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## Final Submission

Baffinland Iron Mines Corporation  
Mary River “Phase 2 Development” Project Proposal

**Submitted to:** Nunavut Impact Review Board

September 23, 2019

DFO File No.: 07-HCAA-CA7-00050

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Canada 

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## Executive Summary

The Mary River “Phase 2 Development” Project proposal (the Project) proposes a modification to an approved iron ore mine operated by Baffinland Iron Mines Corporation (Baffinland or the Proponent) located on Baffin Island approximately 100 km south of Pond Inlet, Nunavut within the Qikiqtani Region of Nunavut. The Project is focused on an increase in production to 12 Mpta (million Tonnes per annum), the transportation of ore to Milne Port via the construction of a new railway running largely parallel to the existing Tote Road, and the construction and operation of a second ore dock which will support increased shipping activities.

On behalf of Fisheries and Oceans Canada (DFO), the Fish and Fish Habitat Protection Program (FFHPP) has reviewed the application and supporting documents related to the Project, as it relates to the departmental mandate under the *Fisheries Act*, to maintain the sustainability and ongoing productivity fisheries, including marine mammals and their habitat. DFO-FFHPP’s primary focus of this review was to ensure that works, undertakings and activities are conducted in compliance with the applicable provisions of the *Fisheries Act*.

The fisheries protection provisions of the *Fisheries Act* (2013), specifically subsection 35(1), state that “No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery or to fish that support such a fishery.” However, under paragraph 35(2)(b) of the *Fisheries Act*, the Minister of Fisheries and Oceans may issue an authorization with terms and conditions in relation to a proposed work, undertaking or activity that may result in serious harm to fish. Serious harm to fish is defined in Section 2 of this Act as the death of fish, or permanent alteration to or destruction of fish habitat.

Fisheries and Oceans Canada, in partnership with Inuit, Parks Canada, Transport Canada, and the Government of Nunavut is, under Schedule 1 of the *Canada National Marine Conservation Areas Act*, in the process of establishing Tallurutiup Imanga National Marine Conservation Area (Tallurutiup Imanga NMCA) in Lancaster Sound; The Act, and the Tallurutiup Imanga Inuit Impact and Benefit Agreement, provide the foundation for the framework under which Tallurutiup Imanga NMCA will be managed. Key elements include: Tallurutiup Imanga NMCA must be “protected and conserved” (s. 4(1), CNMCAA; p. 4, IIBA), Tallurutiup Imanga NMCA must be “managed and used in a sustainable manner that meets the needs of present and future generations without compromising the structure and function of the ecosystems” (s. 4(3), CNMCAA; p. 4, IIBA), and the “principles of ecosystem management and the precautionary principle” will be a primary consideration (s. 9(3), CNMCAA; p.4, IIBA). Tallurutiup Imanga NMCA is approximately 108,000 km<sup>2</sup> in size and includes the waters of Eclipse Sound, Milne Inlet (excluding Milne Port), Navy Board Inlet, and Pond Inlet. Parks Canada, Qikiqtani Inuit Association, Fisheries and Oceans/Canadian Coast Guard, Transport Canada, and Environment and Climate Change Canada/Canadian Wildlife Service and other partners will continue to work together to achieve the purpose and management objectives of Tallurutiup Imanga NMCA.

DFO-FFHPP is providing the following final submission in response to the Nunavut Impact Review Board’s (NIRB) correspondence dated July 25, 2019.

## **DFO Recommendations:**

### **Alternate Routes**

DFO recommends that Baffinland, in consultation with affected Inuit communities, conduct a thorough environmental assessment prior to use of any additional/alternative routes through the Northwest Passage, outside of the current approved shipping route, including Navy Board Inlet.

### **Marine Mammals**

DFO suggests that shipping during the shoulder seasons and ice-breaking may have serious implications for marine mammals. DFO suggests that icebreaking activities should not occur. Icebreaking activities particularly during the shoulder seasons may impede the formation of ice across the inlets (e.g., ice type, lack of formation, rubble) and result in narwhal ice entrapments during the fall migration. Icebreaking may also negatively impact marine mammals by causing displacement, separation of mothers and pups, vessel-seal collisions, and crushing of seals by moving sea ice. Based on the information provided by Baffinland to date it is still unclear when shipping season begins and ends, and, there is not sufficient data from literature or the current monitoring efforts to support their conclusions that effects from ice breaking will be not significant.

Further, marine acoustic noise will have a negative impact on marine mammals. The large number of vessels transiting from the Milne Port and those awaiting entry may deter whales from entering Eclipse Sound. Spring icebreaking could result in a change in migratory patterns and lead to a lack of immigration into the area.

DFO is concerned that the lack of defensible information makes the assessment of the effect of shipping on cetacean difficult and highly uncertain. As such DFO recommends that, for the time being, Baffinland maintain the current level of shipping and avoid shipping during the shoulder seasons and ice-breaking activities. Before any increase in shipping is considered, Baffinland should provide further information and provide further mitigation options in an updated shipping management plan.

### **Ballast Water**

The amount of ballast water to be discharged as a result of this project is estimated to be the third largest in Atlantic Canada and the fourth largest nationally. The increased number of vessels that will be continuously discharging ballast at the port will impact the physical, chemical, and biological characteristics of the marine environment (e.g., fish, fish habitat, and invertebrates). Hull fouling, as well as ballast discharge, has high risk/potential to introduce non-indigenous species and aquatic invasive species. Temperature, salinity, and organisms (type and number) in both ballast water and the environment should be regularly monitored using scientifically rigorous sampling design. Monitoring will allow Baffinland to assess efficacy and risk associated with management strategies as well as ensure vessel compliance with mitigation measures. DFO is of the opinion that Baffinland could conduct exchange and treatment as a combination method to substantially reduce the risk of invasive species spread.

### **Freshwater**

DFO is of the opinion that impacts on freshwater can be mitigated. Outstanding information can be obtained during the regulatory phase, if the project is approved.

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## **Sommaire**

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## 1 Introduction

This final submission summarizes Fisheries and Oceans Canada (DFO) – Fish and Fish Habitat Protection Program’s (FFHPP) assessment and recommendations concerning the Baffinland Iron Mines Corporation’s (Baffinland) Mary River Project, Phase 2 Development Proposal (the Project). The purpose of these technical review comments is to provide expert advice to the Nunavut Impact Review Board (NIRB) regarding Baffinland’s proposed modifications and identify potential impacts to fish and fish habitat associated with the project changes.

This submission focuses on a technical assessment of the Project. The objective being to analyse the updated plans and/or revised information presented by Baffinland in support of the proposed modifications, and reflects DFO-FFHPP’s mandate.

As directed by the NIRB in their letter dated April 18, 2019, and the subsequent update to the process timelines, this submission focuses on analysis of information presented by Baffinland Iron Mines Corporation (Baffinland or the Proponent) as part of the Project application, including the Project proposal and technical supporting documents.

## 2 Mandate, Relevant Legislation and Policy

The *Constitution Act* (1982) provides the Federal Government with exclusive authority for coastal and inland fisheries within Canada’s territorial boundaries. DFO exercises this power through, the administration of the *Fisheries Act* and some aspects of the *Species at Risk Act*. Under the *Fisheries Act*, DFO is responsible for the management, protection and conservation of fish (which include marine mammals as defined by the *Fisheries Act*) and their habitats. The Minister of Fisheries, Oceans and the Canadian Coast Guard is one of the competent ministers under the *Species at Risk Act* (SARA).

In general, DFO-Fish and Fish Habitat Protection Program (DFO-FFHPP) undertakes the review of proposed project in and around fisheries waters to ensure that works, activities and undertakings are conducted in such a way that the proponents are in compliance with the applicable provisions of the *Fisheries Act*.

### Bill C-68

On February 6, 2018, the Government of Canada introduced in Parliament Bill C-68, *An Act to Amend the Fisheries Act and other Acts in Consequence*. On **June 21, 2019** the new *Fisheries Act* received Royal Assent and became law.

The Fish and Fish Habitat Protection Provisions, of the new Act, did not come into force until **August 28<sup>th</sup>, 2019**. As such this project assessment began under the older *Fisheries Act* (2012) but will be assessed in the regulatory phase under the new *Fisheries Act* (2019).

**The new *Fisheries Act* (2019):** As of **August 28<sup>th</sup>, 2019**, new Fish and Fish Habitat Protection Provisions (FFHPP) of the *Fisheries Act* came into force. From the provisions, there are two key prohibitions:

- **Subsection 34.4(1)** of the *Fisheries Act* (2019) prohibits the carrying on of any work, undertaking or activity, other than fishing, that results in the death of fish, and
- **Subsection 35(1)** of the *Fisheries Act* (2019) prohibits the carrying on of any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat.

The new *Fisheries Act* (2019) includes the following definitions:

- *“fish” includes (a) parts of fish, (b) shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and (c) the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.*
- *“fish habitat” means water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas.*
- *“Death of Fish” means any action that results in the end of life of fish. Furthermore, No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.*
  - *“Work” means a physical thing that has been created through labour or the exercise of creative process that has some degree of permanency or lasting quality;*
  - *“Undertaking” means to take upon oneself a task;*
  - *“Activity” means physical task incidental to a work or undertaking as well as physical tasks that may not qualify as works or undertakings.*
- *“Harmful Alteration, Disruption and Destruction of fish habitat” is defined as follows:*

- *Harmful alteration of fish habitat is any permanent change to fish habitat that reduces its capacity to support one or more life processes of fish but does not permanently eliminate the fish habitat.*
- *Disruption of fish habitat is any change to fish habitat occurring for a limited period that reduces its capacity to support one or more life processes of fish for a limited period.*
- *Destruction of fish habitat is any permanent change to fish habitat that completely eliminates its capacity to support one or more life processes of fish.*

Under paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act*, the Minister of Fisheries, Oceans and the Canadian Coast Guard (the Minister) may issue an authorization with terms and conditions in relation to a proposed work, undertaking or activity that may result in death of fish or harmful alteration, disruption or destruction of fish habitat. Factors that the Minister must consider prior to recommending to the Governor-in-Council regulations or the Minister exercising powers related to authorizations, permits, orders or Ministerial regulations include:

- (a) the contribution to the productivity of relevant fisheries;
- (b) fisheries management objectives;
- (c) whether there are measures and standards;
- (d) the cumulative effects;
- (e) any fish habitat banks;
- (f) whether any measures and standards to offset the harmful alteration, disruption or destruction of fish habitat give priority to the restoration of degraded fish habitat;
- (g) Indigenous knowledge of the Indigenous peoples of Canada that has been provided to the Minister; and
- (h) any other factor that the Minister considers relevant.

DFO-FFHPP is guided by the new “Fish and Fish Habitat Protection Program Policy Statement (2019)”. This Policy provides guidance on undertaking effective measures to offset death of fish and the harmful alteration, disruption or destruction of fish habitat, consistent with the fish and fish habitat protection provisions of Canada’s *Fisheries Act*.

The “Policy for Applying Measures and Standards to Offset Impacts to Fish and Fish Habitat Under the Fisheries Act (2019)” was prepared by DFO to provide an overview of how to apply measures and standards to offset for impacts to fish and fish habitat. Furthermore this policy is intended to support the conservation and protection of fish and fish habitat, including objectives, guiding principles and types of measures; and describes step-by-step procedures for developing an offsetting plan.

The *Species at Risk Act* (SARA) is intended to prevent Canadian indigenous species, subspecies and distinct populations of wildlife from being extirpated or becoming extinct. SARA facilitates the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity and manage species of special concern (to prevent them from becoming endangered or threatened). The Minister is the competent minister for listed aquatic species that are fish as defined in the *Fisheries Act* Section (2) and for marine plants as defined in the *Fisheries Act*, Section 47.

Environmental and Climate Change Canada (ECCC) is responsible for the administration and enforcement of the pollution prevention provisions of the *Fisheries Act*, Sections 34 and 36-42 on behalf of DFO.

For more information, see: <http://www.dfo-mpo.gc.ca/pnw-ppe/pol/index-eng.html>

### 3 Technical Review Comments

#### 3.1 Marine Alternative Shipping Routes

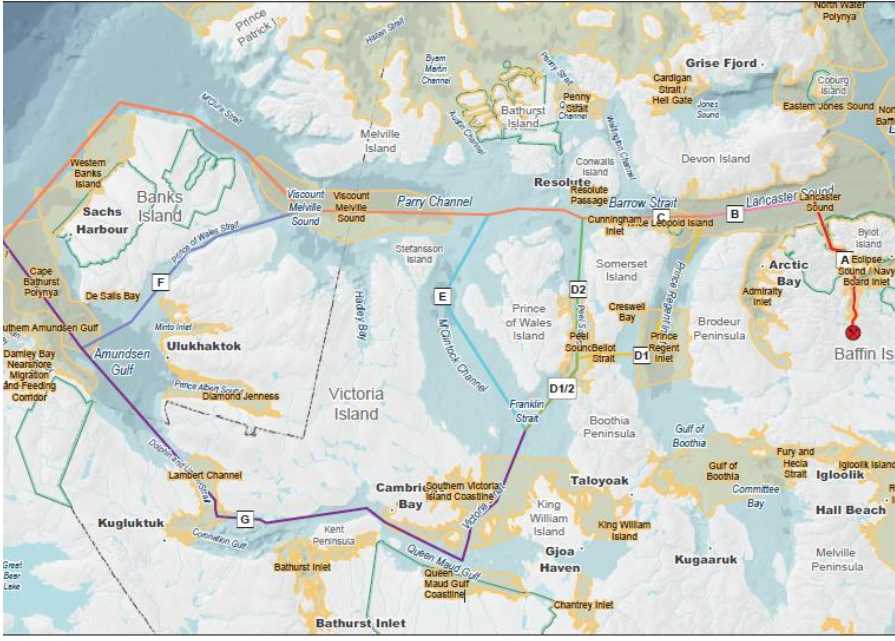
<b>Review Comment Number</b>	3.1 Alternative Shipping Routes
<b>Subject/Topic</b>	Proposed Alternative Shipping Routes including the Northwest Passage
<b>References</b>	<ul style="list-style-type: none"> <li>• Ice Conditions Report (TSD 16): Section 4.5.2</li> <li>• IR Responses Phase 2 Proposal – Mary River Project: Appendix 12, page 5</li> <li>• IR Responses, 'GN 73 Attachment 1: Summary of Ship Track Data 2017-2018'</li> <li>• DFO Technical Review Comments, March 2019, Technical Comment 3.1, DFO recommendation 3.1.4</li> <li>• DFO. 2019a. Science Review of the Phase 2 Addendum to the Final Environmental Impact Statement for the Baffinland Mary River Project. DFO Can. Sci. Advis. Sec. Sci. Resp. 2019/015.</li> <li>• Baffinland Iron Mines Technical Comment Responses to NIRB, March 2019, Response to DFO recommendation 3.1.4</li> <li>• Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment, p. 19</li> <li>• Stantec. July 12, 2019. Mary River Project: Environmental Review of Shipping through the Northwest Passage: Figure 9 and pg. 9</li> <li>• DFO. 2009. Advice relevant to identification of Eastern Canadian Arctic Bowhead (<i>Balaena mysticetus</i>) critical habitat. DFO Can. Sci. Adv. Sec. Sci. Advis. Rep. 2008/060.</li> </ul>
<b>Summary</b>	<p>DFO notes that in section 4.5.2 of TSD 16, Baffinland references a potential alternate route: <i>"We thus conclude that the route to Milne Inlet via Navy Board Inlet and Lancaster Sound should be considered as an alternative only during the open water season and shoulder seasons when ice has not fully formed or is in an advanced state of decay."</i> In relation to the existing shipping route, DFO notes that Baffinland states that the shipping model <i>"does not allow for any delays on site, delays discharging in Europe, weather delays or any downtime between vessels."</i> and <i>"The model assumes a consistent flow of vessels to the port and that all of these vessels will be available for charter. Any contingency required would be best served by starting the year earlier and/or ending later in the season."</i> (IR Responses, Appendix 12, p. 5).</p>

In DFO technical comment 3.1, DFO noted that no impact assessment(s) had (have) been conducted for the potential alternate shipping route mentioned in section 4.5.2 of TSD 16. DFO is concerned that Baffinland has not adequately assessed contingency shipping scenarios, in which, the vessels aren't able travel exactly as planned. DFO notes in Baffinland's response in the IR Responses, 'GN 73 Attachment 1: Summary of Ship Track Data 2017-2018' shows the historical deviation from the shipping route.

