[10] | For the Qikiqtani region, with focus on the potentially interested communities:<br>• Description of community populations, demographics structure, composition, characteristics, and population trends; and<br>• Discussion of observed variations in education levels, dietary habits, religious characteristics, and other social aspects in different demographic categories. |
| **x.** Wellbeing and health of coastal communities[10] | For the Qikiqtani region, with focus on the potentially interested communities:<br>• Description of the current individual and family well-being;<br>• Description of the current status of health, including physical, mental, and psychological; and |

[10] The Board's consideration of these VSECs will be conducted at a high-level and these topics will not be subject to the type of in-depth analysis associated with a project-specific assessment.

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| | • Description of nutritional requirements with quantitative information on the diet habits of residents, including consideration of details such as the seasonal, gender, and age-related consumption of country foods. |
| **y.** Community infrastructure and services | For the Qikiqtani region, with focus on the potentially interested communities:<br>• Description of existing transportation modes and travel routes; and<br>• Coastal infrastructure (e.g., ports) associated with communities as well as with mineral exploration (e.g., metal mines). |
| **z.** Traditional activity & knowledge and community knowledge including<br>• Land use<br>• Food security<br>• Cultural activities | • Description of cultural and traditional activities, including but not limited to travel routes, activity type, dependence on traditional foods (including cultural and financial significance), and type and location of species consumed; and<br>• Current land uses and limits/interference with existing uses. |
| **aa.** Non-traditional, recreation, and tourism activities | • Type of activity, timing, and location;<br>• Description of identified and anticipated overlapping zones and/or areas where the land use activities co-exist or interact with Project components and activities;<br>• Canadian/Armed forces exercises;<br>• Pleasure crafts; and<br>• Value of the 'Nunavut Brand:' clean, unspoiled, and uncontaminated wilderness. |
| **bb.** Cultural and commercial harvesting (including fisheries) | • Historic, current, and potential future practices, encompassing areas, timing, and species, and quality of harvest. |
| **cc.** Marine commercial traffic (including cruise tourism and re-supply vessels) | • Routes and frequency (including entry to the Northwest Passage); and<br>• Associated regulations. |
| **dd.** Other reasonably foreseeable future activities | Identify and describe known and planned future activities and developments that are |

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| | either already occurring, likely to continue to expand, and/or publically announced, including those related to:<br>• Marine transportation;<br>• Commercial fisheries;<br>• Submarine fibre optic communication cables;<br>• Canadian/Armed forces exercises; and<br>• Coastal infrastructure (e.g., ports). |
| **ee.** Heritage resources | • Summary description of known archaeological/paleontological, cultural and historic, sacred and spiritual sites within the SEA Area of Focus (including shipwrecks);<br>• Description of regulatory requirements and procedures for recovery and removal of artefacts and/or fossils in areas of proposed development; and<br>• Description of the relationship between the cultural sites and social lives of the potentially interested communities. |

Other Considerations

| Component | Consideration |
|---|---|
| **ff.** Climate change | • Trends, extreme events, and seasonal variations;<br>• Surface air temperature;<br>• Sea water temperature;<br>• Precipitation;<br>• Snow cover;<br>• Sea ice extent; and<br>• Frequency of extreme precipitation events. |
| **gg.** Accidents and malfunctions | • Types and likelihood of spills, including the potential source of contaminants and other materials that could be released to the surrounding environment; |

| | |
|---|---|
| | • Discussion of spill and accident preparedness, prevention, and response;<br>  • Identification of standard mitigations and planning considerations;<br>  • Discussion of standard response measures, including contingency, clean-up, or restoration work, response regimes, capabilities, and associated available infrastructure; and<br>• Identification and brief description of common tools and data that can be used in the assessment of project-specific effects from accidents and malfunctions. |
| **hh.** Jurisdiction and responsible authorities | • Roles and responsibility of the federal and territorial governments and Inuit organizations in land use management, including community based monitoring, throughout the SEA Area of Focus.<br>• Relevant international agreements (e.g., the Agreement between the Government of Canada and the Government of the Kingdom of Denmark for Cooperation Relating to the Marine Environment (Treaty E101887)). |

Subject of Note:
Energy security and diversification

- Potential implications of possible offshore oil and gas development on the availability of affordable energy sources in Nunavut and Canada, such as through resource, infrastructure, and technology sharing.

Naturally occurring oil seeps, including location and extent.

## ASSESSMENT OF EFFECTS OF OFFSHORE OIL AND GAS PROJECTS/ACTIVITIES

The prospective interactions of the activities and components associated with each possible oil and gas development scenario and the surrounding environment will be identified through an effects assessment on the Valued Ecosystem Components and Valued Socio-Economic Components identified in the previous section.

If a possible interaction between possible oil and gas activities identified through the scenarios and the VECs or VSECs have been identified, the potential negative effects related to the following could be considered:

- Disturbances to benthic habitat;
- Disturbances to marine mammals and seabirds, including but not limited to, noise, light interference, and contact (such as death, behaviour, movement and migration routes, hearing, and communication);
- Attractions of marine wildlife and birds to potential future oil and gas activities and components;
- Changes to air quality, including production of greenhouse gas emissions;
- Changes to water quality;
- Operational discharges and the effects on water and sediment quality;
- Disturbances to traditional harvesting activities, areas of importance to Inuit, and migration routes;
- Disturbances to food security through changes to harvesting activities and species availability, and through species ingesting contaminants;
- Bio-accumulation within the food chain;
- Disturbances to human health;
- Interactions with the coastal environment;
- Conflict with other types of land use (including Aboriginal and Traditional fisheries, commercial fisheries, marine shipping, cultural and travel routes, and tourism activities);
- Decreased level of interest in participating in tourist activities in areas that overlap with oil and gas activities;
- Disturbances to the quality of seafood harvested through commercial fishing and resulting impacts to the industry; and
- Disturbances resulting from accidents and malfunctions, particularly associated with oil and fuel spills and sub-sea blowouts or leaks.