DFO recommendation 3.1.4 from DFO's March technical review comments, stated *"DFO recommends Baffinland identify scenarios where the alternative route would be used, including probabilities (e.g., ice scenarios) and that Baffinland conduct an impact assessment of the alternate route scenario, if utilizing this route is a possibility."*

In response to DFO recommendation 3.1.4 in the "Technical Comment Responses", Baffinland stated: *"Baffinland may advise relevant Ice Class Ore Carriers to proceed to Milne Inlet via Navy Board Inlet."* and *"In addition to the circumstance cited in the alternatives assessment, it's also possible that Navy Board Inlet could be used during the open water season to offset the number of ships transiting past Pond Inlet, or to access the Northwest Passage."* Further: *"Baffinland is open to discussing the use of Navy Board Inlet as an optional shipping route and is willing to provide a report containing a more complete baseline characterization of environmental conditions, as well as an assessment of potential interactions with project-related shipping in Navy Board Inlet, as well as, the Northwest Passage within the Nunavut Settlement Area, on or before July 10th."*

Baffinland submitted the 'Environmental Review of Shipping through the Northwest Passage' report on July 12, stating on page 1 of the report that *"The objective of this report is to review potential shipping routes through the NWP for ore carriers from Milne Port, the existing biophysical conditions along those routes, and identify issues of greatest potential concern with respect to potential interactions between Project-related shipping and the environment."* Baffinland further states in section 3 on page 9 of the report that *"This report is not an environmental assessment, and does not present conclusions as to the significance of residual environmental effects."*

	<p>Baffinland states in the updated Cumulative Effects Assessment that <i>“Baffinland is currently investigating the feasibility of using Navy Board Inlet and Lancaster Sound as an alternate route to Eclipse Sound in certain conditions, however, the transits will vary and the potential range has not yet been confirmed. Since the alternative route would still impact the same marine mammal populations, having all project shipping captured under Eclipse Sound is acceptable”</i> (Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment, p. 19).</p>
<p><b>Importance of issue to the impact assessment</b></p>	<p>It's important to fully understand the proposed shipping routes, in order to adequately evaluate impacts associated with the project.</p>
<p><b>Detailed Review Comment</b></p> <ol style="list-style-type: none"> <li>1. Gap/Issue</li> <li>2. Disagreement with Addendum/TSD conclusion</li> <li>3. Reasons for disagreement with Addendum conclusion</li> </ol>	<p>DFO notes that the shipping routes described in this new report are extensive. Below is Figure 9 from the 'Environmental Review of Shipping through the Northwest Passage' and displays potential routes throughout the arctic, noting that all coloured routes are potential routes.</p>  <p>DFO is unclear what route would be used and when and is concerned about the potential impacts throughout the arctic. DFO is further unclear which vessels would be travelling these routes and how the timing would impact marine mammals through these areas. DFO further notes that all of these shipping routes are outside of the Regional Study Area (RSA).</p>

DFO notes Baffinland's statement, that the 'Environmental Review of Shipping through the Northwest Passage' report is not an environmental assessment (pg. 9). Baffinland has provided some baseline characterization, but hasn't provided the level of detail that would be necessary for review for the level of shipping and number of routes proposed. DFO notes the current uncertainties outlined for the existing approved shipping route. DFO is concerned about the project going forward without a proper environmental assessment of the effects of shipping on marine mammals throughout all of the potential routes outlined. DFO notes that in order to conduct a proper review of the potential impacts of the proposed routes, a robust and thorough environmental assessment should be provided.

DFO further notes that in addition to the lack of information provided, the 'Environmental Review of Shipping through the Northwest Passage' report was only provided on July 12, following both technical sessions. As such, parties have thus far been unable to discuss the content and address/resolve any concerns with Baffinland. DFO further notes that if shipping were to be approved through the Northwest Passage, it may be appropriate to include other communities and territories, to participate in the review process, since the routes extend past additional communities and along the shore of both the Northwest Territories and Yukon. DFO suggests that there is currently not enough information provided by Baffinland to adequately review the impacts of shipping through the proposed alternative routes.

As identified in the DFO (2019a) review, Baffinland evaluates impacts only within the defined marine mammal local and regional study areas which extend to the Nunavut Settlement Area boundary. The ship track continues east into Baffin Bay and at some point crosses the Economic Exclusive Zone (EEZ) as the vessels travel to Europe and make their return voyage. For both the Northern Shipping Route and the alternate route (i.e., Navy Board Inlet) would impact a larger proportion of the Eastern Canada–West Greenland bowhead population as it is migrating during the spring and fall along the coast in Baffin Bay and Lancaster Sound to access important nursing, foraging and refugia (i.e., predator avoidance) habitat in the summer (DFO 2009). Although the alternate route will impact the same marine mammal populations, it will also have a greater chance to impact other narwhal stocks (Admiralty Inlet and Somerset Island) and walrus haulout sites on the northwestern tip of Bylot Island. Furthermore,



	<p>DFO is concerned that the transit times will be greater using the alternate route which may have a greater influence/impact on narwhal distribution. As such, DFO disagrees with Baffinland's conclusion that <i>"Since the alternative route would still impact the same marine mammal populations, having all project shipping captured under Eclipse Sound is acceptable."</i> (Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment, p. 19).</p> <p>DFO notes that the current monitoring programs also do not extend to the areas in the Northwest Passage. It's important to monitor effects of shipping as the project progresses and to develop a robust monitoring plan that includes shipping routes through sensitive areas.</p>
<b>Recommendation / Request</b>	<p><b>Recommendation 3.1:</b> DFO recommends that Baffinland:</p> <p>In consultation with affected Inuit communities, conduct a thorough environmental assessment prior to use of any additional/alternative routes through the Northwest Passage, outside of the current approved shipping route, including Navy Board Inlet.</p> <p>The assessment should include:</p> <ul style="list-style-type: none"> <li><b>3.1.1</b> Clarification whether Baffinland intends to use the alternative routes including the Northwest Passage at any point as part of Phase 2, or whether the alternatives would be solely reserved for future development and will be assessed at such a time, that Baffinland would seek approval for said development.</li> <li><b>3.1.2</b> Consideration of a larger proportion of the potentially impacted populations for each species along the alternate route, to adequately reflects the increase of use.</li> <li><b>3.1.3</b> An updated monitoring plan, which would include monitoring shipping through all alternative routes utilized for the Mary River Project, prior to usage of any additional routes outside the current approved shipping route.</li> </ul>

### 3.2 Marine Vessel Traffic

<b>Review Comment Number</b>	3.2 Vessel Traffic
<b>Subject/Topic</b>	Proposed cumulative vessel traffic and marine operations
<b>References</b>	<ul style="list-style-type: none"> <li>• Project Description (TSD 02): Section 4.1.3 (p. 4.6),</li> <li>• Marine Mammal Effects Assessment (TSD 24): Appendix B, Underwater Acoustic Modelling Report (entire document)</li> <li>• IR Responses Phase 2 Proposal – Mary River Project: DFO 3.2.1 (p. 59); Appendix 12, Overview of Marine Operations, page 4</li> <li>• Advance Technical Comment Responses Phase 2 Proposal – Mary River Project: 3.2.2 (p. 6-7)</li> <li>• DFO Technical Review Comments to the NIRB, March 2019, Technical Comment 3.1, Recommendation 3.1.1</li> <li>• Golder Associates Ltd. May 17, 2019, Assessment of Icebreaking Operations during Shipping Shoulder Seasons on Marine Biophysical Valued Ecosystem Components (VECs), page 49</li> <li>• Draft Revised Project Certificate No. 005 for Phase 2, August 23, 2019, Project Certificate Condition No. 179a, page 87</li> </ul>
<b>Summary</b>	<p>In response, on page 4 of Appendix 12 of the IR Responses, Baffinland provided the definitive numbers for vessels that were used for assessment purposes, stating:</p> <p><i>“a) 176 ore carriers have been used in the marine effects assessment. This number does not include tanker related voyages, re-supply related voyages, tug related voyages and/or ice breaker/management related voyages.</i></p> <p><i>b) An estimate of 24 voyages for other vessels (e.g. wet/dry re-supply) has been considered. For resupply vessels, efforts are currently underway to increase the cubic capacity of vessels employed by BIM, meaning number of voyages might be reduced.</i></p> <p><i>c) For tugs, a range of between 6 to 10 tugs will be operating for the same period of time that ore carriers are loading in Milne Inlet. As tugs operate predominantly within Milne Port an estimate of 10 voyages has been included for assessment purposes.</i></p> <p><i>d) For Ice Breakers, operations could require one to two assets operating for the first 15 – 20 or more days of the shoulder season, weather dependent, and then again for the same duration at the end of the season.</i></p> <p><i>e) For sake of clarification, a voyage constitutes a round trip between a load port (Milne Inlet) and the designated discharge port for that vessel. Trips/year throughout the document refers to a voyage. A transit is considered to be a one-way track either to or from Milne Inlet by any of the</i></p>

vessels. A voyage represents two transits through the Northern Transportation Corridor.”

Information provided in TSD 24, Appendix B, Section 3.2, also states: “we determined that within any 24-h period, the Northern Shipping Route (Figure 1) will be transited at most by two PP carriers (one inbound and one returning from the ore dock) for Scenarios 5-11 (Phase 2A). Once both docks are operational (Phase 2B), two additional CS carriers (one inbound and one returning from the ore dock) are expected, for a total of four carriers transiting the shipping route” (emphasis added). DFO notes contradicting information provided in the Advance Technical Comment Responses, to DFO 3.2.2: “Based on the Phase 2 Proposal shipping schedule, a maximum of two ship transits per day is anticipated” (emphasis added).

In relation to tugs and various support vessels, DFO notes in TSD 02, section 4.1.3, on p. 4.6, it states: “Tugs and line boats will be used to shift the ore vessels from anchorages onto and off the dock. Market ore carriers transiting towards Milne Port will proceed directly to either an open loading dock, or to one of several anchorages available in the event dock space is full.”

In recommendation 3.1.1, from DFO’s March Technical Review Comments, DFO recommended “Baffinland clarify the maximum number of vessels which may be present at any given time, along the shipping route during open water season and during the shoulder seasons. This should include vessels present along the shipping route starting at Milne port until the limit of the marine mammal study area.”

In the ‘Assessment of Icebreaking Operations, Baffinland states “Based on a maximum-case icebreaker transit scenario (2 icebreakers escorting 2 capesize carriers)” (p. 49).

DFO notes that Baffinland has provided a ‘Revised Project Certificate No. 005 for Phase 2’ document on August 23, 2019, proposing changes to Project Certificate conditions. Baffinland requests a change to Project Certificate Condition No. 179a on page 87 as follows: “Unless otherwise approved by the NIRB, in any given calendar year, the total number of ore carriers calling on Milne Port should not exceed 176” with the rationale: “To date the quantity limits on transport in 179(a) and 179(b) have been a) difficult to comply with as any overage, however minimal, is an immediate

	<i>compliance issue, and b) not necessarily reflective of the environmental limits established through the relevant assessments (i.e. effects have been within predictions)” and “The proposed changes would provide clarity that Baffinland may operate at a certain level without automatically requiring a project certificate reconsideration process. Baffinland believes a maximum of 176 ore carriers will provide the operational flexibility it requires.”</i>
<b>Importance of issue to the impact assessment</b>	Increased shipping has the potential to cause negative impacts to marine mammals and the marine environment. It’s important to fully understand the proposed vessel traffic at Milne Port, throughout Milne Inlet and along the shipping route, in order to adequately evaluate impacts associated with the project.
<b>Detailed Review Comment</b> <b>4. Gap/Issue</b> <b>5. Disagreement with Addendum/TSD conclusion</b> <b>6. Reasons for disagreement with Addendum conclusion</b>	<p>DFO understands that tugs will travel one complete voyage per season, travelling into and out of Milne Port at the beginning and end of the season, respectively and that tugs will travel within the Milne Port area. Tug movement adds additional acoustic disturbance to the area. DFO notes that it’s important for reviewers to understand the movement of tugs in relation to the other vessels transiting the area. DFO notes Baffinland states “<i>Based on a maximum-case icebreaker transit scenario (2 icebreakers escorting 2 capesize carriers)</i>”. DFO notes that Baffinland hasn’t considered escorting tug boats in this maximum case scenario.</p> <p>DFO notes that Baffinland has proposed to change project certificate condition 179a. DFO agrees that changing to limiting number of ships instead of ore, will be a clearer way to track as stated by Baffinland. However, DFO is unclear how Baffinland arrived at the number of transits at 176. DFO notes that this is only limiting ore ships and does not include other vessel traffic. DFO notes that it is important, before changing the project certificate, that Baffinland provide appropriate rationale for the number of ships provided and that this change has been adequately assessed by interveners.</p>
<b>Recommendation / Request</b>	<p><b>Recommendation 3.2:</b></p> <p>In order for DFO to adequately assess the project’s marine vessel traffic, DFO requires that Baffinland clarifies:</p> <p><b>3.2.1</b> the number of escorted vessels that will be permitted at any one time into the RSA</p> <p><b>3.2.2</b> the rationale for the maximum of 176 ore carrier transits</p>

### 3.3 Marine Impact of Shipping - Vessel Strikes

<b>Review Comment Number</b>	3.3 Marine Environment: Impact of Shipping- Vessel Strikes
<b>Subject/Topic</b>	Impacts to bowhead whales due to potential vessel strikes
<b>References</b>	<ul style="list-style-type: none"> <li>• Project Description (TSD 02): Table 10-2, Major Accidents and Malfunctions Risk Summary, p. 10.5</li> <li>• Marine Mammal Effects Assessment (TSD 24): Section 2.1.5 (p. 14); Section 2.8.4 (p. 48); Section, 2.8.5.4, p. 49; Table 2-11 (p. 49)</li> <li>• Golder Associates Ltd. May 17, 2019, Assessment of Icebreaking Operations during Shipping Shoulder Seasons on Marine Biophysical Valued Ecosystem Components (VECs), pg 70-71</li> </ul> <p><u>Publications:</u></p> <p>DFO. 2019a. Science Review of the Phase 2 Addendum to the Final Environmental Impact Statement for the Baffinland Mary River Project. DFO Can. Sci. Advis. Sec. Sci. Resp. 2019/015.</p> <p>Higdon, J.W., and Ferguson, S.H. 2009. Loss of Arctic sea ice causing punctuated change in sightings of killer whales (<i>Orcinus orca</i>) over the past century. Ecological Applications, 19(5), 2009, pp. 1365–1375.</p> <p>Higdon, J.W., Hauser, D.D.W., and Ferguson, S.H. 2011. Killer whales in the Canadian Arctic: distribution, prey items, group sizes, and seasonality. Mar Mammal Sci. doi:10.1111/j.1748-7692.2011.00489.x.</p> <p>Lawson, J.W. and Lesage, V. 2013. A draft framework to quantify and cumulate risks of impacts from large development projects for marine mammal populations: A case study using shipping associated with the Mary River Iron Mine project. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/154 iv + 22 p.</p> <p>Reeves, R.R., Rosa, C., George, J.C., Sheffield, G., and Moore, M. 2011. Implications of Arctic industrial growth and strategies to mitigate future vessel and fishing gear impacts on bowhead whales. Mar. Policy 36(2): 454–462.</p> <p>Sheldon, K. E. W., Hobbs, R. C., Sims, C. L., Vate Brattstrom, L., Mocklin, J. A., Boyd, C., and Mahoney, B. A. (2017). Aerial surveys of beluga whales (<i>Delphinapterus leucas</i>) in Cook Inlet, Alaska, June 2016. Alaska Fish Science Centre Processed Report 2017–09, NOAA, Seattle, WA, USA.</p>
<b>Summary</b>	In TSD 24, Section 2.8.4, on page 48, Baffinland states: “Bowhead whale mortality is not expected to occur as a result of the Phase 2 Proposal activities. All available information suggests that bowhead will actively avoid vessels transiting in the LSA (Section 2.8.1). With the effective