Below are examples of potential benefits that could be experienced within Nunavut as a result of possible oil and gas development in the Canadian offshore waters of Baffin Bay and Davis Strait and/or associated activities within the NSA:

- Direct and indirect employment: Opportunities for unskilled, skilled, and professional positions;
- Education: Trades and training programs;
- Direct and indirect contracting and business opportunities;
- Capacity building and transferable skills;
- Benefits and revenues: Tax, royalties, etc.; and
- Transportation infrastructure.

Note: While the SEA will include an assessment of whether royalties and benefits could reasonably be expected to be experienced, the NIRB will not be analyzing the extent or appropriateness of possible benefits. The SEA is expected to identify the regulatory and royalty regimes, including mechanisms for benefits and revenues, and general employment and business requirements associated with the possible oil and gas development scenarios to assist with future planning considerations. Related concerns expressed during the SEA process will be brought forward.

Assessment of potential project effects to include:

- Potential effects mechanisms;
- Potential mitigation of effects;
- Likelihood of residual effects after mitigation; and
- Measures for effects monitoring and compensation.

## ASSESSMENT OF EFFECTS OF THE ENVIRONMENT ON POTENTIAL OFFSHORE OIL AND GAS PROJECTS/ACTIVITIES

The scope of the assessment will include the potential for the Arctic environment to exert effects on the potential oil and gas exploration and development activities, including the following specific factors:

- Climate and meteorology including climate change, storms, and weather;
- Severe winds, storms, and waves;
- Extreme temperature;
- Sea ice and icebergs;
- Seismic events;
- Available infrastructure and capabilities for response to potential accidents and malfunctions, including follow up measures (e.g., spill response waste treatment);
- Public perception of oil and gas activities; as well as
- Global factors, including issues related to climate change, contributing to demand for oil and gas and potential volatility for each development scenario.

## ASSESSMENT OF CUMULATIVE EFFECTS

The scope of the SEA will include an assessment of how potential residual effects from oil and gas activities, under various development scenarios, are likely to interact cumulatively with residual effects from other projects and activities conducted or expected to be conducted in or adjacent to the SEA Area of Focus.

Assessment of potential cumulative effects to include:

- Cumulative effects mechanisms;
- Potential mitigation measures and planning considerations for cumulative effects; and
- Likelihood of residual cumulative effects.

## ASSESSMENT OF TRANSBOUNDARY EFFECTS

The scope of the SEA will include an assessment of how oil and gas activities, under various development scenarios, are likely to interact with VECs and VSECs in neighbouring jurisdictions.[11]

[11] Waters within adjacent jurisdictions refer to those within the Nunavut Settlement Area, outside of the Nunavut Settlement Area but still within Canadian jurisdiction, and within Greenland.

Assessment of potential transboundary effects to include:

- Relevant international agreements (e.g., the Agreement between the Government of Canada and the Government of the Kingdom of Denmark for Cooperation Relating to the Marine Environment (Treaty E101887));
- Transboundary effect mechanisms;
- Potential additional mitigation measures for transboundary effects; and
- Likelihood of residual transboundary effects.

## ANY OTHER RELEVANT MATTERS

The scope of the SEA will include any other matters that the NIRB considers relevant, including:

- Technical innovations previously tested and untested in the Arctic (e.g., oil detection methods below snow and ice); and
- Discussion of similar resource development projects in other jurisdictions, specifically noting the experiences of other Arctic jurisdictions with oil and gas development, including the Inuvialuit Settlement Region, Eastern Canada, Greenland, and Alaska.

# APPENDIX E: PUBLIC ENGAGEMENT EVENTS AND OPPORTUNITIES

## Engagement Opportunities

The NIRB held a mix of formal and informal community engagement opportunities with potentially interested communities. NIRB staff were joined by staff representatives of the SEA working group for each of the community engagement tours: Nunavut Tunngavik Incorporated (NTI), Qikiqtani Inuit Association (QIA), Government of Nunavut (GN), and Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC).

**Advertisements and Materials**

Providing sufficient public notice is essential to effective public engagement and is a prerequisite of all the NIRB's community information sessions. During the SEA the NIRB informed each of the 10 communities of all upcoming meetings a minimum of 30 days in advance through various advertisements, including letters of invitation to the mayors, print media, radio, posters placed around town, and the Facebook pages of the NIRB and individual communities. When possible, the NIRB SEA Summary brochures and update newsletters were further placed around each community in key businesses and other locations, specifically the local post offices and grocery stores.

All NIRB materials and advertisements were made available in English and Inuktitut. Multiple types of printed meeting materials were prepared by the NIRB and the SEA Working Group for the public engagement sessions, including:

- PowerPoint presentations;
- Brochures, newsletters, and pamphlets;
- Posters and maps;
- *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada* (*Nunavut Agreement*);
- *Nunavut Planning and Project Assessment Ac*t; and
- NIRB Sign-in Sheets and comment forms.

The NIRB presentations were delivered in English with simultaneous interpretation in Inuktitut. The public was encouraged to provide comments and ask questions related to the SEA. Both written and verbal comments provided during the public engagement sessions were recorded by the NIRB staff and the representatives of the SEA working group. The public engagement sessions were open to all members of the public; bannock and refreshments were provided and door prizes were drawn at the conclusion of each session. All attendees were asked to sign in at each meeting.

The NIRB distributed to the public distribution list and posted to the public registry follow-up summary reports of comments provided by community members and details regarding specific activities and materials provided by the NIRB and the SEA Working Group for each public engagement tour. [242] All materials, including sign in sheets, were posted to the public registry as well. Table 41: Questions raised by NIRB Staff during Community Engagement Sessions provides a summarized and compiled list of questions raised by NIRB staff to community members and community representatives during each phase. The following are summaries of the NIRB's engagement efforts in the 10 communities throughout each phase of the SEA:

**Phase 1: Issues Scoping**

*Initial Engagement Session (April 20 – May 15, 2017)*

NIRB staff and representatives of the SEA working group held activities over a one (1) day period. During the afternoons, one (1) group met briefly with hamlet staff and council to explain the purpose and steps of the SEA and the other met with high school students to explain the purpose of the meetings as well as to provide an overview of the respective organizations and potential employment opportunities, emphasizing the importance of school attendance and participation in community engagement opportunities.

*Public Scoping Sessions (October 18-19, 2017 and November 6-16, 2017)*

NIRB staff and representatives of the SEA working group held activities over a two (2) day period. The NIRB delivered a detailed presentation on the first evening in each community, which included background information on the role of the Board as well information on:

- the SEA processes;
- how public feedback provided during the initial public engagement sessions were incorporated into the *Draft* Scope List;
- components of the *Draft* Scope List;
- general oil and gas activities; and
- potential effects.

During the second evening in each community, the NIRB provided a summary of the previous evening and then presentations were made by representatives of each organization in the SEA working group.[243] These presentations include the role of the respective organization in the SEA and relative associated work being conducted. Additionally, three (3) sections of the Summary *Draft* Scope – Valued Ecosystem and Socio-economic Components, Possible Oil and Gas Activities, and Potential Effects of Oil and Gas Activities on the Environment – were incorporated into poster size paper and made available for community members to provide direct written feedback.

NIRB staff and SEA working group members further attended information sessions at the local high schools, organized and led by the GN and the QIA, and meetings with the Hunters and Trappers Organizations and Community Land and Resource Committees, organized and led by the QIA to support its collection of Inuit Qaujimajatuqangit used to inform the SEA.

[242] Public Registry IDs: 312061 and 312868 (Initial Engagement Session); 314604 (Public Scoping Sessions); 3121940 (Public Engagement Sessions)

[243] In the event the first evening was cancelled or if the audience the second evening was significantly different than the first, more information from the first evening was presented.

**Phase 2: Analyze Potential Development Scenarios (September 27 – October 7, 2018 and October 29 – November 8, 2018)**
NIRB staff and representatives of the SEA working group held activities over a two (2) day period. During the mornings and afternoons in each community, NIRB staff, along with representatives of the SEA working group, undertook the following activities:

- *Engaging with local organizations*: The NIRB attempted to visit the hamlet, hunters and trappers organizations, and the QIA Community Liaison Officers in each community to provide updates on the SEA process and next steps. Staff provided information on the planned Final Public Meeting and the process for selecting community representatives to attend and participate in the associated Community Roundtable. The NIRB also dropped off, where possible, hard copies of the Final SEA Scope and summary reports from the two (2) previous public engagement sessions as well as digital versions of the documents and the Preliminary Findings Report.
- *Grocery store table:* NIRB and QIA staff set up information tables at the Co-op or Northern Store in each community to talk with community members and discuss the SEA process as well as advertise the meetings.
- *School sessions*: NIRB and QIA staff led classroom visits with high school students to discuss the SEA and learn about the local environment and land use by youth. These visits enabled NIRB and QIA staff to learn from youth in the communities and to encourage them to be actively involved in the SEA process. After a short presentation, students took part in two (2) interactive exercises:
  - Exercise 1: Students worked together to determine which animals could be found near their community throughout the year and then recorded this knowledge onto a traditional Inuit calendar; and
  - Exercise 2: Students described how country food is shared throughout their community and drew a diagram to illustrate this process.
- *GN Information Session*: The GN hosted an afternoon information session to provide information related to geology and spill response.
- *Public open house:* NIRB and working group staff made themselves available for informal discussions with members of the community.

The NIRB and the QIA delivered a detailed presentation on the first evening in each community, which provided an overview of the work undertaken by the respective organizations and information and conclusions presented in the Preliminary Findings Report.[244,245] For additional information on the Preliminary Findings Report, see Volume 2, Chapter 2.5.1: Methodology for the SEA.

[244] Public Registry ID: 320496.
[245] Unless an entirely different audience attended the meeting on the second evening, the NIRB and QIA did not present the formal presentation again but instead provided a summary of the presentation and then let community members lead the direction of the discussion.

The GN and NTI also presented on work undertaken to study the naturally occurring oil seep in Scott Inlet. The public was encouraged to ask questions and provide information related to the SEA.

***Develop Final SEA Report***

The NIRB invited up to three (3) community representatives from each of the 10 potentially interested communities to attend the five (5) day Final Public Meeting. Community representatives were provided with information packages, including non-technical summaries, and NIRB staff held a preparatory public information session prior to the commencement of the proceedings. Community representatives asked questions, provided information, and shared knowledge with the Board and other participants throughout the week.[246]

**Table 41: Questions raised by NIRB Staff during Community Engagement Sessions**

| Activity | Questions Raised |
|---|---|
| **Initial Engagement Sessions** | ▪ What do you think about the potential for offshore development?<br>▪ Comments, questions, or concerns?<br>▪ What components of the environment should be focused on?<br>▪ What potential effects do you think could occur on the land/water, animals, and people? |
| **Public Scoping Sessions** | ▪ What have we missed?<br>▪ What are your concerns?<br>▪ What would you like more information on? |
| **Preliminary Findings Sessions**[247] | ▪ How could these types of activities impact the environment and communities?<br>▪ What additional questions should be addressed?<br>▪ What information is missing<br>▪ What types of changes would be okay?<br>▪ What types of changes would not be okay?<br>▪ Where does additional research still need to take place?<br>▪ What types of research do you think should happen?<br>▪ What information would you need before you were comfortable for a decision to take place?<br>▪ What do you think some of the benefits could be? Did we miss any?<br>▪ What do you think some of the risks could be? Did we miss any? |

[246] For full text of the questions, comments and knowledge shared by community representatives during the Final Public Meeting, parties are invited to review the transcripts of the Final Public Meeting available from the NIRB's public registry at www.nirb.ca, Public Registry ID: 324606.