	<p><i>implementation of mitigation, the potential residual effects of bowhead mortality due to vessel strikes is predicted to be negligible. The residual environmental effect on bowhead is expected to be “Not Significant”.</i></p> <p>Baffinland states (TSD 24, s. 2.1.5; p. 14): <i>“The potential for a marine mammal-vessel strike resulting in injury or mortality was evaluated in the previous assessment. Mitigation measures proposed to reduce the potential for a ship strike included reductions in ship speeds (to between 7 and 10 knots) along the Northern Shipping Route, as well as the requirement for vessels to maintain a constant course and speed when in transit. With mitigation measures in place, residual environmental effects to marine mammals was predicted to be “Not Significant” for all marine mammals.”</i></p> <p>Baffinland suggests that: <i>“With the effective implementation of mitigation, the residual effects of mortality on bowhead due to vessel strikes are predicted to be low in magnitude (Level I), confined to the LSA (Level I), infrequent (Level I) in occurrence, medium-term (Level I) in duration, and fully reversible (Level I) (Table 2.11). The residual environmental effect is predicted to be ‘Not Significant’”</i> (TSD 24, 2.8.5.4, p. 49). This was further reiterated in TSD 24, Table 10-2, (p. 10.5), where a potential risk via shipping is <i>“Collision with marine mammals resulting in harm to marine mammals”</i>, with the “consequence” viewed as “minor”, the “likelihood” as “rare” and the “risk rating” as “low”</p> <p>In the Assessment of Icebreaking Operations, Baffinland presents a lengthy rationale for why bowhead are susceptible to vessel strikes (p. 70). They go on to say that <i>“North Atlantic right whales have been found to exhibit no avoidance response when presented with sounds of approaching vessels (either real or play-back recordings) (Nowacek et al. 2004) and have been the subject of numerous vessel strike casualties in the last few years”</i> but that <i>“The difference between North Atlantic right whale and bowhead is that bowheads are more prone to exhibit avoidance of vessels”</i> (p. 70) and that <i>“All available information indicates that bowhead are likely to avoid vessels under way in the RSA”</i> (p. 71).</p>
<b>Importance of issue to the impact assessment process</b>	Increased shipping has the potential to cause mortality and injury to marine mammals through shipping strikes.
<b>Detailed Review Comment</b> <b>1. Gap/Issue</b>	As stated in DFO 2019a, DFO does not agree with the current effects assessment summary for bowhead for the open water shipping season, as provided in Table 2.11, Effects Assessment Summary and Significance of

<p><b>2. Disagreement with conclusion</b></p> <p><b>3. Reasons for disagreement with conclusion</b></p>	<p>Residual Effects on Bowhead Whale (TSD 24; p. 49). Bowhead face some of the same risks as North Atlantic Right Whale in terms of ship strikes.</p> <p>Vessel strike and fishing gear trauma have been documented in bowhead, but at a much lower rate than in Right Whales (see Reeves et al. 2011), likely due to the lower amount of vessel traffic and fishing activities in the Arctic. However, with the proposed introduction of increased shipping, it is likely that the risk and incidence of Arctic bowhead whale injury and mortality from vessel traffic will increase.</p> <p>Ship strikes typically go undocumented, largely due to the fact that most whales are negatively buoyant and sink rather than wash ashore or float (Allison <i>et al.</i> 1991 in Lawson and Lesage 2013); in the Arctic there is a lowered capacity to detect whales or collisions from ships or icebreakers as a result of prevailing light and weather conditions (Lawson and Lesage 2013). Lawson and Lesage (2013) also highlight the characteristics that make Bowhead vulnerable to ship strikes (e.g., low degree of escape response). Even though Baffinland indicates in Appendix 12 under vessel Communications (Shipping Instructions to Masters): “<i>Vessel speed (regardless of vessel type) has been assessed at max of 9 knots through Eclipse Sound and 5 knots in Milne Port.</i>” The impacts associated with Bowhead are more likely associated with the shoulder seasons and when the vessels no longer have these speed restrictions imposed on them, such as outside of the RSA.</p> <p>The impact of vessel strikes on bowhead whales is likely underestimated based on the current level of marine mammal ship based observing effort and assessment. Although there are few bowhead sighted within the LSA and at the Milne Port site, the proportion of bowhead within the RSA in Baffin Bay and along the alternate route in Lancaster Sound would be greater. Additionally, the seasonality of when bowhead would be impacted by the Project does not temporally correlate with when the monitoring took place.</p> <p>DFO believes that the extent of effects should be evaluated as a Level II (within the RSA and beyond). This is a general comment for all effects tables within the TSD 24. Additionally, in reference to Table 10-2 (TSD 02; p. 10.5) contrary to being an “insignificant” consequence, the consequence of a collision is likely to be fatal, and the likelihood of a slow moving large cetacean colliding with a vessel becomes greater (not rarer) due to the significant increase in vessel activity in the region.</p>
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	Although beluga and narwhal would be expected to be less vulnerable to ship strikes than bowhead whales, there is still a risk, particularly based on the increases in voyages, ship size and expanding the season into the shoulder seasons when whales have begun their migrations. In addition, as the ice environment continues to change from climate change, the removal of sea-ice choked points means that other whales are venturing farther north into the Canadian Arctic, including Baffin Bay to take the advantage of the productive summer months (e.g., Killer whale, Sperm whale, Fin whale)(Higdon and Ferguson 2009, Higdon <i>et al.</i> 2011, Sheldon <i>et al.</i> 2017). The Baffinland shipping corridor crosses perpendicularly to the migration corridor for many of these summer species.
<b>Recommendation/Request</b>	<p><b>Recommendation 3.3:</b></p> <p>DFO is concerned that the present level of assessment may not be adequate to fully assess the effects of the vessels strikes on whales and other marine mammals. In order for DFO to adequately assess the effects of vessel strikes on marine mammals, Baffinland, working cooperatively with DFO, shall re-assess the impact of vessel strikes on bowhead whales and re-evaluate the significance of ship strikes related to the project (including inside and outside the RSA) and should consider other marine mammals (e.g., Killer whale, Sperm whale, Fin whale) that would potentially be entering the RSA in summer during the open water shipping season and risk of vessel strikes. The assessment shall include the knowledge and observation of Inuit hunters and trappers.</p>

### 3.4 Marine Environment: Shipping Season

<b>Review Comment Number</b>	3.4 Shipping Season
<b>Subject/Topic</b>	Timing of shipping in the shoulder seasons and associated assessments
<b>References</b>	<ul style="list-style-type: none"> <li>• Ice Conditions Report (TSD 16), Appendix I: Ice navigation in the Canadian Arctic, p.1</li> <li>• Marine and Environmental Effects Assessment (TSD 17)</li> <li>• Marine Mammal Effects Assessment (TSD 24)</li> <li>• IR Responses Phase 2 Proposal – Mary River Project: Appendix 11, Commitment Register, Commitment 156 (p. 24 of 27); Appendix 12 (p.3, Section 4,)</li> <li>• DFO Technical Review Comments to the NIRB, March 2019, Technical Comment 3.3, Recommendation 3.3.1</li> <li>• Baffinland Iron Mines Corporation. March 26, 2019. Technical Comment Responses, Phase 2 Proposal – Mary River Project: page 17</li> </ul>



	<ul style="list-style-type: none"> <li>• Golder Associates Ltd. May 17, 2019, Assessment of Icebreaking Operations during Shipping Shoulder Seasons on Marine Biophysical Valued Ecosystem Components (VECs), page 4 &amp; 49</li> <li>• Knight-Piésold Consulting. May 17, 2019. Socio-economic Assessment of Icebreaking Operations during Shipping Shoulder Seasons: Table 2.2: Timing of Ice Events on the Northern Shipping Route</li> </ul>
<b>Summary</b>	<p>In relation to the proposed shipping season, Baffinland has stated: <i>“Baffinland is proposing a shipping window that potentially commences in early July and ends in the middle of November, the exact duration of the annual shipping season will be dictated by the ice conditions for that year.”</i> Further: <i>“The dates provided in the FEIS addendum reference a period of <b>July 1 – November 15</b>. The operative limit of the proposed shipping window is the commitment to not break land fast ice.”</i> Baffinland also states <i>“there is significant variability in the timing of break up (July 18 average; 21 days of variability) and freeze-up (November 14 average; 29 days variability)”</i> and <i>“The actual operational season will vary from year to year”</i> (IR Responses, Appendix 12, p.3).</p> <p>Baffinland also states that <i>“Based on annual ice conditions (e.g., as described in Enfotec 2016/TSD-16), the level of icebreaking (e.g., duration, frequency, extent) will likely vary annually”</i> (Assessment of Icebreaking Operations, p. 4). Within Baffinland’s Information Request (IR) Response (Appendix 12, Section 4), Baffinland states that <i>“Ice Breaker operations will be performed when prevailing ice conditions require the Ice Class 1A – 1C ore carries to operate under escort. Generally speaking, the Ice Breaker(s) will operate from the time of break-up to freeze-up within the nominal shipping window (July 1 – November 15)”</i>. However, DFO notes that throughout Baffinland’s Assessment of Icebreaking Operations and Socio-economic Icebreaking Assessment, Baffinland only addresses icebreaking operations during the shoulder seasons (July 1 – August 5 and October 15 – November 15, as noted in both reports).</p> <p>In determining the start and end date of the shipping season, Baffinland stated the following: <i>“To open and close each season, Baffinland will rely on a combination of technical factors and known land use, both of which are tied to ice conditions: Technical – The Arctic Ice Regime Shipping System (AIRSS)”, which “uses a four-step process that includes defining the ice regime, obtaining ice multipliers, calculating ice numerals, and obtaining permission” and “Land Use –” ... [and]... “Before Baffinland commences its shipping season each year it will rely on a protocol with the</i></p>

	<p><i>community of Pond Inlet to inform Baffinland that residents are no longer using the sea ice” (IR Responses, Appendix 12, p.3).</i></p> <p>In recommendation 3.3.1, from DFO’s March Technical Review Comments, DFO recommended <i>“Baffinland provide clarification on the roles that both environmental conditions and ecological factors will play in determining start and end dates for the shipping season and how will this be monitored to determine if ice-breaking in the fall season will have an impact on ice formation.”</i> Baffinland responded to this recommendation in their ‘Technical Comments Responses’ on page 17, stating: <i>“Baffinland is preparing a stand-alone effects assessment of icebreaking activities that addresses icebreaking during the shoulder seasons. This effects assessment addresses the information requested in this technical comment (DFO 3.3.1). The stand-alone icebreaking effects assessment is scheduled for delivery to the NIRB in Q1 2019, prior to the Phase 2 Proposal Technical Meetings in Iqaluit.”</i> Baffinland provided the ‘Assessment of Icebreaking Operations’ and the ‘Socio-economic Assessment of Icebreaking Operations’ in May, 2019.</p>
<b>Importance of issue to the impact assessment</b>	<p>Shipping during the shoulder seasons may have serious implications for marine mammals. It’s important to fully understand when and how activities will occur over the shoulder seasons in order to adequately review impacts.</p>
<b>Detailed Review Comment Gap/Issue Disagreement with Addendum/TSD conclusion Reasons for disagreement with Addendum conclusion</b>	<p>DFO acknowledges that Baffinland submitted an additional ice-breaking assessment, however, is unclear why this assessment will only cover the shoulder season as DFO notes section 4 of Appendix 12 of the IR Responses indicates that <i>“Ice Breaker(s) will operate from the time of break-up to freeze-up within the nominal shipping window (July 1- November 15)”</i>. DFO notes it is relevant to assess icebreaking impacts for the entire shipping window as it has been shown that icebreaking is taking place and/or has the potential to take place outside the defined shoulder season dates (e.g., Table 2.2: Timing of Ice Events on the Northern Shipping Route, Socio-economic Icebreaking Assessment indicates that drift ice was present along the Northern Shipping Route in 6 of 22 years (1997-2018) during the "open-water season").</p> <p>DFO is also unclear whether ice-breaking assessment will assess impacts of ice-breaking on the VECs identified in TSD 17, TSD 24 and on the ecological role of ice itself. DFO notes there is a potential for shipping in the shoulder season to advance break-up of ice in the spring or delay freeze-up in the fall. DFO further notes, there could be serious indirect and direct impacts of a reduced ice season on a number of ecological components. As such,</p>

	<p>it's important that an assessment of the ecological consequences of advanced break-up or delayed freeze-up from vessel activities be included to adequately review the impacts of ice-breaking activities.</p> <p>DFO is concerned with Baffinland's determination of the start and end of the shipping season, as the operational season can vary year-to-year. DFO notes it's important understand the specific criteria that will be used to inform/ Baffinland's decision to stop and resume shipping activities in the shoulder seasons. Although Baffinland provides a summary of factors that will influence the start and close of the shipping season; DFO is not clear what specific criteria or thresholds will be used to determine when each individual seasons begins and ends. In addition, DFO notes that while ice, weather, economic and land use are considered, ecological criteria are also vitally important for consideration. Ideally the decision would take into consideration ecological factors, such as key life history stages for marine mammals that utilize the ice habitat and consideration of the risk of entrapment during the freeze-up period.</p>
<b>Recommendation / Request</b>	<p><b>Recommendation 3.4:</b></p> <p>In order for DFO to properly assess the impact of the shipping season on ice formation, DFO recommends that Baffinland provide environmental conditions and ecological factors criteria used to determine yearly opening and closing of the shipping season, along with the monitoring plan to determine if ice-breaking in the shoulder season will have an impact on ice formation and that Baffinland report annually on the determination of opening and closing the shipping season.</p>

### 3.5 Marine Impacts to Pinnipeds: Shoulder Season Shipping and Ice-breaking

<b>Review Comment Number</b>	3.5 Impacts to Pinnipeds: Shoulder Season Shipping and Ice-breaking
<b>Subject/Topic</b>	Environmental Impacts to pinnipeds from Shoulder Season Shipping and Ice-breaking activities
<b>References</b>	<ul style="list-style-type: none"> <li>Marine Mammal Effects Assessment (TSD 24): Section 2.5. Table 2.3 (p. 20); Section 2.5.2.2 (p. 26); Appendix A: Marine Mammal Baseline report (entire document)</li> <li>Cumulative and Transboundary Assessment (TSD 27): Section 1.4.14 (p. 42-46)</li> <li>IR Responses Phase 2 Proposal – Mary River Project: Appendix 11, Commitment Register, Commitment 156 (p. 24 of 27)</li> </ul>

- Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment, p. 20-21).
- DFO Technical Review Comments to the NIRB, March 2019, Technical Comment 3.4, recommendation 3.4.2, 3.4.4
- Baffinland Iron Mines Corporation. March 26, 2019. Technical Comment Responses, Phase 2 Proposal – Mary River Project: DFO 3.4.4, pg. 21
- Golder Associates Ltd. May 17, 2019, Assessment of Icebreaking Operations during Shipping Shoulder Seasons on Marine Biophysical Valued Ecosystem Components (VECs): Section 1.3, pg. 13; p. 48; pg. 77–80.
- Knight-Piésold Consulting. May 17, 2019. Socio-economic Assessment of Icebreaking Operations during Shipping Shoulder Seasons: section 5.6.3, pg. 13 & pg. 42
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	<p>walrus (<i>Odobenus rosmarus divergens</i>). US Fish and Wildlife Service, Marine Mammals Management, Anchorage, AK. vi + 155 p.</p> <p>McFarland, S.E., and Aerts, L.A.M. 2015. Assessing disturbance responses of Pacific Walrus (<i>Odobenus rosmarus divergens</i>) to vessel presence in the Chukchi Sea (Abstract). Chukchi Sea Environmental Studies Program (CSESP), Olgoonik-Fairweather, Fairweather Science, Anchorage, AK.</p> <p>Wilson, S.C., Trukhanova, I., Dmitrieva, L., Dolgova, E., Crawford, I., Baimukanov, M., Baimukanov, T., Ismagambetov, B., Pazylbekov, M., Jüssi, M., and Goodman, S.J. 2017. Assessment of impacts and potential mitigation for icebreaking vessels transiting pupping areas of an ice-breeding seal. <i>Biol. Conserv.</i> 214: 213–222.</p> <p>Yurkowski, D.J., Young, B.G., Dunn, J.B., and Ferguson, S.H., 2018. Spring distribution of ringed seals (<i>Pusa hispida</i>) in Eclipse Sound and Milne Inlet, Nunavut: implications for potential ice-breaking activities. <i>Arctic Science</i>. <a href="https://doi.org/10.1139/as-2018-0020">https://doi.org/10.1139/as-2018-0020</a></p> <p>Yurkowski, D.J., Young, B.G., Dunn, J.B., and Ferguson, S.H. 2019b. Spring distribution of ringed seals (<i>Pusa hispida</i>) in Eclipse Sound and Milne Inlet, Nunavut: implications for potential ice-breaking activities. <i>Arctic Sci.</i> 5(1): 54–61.</p>
<b>Summary</b>	<p>In their IR Responses under Appendix 11, Commitment 156 (p. 24 of 27) indicates that Baffinland will “<i>undertake an additional stand-alone assessment of ice-breaking effects during the shoulder seasons that addresses this concern and which will include underwater noise modelling of icebreaker transits along the Northern Shipping Route. The acoustic modelling will be based on a conservative scenario for ice-breaking noise based on thickest seasonal ice conditions in the RSA and maximum acoustic propagation potential. The stand-alone acoustic modelling report and icebreaking assessment will be submitted to the NIRB in 2019 once reporting is complete.</i>”</p> <p>In DFO recommendation 3.4.2 from DFO’s March technical review comments, DFO recommended “<i>Baffinland conduct an Impact assessment of pinnipeds during the ice-breaking season, specifically including a spring survey and a floe edge survey for shoulder seasons in Baffin Bay. Species considered in such an assessment should include walrus, seals and whales and the extent of sea-ice habitat loss should be considered for ice-dependent species.</i>”</p> <p><u>Walrus</u></p>

In DFO recommendation 3.4.4 from DFO's March technical review comments, DFO recommended multiple *"mitigation strategies to minimize the negative impacts of ice-breaking traffic on marine mammals in the LSA, and beyond the current proposed RSA"*, which included *"Use walrus haul out buffer zone guidelines set by the US Fish and Wildlife Service (USFWS) and the US Federal Aviation Administration (FAA)"*. In their responses to technical comments, Baffinland responded that *"Walrus haul-out buffer zones guidelines are designed to protect walrus haul-outs on land from disturbance that might cause a stampede that would result in crushed animals. There are no walrus haul-out sites along the Northern Shipping Route in areas where icebreaking activities could occur."*

#### Seals

In DFO recommendation 3.4.4 from DFO's March technical review comments, DFO recommended multiple *"mitigation strategies to minimize the negative impacts of ice-breaking traffic on marine mammals in the LSA, and beyond the current proposed RSA"*, which included recommending Baffinland *"maintain a 'safe distance' from hauled out seals, of at least 250m."* In their responses to technical comments, Baffinland responded that *"it should be noted that there will be limited potential interactions with seals on ice during the shoulder seasons as ringed seals will be in their foraging period and spending most of the time in the water"* and that *"Project vessel transits during the shoulder season will occur after ringed seal parturition, nursing, and breeding periods, therefore a 'safe distance' of 250 m is not considered necessary"*.