[247] The purpose of the Public Engagement Sessions when presenting the Preliminary Findings Sessions was to bring information back to the communities. Questions were provided for community members to think about to help prepare for the Final Public Meeting, particularly if attending as a community representative or sharing with a community representative.

| Activity | Questions Raised |
|---|---|
| **Community Representative Letters** | ▪ How might the environment around my community be impacted if oil or gas activities were allowed to proceed in the offshore waters of Baffin Bay and Davis Strait?<br>▪ How might the environment in my region be impacted if oil or gas activities were allowed to proceed in the offshore waters of Baffin Bay and Davis Strait?<br>▪ How might traditional activities, that either I or my community participate in, be impacted or changed if oil or gas activities were allowed to proceed in the offshore waters of Baffin Bay and Davis Strait?<br>▪ How might my community change or be impacted if oil or gas activities were allowed to proceed in the offshore waters of Baffin Bay and Davis Strait?<br>▪ What are the potential impacts I am concerned about?<br>▪ Have my concerns been addressed?<br>▪ If my concerns have not been addressed, what suggestions do I have to address these concerns (including plans or actions to avoid or reduce a negative effect and monitoring plans)?<br>▪ Do I support possible oil and gas development in the Canadian offshore waters of Baffin Bay and Davis Strait? Why or why not?<br>▪ What other questions do I have that have not been answered?<br>▪ Is there additional information that needs to be collected? |

## *Transboundary Engagement*

The NIRB reached out to organizations and governments in neighboring jurisdictions to Baffin Bay and Davis Strait, including: Makivik Corporation, Nunavik Marine Region Impact Review Board, Nunatsiavut Government, and the Government of Greenland. The NIRB included relative organizations, including those listed above, on its distribution list and issued Information Requests on the potential for transboundary effects of possible offshore oil and gas activities in the Development Scenarios Area. NIRB staff further reached out to representatives via email and phone calls to discuss the SEA. In particular, Greenlandic and Danish government agencies provided written comments and information during each phase of the SEA and participated in multiple teleconferences with NIRB staff to discuss the SEA and provide relevant information.

# APPENDIX F: LIFE CYCLE OF OIL AND GAS DEVELOPMENT

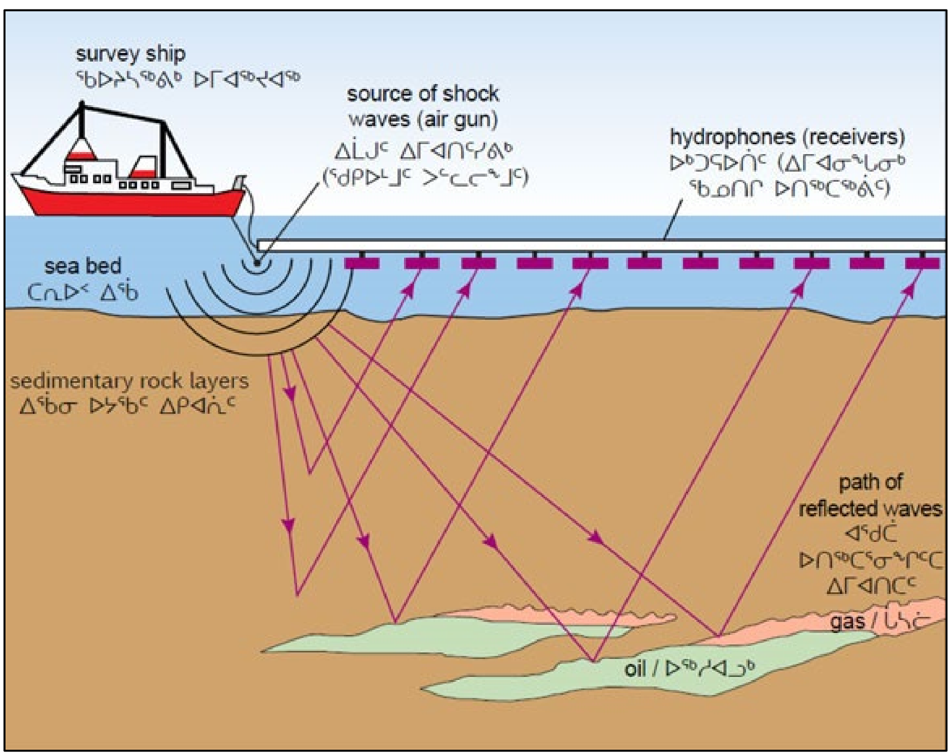
This section provides a summary of information found throughout the *Oil and Gas Hypothetical Scenarios Report* and describes generic, credible, and common steps covering a typical life cycle of offshore oil and gas development, from conducting two and three dimensional (2D; 3D) marine seismic data and acquiring the associated data, conducting exploration drilling (ED), and if a discovery is made, securing a Significant Discovery Licence (SDL).

All of these steps would not necessarily occur for a specific project and it is not uncommon for a company to terminate further activity after seismic or exploration drilling of one (1) or more wells in a licence area do not identify a show of hydrocarbons. A project may also be suspended after making a discovery if it is not yet economic to develop.

## *Offshore Seismic Surveys*

Seismic surveys are used to collect information on the geological characteristics of the seabed and this information can be used to identify areas where potential oil and gas reservoirs may exist (Figure 44: Seismic Survey Components).

**Figure 44: Seismic Survey Components (Source: NEB, 2019)**




## *Process*

During a seismic survey, sound waves are mechanically generated at the water's surface and directed below the seabed; some of that energy is reflected from different layers of rock below the surface. The strength of these waves and the length of time it takes for them to travel are recorded by hydrophones (receiving devices). The information collected is used to make an image providing a picture of the structure and nature of the rock layers. A seismic survey requires open water and good weather, typically from June to September, as rough water can affect the quality of the information collected.

### *Types of Seismic Surveys*

There are two (2) main types of seismic surveys:

- **Two dimensional (2D)** marine seismic surveys can be used to gain a general understanding of a region's geological structure and are often used in frontier areas. The information collected would likely be too coarse to support a drilling program.
- **Three dimensional (3D)** marine seismic surveys are designed to cover a specific area with known geological targets and is used to support the selection of drilling locations. 3D seismic surveys provide more detailed subsurface information than 2D and more than 95% of marine seismic data is collected using 3D seismic surveys.

A comparison of 2D and 3D seismic surveys is provided in Table 42: General Comparison of 2D and 3D Seismic Surveys.

**Table 42: General Comparison of 2D and 3D Seismic Surveys**

| Two Dimensional (2D) Seismic Surveys | Three Dimensional (3D) Seismic Surveys |
|---|---|
| 1 seismic cable and 1 airgun | 2 or more airguns |
| 1 cable (streamer) with hydrophones | 6-24 streamers with hydrophones spaced 25-50 metres (m) apart |
| Ship sails over a wide grid pattern several kilometres apart and requires oblique lines | Ship sails over racetrack pattern typically spaced 200-400m apart |
| Could require multiple survey seasons to collect sufficient data | Completed in 1 open water season and would likely take 2-3 years to get the information required |
| **Both 2D and 3D Seismic Surveys** | |
| Constant towing speed during seismic surveys of approximately 9 kilometres (km) /hour, or 5 knots[248] | |
| Streamers are typically 5,000-6,000m or longer and in deeper water like Baffin Bay and Davis Strait, streamers would float 8-15m below the water surface | |
| Actual numbers would be project specific | |

Although explosives were used in the past before airguns, they are not used in present day operations as the sound produced by airguns is more targeted and less disruptive to marine wildlife. Waterguns[249] and vibrators[250] are other types of seismic sources. However, it was noted that airguns are typically used for marine seismic surveys as they can send sound waves deeper into the seabed than other existing technologies. New and emerging technologies are being developed to collect the same type of information with less noise lost under water, including using underwater vehicles that would operate closer to the seabed. Four dimensional (4D) seismic surveys, also

[248] While 3D seismic surveys may be slightly faster than 2D surveys, they would generally be the same speed.

called time lapse surveys, are used in established production fields to monitor reservoir characteristics and depletion rates. 4D seismic surveys compare changes in 3D seismic surveys taken at different times.

Vertical seismic profiling (VSP) refers to a class of borehole seismic measurements used in correlation with surface seismic data. VSP is used to support drilling activities and is conducted inside the wellbore to provide a higher resolution of the structural geology at the drilling location. Most marine VSPs use an air gun as a surface seismic source and geophones to record sound wave data. Within comments on the *Oil and Gas Hypothetical Scenarios Report,* the National Energy Board noted that aerial, marine magnetic, and gravity surveys could also be conducted.

### *Sound Produced*

Typical air source arrays (use of multiple air guns) produce a sound ranging from 220-260 decibels (dBA) one (1) metre (m) from the airgun and lasting approximately 0.1 seconds, repeated every 10-15 seconds. The sound level decreases away from the airgun to 180 dBA at 500 m and about 170 dBA one (1) km away. How sound moves through water depends on many factors, including: bathymetry (water depth); seabed sediment properties; ice coverage; speed of sound at different depths; water salinity and temperature; airgun size; and rate the sound is produced. Nunami Stantec noted that modelling sound is difficult and best done at a project level assessment with information such as the proposed seismic survey plan, location, and equipment to be used. In Canada, marine seismic companies are required to follow guidelines produced by Fisheries and Oceans Canada within the *Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment*. This does not apply to ice covered marine waters.

### *Offshore Drilling Design and*

### *Operation xploratory Drilling*

Drilling wells and collecting rock and liquid samples is the only way to confirm the presence of hydrocarbons and the depth of the reservoir. There are two (2) types of exploration drilling:

- *Exploratory drilling* to determine whether the type of hydrocarbon in the reservoir is oil or natural gas as well as the vertical extent (depth); and
- *Delineation drilling* to determine the horizontal extent (width) of the reservoir.

### *Well Site Surveys*

Before drilling begins, well site geotechnical and geohazard surveys of the seabed and the layers immediately below the seabed are used to determine the drilling location and if it would be safe to drill by identifying the presence or absence of physical hazards (e.g., gas pockets, buried brine channels, or ice scours). *Geotechnical surveys* identify characteristics of the rocks and materials on the seabed and layers below, such as strength, material type, and how compact the material is. *Geohazard surveys* look at natural risks, such as landslides, earthquakes, or icebergs. Well site surveys could include: high-resolution multi-channel seismic data; side-scan sonar; and high-resolution sub-bottom profiles; seabed photography; magnetometer data; or sediment grab samples.

### *Drilling Program Design*

A well-specific drilling program would be used to design the well and select the appropriate equipment and materials, including drill strings, casing strings, cement, and the blowout prevention system. The design of a well, including the depth and type of liquids used, would be based on multiple site-specific factors, specifically pore pressure and fracture gradient. The program design would include well control and suspension and eventual abandonment. The equipment, materials, and environment would be tested and monitored to ensure effective and safe operations.