In the 'Assessment of Icebreaking Operations' document, provided by Baffinland July 12, Baffinland provides a sufficient overview of the possible impacts of vessel strikes on ringed seal, *"...serious injury or mortality by means of blunt force trauma from direct impact with the hull of a vessel, or from lacerations due to contact with rotating propellers..."* and *"Observed impacts included displacement, separation of mothers from pups, breakage of birth or nursery sites, and vessel-seal collisions"* (Assessment of Icebreaking Operations, p. 78–80). Baffinland also summarizes literature on the correlation of vessel strikes with vessel speed in the assessment, stating *"The probability of a lethal vessel strike is thus positively correlated with vessel speed and gross tonnage of the vessel (Dolman et al. 2006; Kite-Powell et al. 2007; Vanderlaan and Taggart 2007). Wilson et al. (2017) presented the first quantitative study of icebreakers transiting ice-breeding habitat of a phocid seal between late January and mid-March"*. Further, *"Icebreaking in the early shoulder season (July/August,*

*October/November) will overlap with the end of the moulting period when ringed seal are engaged in basking behaviour. Seals hauled out on ice floes during this time are likely to show a greater response to vessels than seals in-water. Fleeing behaviour has been observed in seals when approached within 0.4 to 0.8 km by a ship (Richardson et al. 1995b)."* Baffinland then goes on to state *"adult ringed seal have more than enough mobility under the ice to avoid the close approach of an icebreaker, and that it was considered unlikely that icebreaking vessels would strike adult seals and cause mortality"* (emphasis added) and *"Since the start of operations at Milne Port in 2015, no vessel strikes on pinnipeds (or near misses) have been reported along the Northern Shipping Route"* (p. 78–80). Baffinland presents mitigation measure 10 that *"All icebreaking, ice management and ice escort activities will be conducted outside of the period of ringed [seal] parturition, nursing, and breeding periods"*. This is presented in both the Operational Icebreaking Assessment (p. 48) and the Socio-economic Icebreaking Assessment (p. 13).

Baffinland states that *"The habitat change [for ringed seal] was estimated at 4% to 6% of the available landfast ice in Section 1.4.14.2, which is less than the 10% threshold applied in the ringed seal habitat loss assessment in the FEIS (Volume 8, Section 5.6.2.1)"* (Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment, p. 20-21).

Baffinland states *"For icebreaking operations, if it is assumed that approximately 70 to 200 ringed seal in Milne Inlet and Eclipse Sound will exhibit avoidance of the icebreaking noise source per icebreaker transit, this represents <1 % of the population of ringed seals in the Canadian Arctic (estimated at least a few million individuals based on Reeves 1998, NAMMCO 2010). Based on these estimates, the residual effects of disturbance on ringed seal from icebreaking activities is predicted to be not significant (Table 5.16)"* (Assessment of Icebreaking Operations, p. 77).

DFO notes in Baffinland's Early Shipping Season – Operational Guide under section 5.2, on page 9, mitigation measure number 13 states *"All vessels will be provided with standard instructions to not approach within 300 m of a walrus or polar bear observed on sea ice"* respectively.

Within the Socio-economic Assessment of Icebreaking Operations (Section 5.6.3, p. 42), there are several statements regarding the residual effects on several marine mammals as *"Not Significant"* (e.g., ringed seals, beluga,



	bowhead, narwhal habitat loss/fragmentation, ice entrapment and ship strikes).
<b>Importance of issue to the impact assessment</b>	Shipping and Ice breaking activities on the shoulder seasons may cause serious harm to pinnipeds during critical life stages.
<b>Detailed Review Comment Gap/Issue Disagreement with Addendum/TSD conclusion Reasons for disagreement with Addendum conclusion</b>	<p>DFO continues to be concerned about impacts to pinnipeds from increased shipping and ice-breaking activities on the shoulder seasons. The ice platform is habitat for a number of ice-dependent pinniped species. DFO notes there is a high abundance of seals in the narrow waterway at Bruce Head and as such, is an important habitat for marine mammals (Yurkowski <i>et al.</i> 2018) and that ice-breaking represents a serious potential threat for pinniped species utilizing the ice.</p> <p><u>Walrus</u></p> <p>DFO notes in TSD 24, under section 2.5.2.2, page 26, it states: “<i>Project vessels shall not approach within 300 m of a walrus or polar bear observed on sea ice</i>”. DFO disagrees that the 300 m buffer zone is a sufficient distance for walrus on sea ice (DFO 2019a,b). DFO notes that walrus haul out areas have been identified close to the alternate route and that a 300m buffer zone may not be a sufficient distance for walrus on sea ice. Fay <i>et al.</i> (1984) found Pacific walruses on ice reacted to an icebreaking ship when it was within 2 km, and females with young went into the water when the ship was 500–1000m away. However, Brueggeman <i>et al.</i> (1990) found most groups of walruses hauled out on ice showed little reaction to ice breaker activities beyond 800m. McFarland and Aerts (2015) recorded the behavior of walruses in water and on ice, finding that diving and changing course or speed occurred primarily within 500m of the vessel. DFO notes that ice breakers have the greatest potential for disturbance given their frequent accelerations, turns, and reversals of direction (Garlich-Miller <i>et al.</i> 2011).</p> <p>Further, DFO (2019) reiterates that the walrus haul out buffer zone guidelines set by the US Fish and Wildlife Service (USFWS) and the US Federal Aviation Administration (FAA), should be followed in the absence of similar guidelines in Canada. The USFWS Guidelines (2012) stipulate that marine vessels ≤ 50 ft (~ 15.2 m) in length should remain at least a 0.5 nautical mile (~ 900m) away from hauled out walruses; those 50-100 ft (~ 15.2 to 30.5 m) should remain at least 1 nautical mile (~ 1.9 km) away; and those greater than 100 ft (30.5 m) should remain at least 3 nautical miles (~ 5.6 km) away. All vessels are to refrain from anchoring and other activities within 3 miles (~ 4.8 km) of hauled out walrus, and to maintain a 0.5 nautical mile (~0.9 km) exclusion zone around feeding walruses.</p>



Seals

Wilson et al. (2017) discuss icebreaking activities and their effect on seals including an assessment of impacts and potential mitigation for icebreaking vessels transiting areas of an ice-breeding seal. DFO notes that Wilson et al. (2017) reported 13 seal collisions, all except one occurred with vessel speeds exceeding 4 knots. DFO further notes that Wilson et al. (2017) reported that seal collisions and mortalities were much more likely at speeds  $\geq 4$  knots. Further, Wilson et al. (2017) reported deaths within 10 m of the vessel on either side, not only seals occurring in the direct physical path of the vessel. In addition, DFO notes that Baffinland is using distance buffers and justifications from Wilson et al. (2017). However, DFO notes that the ice-breakers used in the Caspian Sea are approximately half the size of Arctic ice-breakers. Therefore, the Arctic ice-breakers would likely have a larger effect on sea ice and in turn cause higher mortality within 10 m of the vessel on either side than in Wilson et al. (2017). Baffinland states that no vessel strikes on pinnipeds have been reported in the area, however, Baffinland also reports that local Inuit recount finding dead seals attributed to vessel encounters, in section 1.3: 'Inuit Community and Stakeholder Comments' of Baffinland's 'Assessment of Icebreaking Operations' (p. 13). DFO remains concerned that seals may be killed due to icebreaking activity.

Yurkowski et al. (2019b) provides a summary of key ringed seal behavior and life-history parameters by month during the ice-covered winter and spring seasons (i.e., January to July) (Table 2) and shows that Western Eclipse Sound and Milne Inlet is an important pupping area. DFO recognizes that shipping will be conducted outside of "*parturition, nursing, and breeding periods*" (Assessment of Icebreaking Operations, p. 48), however, notes that young seals in July will remain near their birth site. The pups are naïve and susceptible to ship strikes and moving chunks of brash sea ice created from icebreaking activity. All seals on the ice would be at risk (more so the young) as they could easily be crushed by moving ice. DFO notes this may occur less so because of the actual icebreaker and more due to the movement of ice caused by the icebreaker. DFO is concerned that resting on ice, following the moulting stage will occur as long as sea ice persists. Juveniles and pups moult last and they could be reluctant to go into the water with an icebreaker breaking up the fast ice. Additional impacts may include the incidence of displacement, separation of mothers and pups, and increase of destruction of resting and birth lairs, and potential changes to the prey base for seals.

DFO is also concerned that ice-breaking activities at the end of the shipping season have the potential to impede the formation of ice across the inlets (e.g., ice type, lack of formation, rubble). DFO considers sea ice as critical habitat for seals and notes that an increase in wave action would be heightened as a result of increased shipping and during times of ice-breaking vessel activity. This increased wave action has the potential to delay the formation of a solid ice platform and delay the ability to use the land fast ice. Additionally, icebreaking during the ice formation season in autumn may cause ringed and bearded seals to avoid setting up mating territories during landfast ice formation in areas of vessel traffic and icebreaking such as Milne Inlet. DFO notes this may reduce overall seal density, shift distribution, and could potentially cause overcrowding in alternative habitat nearby.

Disturbance of ringed seals by icebreaking operations in Eclipse Sound could have a significant impact on the local population. DFO notes Baffinland's statement that *"70 to 200 ringed seal in Milne Inlet and Eclipse Sound will exhibit avoidance of the icebreaking noise source per icebreaker transit, this represents <1 % of the population of ringed seals in the Canadian Arctic"*. DFO notes it is inappropriate to use a percentage of the entire Canadian Arctic population, when region and water-body specific abundance estimates exist. DFO notes an estimate of how many ringed seals are in Eclipse Sound, should be used in order to make a proper assessment.

Baffinland's statement that *"The habitat change [for ringed seal] was estimated at 4% to 6% of the available landfast ice"* (Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment, p. 20-21). However, DFO notes that if the 6% change happens to be in an area of high use by seals, such as eastern and western Eclipse Sound and Milne Inlet (Yurkowski et al. 2019b), this will likely have a disproportionately larger impact. A more thorough discussion on where the 6% habitat change will occur, including providing information on ringed seal distribution on ice at the specific time of year, would benefit DFO's review.

Further, DFO is unclear how key ringed and bearded seal phenology and life history events will be measured, assessed, and monitored to address seal conflicts with shipping activity. If the project is to proceed at these critical times, as proposed, then extensive and robust monitoring and mitigation strategies should be implemented along the full shipping route.

	<p>DFO also notes for mitigation strategies, that Baffinland has committed to approach limitations for walrus and polar bear as stated in “<i>Project vessels shall not approach within 300 m...observed on sea ice</i>” (Table 20, p. 32). DFO suggest that polar bear distribution is linked with seal distribution. Often if seals are present, polar bears will also be in the vicinity, although potentially harder to see. DFO suggests that seals should also be given a 300m buffer and that this could benefit adhering to polar bear mitigations as well.</p> <p>Baffinland concludes that the effects of icebreaking on ringed seals will not be significant. DFO notes that this statement is made without supporting information. DFO notes there is recent literature Baffinland could draw on, that would more accurately reflect the potential impacts of icebreaking on seals during critical life-history periods. Yurkowski et al. (2019b) provide rough density estimates and spatial coverage of Eclipse Sound ringed seals in spring. Wilson et al. (2017) discuss icebreaking activities and their effect on seals, including an assessment of impacts and potential mitigation for icebreaking vessels transiting pupping areas of an ice-breeding seal.</p> <p>DFO notes that overall there continue to be uncertainties with conducting icebreaking and shipping during the shoulder season and the impacts to pinnipeds along the icebreaker’s shipping route. Within the <i>Socio-economic Assessment of Icebreaking Operations</i> (Section 5.6.3, p. 42), there are several statements regarding the residual effects on several marine mammals as “<i>Not Significant</i>” (e.g., ringed seals, beluga, bowhead, narwhal habitat loss/fragmentation, ice entrapment and ship strikes). DFO disagrees with the conclusions made by Baffinland that overall the impacts will be insignificant As discussed throughout the DFO Science review of past and present Baffinland FEIS documents, Baffinland has not provided information, references, data and/or analyses to support the “<i>Not Significant</i>” rating (DFO 2012a,b, DFO 2014, DFO 2019a). DFO finally notes that the most conservative mitigation measure, would be to avoid shipping during the shoulder seasons and ice-breaking activities altogether.</p>
<b>Recommendation / Request</b>	<p><b>Recommendation 3.5:</b></p> <p>DFO is concerned about the impacts to pinnipeds and disagrees with Baffinland’s conclusions that effects will be non-significant. As such, DFO overall recommends Baffinland implement the most conservative mitigation measure and avoid shipping during the shoulder seasons and ice-breaking activities; only ship during the open water season.</p>

	<p>If the Project is approved as proposed, DFO recommends that Baffinland:</p> <p><b>3.5.1</b> Uses walrus haul out buffer zone guidelines set by the US Fish and Wildlife Service (USFWS) and the US Federal Aviation Administration (FAA).</p> <p><b>3.5.2</b> Avoid icebreaking where and when seal density is relatively high. These areas occur in closed embayments and inlets where landfast ice exists</p> <p><b>3.5.3</b> Provide an estimate of how many ringed seals are in Eclipse Sound, and re-evaluate the percentage of affected seals using available region and water-body specific abundance estimates.</p> <p><b>3.5.4</b> Implement 300m proposed buffer zone for seals as there currently is for polar bears and walrus.</p> <p><b>3.5.5</b> Avoid shipping during the shoulder seasons and ice-breaking activities and only ship during the open water season.</p> <p><b>3.5.6</b> Prepare a monitoring plan, with an appropriate survey methodology (e.g., Wilson et al. 2017), for the purpose of documenting and reporting any mortalities due to icebreaking and shoulder season shipping activities or otherwise.</p>
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### 3.6 Marine Impacts to Cetaceans: Shoulder Season Shipping and Ice-breaking

<b>Review Comment Number</b>	3.6 Impacts: Shoulder Season Shipping and Ice-breaking
<b>Subject/Topic</b>	Environmental Impacts of Shoulder Season Shipping and Ice-breaking activities
<b>References</b>	<ul style="list-style-type: none"> <li>• Baffinland Iron Mines Corporation Final Environmental Impact Statement, Volume 2, Table 2.3.4</li> <li>• Marine Mammal Effects Assessment (TSD 24): Appendix A: Marine Mammal Baseline report (entire document)</li> <li>• Cumulative and Transboundary Assessment (TSD 27): Section 1.4.14 (p. 42-46)</li> <li>• IR Responses Phase 2 Proposal – Mary River Project: Appendix 11, Commitment Register, Commitment 156 (p. 24 of 27)</li> </ul>

	<ul style="list-style-type: none"> <li>• Golder Associates Ltd. May 17, 2019, Assessment of Icebreaking Operations during Shipping Shoulder Seasons on Marine Biophysical Valued Ecosystem Components (VECs): section 5.6.3, pg. 42; pages 50, 53, 54 &amp; 56.</li> <li>• DFO Technical Review Comments to the NIRB, March 2019, Technical Comment 3.4</li> <li>• Baffinland Iron Mines Corporation. March 26, 2019. Technical Comment Responses, Phase 2 Proposal – Mary River Project: DFO Recommendation 3.4.1, pg. 19</li> <li>• Knight-Piésold Consulting. May 17, 2019. Socio-economic Assessment of Icebreaking Operations during Shipping Shoulder Seasons: pg. 46-47, pg. 50</li> <li>• L. Postma, DFO Science pers. communication</li> </ul> <p><u>Publications:</u></p> <p>DFO. 2015a. Abundance estimates of narwhal stocks in the Canadian High Arctic in 2013. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/046.</p> <p>Marcoux, M., Montsion, L.M., Dunn, J.B., Ferguson, S.H., and Matthews, C.J.D. 2019. Estimate of the abundance of the Eclipse Sound narwhal (<i>Monodon monoceros</i>) summer stock from the 2016 photographic aerial survey. DFO Can. Sci. Advis. Sec. Res. Doc. 2019/028. iv + 16 p.</p> <p>Matthews, C.J.D., Hornby, C.A., Ferguson, S.H., and Marcoux, M. 2019. Evaluation of LGL visual aerial survey data for estimating narwhal abundance in Eclipse Sound during the open water season 2013–2015. DFO Can. Sci. Advis. Sec. Res. Doc. 2019/029. iv + 23 p</p> <p>Thomas, T.A., Raborn, S., Elliott, R.E., and Moulton, V.D. 2015. Marine mammal aerial surveys in Eclipse Sound, Milne Inlet, Navy Board Inlet, and Pond Inlet, 1 August – 22 October 2014. Final LGL Report No. FA0024-2. Prepared by LGL Limited, King City, ON for Baffinland Iron Mines Corporation, Oakville, ON. 70 p.</p> <p>Watt, C.A., Marcoux, M., Dunn, J.B., Hodgson, R., Moore, R., and Ferguson, S.H. 2019. Effect of the 2015 narwhal (<i>Monodon monoceros</i>) entrapment on the Eclipse Sound narwhal stock. DFO Can. Sci. Advis. Sec. Res. Doc. 2019/030. iv + 12 p.</p>
<b>Summary</b>	<p>Baffinland states: <i>“the effect of winter shipping through Hudson Strait on Beluga was previously assessed to be not significant”</i> (TSD 27, s.1.4.14.4, p. 45). Baffinland presents similar findings for Bowhead (s.1.4.14.5, p. 46) and Narwhal (1.4.14.3, p. 44).</p> <p>In their IR Responses under Appendix 11, Commitment 156 (p. 24 of 27) indicates that Baffinland will <i>“undertake an additional stand-alone</i></p>

*assessment of ice-breaking effects during the shoulder seasons that addresses this concern.” Baffinland repeated this in response to DFO technical comment 3.4.1: “Baffinland is preparing a stand-alone effects assessment of icebreaking activities that addresses icebreaking during the shoulder seasons. The stand-alone icebreaking effects assessment is scheduled for delivery to the NIRB in Q1 2019, prior to the Phase 2 Proposal Technical Meetings in Iqaluit” (pg. 19).*

#### Displacement

Baffinland acknowledges that *“Narwhal is particularly sensitive when congregating at the floe edge in July, as mothers are carrying calves, and narwhal represent a significant proportion of the community’s country food harvest.”* (Socio-economic Assessment of Icebreaking Operations, p. 50). Baffinland then concludes that *“with application of the mitigation measures summarized in Section 2.8, the local population of narwhal is not expected to abandon the area as a result of icebreaking during the shoulder season, and effects to narwhal will be Not Significant. Based on the expectation that the local narwhal population will not be reduced or displaced, harvesting of narwhal is not expected to be meaningfully affected”* (Socio-economic Assessment of Icebreaking Operations, p. 46–47 and repeated on p. 50).

#### Entrapment

On page 53 of the ‘Assessment of Icebreaking Operations’ document, provided by Baffinland July 12, Baffinland states that *“There is concern that artificially opened water channels can be problematic for marine mammals, who may confuse them for polynyas and can get trapped too far from the ice edge as the channel eventually refreezes”*. DFO notes that Baffinland acknowledges that *“Mortality can occur through drowning if open water is no longer accessible or if narwhal fail to leave an area before freeze-up occurs in late autumn and the ice is too thick for them to break through (Laidre et al. 2011)”* (p. 53), and also acknowledges that *“narwhals were also observed using old icebreaking tracks”* (p. 53).

However, Baffinland concludes that *“The residual environmental effect of ice entrapment on narwhal is predicted to be not significant (Table 5.7)”* (Assessment of Icebreaking Operations, p. 54). Baffinland states *“With the effective implementation of mitigation, it is predicted that the residual effects of ice entrapment on narwhal due to icebreaking activities will be of low magnitude (Level I), confined to the LSA (Level I), infrequent in occurrence (Level I), medium-term (Level II) in duration, and fully reversible*

	<p>(Level I). <i>The residual environmental effect of ice entrapment on narwhal is predicted to be not significant (Table 5.7)</i>" (Assessment of Icebreaking Operations, p. 56). Baffinland states that <i>"The passage of an icebreaker in the early summer is not expected to result in an ice entrapment because the ice is breaking up at this time and there are multiple open leads narwhal could use"</i> and <i>"By mid-October, most narwhal have left the Eclipse Sound complex and the limited number of individuals still present in the RSA are in the Eclipse Sound East and Pond Inlet area and heading east out of the study area (Elliott et al. 2015; Thomas et al. 2015). The residual environmental effect of ice entrapment on narwhal is predicted to be not significant (Table 5.7)"</i> (Assessment of Icebreaking Operations, p. 54).</p> <p><u>Conclusions</u></p> <p>Baffinland states <i>"It is considered plausible that narwhal may habituate to non-threatening icebreaking transits"</i> (Assessment of Icebreaking Operations, p. 50). Further: <i>"Any avoidance behavior [by narwhal] is predicted to be temporary"</i> (Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment, p. 21). Baffinland states <i>"Based on these estimates and in light of proposed mitigation measures during the shoulder seasons, the residual effects of disturbance on narwhal from icebreaking activities is predicted to be not significant"</i> (Assessment of Icebreaking Operations, Residual Effects Section, Page 50).</p>
<b>Importance of issue to the impact assessment</b>	Shipping and Ice breaking activities on the shoulder seasons may cause serious harm to marine mammals during critical life stages.
<b>Detailed Review Comment Gap/Issue Disagreement with Addendum/TSD conclusion Reasons for disagreement with Addendum conclusion</b>	<p>DFO is concerned about impacts to cetaceans from increased shipping and ice-breaking activities on the shoulder seasons. DFO is concerned about shipping and ice breaking on the shoulder seasons, as these shoulder periods are vital for migration of Narwhals both into (in July) and out of Milne Inlet (in October).</p> <p><u>Displacement</u></p> <p>Spring icebreaking could result in a change in narwhal migratory patterns and lead to a lack of immigration into the area. Shipping to Milne Port may cause Narwhal to display avoidance behaviour. This impact is to migrating Narwhal, and their decision as to whether to enter the Eclipse Sound area or to continue on to Admiralty Inlet or Prince Regent Inlet. At the NIRB's Marine Monitoring and Marine Mitigation Workshop in Pond Inlet for the Mary River Project on May 1-2, 2019, participants had discussions around recent Inuit Qaujimajatuqangit, noting that narwhals were present in very low numbers in the RSA in 2018. One hypothesis is that the narwhals were displaced because of icebreaking in the spring.</p>



Shipping may also cause displacement of Narwhals from preferred feeding or nursery habitat. The narrow waters adjacent to Bruce Head are a hotspot for Narwhal in the summer (e.g. TSD 24, Appendix A), and the daily transit of Panamax sized vessels to and from Milne port, could affect foraging ability of marine mammals and resulting in a loss of fitness.

It's important for Baffinland to provide adequate data and information to support conclusions that the mitigation measures summarized will prevent narwhal from abandoning the area. DFO notes that there may be information from 2018 on narwhal abundance following the conducted icebreaking, that would be valuable to the assessment. DFO notes that Baffinland acknowledges "*Narwhal is particularly sensitive when congregating at the floe edge in July*" (Socio-economic Assessment of Icebreaking Operations, p. 50), however, Baffinland does not expect narwhals to be negatively impacted. As this is a sensitive time for them, noise pollution and habitat destruction is highly likely to lead to displacement of narwhals.

#### Entrapment

DFO notes that shipping in the late fall may also prevent Narwhal from moving out of the sound, due to avoidance, and lead to ice entrapments. DFO is concerned that frequency of entrapments will increase over natural levels due to icebreaking in the fall shoulder season. Icebreaking activities during the fall may impede the formation of ice across the inlets (e.g., ice type, lack of formation, rubble) and result in ice entrapments during the fall migration of narwhal. Baffinland's cited information supports the fact that narwhals might use icebreaker tracks to navigate in late fall, which may increase their chance of getting ice entrapped. Community members in Pond Inlet suggested an entrapment of at least 250 whales in 2015 may have been the result of shipping activity in Eclipse Sound, which may have interfered with the narwhal's typical fall migration pattern (L. Postma, DFO science pers. comm., Watt et al. 2019).

Baffinland states that "*most narwhals have left the Eclipse Sound complex*" by mid-October and that the limited number of individuals still present in the RSA are in the Eclipse Sound East and Pond Inlet area and heading east out of the study area. DFO is concerned about the context of Baffinland's assessment and requires clarification on what the Eclipse Sound complex refers to and a justification for not including the Pond Inlet area in this statement.



Matthews et al. (2019) estimated that there were 11,756 and 3,053 narwhals in Pond Inlet on October 17 and 22, 2014, respectively. This represents a large proportion of the Eclipse Sound narwhal stock still present during the proposed icebreaking period based on the two recent stock estimates (10,489, DFO 2015a; 12,039, Marcoux et al. 2019). DFO is further concerned that Baffinland's statements and conclusions are based on one year (2014) of aerial survey data (Thomas et al. 2015). Given the large proportion of narwhals that may still be present in October, and the uncertainty related to the reaction of narwhals to icebreaking in the fall, DFO disagrees with Baffinland's conclusion that the residual environmental effect of ice entrapment on narwhal is predicted to be not significant.

#### Conclusions

Within the Socio-economic Assessment of Icebreaking Operations (Section 5.6.3, p. 42), there are several statements regarding the residual effects on several marine mammals as "Not Significant" (e.g., ringed seals, beluga, bowhead, narwhal habitat loss/fragmentation, ice entrapment and ship strikes). DFO notes that Baffinland has not presented adequate data to support their conclusion that residual effects from icebreaking is predicted to be not significant. DFO also notes that the assessed impacts to date are confined to the RSA.

DFO notes that Baffinland concluded *"that the residual effects of ice entrapment on narwhal due to icebreaking activities will be of low magnitude (Level I)"* (Assessment of Icebreaking Operations, p. 56). According to Table 2.3.4 of Volume 2 of the FEIS – Consultation, Regulatory Framework, and Assessment Methodology, Baffinland has defined a Magnitude of Level I as *"An effect of the exposed indicator/VEC that results in a change that is not distinguishable from natural variation and is within regulated values"*. However, DFO notes Narwhal ice entrapments tend to be large, sometimes numbering more than a thousand individuals, and the residual effects of an entrapment of that magnitude might not be reversible. DFO notes that an ice entrapment would better correspond to what Baffinland defines as a Magnitude of Level II which is defined as *"An effect that results in some exceedance of regulated values and/or results in a change that is measureable but allows recovery within one or two generations"*. Baffinland concludes that the predicted residual environmental effects of disturbance on narwhal from icebreaking activities will be fully reversible (Level I). DFO is unclear on

	<p>what information was used to suggest that disturbance on narwhal is fully reversible and DFO is concerned with Baffinland's conclusion.</p> <p>Baffinland states "<i>that narwhal may habituate to non-threatening icebreaking transits</i>" (Assessment of Icebreaking Operations, p. 50), however hasn't provide any information to support whether it is plausible that narwhal may habituate to non-threatening icebreaking transits. DFO is currently unaware of any existing studies on narwhal ability to "habituate" to icebreaking transits, noise, etc. and notes Baffinland should provide supporting data and literature to support their statement. DFO notes there could additionally be energetic and long-term costs associated with habituation such as stress, and reduced reproductive rates, with subsequent declines in abundance and fitness declines. DFO recommends Baffinland consider the impacts of habituation in determining significance for the environmental assessment.</p> <p>DFO reiterates from DFO Comment 3.5, above, that "<i>the most conservative mitigation measure, would be to avoid shipping during the shoulder seasons and ice-breaking activities altogether.</i>"</p>
<b>Recommendation / Request</b>	<p><b>Recommendation 3.6:</b></p> <p>DFO is concerned that the lack of defensible information makes the assessment of the effect of shipping on cetacean difficult and highly uncertain. As such DFO recommends that, for the time being, Baffinland maintain the current level of shipping and avoid shipping during the shoulder seasons and ice-breaking activities. Before any increase in shipping is considered, Baffinland should provide further information and provide further mitigation options in an updated shipping management plan as follows:</p> <p><b>3.6.1</b> An estimate of the percentage of narwhal that could exhibit disturbance and avoidance behavior regularly depending on the icebreaking scenarios.</p> <p><b>3.6.2</b> Mitigation measures to address this concern that frequency of entrapments will increase over natural levels due to icebreaking in the fall shoulder season (e.g., no icebreaking while narwhal migrate into and out of Eclipse Sound).</p> <p><b>3.6.3</b> Clarify what the 'Eclipse Sound complex' refers to and provide justification for not including the Pond Inlet area in this statement.</p>

	<b>3.6.4</b>	Re-evaluation of the potential effects using the most recent stock size estimate.
	<b>3.6.5</b>	Re-evaluation of the extent beyond the local study area (LSA) and within the RSA, the magnitude and the reversibility of the impacts of ice entrapment on narwhals.
	<b>3.6.6</b>	Short and long term monitoring of potential effects of shipping on cetaceans, potentially including multi-year aerial surveys in the fall shoulder season for determination of the residual environmental effect of ice entrapment.