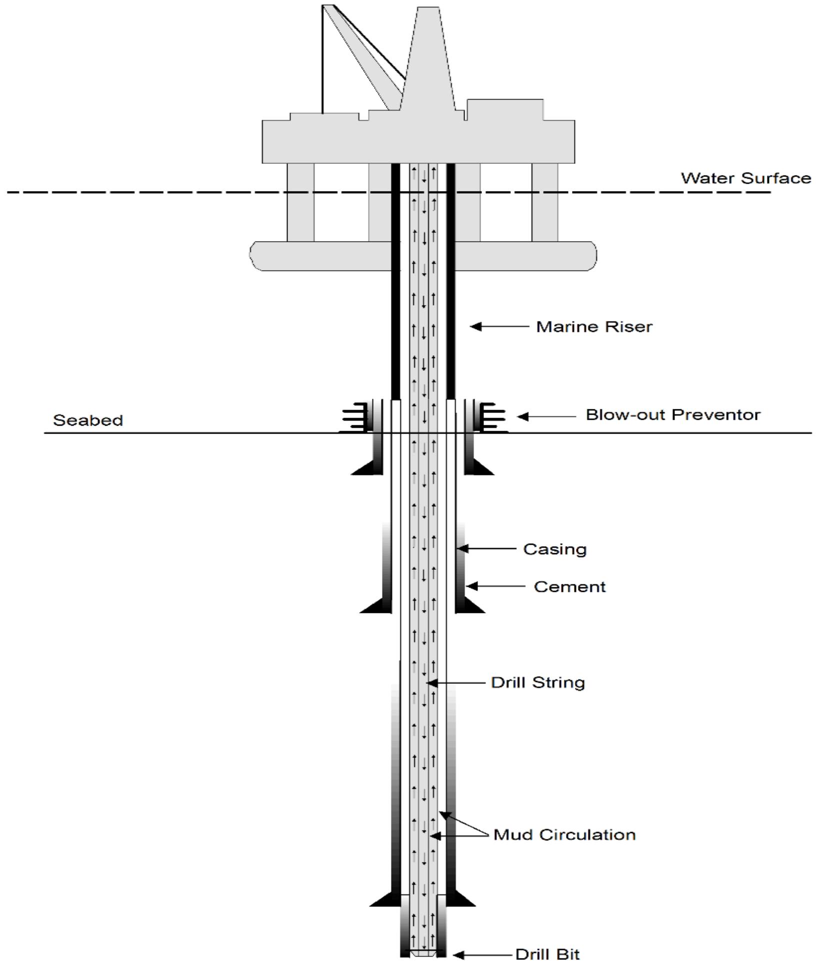
A key component of well design is the drilling fluids, also referred to as drilling muds when they are water, oil, or synthetic based. Drilling fluids are used to:

- Remove solids/drill cuttings from the bottom of the wellbore and transfer to the rig;
- Deposit an impermeable cake on the wellbore to seal the formations being drilled into;
- Maintain structural stability of the wellbore; and
- Cool and lubricate the drill bit.

### *Drilling Process*

The time it takes to drill a well depends on multiple factors, including: water depth; well design; depth of the oil or gas resource; weather; ice conditions; and various technical; safety; and operating conditions. Based on timelines to drill wells in offshore Newfoundland, it was assumed a well would take 35-65 days to drill. Within its comments on the *Oil and Gas Hypothetical Scenarios Report,* the National Energy Board (NEB) noted that exploration wells in harsh environmental conditions (i.e., sea ice, glacial ice, waves, storms, etc.,) could take much longer. While exploration drilling could be conducted year-round, it is typically conducted in open water over a 1-2 month period. The typical components of an offshore well are depicted in Figure 45: Diagram of a Typical Offshore Well.

**Figure 45: Diagram of a Typical Offshore Well (Not to Scale; Source: ExxonMobile, n.d., as cited in Nunami Stantec, 2018b)**




The typical components associated with drilling as identified in Figure 45: Diagram of a Typical Offshore Well are:

- Drill rig: a stable platform from which to drill a well.
- Marine riser: tubing attached to the blow-out preventer to bring drilling muds and cuttings back up to the drillship or semi-submersible.
- Blow-out preventer: large piece of equipment that sits on top of the well with a valve that can be closed to prevent an uncontrolled release of oil or gas (see Figure 46: Typical Subsea Blowout Preventer for Offshore Drilling).
- Casing: pipe placed into the wellbore and which provides main structural support.
- Drill String: drill pipe that transmits drilling fluid to the drill bit.
- Drilling mud: drilling fluids formed of a mixture of clay and minerals to make it heavier and denser.
- Drill bit: a drill pipe with the drill bit on the end is used to drill into the seabed.

Drilling fluids are a mixture of clay (bentonite) and weighting agents (barite, carbonates, and soluble salts) and are the key component of the well design. These fluids are typically designed to prevent harmful effects to the environment and have low toxicity; most are highly biodegradable. When drilling the first few sections of the wellbore, water-based drilling fluids (WBDF) are used to cool and lubricate the drill bit and bring the rock cuttings from the bottom of the hole up to the drilling vessel. The majority of WBDF are classified under the *Convention for the Protection of the Marine Environment of the North-East Atlantic Convention 1999 Annex C.* WBDF are typically discharged into the ocean without treatment; the WBDF discharged for a single well could total approximately 30,000-40,000 barrels.

The casing is then installed and cemented to hold it in place. The casing is used to prevent the sides from caving into the wellbore and to stop fluid or gases from one (1) layer of rock flowing into a different rock layer. The cuttings are brought back to the rig where they are separated from the drilling fluids by solids control equipment, which are often re-conditioned and re-used. Solids control equipment is used to remove and reduce synthetic oil content from any solids brought to the surface meeting parameters as outlined in the NEB *National Waste Treatment Guidelines.* Once the casing is installed, the blowout preventer and drilling riser are installed.