### 3.7 Marine Acoustic Modelling

<b>Review Comment Number</b>	3.7 Acoustic Modelling
<b>Subject/Topic</b>	Acoustic modelling
<b>References</b>	<ul style="list-style-type: none"> <li>• Marine Mammal Effects Assessment (TSD 24): Appendix B, Underwater Acoustic Modelling Report (entire document);</li> <li>• Cumulative and Transboundary Assessment (TSD 27): Section 1.4.14 (p. 42)</li> <li>• IR Responses Phase 2 Proposal – Mary River Project: DFO 3.2.1 (p. 59-60); Appendix 12, Overview of Marine Operations (entire document)</li> <li>• Advance Technical Comment Responses Phase 2 Proposal – Mary River Project: 3.2.2 (p. 6-7)</li> <li>• Golder Associates Ltd. May 17, 2019, Assessment of Icebreaking Operations during Shipping Shoulder Seasons on Marine Biophysical Valued Ecosystem Components (VECs), Figures D-31 &amp; D-38; Appendix D, section D.2, Figures D-39 – D-76; pg. 49</li> <li>• DFO Technical Review Comments to the NIRB, March 2019, Technical Comment 3.5, recommendation 3.5.3</li> <li>• JASCO Applied Sciences. May 10, 2019. Technical Memorandum: Baffinland Phase 2 Acoustic Modelling: Responses to Technical Comment DFO 3.5.4; page 1.</li> <li>• Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment: sections 4.3.2, 4.3.3 &amp; 4.3.4, pg. 20-23.</li> </ul> <p><u>Publications:</u></p> <p>Gervaise, C., Simard, Y., Roy, N., Kinda, B., and Ménard, N. 2012. Shipping noise in whale habitat: Characteristics, sources, budget, and impact on belugas in Saguenay-St. Lawrence Marine Park hub. J. Acoust. Soc. Am. 132(1): 76–89.</p>

	<p>NRC (National Research Council). 2003. Ocean Noise and Marine Mammals. National Academies Press, Washington, DC. 220 p.  <a href="https://doi.org/10.17226/10564">https://doi.org/10.17226/10564</a>.</p> <p>Pine, M.K., Hannay, D.E., Insley, S.J., Halliday, W.D., and Juanes, F. 2018. Assessing vessel slowdown for reducing auditory masking for marine mammals and fish of the western Canadian Arctic. Mar. Pollut. Bull. 135: 290–302.  doi:10.1016/j.marpolbul.2018.07.031</p> <p>Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr., C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A., and Tyack, P.L. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquat. Mamm. 33: 411–521.</p> <ul style="list-style-type: none"> <li>• Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P., and Tyack, P.L. 2019. Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquat. Mamm. 45(2): 125–232.  doi:10.1578/AM.45.2.2019.125</li> </ul>
<b>Summary</b>	<p>In DFO Technical Comment submission, Recommendation 3.5.3, DFO recommended <i>“Baffinland provide 24 hour sound exposure levels (SEL) related to shipping, in 10 dB increments and that Baffinland compare SEL results using their protocol versus the internationally recognized protocol.”</i> In the Assessment of Icebreaking Operations, BIM presents scenario 31 and 38 maps of SPL isopleths in 10dB steps corresponding to an Icebreaker and two Cape size ore carriers transiting at 2 knots at the floe edge (Figure D-31, Figure D-38).</p> <p>In their response to DFO IR 3.2.1 (IR Responses, Appendix 12), Baffinland provided the <i>‘definitive numbers [for vessels] that were used for assessment purposes’</i> as stated in the summary of DFO’s Technical Comment 3.1. Also in Appendix 12 of Baffinland’s IR Responses, Baffinland noted that their shipping model: <i>“does not allow for any delays on site, delays discharging in Europe, weather delays or any downtime between vessels”, “...assumes a consistent flow of vessels to the port”,</i> further indicating under ‘Vessel Communication’ that <i>“<u>24 hours of operation can be expected</u>”</i>. In the Advance Technical Comment Response to DFO 3.2.2, Baffinland concludes <i>“all ship transits along the Northern Shipping Route would likely emit a <u>masking zone that extends shoreline to shoreline</u> (around the immediate vicinity of the vessel)”</i> (emphasis added).</p> <p>In DFO Technical Comment submission, Recommendation 3.5.4, DFO recommended <i>“DFO recommends Baffinland conduct a more robust simulation of masking to adequately evaluate the impact of masking on narwhals.”</i> In response, Baffinland committed to providing <i>“the modelling for pulse call at 1 kHz, similar to Section 4.1. Ambient Noise and Vessel Measurements in Frouin-Mouy, H. and E.E. Maxner. 2018. Baffinland Iron Mines Corporation–Mary River Project: 2018</i></p>

*Passive Acoustic Monitoring Program. Document 01720, Version 2.0. Technical report by JASCO Applied Sciences for Golder Associates Ltd. by May 13"* (JASCO Technical Memorandum, Response to DFO TC 3.5.4, pg. 1).

Baffinland provided a Technical Memorandum produced by JASCO in response to DFO technical comment 3.5.4 on May 10, 2019. On page 1-2 of this Technical Memorandum, the following 'Equation 1' and 'Figure 1' are presented:

$$LRR = 100 \times \left( 1 - 10^{\frac{NL_2 - NL_1}{N}} \right)$$

Equation 1

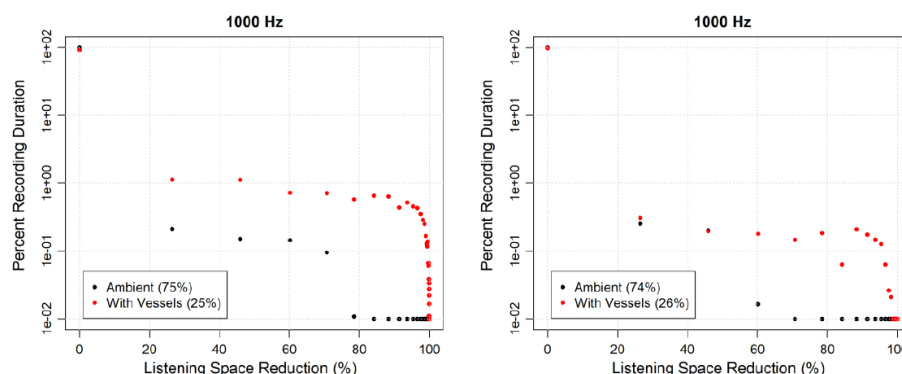


Figure 1 Listening space reduction (LSR) in Milne-Inlet for narwhal communication at 1 kHz: (Left) AMAR-1 and (right) AMAR-3. The black dots show the distribution of LSR for ambient data only, while the red dots show the distribution of LSR for minutes with vessels detected in the data. The y-axis is logarithmic to better view the rare high LSR events.

In addition, the Technical Memorandum further states that *"The LSR was then computed following Equation 1 (Equation 7 from Pine et al. (2018), modified to remove the factor of 2)"* (emphasis added)(p. 1). Baffinland also states that LSR *"was computed for underwater sound levels recorded during the 2018 shipping season (Frouin-Mouy and Maxner, 2018) at a typical recording location (AMAR-1) as well as the quietest location (AMAR-3)"* in Koluktoo Bay (Memorandum: Listening Space Reduction Analysis at 1kHz for 2018 Acoustic Monitoring Data, p. 1).

Also in relation to calculating the LSR, DFO further notes that within the Technical Memorandum, it states that *"N is the geometric spreading coefficient for the acoustic propagation environment, here set to the nominal value of N=15"* (p. 1).

Baffinland presents calculations of sound exposure level (SEL<sub>24</sub>) and thresholds for auditory injury on page 3 of their document: 'Memorandum: Additional Modelling for one Cape Size Ore Carrier at 13KTS at Eclipse Sound'. Similarly, in the *Assessment of Icebreaking Operations*, under Appendix D, section D.2. SEL<sub>24h</sub> Accumulation for Transiting Vessels in Ice, Figures D-39 to D-76 are presented.

	<p><u>Cumulative Sound Levels</u></p> <p>In regard to <u>cumulative sound levels</u> Baffinland also concludes in TSD 27, under section 1.4.14, on page 42: “...given the physics of underwater sound, the <u>cumulative sound level</u> is not predicted to increase when multiple vessels are present in the same area (TSD-24). Therefore, [...] it is not expected that marine mammals including species at risk would be affected at the population level” (emphasis added).</p> <p>In TSD 24, Appendix B, section 2.1.3 (p. 12), Baffinland states “that the measured levels were adjusted to the modelled speeds of 9 and 5 knots using Equation A-1”. Appendix B also presents various sound models in Milne Inlet (e.g., Appendix E: Modelled Sound Fields, Figures E1, E3, E26, E 27)</p> <p>DFO notes that Baffinland repeatedly states in Sections 4.3.1 (Ringed Seal), 4.3.2 (Narwhal), 4.3.3. (Beluga Whale), and 4.3.4 (Bowhead Whale) of Knight Piésold Consulting’s Memorandum TSD27 – Cumulative Effects Assessment, that “However, the cumulative sound level (‘loudness’) is not predicted to increase when multiple vessels are present in the same area – it would remain roughly equivalent to that of the single (larger) vessel at any single point within the zone of acoustic overlap. This is due to the logarithmic nature of sound underwater (i.e., the cumulative effect of multiple co-occurring noise sources is not linear in scale)” (pg. 20–23). DFO notes that in the Assessment of Icebreaking Operations, on page 49, Baffinland states “Based on a maximum-case icebreaker transit scenario (2 icebreakers escorting 2 capesize carriers)”.</p>
<b>Importance of issue to the impact assessment</b>	Increased shipping activities have the potential for significant increases in acoustic disturbances and significant adverse effects to marine mammals, and it’s important that adequate modelling is conducted in order to fully assess these impacts.
<b>Detailed Review Comment Gap/Issue Disagreement with Addendum/TSD conclusion Reasons for disagreement with Addendum conclusion</b>	<p>DFO notes that understanding the level and duration of sounds that will be expected to occur are required to adequately assess the impacts to sound exposure related to shipping activities.</p> <p>Understanding the ratio of quiet hours to when vessels are present and an estimate of the proportion of time that marine mammals would be exposed to different levels of sound, is important in the review and interpretation of associated potential impacts. DFO notes that Baffinland has provided estimates of the 24 hour sound exposure levels (SEL) related to shipping in 10 dB increments as previously recommended by DFO in the DFO Technical Comment submission, Recommendation 3.5.3. In the Assessment of Icebreaking Operations, BIM presents scenario 31 and 38 maps of SPL isopleths in 10dB steps corresponding to</p>

an Icebreaker and two Cape size ore carriers transiting at 2 knots at the floe edge (Figure D-31, Figure D-38).

As noted in the summary above, Baffinland provides calculations for Listening Space Reduction (LSR) in Milne Inlet for ambient noise. In the calculation for LSR provided by Baffinland, NL2 is the sound pressure level with the masking noise present, NL1 is the sound pressure level without the masking present. DFO assumes that NL1 is equal to ambient noise and therefore, by definition, LSR for ambient noise should be 0. Secondly, in the description of Equation 1, the memo specifies that the equation used here is a modification of Equation 7 from Pine et al. (2018). Baffinland does not provide justification for any of the modifications; therefore it is not clear why the factor 2, or the negative sign in front of it, was removed from the original equation (Pine et al. 2018). DFO also requires an example of how LSR is calculated. Specifically, it is not clear if Baffinland calculated the LSR or the LRR. As an overarching comment, Equation 1 assumes an isotropic noise propagation and that noise propagation is not constrained (NRC 2003, Gervaise et al. 2012). DFO is concerned that the location of the two listening stations (AMAR-1 and AMAR-3) for which the LSR was calculated is in Koluktoo Bay. Sound propagation is likely to be non-isotropic and limited by land in Koluktoo Bay. DFO is unclear if sound propagation in Koluktoo Bay is isotropic and non-limited by land. If it is not the case, DFO notes that Baffinland should provide comments on the impact of the violation of the assumptions of the equation. DFO is concerned that the violation of the assumptions might result in an underestimate of the listening space reduction.

DFO further notes that the LSR performed by JASCO in the May 2019 'Technical Memorandum: Listening Space Reduction Analysis at 1kHz for 2018 Acoustic Monitoring Data' is based on the current noise from the shipping traffic recorded in 2018. DFO notes that Baffinland is proposing to increase shipping to 420 annual transits in Milne Inlet (Baffinland Information Response, Appendix 12, p. 4-5). Given the significant increase in shipping traffic expected with Phase 2, DFO notes that it would be more appropriate to conduct a modelling exercise to calculate the LSR associated with the increased transits. Additionally, in order to properly assess the LSR, Baffinland should conduct similar modelling in other parts of the Regional Study Area including Milne Inlet and Eclipse Sound. DFO notes that additional information is required for DFO to adequately review Baffinland's assessment.

Further, DFO is unclear as to why Baffinland has "*set to the nominal value of N=15*" (May 2019 Technical Memorandum, pg. 1) Baffinland does not provide justification or reference as to why N = 15 was chosen. DFO notes that this value will ultimately influence the calculation of the LSR.



	<p>DFO notes the calculations provided by Baffinland in both the ‘Additional Modelling for one Cape Size Ore Carrier at 13KTS at Eclipse Sound’ and the ‘Assessment of Ice Breaking Operations’. DFO further notes that the references used for these calculations were based on NMFS (2018) and Southall et al. (2007). However, Southall et al. (2019) have published new guidelines for the calculation of SEL24 and thresholds for auditory injury. DFO notes that use of the updated guidelines would be more appropriate.</p> <p><u>Cumulative Sound Levels</u></p> <p>DFO notes Baffinland’s assessment of cumulative sound levels and acknowledges that that sound levels are appropriately represented by a logarithmic scale, however, DFO notes that this means an increase of 3dB is equivalent to doubling the perceived noise level. In addition, while the following statement “<i>given the physics of underwater sound, the cumulative sound level is not predicted to increase when multiple vessels are present in the same area</i>” may be true, the total area with sound disturbance would be greater since the ships will be spaced apart. This could result in noise disturbance across the entire Inlet. DFO notes that Baffinland states that the cumulative sound level of multiple vessels would remain roughly equivalent to the sound level of one vessel. The sound pressure level of two vessels of the same acoustic signature is louder than the sounds pressure from one vessel and results in an increase of 3dB. As pointed out by Baffinland, sound levels are represented by a logarithmic scale and an increase in 3dB can be significant. Noise propagation modelling including the cumulative noise of two cape-size carriers, would be appropriate to represent this potential increase and helpful for DFO’s review, based on Baffinland’s “<i>maximum-case icebreaker transit scenario (2 icebreakers escorting 2 capesize carriers)</i>” ( Assessment of Icebreaking Operations, pg. 49).</p>
<p><b>Recommendation / Request</b></p>	<p><b>Recommendation 3.7:</b></p> <p>DFO is concerned that the Baffinland provided acoustic modelling does not fully allow DFO to assess cumulative sound level and the assessment of the effect of the sound on marine mammals.</p> <p>DFO-FFHPP recommends that Baffinland:</p> <p><b>3.7.1</b> Clarify on how NL1 was calculated and on how LSR was calculated for ambient noise, providing rationale for the modifications to the equation from Pine et al. (2018), and providing an example of how LSR is calculated.</p>



	<p><b>3.7.2</b> Conduct a modelling exercise to calculate the LSR associated with the proposed increased transits. Including modelling in other parts of the Regional Study Area including Milne Inlet and Eclipse Sound.</p> <p><b>3.7.3</b> Provide new calculations based on the new guidelines (Southall et al. 2019) or provide comments on the difference in methods and results between the older and newer methods, as well as consider temporary threshold shift (TTS) and not just permanent threshold shift (PTS), where relevant.</p> <p><b>3.7.4</b> Provide long term monitoring plan to verify the prediction of the sound propagation modelling and its potential effects on the populations of marine mammals.</p>
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### 3.8 Marine Acoustic Disturbance

<b>Review Comment Number</b>	3.8 Acoustic Disturbance
<b>Subject/Topic</b>	Impacts due to marine acoustic disturbances
<b>References</b>	<ul style="list-style-type: none"> <li>• Marine and Environmental Effects Assessment (TSD 24), Section 2.1 (p. 12-14), Section 2.1.4 (p. 13), Section 2.5.2.2 (p. 26) Table 2.6, Section 2.6.2.2 (p. 33-35)</li> <li>• Cumulative and Transboundary Assessment (TSD 27): Section 1.4.14.3 (p.44-45),</li> <li>• Golder Associates Ltd. May 17, 2019, Assessment of Icebreaking Operations during Shipping Shoulder Seasons on Marine Biophysical Valued Ecosystem Components (VECs), p. i-ii, page 45-46, 51, 53, 71</li> <li>• Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment, p. 21-22).</li> <li>• Baffinland Iron Mines Corporation. August 15, 2019. Animation of Simulated Vessel Movements with Estimated Sound Field</li> </ul> <p><u>Publications:</u></p> <p>DFO. 2019a. Science Review of the Phase 2 Addendum to the Final Environmental Impact Statement for the Baffinland Mary River Project. DFO Can. Sci. Advis. Sec. Sci. Resp. 2019/015.</p> <p>Elliott, R.E., Raborn, S., Smith, H.R., and Moulton, V.D. 2015. Marine mammal aerial surveys in Eclipse Sound, Milne Inlet, Navy Board Inlet, and Pond Inlet, 31 August – 18 October 2013. Final LGL Report No.</p>

	<p>TA8357-3. Prepared by LGL Limited, King City, ON for Baffinland Iron Mines Corporation, Oakville, ON. 61 p.</p> <p>Lesage, V., Barrette, C., Kingsley, M.C.S., and Sjare, B. 1999. The effect of noise on the vocal behavior of Belugas in the St. Lawrence River Estuary, Canada. <i>Mar. Mamm. Sci.</i> 15(1): 65–84.</p> <p>NAMMCO (North Atlantic Marine Mammal Commission). 2010. Report on the Joint NAMMCO/JCNB Scientific Working Group – narwhal. In: NAMMCO Annual Report 2009. NAMMCO. Tromsø, Norway. 291–296</p> <p>Radford, A.N., Kerridge, E., and Simpson, S.D. 2014. Acoustic communication in a noisy world: can fish compete with anthropogenic noise? <i>Behav. Ecol.</i> 25(5): 1022–1030. doi:10.1093/beheco/aru029</p> <p>Thomas, T.A., Raborn, S., Elliott, R.E., and Moulton, V.D. 2015. Marine mammal aerial surveys in Eclipse Sound, Milne Inlet, Navy Board Inlet, and Pond Inlet, 1 August – 22 October 2014. Final LGL Report No. FA0024-2. Prepared by LGL Limited, King City, ON for Baffinland Iron Mines Corporation, Oakville, ON. 70 p.</p>
<b>Summary</b>	<p>In relation to impacts on marine mammals due to acoustic disturbance, Baffinland concludes in TSD 24, under section 2.6.2.2, on page 35, that: <i>“Narwhal are expected to exhibit temporary and localized avoidance behavior when encountering Project vessels along the shipping route and in Milne Port.”</i> (s.2.1.4; p. 13). In TSD 27, section 1.4.14.3, on pages 44-45: <i>“With the effective implementation of mitigation, effects on narwhal from cumulative underwater noise sources are predicted to be moderate in magnitude (Level II), confined to the LSA (Level I), intermittent (Level II) in frequency, short-term (Level I) for pile driving and medium-term (Level II) for shipping, and fully reversible (Level I). The residual environmental effect is predicted to be not significant”</i>.</p> <p>In the Assessment of Icebreaking Operations document, on page 51, Baffinland states <i>“Given the degree of frequency overlap between icebreaker noise and narwhal hearing, animals that do occur within the modelled disturbance zones are predicted to experience masking caused by icebreakers on a local and <u>short-term</u> scale”</i> (emphasis added).</p> <p>Baffinland states <i>“A software model estimating zones of impact on beluga whales around icebreakers estimated that masking of beluga communication signals is predicted within 14–71 km range (Erbe and Farmer 2000). However, narwhals have shown avoidance of icebreakers when first detected (LGL and Greeneridge 1986; Finley et al. 1990; Cosens and Dueck 1988), so individuals are unlikely to get close enough for effects such as masking to occur”</i> (Assessment of Icebreaking Operations, p. 51).</p>

Baffinland also states that *“Based on acoustic modelling results, it is predicted that narwhal will demonstrate avoidance of the icebreaker at distances ranging from 2.2 to 12.5 km from the source based on a maximum-case icebreaker transit scenario...The estimated range (R95%) for narwhal avoidance (135 dB re 1  $\mu$ Pa SPL) at the floe edge is 0.5 km from the source”* (Assessment of Icebreaking Operations, p. 46).

Baffinland states *“The estimated frequency of shipping during the shoulder season includes a maximum of two icebreaker escorts per day in the regional study area (RSA). For the scenario of two icebreakers escorting two capesize carriers in Pond Inlet, a stationary narwhal in this area could be exposed to a 50% or more reduction in listening space for a period up to ~6 hours per day for transits at 9 knots, and up to ~12 hours per day for vessels travelling at 4.6 knots. There is some overlap in frequency between shipping sounds and narwhal communications, therefore there is potential for masking effects out to an unknown distance from the source. If masking does occur, narwhal may change their call types and call frequency to overcome this effect (e.g., Au et al. 1985; Lesage et al. 1999); although this has not yet been studied in narwhal.”* Baffinland then concludes that *“Given that sounds important to narwhal are predominantly at much higher frequencies than icebreaker noise, it is considered unlikely that masking would have a significant effect on narwhal. The residual environmental effect of masking on narwhal due to icebreaking noise is therefore predicted to be not significant (Table 5.7)”* (Assessment of Icebreaking Operations, p. 53).

Baffinland states that *“Based on the available literature, bowheads are likely to tolerate/habituate to the short-term increased levels of underwater noise and remain in the area, or leave temporarily and return once the noise subsides”* (Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment, p. 22). Similarly, *“Based on behavioral observations collected to date from the various monitoring programs and information provided in the available literature, narwhal are likely to tolerate/habituate to the short-term increased levels of underwater noise and remain in the area, or leave temporarily and return once the noise subsides”* (Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment, p. 21). Baffinland concludes *“With the effective implementation of mitigation, the residual disturbance effects on bowhead from icebreaking noise are predicted to of moderate magnitude (Level II), confined to the RSA (Level III), frequent in occurrence (Level II), medium-term in duration (Level II), and fully reversible (Level I). The residual*

	<p><i>environmental effect of acoustic disturbance of bowhead whale is predicted to be not significant (Table 5.13)” (Assessment of Icebreaking Operations, p. 71).</i></p> <p><i>Baffinland states “With the effective implementation of mitigation, the residual disturbance effects on narwhal from cumulative underwater noise effects are predicted to be moderate in magnitude (Level II), confined to the LSA (Level I), intermittent (Level II) in frequency, short-term (level I) for pile driving and medium-term (Level II) for shipping, and fully reversible (Level I). The residual environmental effect is predicted to be not significant” (Knight Piésold Consulting Memorandum TSD27 – Cumulative Effects Assessment, p. 21-22) with the same assessment for ringed seal (p 20), beluga (p. 22) and bowhead (p. 23).</i></p> <p><i>Baffinland states “Baffinland will implement the outlined mitigation measures based on the current assessment and conduct additional acoustic monitoring in the 2019 season. The results of this monitoring will be used to refine the underwater sound model. The refined model will be used to confirm the results of this assessment and verify needs for ongoing mitigation and monitoring” (Assessment of Icebreaking Operations, p. i–ii).</i></p>
<b>Importance of issue to the impact assessment</b>	<p>Increased shipping activities, including those occurring during ice conditions, have the potential for significant increases in acoustic disturbances and adverse effects to marine mammals.</p>
<b>Detailed Review Comment Gap/Issue Disagreement with Addendum/TSD conclusion Reasons for disagreement with Addendum conclusion</b>	<p>Baffinland provides information on how noise might impact marine mammals in the RSA including injury, disturbance, and communication masking. However, DFO is concerned that Baffinland does not consider the effect of all project related noise on marine mammal habitat and other ecosystem components. For example, Baffinland does not consider the impact of noise on fishes (e.g., Radford et al. 2014) which are the prey of marine mammals. A significant change on marine mammal prey abundance and availability in addition to the other project related impacts could adversely impact marine mammal stocks. DFO notes that impacts of noise on fishes as this is a significant gap in Baffinland’s assessment.</p> <p>Baffinland states “<i>animals that do occur within the modelled disturbance zones are predicted to experience masking caused by icebreakers on a local and <u>short-term</u> scale</i>” (emphasis added) DFO is unclear on what Baffinland defines as “short-term”. DFO is concerned that Baffinland states that the whales have the “<i>potential to be in the disturbance zone for a period of up to 3 h (for transits at 9 knots in 0/10 ice), 5 h (for transits at 9 knots in 3/10 ice), and 10 h (for transits at 4.6 knots in 10/10 ice) per icebreaker transit</i>”</p>

(Assessment of Icebreaking Operations, p. 45). A total of 10 daily over a period of 4.5 months represents a considerable proportion of time the Eclipse Sound narwhal stock resides in the LSA.

DFO notes that Baffinland is estimating that about 5–14% of the Eclipse Sound narwhal stock will exhibit avoidance of the icebreaking noise source. However, Baffinland is using an older estimate for the size of the Eclipse Sound narwhal stock (i.e., NAMMCO 2010). The most recent estimate for Eclipse Sound is 12,039 narwhals (Marcoux et al. 2019) with an estimated 141,909 in the population (DFO 2015a). Based on this recent estimate, the percentage of the Eclipse Sound narwhal stock that is predicted to exhibit avoidance is about 8–24% (assuming that 1,000 to 2,900 narwhals will exhibit avoidance of the icebreaker noise). Data from Elliott et al. (2015) and Thomas et al. (2015) show considerable variation in both the numbers and distribution of narwhals in the local study area (LSA) over the shipping period, so averages as applied are insufficient. DFO suggests the use of bracketing estimates with error estimates, or using season and water body specific density estimates in calculations of numbers of narwhals predicted to occur in avoidance zones.

Baffinland has demonstrated that narwhal will get close enough to vessels to experience masking effects, which is supported by modelling results that showed narwhal demonstrated avoidance of icebreakers at distances ranging from 2.2 and 12 km from the source and 0.5 km at the floe edge. This is much closer than the 14 to 71 km range where masking is predicted to occur. Baffinland recognizes that icebreaking might reduce narwhals' communication space by more than 50% for up to 12 hours. Based on two studies of beluga, Baffinland states that narwhals might change their call frequency to overcome the masking effect. In the same studies, it was also observed that belugas reduced their calling rate in the presence of shipping noise and that a decrease in calling rate is likely to have an impact on the efficiency of beluga communication (Lesage et al. 1999). Therefore, masking from icebreaking is likely to impact narwhals' ability to communicate, for up to 12 hours per day. Given this, DFO does not agree with Baffinland's conclusion that *"the residual environmental effect of masking on narwhal due to icebreaking noise is therefore predicted to not be significant"*. Reference DFO further notes the provided 'Vessel Traffic Animation' provided by Baffinland on August 15. DFO is further concerned about the amount of quiet time available for marine mammals during the shipping season.

	<p>DFO Baffinland provide reference to the data and literature that supports a “not significant” rating as DFO does not agree with Baffinland’s assessment as stated previously (DFO 2019a). DFO is unclear what information exists to suggest noise effects are fully reversible.</p> <p>DFO Science is concerned that acoustic monitoring is only going to be conducted in 2019, given the long-term nature of the Project.</p>
<b>Recommendation / Request</b>	<p><b>Recommendation 3.8:</b> In order to better assess the effect of noise on whales populations DFO recommends that, before the Project is approved, Baffinland:</p> <p><b>3.8.1</b> provide an assessment of the percentage (%) of time that narwhals will be exposed to noise under the Phase 2 proposal shipping scenario.</p> <p><b>3.8.2</b> re-evaluate the impact of masking on narwhal noting the evidence that narwhals will get close enough to vessels to experience masking effects.</p> <p><b>3.8.3</b> re-evaluate the level of the impact of masking from icebreaking on narwhal and provide supporting evidence, justification, and rationale for their conclusions.</p> <p><b>3.8.4</b> commits to additional acoustic monitoring related to icebreaking beyond 2019 regardless of if Phase 2 is approved or not, to verify predictions and better inform/refine ongoing monitoring, mitigation, and adaptive management</p>

### 3.9 Marine Mammal Observation

<b>Review Comment Number</b>	3.9 Marine Mammal Observation
<b>Subject/Topic</b>	Marine Mammal Observation and Ship-board observation programs
<b>References</b>	<ul style="list-style-type: none"> <li>• Marine Mammal Effects Assessment (TSD 24);; Section 2.3 (p. 14-15)</li> <li>• TSD28, Appendix V, Section 5.3, Table 2, p. 166; Draft Shipping and Marine Wildlife Management Plan, p. 72</li> <li>• IR Responses Phase 2 Proposal – Mary River Project: GN 67 (p. 29)</li> <li>• Advance Technical Comment Responses Phase 2 Proposal – Mary River Project: 3.2.3 (p. 6-7)</li> </ul>

	<ul style="list-style-type: none"> <li>• DFO Technical Review Comments to the NIRB, March 2019, Technical Comment 3.7, recommendation 3.7.1</li> <li>• Baffinland Iron Mines Corporation. March 26, 2019. Technical Comment Responses, Phase 2 Proposal – Mary River Project: DFO 3.7.1, pg.</li> <li>• Golder Associates Ltd. May 17, 2019, Assessment of Icebreaking Operations during Shipping Shoulder Seasons on Marine Biophysical Valued Ecosystem Components (VECs): pg. 70; Shipping Mitigation Measures</li> <li>• Knight-Piésold Consulting. May 17, 2019. Socio-economic Assessment of Icebreaking Operations during Shipping Shoulder Seasons: pg. 14</li> </ul> <p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>• DFO. 2019a. Science Review of the Phase 2 Addendum to the Final Environmental Impact Statement for the Baffinland Mary River Project. DFO Can. Sci. Advis. Sec. Sci. Resp. 2019/015.</li> </ul>
<b>Summary</b>	<p>In TSD 24, under section 2.3, on pages 14-15, it states: <i>“A marine mammal surveillance monitoring program was [...] discontinued in 2016 as it was determined that very few marine mammals were visible to observers on board the vessels, and there were safety concerns regarding observers boarding the vessels at sea.”</i> In the IR Response to GN 67 (p. 29), Baffinland indicates that <i>“the Ship-based Observer (SBO) marine mammal monitoring program ran in 2018 aboard the MSV Botnica during the shoulder seasons”</i>.</p> <p>In the Advance Technical Comment Responses to DFO 3.2.3 (p. 6), Baffinland provide details regarding the marine mammal surveillance monitoring program conducted onboard the Project ore carriers in 2014 and 2015, including: <i>“In 2018, the ship-based monitoring program was implemented using an ice management vessel during the shipping shoulder seasons. The 2018 program mitigated BIM's health and safety concerns by boarding Inuit MMOs at Milne Inlet and provided greater survey time since MMOs could remain aboard the vessel for multiple days”</i> and <i>“Continued Project monitoring of marine mammal-vessel strikes will reduce uncertainty regarding marine mammal-vessel strikes and will inform on the accuracy of assessment predictions and mitigation effectiveness.”</i></p> <p>DFO notes that Baffinland's current Project Certificate, term and condition number 106 to 108 specifically relate to Shipboard Observers. Particularly, term and condition 106 states: <i>“The Proponent shall ensure that shipboard observers are employed during seasons where shipping occurs and</i></p>



*provided with the means to effectively carry out assigned duties. The role of shipboard observers in shipping operations should be taken into consideration during the design of any ore carriers purpose-built for the Project, with climate controlled stations and shipboard lighting incorporated to permit visual sightings by shipboard observers during all seasons and conditions. Any shipboard lighting incorporated should be in accordance with the Canada Shipping Act, 2001's Collision Regulations, and should not interfere with safe navigation of the vessel."*

DFO recommendation 3.7.1 from DFO's March technical review comments, stated *"DFO recommends Baffinland clarify the following in relation to marine mammal observers and the ship-board observer program:*

- a. Clarify if an updated monitoring plan will be provided, which addresses Term and Condition 107*
- b. Clarify what is being done to mitigate the current issues with the ship-board observer program, including the inability to have marine mammal observers during the bulk of the shipping season"*

DFO notes Baffinland's responded to DFO recommendation 3.7.1, providing clarification. As part of the response, Baffinland states: *"An updated monitoring plan is not required to address Term and Condition 107. In 2018, a Ship-Based Observer (SBO) Program was conducted from on-board the MSV Botnica, an Ice Management Vessel (IMV) that was commissioned by Baffinland to serve as an escort vessel to ore carriers during the spring and fall shoulder seasons."* Further, *"Currently there are limited opportunities to run the ship board observer program throughout the entirety of the season. The MSV Botnica (or similar type vessel) provides a safe and appropriate vessel for conducting the ship-board observer program unlike the ore carriers or fuel/re-supply vessels because the MSV Botnica provided a safe climate-controlled viewing platform 20 m above sea level, where port and starboard-stationed Marine Wildlife Observers (MWOs) could comfortably and more effectively observe marine mammals and birds and record observations"* and *"Baffinland has been working with the MEWG to investigate other opportunities or options to employ the SBO program throughout the shipping season, including holding dedicated meetings in 2017 and 2018 on the subject. No other viable options were put forward in those discussions."*



	<p>DFO notes that Baffinland states <i>“Data indicates that a dedicated observer could be effective in reducing the risk of colliding with a whale”</i> (Assessment of Icebreaking Operations, p. 70).</p> <p>Baffinland also states in the Shipping Mitigation Measures section that <i>“Baffinland will place Marine Wildlife Observers (MWOs) on icebreaking vessels during the shoulder seasons that will be responsible for recording relative abundance, group composition and behaviour of marine mammals relative to icebreaker transits along the Northern Shipping Route. MWOs will also be responsible for recording any incidences of marine mammal strikes or near misses with Project vessels, including icebreaker vessels”</i>. (Socio-economic Assessment of Icebreaking Operations, p. 14).</p> <p>DFO notes that Baffinland states <i>“When marine mammals appear to be trapped or disturbed by Project vessel movements, the vessel will implement appropriate measures to mitigate disturbance, including stoppage of movement until wildlife move away from the immediate area (as safe navigation allows)”</i> and that <i>“All Project vessels will be provided with standard instructions to operate their vessel in a manner that avoids separating an individual member(s) of a group of marine mammals from other members of the group”</i> (Socio-economic Assessment of Icebreaking Operations, p. 14).</p>
<b>Importance of issue to the impact assessment</b>	It is important to have experienced Marine Mammal Observers aboard ore carriers to monitor reactions and provide localized measures of marine mammal densities along the shipping route.
<b>Detailed Review Comment Gap/Issue Disagreement with Addendum/TSD conclusion Reasons for disagreement with Addendum conclusion</b>	<p>DFO notes that Baffinland’s statement that <i>“Data indicates that a dedicated observer could be effective in reducing the risk of colliding with a whale”</i> (Assessment of Icebreaking Operations, p. 70), supports DFO’s recommendation that an MWO should be on board on every vessel related to the project and its activities, even outside of the shoulder seasons (DFO 2019a). DFO notes the 2018 program; only saw marine mammal observers for the shoulder seasons aboard the ice-breaking vessel and that data collected during the open water season, is vital for monitoring effects to marine mammals.</p> <p>DFO notes Baffinland’s statement that <i>“ Baffinland will place Marine Wildlife Observers (MWOs) on icebreaking vessels during the shoulder seasons”</i> (Socio-economic Assessment of Icebreaking Operations, p. 14). DFO is unclear if there will be MWOs on every icebreaking vessel including their escort vessels as it was stated previously that MWOs would be on</p>