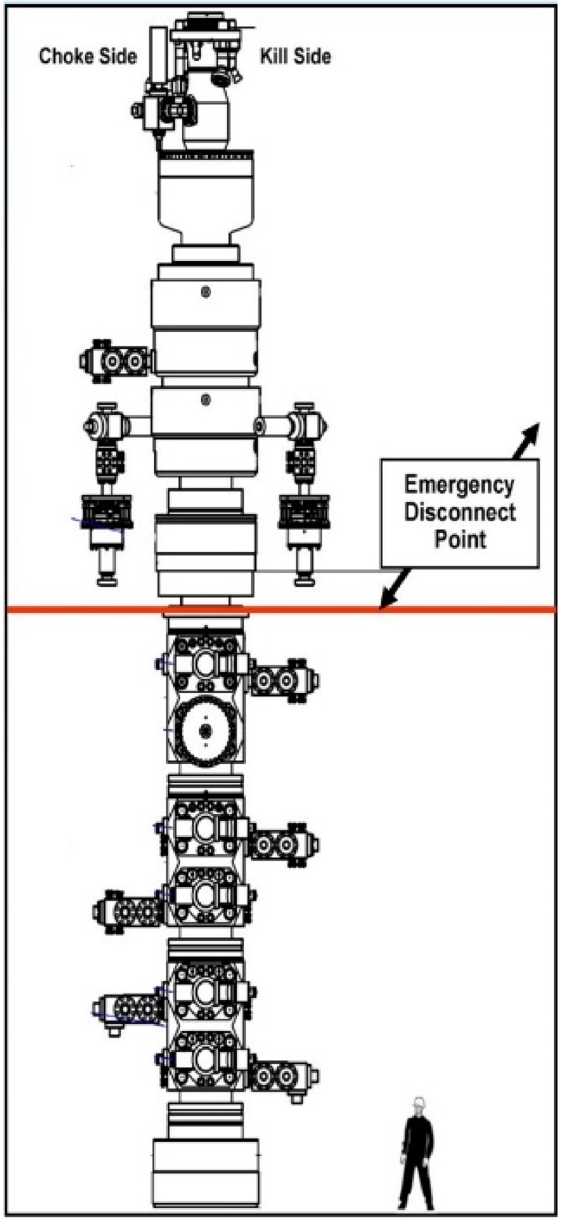
For deeper well sections, synthetic oil-based drilling fluids called non-aqueous drilling fluids (NADF) are used as they are designed for higher temperatures and to slow down or prevent gas hydrates from forming. These drilling fluids may be toxic and harmful to the environment and are therefore not discharged into the surrounding water. They can be cleaned and reused, and any rock cuttings that come into contact with the fluids must be treated before they can be discharged into the ocean, as per the NEB's *Offshore Waste Treatment Guidelines.* Cuttings can fall to the seabed in a pile or be carried away and dispersed over a large area.

### *Well Control*

Wells are designed to prevent an uncontrolled escape of oil or gas through the following steps:

- Designed to handle all identifiable risks (e.g., ice or equipment failure);
- Establish and follow detailed procedures;
- Build multiple safeguards into the design of well and drilling systems;
- Inspection and maintenance of all equipment according to specified schedules;
- Properly train all equipment operators;
- Conduct on-going testing and emergency response drills prior to and throughout drilling;
- Use drilling fluids that are denser than oil, gas, and water to keep those from uncontrollably flowing up and out of the well; and
- Use logging while drilling techniques to continuously monitor the wellbore and adjust the drilling fluid if needed to maintain hydrostatic overbalance, keep formation fluids under control, and avoid oil, gas, or formation water flowing into the wellbore.

**Figure 46: Typical Subsea Blowout Preventer for Offshore Drilling (Source: ExxonMobile, n.d., as cited in Nunami Stantec, 2018b)**




A blowout preventer (Figure 46: Typical Subsea Blowout Preventer for Offshore Drilling) is designed to close off a well to stop further loss of pressure and fluids if there is an uncontrolled flow. All drilling programs are required to have contingency plans in place, including a Well Control Plan and an Emergency Response Plan. Blowout Preventers and other well control and emergency response equipment are expected to be fit for purpose and meet regulatory, industry, and operator specific standards.

### *Formation Evaluation*

During drilling, the properties of the rock cuttings and fluid encountered would frequently be evaluated through formation evaluation (the 'form' of the hydrocarbons would be evaluated) to determine whether there is a commercial discovery or if the well should be abandoned. Techniques to undertake formation evaluation include:

- Periodic well logging;
- Conducting vertical seismic profiling after drilling is completed;
- Well testing using down hole wireline tools; and
- Production flow testing to the surface if required by the regulator.

Flow testing of hydrocarbons to the surface may require flaring oil or gas for multiple days to test the reservoir pressure over time. In comments on the *Oil and Gas Hypothetical Scenarios Report* and during the Final Public Meeting, the NEB noted that flow testing is a requirement if an operator wishes to extend an Exploration Licence to a Significant Discovery Licence and that flaring activities would require NEB approval.

### *Equipment and Infrastructure*

*Drilling Units*
Exploration drilling requires a stable platform to drill a well. Drilling units have an opening (moon pool) that allows the drill string to be extended into the ocean. For more information on the two (2) types of drilling units that could be used for exploration drilling in Baffin Bay and Davis Strait please see 6.2.2 Equipment and Infrastructure.

*Drilling Support*
The major components of an Arctic offshore drilling program in Baffin Bay and Davis Strait in addition to an Arctic-class drilling platform would be expected to include:

| | |
|---|---|
| Icebreaking support vessels | ▪ Ice reconnaissance<br>▪ Carry and deliver fuel and supplies<br>▪ Install and retrieve pre-set anchors, if applicable<br>▪ Deploy and retrieve remotely operated underwater vehicles<br>▪ Support emergency response operations, if necessary |
| Ice-strengthened supply vessels | ▪ Transport fuel, drilling materials, other supplies, waste products, and personnel between drilling unit vessels and the wareship or shore facilities<br>▪ Support well control operations and oil spill response operations, if necessary |
| Ice-strengthened fuel tankers | ▪ Supply fuel for the drilling unit and support vessels |
| Possibly ice-strengthened wareships for offshore storage if no deep-water port is available | ▪ Carry fuel, drilling materials, and other supplies<br>▪ Store and ship waste products<br>▪ Provide maintenance and repair operations<br>▪ Support helicopter, well control, and oil spill response operations |

*Ice-Strengthened Supply Vessel*

Supply vessels would be expected to be ice strengthened and fuel tankers for use in an Arctic environment would be expected to be ice class double-hulled. The NEB referenced the International Maritime Organization Polar Code requirements for ships operating in polar waters in comments on the *Oil and Gas Hypothetical Scenarios Report.* A drilling program, particularly in ice covered waters, may require five (5) to eight (8) vessels within two to five (2-5) kilometres (km) and farther afield (10-50 km) to monitor approaching icebergs or transit back and forth to a shore-based facility.

Shore-based facilities and services could be provided in Nuuk (Greenland) or St. John's, Newfoundland and Labrador, as there is already established infrastructure that specializes in the offshore oil and gas industry. Facilities could include office space, warehouses, equipment staging sites, storage yards, docking area, and storage facilities for emergency equipment. Services could include: communications, land transportation, air transportation, and waste management services for waste materials and used chemicals removed from the drilling platform.

While it was noted that services and facilities in Iqaluit could be used if available, it was considered unlikely that additional infrastructure would be built specifically for offshore oil and gas, unless it was deemed to be more economical or practical than using existing infrastructure in Greenland or Newfoundland. The exception to this would likely be related to storage of emergency equipment at key locations in Nunavut.

### *Development and Production Drilling*

The purpose of field development and production is to extract and transport oil and gas to market. Once the presence and extent of a reservoir is determined, the operator would run reservoir models to prepare a field development plan. This plan would be used to make a business decision to develop the resource or not. Once all necessary licences are obtained, the operator would create the field development plan and proceed with field development and production drilling. A field development plan would include the:

- Number of development wells to be drilled to most efficiently extract the oil or gas or both;
- Recovery techniques to be used to extract the oil or gas;
- Type and cost of installations, both under the sea and on the surface; and
- Oil and gas separation systems, if needed.

The process of development drilling would be similar to those described previously. Unlike exploration drilling, development drilling could also use deviated, horizontal, and multi-drain wells, which could reduce the surface footprint while increasing well productivity. Instead of anchoring a ship or platform in multiple points to drill multiple wells, it can stay in one (1) place and send wells horizontally off in different directions, all feeding from a central point and reducing the number of drilling locations needed.

Additional activities unique to field development and production are:

- Multiple wells drilled into the resource;
- Equipment under the sea to collect and transfer oil or gas from the wells to the surface; and
- Transportation of the oil or gas from the offshore production facility by tankers to global markets.

Activities would occur year-round during production drilling, which would require storage capability and a means to routinely move the product to market. The lifetime of a reservoir is comprised of the following successive phases:

- Production increase;
- Stabilization phase wherein production plateaus;
- Injection phase of water, gas, or chemicals to assist hydrocarbon recovery; and
- Depletion period when production progressively declines.

### *Equipment and Infrastructure*

There are multiple types of offshore production options available, including:

- Gravity-based structure with a topside (suitable for use in shallow water less than 300 metres);
- Subsea installation with tie back to a shore-based facility for processing via an undersea pipeline; and
- Subsea installations with tie back to a floating production platform.

Although there are several development options, this scenario assumes that the system would be similar to what has recently been used in Norway and would limit or avoid land-based production infrastructure in the Nunavut Settlement Area. It is assumed that Floating Production Storage and Offloading vessels (FPSO) for oil production and Floating Liquefied Natural Gas vessels (FLNG) for liquefied natural gas would be used to process, store, and transfer extracted oil and gas to tankers for transport to an export destination. For details on FPSO and FLNGs please see Chapter 6.3.2 Equipment and Infrastructure. For more information on gravity-based structures or shore-based facilities with undersea pipeline, please refer to the *Oil and Gas Hypothetical Scenarios Report.*

### *Transport of Production*

Marine tankers would be required to transport produced crude oil and natural gas to an export destination. The number of tankers and frequency of transport would depend on multiple factors including: production rates; storage capacity; vessel capacity; and destination locations. Tankers would need to meet applicable Arctic Class requirements, with double-hulls and the latest navigation and communications equipment. Ballast water would be stored in segregated tanks on the vessel. A typical large offshore oil production could require 200,000 tonnes of deadweight tankers loading every few days, with similar frequency of LNG tankers for a natural gas facility.

### *Support Infrastructure*

The support infrastructure for development and production is similar to that described in Chapter 10.4.4 Development and Production Drilling and would consist of a permanent fleet of supply and support vessels, icebreakers as required, and aviation support. A supply and helicopter base could be located in Iqaluit.

The time period for offshore hydrocarbon production (crude oil and natural gas) extraction can vary from 15–30 years, depending on the size of the discovery, and can be extended for 50 years or more for giant fields or tie-ins with new discoveries in the area. The lifetime of a reservoir is composed of different successive phases, including:

- Period of production increase (including additional drilling or tie-in with new fields in close proximity);
- Stabilization phase in which the production plateaus;
- Injection phase (water, gas, or chemicals) to assist hydrocarbon recovery; and
- Depletion period when production progressively declines.

### *Well Abandonment*

At the end of each drilling season, drilling activities would be suspended and the well secured to prevent an uncontrolled flow of oil or gas. When the production rate becomes non-economical, all facilities on the seabed and wells would be taken out and are put into a permanent safe state to abandon safely as per regulatory requirements. Sometimes a field may be preserved and re-opened later to extract any left-over oil and gas.

Once a well is no longer needed, it would be plugged and abandoned to meet National Energy Board regulations. Abandoned wells are defined in the *Canada Oil and Gas Drilling and Production Regulations* as a well, or part of a well, that is permanently plugged. Cement and steel plugs are typically set at specific points along the drill hole and the cement is tested ensure it is properly sealed. After the last plug is set and tested, the blowout preventer is removed, and a cap is installed over the wellhead. The NEB noted in its final written submission that there are no legislated monitoring requirements associated with abandoned wells regulated under the *Canada Oil and Gas Operations Act.*