	<p><i>“select vessels”</i> (TSD28, Appendix V, Section 5.3, Table 2, p. 166; Draft Shipping and Marine Wildlife Management Plan, p. 72).</p> <p>DFO notes Baffinland’s statement that <i>“All Project vessels will be provided with standard instructions to operate their vessel in a manner that avoids separating an individual member(s) of a group of marine mammals from other members of the group”</i> (Socio-economic Assessment of Icebreaking Operations, p. 14). However, Baffinland does not describe these instructions. DFO is unclear what additional measures beyond stoppage of movement will be taken to mitigate disturbance. DFO is further unclear what wildlife distance and behavior criteria will be used to dictate when normal shipping activities are allowed to resume. DFO notes it’s important for Baffinland to provide detail on what instructions will be provided, in order to conduct a proper review of the project and ensure the best possible practices are being implemented. DFO further notes that Baffinland should provide clarification as to who will observe and identify marine mammals in order to implement the provided <i>“standard instructions”</i>, and which criteria and thresholds will be used to assess further disturbance.</p>
<b>Recommendation / Request</b>	<p><b>Recommendation 3.9:</b> DFO recommends that:</p> <p><b>3.9.1</b> all project related vessels (e.g., icebreakers, escort vessels, ore carriers) have MWOs present for the entire shipping season (e.g., port to port). If this not logistically possible, an alternative plan should be developed by Baffinland to monitor presence and behavior of marine mammals.</p> <p><b>3.9.2</b> Baffinland provide the <i>“standard instructions to operate their vessel in a manner that avoids separating an individual member(s) of a group of marine mammals from other members of the group”</i> for DFO to review.</p>

### 3.10 Marine Environment: Ballast Water and Non-indigenous Species

<b>Review Comment Number</b>	3.10 Ballast Water and Non-indigenous Species
<b>Subject/Topic</b>	Impacts of increased shipping related to aquatic invasive species (AIS) and non-indigenous species (NIS)

<b>References</b>	<ul style="list-style-type: none"> <li>• Marine Environmental Effects Assessment (TSD 17): Section 3.7.3 (p. 65)</li> <li>• TSD 21, Risk Assessment for Introduction of Aquatic Invasive Species from Ballast Water, Summary; Section 4</li> <li>• DFO Technical Review Comments to the NIRB, March 2019, Technical Comment 3.8</li> <li>• Baffinland Iron Mines Corporation. March 26, 2019. Technical Comment Responses, Phase 2 Proposal – Mary River Project: DFO 3.8.1, DFO 3.8.2, DFO 3.8.3,</li> <li>• Baffinland Iron Mines Corporation. March 31, 2019. Ballast Water Management Plan: Section 4, pg. 13–14, pg. 8; pg. 7; Section 2, pg. 9; Section 3.2, pg. 13</li> <li>• Baffinland Iron Mines Corporation. May 13, 2019. Draft Shipping and Marine Wildlife Management Plan (SMWMP): Page 11; Section 6.6, pg. 76</li> </ul> <p><u>Publications:</u></p> <p>Casas-Monroy, O., Linley, R.D., Adams, J.K., Chan, F.T., Drake, D.A.R., and Bailey, S.A. 2014. National risk assessment for introduction of aquatic nonindigenous species to Canada by ballast water. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/128. vi + 73 p.</p> <p>Chan, F.T., Bronnenhuber, J.E., Bradie, J.N., Howland, K.L., Simard, N., and Bailey, S.A. 2012. Risk assessment for ship-mediated introductions of aquatic nonindigenous species to the Canadian Arctic. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/105.</p> <p>DFO. 2015b. Risk assessment of alternate ballast water exchange zones for vessel traffic to the eastern Canadian Arctic. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/019.</p> <p>Goldsmid, J., Nudds, S.H., Stewart, D.B., Higdon, J.W., Hannah, C.G., and Howland, K.L. 2019. Where else? Assessing Zones of Alternate Ballast Water Exchange in the Canadian Eastern Arctic. Mar. Pollut. Bull. 139:74–90.</p> <p>Laget, F. 2017. Transport d'espèces de dinoflagellés non-indigènes dans l'Arctique Canadien, suite au déversement des eaux de ballast par un navire domestique. M.Sc. Thesis. Université du Québec à Rimouski. 130 p.</p> <p>Locke, A., Mandrak, N.E., and Therriault, T.W. 2011. A Canadian rapid response framework for Aquatic Invasive Species. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/114. vi + 30 p.</p> <p>Stewart, D.B., Nudds, S.H., Howland, K.L., Hannah, C.G., and Higdon, J.W. 2015. An ecological and oceanographical assessment of alternate</p>
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	<p>ballast water exchange zones in the Canadian eastern Arctic. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/037. vi + 75 p.</p> <p>Tremblay, P. 2017. Évaluation du risque potentiel d'introduction d'espèces non-indigènes de mésozooplancton suite au déversement des eaux de ballast d'un navire domestique dans l'Arctique Canadien. M.Sc. Thesis. Université du Québec à Rimouski. 126 p.</p>
<b>Summary</b>	<p>In TSD 17, under section 3.7.3 on page 65, Baffinland states: <i>“There is a potential of introduction of invasive species and harmful bacteria and parasites that may negatively affect Arctic char health and conditions. The AIS risk assessment and mitigation measures are discussed in Section 3.6.4. As the result of the mitigation measures implemented by Baffinland, the residual effect from AIS introduced with ballast water will be negligible (Table 3-12).”</i></p> <p>In TSD 21 Summary, Baffinland states: <i>“The study determined that, with the large volume of ballast water discharged, the probability of AIS being introduced at Milne Port is very high. However, the risk assessment does not take into account potential mitigation measures against the introduction of AIS.” [...] “In addition, Baffinland’s Shipping and Wildlife Management Plan, and Aquatic Invasive Species Monitoring Programs will be updated to address the increase in ballast water discharge volume as well as ballast water treatment options and monitoring.”</i></p> <p>In DFO’s technical comment 3.8 DFO provided recommendations in relation to ballast water discharge, noting the increased the risk of release of non-indigenous (and potentially invasive) species. Recommendation 3.8.1 included <i>“Please clarify what sampling Baffinland plans to conduct and how they plan to properly identify non-indigenous and invasive species”</i> and <i>“Please clarify whether Baffinland plans on conducting aquatic invasive species analyses for all of the more than 176 ship trips planned”</i>. Under 3.8.2, DFO recommended that <i>“the proponent develop a mitigation and management plan to address the possibility of an event, when a harmful invasive species is introduced and/or establishes in the area”</i> and in 3.8.3, DFO recommended <i>“Baffinland require vessels follow the International Marine Organization’s 2011 Guidelines for the control and management of ships’ biofouling to minimize the transfer of invasive aquatic species.”</i></p> <p>In Baffinland’s responses to DFO technical comment 3.8.1, Baffinland states: <i>“Baffinland’s AIS Monitoring Program was developed in 2015 to detect non-native species potentially introduced to Milne Inlet via ballast</i></p>

water discharges or hull biofouling. AIS monitoring is conducted annually and targets lower trophic levels, including zooplankton, benthic infauna and epifauna, macroflora, and fish. In 2017, the AIS monitoring program was expanded to include sampling sites near Ragged Island to capture potential AIS at existing anchorage locations in this area as a direct result of community concerns raised about vessel presence in the area. In 2018, AIS monitoring continued in Milne Port and at Ragged Island and included underwater video surveys of ore carrier hulls for detection of biofouling organisms” and “AIS monitoring will continue during the shipping season throughout Phase 2 operations. The frequency and scope of the AIS program will be discussed with the MEWG.” Baffinland’s response to DFO technical comment 3.8.2 states “Baffinland’s management of AIS is focused on prevention through regular ship inspections and on-board ballast water testing (as outlined in Baffinland’s BWMP) and through comprehensive AIS monitoring in the marine receiving environment as outlined in the MEEMP and AIS Monitoring Program Annual Reports. Should it be confirmed that an AIS has become established in the Project area and that this introduction was a direct result of Baffinland shipping operations, Baffinland is committed to working with DFO to develop management actions for control of the AIS in accordance with DFO’s Canadian Action Plan to Address the Threat of AIS.” Baffinland responded to DFO technical comment 3.8.3 with “Comment acknowledged. Baffinland is committed to working with DFO during the review process and appreciates additional specific recommendations and guidance from DFO related to biofouling management.”

DFO notes that the most recent version of the disposition table, created as a result of the second technical session, sets the “Target Submission Date” for all of the ballast water/AIS/NIS issues from DFO, as “Post EA”. DFO further notes a meeting on September 6<sup>th</sup> between Baffinland, and multiple federal parties including DFO to discuss incorporating suggestions surrounding Ballast water management.

Baffinland states that: “In the unlikely scenario of a non-compliance event, Baffinland will initiate adaptive management measures (see Section 4.0). If the average salinity reading is less than 30 ppt or greater than 40 ppt, the following steps will be taken:

- Recalibration of YSI to determine if there is an error with the instrument.
- Review vessel Ballast Water Records to verify ballast water exchange occurred
- Using secondary YSI instrument if needed to retest ballast water tanks.

*If after the above steps have been followed and the average salinity reading remains less than 30 ppt or greater than 40 ppt, the Port Captain will notify Baffinland's Head of Shipping of the situation.” [...] “Baffinland will continue to consult with Transport Guidance on guidance regarding best practices for testing and adaptive management in relation to the D-2 standard” (Ballast Water Management Plan, Section 4, p. 13–14).*

*Baffinland states that “the Proponent shall develop and implement an effective ballast water management program that may include the treatment and monitoring of ballast water discharges in a manner consistent with applicable regulations and/or exceed those regulations if they are determined to be ineffective for providing the desired and predicted results. The ballast water management program shall include, without limitation, a provision that requires ship owners to test their ballast water to confirm that it meets the salinity requirements of the applicable regulations prior to discharge at the Milne Port.” (Ballast Water Management Plan, p. 8)*

*Baffinland states that “Canada is an active member of the International Maritime Organization (IMO) and is a signatory to IMO agreements such as the International Convention for the Safety of Life at Sea (SOLAS), the International Convention for the Prevention of Pollution from Ships (MARPOL), the International Loadline Conventions Convention on Load Lines, the International Safety Management Code (ISM), and the IMO International Convention for the Control and Management of Ships’ Ballast Water and Sediment. The majority of operations described in this SMWMP are marine or port-related and are federally regulated by Transport Canada through the Canada Shipping Act and various International Regulations augmented by various Shipping Notices and Publications” (Draft Shipping and Marine Wildlife Management Plan (SMWMP), Page 11).*

*Baffinland states that “At this point in time, sampling and analysis methodologies to test for compliance with the D-2 standard have not been fully developed” (Ballast Water Management Plan, p. 7).*

*Baffinland states they will ensure “management measures are implemented for foreign flag vessels arriving directly to Milne Port from international waters” to “minimize the risk of introduction of AIS through ballast water discharge” (Ballast Water Management Plan, Section 2, p. 9).*

	<p>Baffinland also states that <i>“As a matter of due diligence, Baffinland has elected to conduct ballast water sampling in one randomly selected ballast water tank on all foreign flag vessels arriving directly to Milne Port from international waters to confirm that effective exchange has occurred in accordance with the Regulations and the BMW Convention. Specifically, ballast water salinity will be measured prior to discharge to verify that it meets the D-1 threshold (at least 30 parts per thousand [ppt])”</i> (Ballast Water Management Plan, Section 3.2, p. 13).</p> <p>In Section 6.6 (Environmental Monitoring – Marine Environment), p.76 of the <i>Draft Shipping and Marine Wildlife Management Plan</i>, Baffinland states that <i>“Baffinland is committed to implementing marine-based monitoring programs for the Mary River Project to monitor for possible Projectrelated impacts to the marine environment as identified in the FEIS (Baffinland 2012) and Addendums (Baffinland 2013; 2018) and to meet monitoring requirements outlined in Terms and Conditions of Project Certificate No. 005. The main objectives of the monitoring programs are to:</i></p> <ul style="list-style-type: none"> <li>• <i>Verify effects predictions described in the Approved Project;</i></li> <li>• <i>Evaluate the effectiveness of Project mitigation measures;</i></li> <li>• <i>Identify unforeseen environmental effects;</i></li> <li>• <i>Provide an early warning of an adverse change in the environment; and</i></li> <li>• <i>Improve the understanding of cause-and-effect relationships”.</i></li> </ul>
<b>Importance of issue to the impact assessment</b>	<p>Introduction of aquatic invasive species can cause serious harm to the natural environment in an area and it's important to adequately assess and mitigate the risks of spreading unwanted species to the project area.</p>
<b>Detailed Review Comment Gap/Issue Disagreement with Addendum/TSD conclusion Reasons for disagreement with Addendum conclusion</b>	<p>There are concerns that domestic ballast water release could result in the spread of species to non-native areas as well as the secondary spread of non-native species across Canada. DFO notes that Baffinland has concluded that with implementation of mitigation plans and continuing AIS monitoring, the residual effect from AIS introduced with ballast water, will be negligible. However, DFO notes the increase in shipping activity, number of ballast discharges, and size of vessels will increase the risk of species introductions. Even with the use of ballast water exchange, there is a potential for some number of new species to be introduced by ballast water. DFO notes the importance of implanting appropriate mitigation and monitoring to reduce the risk of introducing AIS and NIS.</p> <p>DFO notes the ballast water/AIS/NIS issues from DFO, are given a timeline of <i>“Post EA”</i> in the disposition table. DFO disagrees with this timeline and notes updated management plans and other associated documents should be provided for review. DFO acknowledges Baffinland's consideration of suggestions by parties at the September 6<sup>th</sup> meeting. DFO will review</p>



	<p>updated Ballast Water Management documents once they are provided by Baffinland.</p> <p>DFO recognizes Baffinland has been exercising due diligence and that they will be regularly testing ballast for D-1 compliance in vessels that conduct exchange and for D-2 compliance in cases where vessels are using treatment. However, Section 3.2 (page 13) of the doc only specifies that Baffinland will conduct salinity testing for D-1 compliance and DFO notes there is no mention of any requirements of ship owners to test for D-2 compliance and efficacy of treatment. DFO notes salinity sampling will not allow testing for compliance with D-2 standards regarding concentration of viable organisms. DFO agrees that methods for sampling and analysis of ballast water to verify compliance with the D-2 standard are still under development. However, Baffinland should note that IMO does have Guidelines for Port State Control related to the Convention [resolution MEPC.252(67)] of which sampling and analysis are only one small part. Documentation checks and instrument self-monitoring logs are used to check for proper operation of Ballast Water Management Systems.</p> <p>DFO is concerned that adaptive management measures outlined by Baffinland appear to only concern vessels that do not comply with D-1 standards. However, some vessels already have treatment systems and need to adhere to the D-2 standard as per the BWM convention.</p> <p>DFO notes that in order to assess the marine fish community in relation to water masses, more intensive seasonal sampling for marine fish and invertebrates should be undertaken. DFO further notes that Temperature, salinity, and depth instruments would be best used on/or beside the nets/sampling gear to most accurately reflect oceanographic conditions at exact locations where fishing/organism collection and support sampling data.</p> <p>DFO notes that a proper monitoring and sampling plan would allow ship owners, as well as Baffinland, to evaluate the level of risk for species introductions, develop appropriate mitigation strategies to reduce risk, and inform if a potential introduction occurs. Further, DFO notes that biofouling of vessels is also an important vector for the transfer of species. As previously commented on Baffinland's ballast management plan, DFO has concerns that simply achieving compliance will not necessarily mitigate risk. DFO previously provided an example of a potential ballast sampling protocol to Baffinland at their request (emailed June 9, 2017),</p>
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which could be adapted as needed. DFO notes there are also a variety of examples of different sampling methods for sampling ballast in the scientific literature which could be considered.

DFO notes that throughout the Ballast Water Management Plan, Baffinland makes reference to foreign flagged vessels. However, DFO notes that the flag of a vessel does not correspond to ballast source (relevant to level of risk) or last port of call (relevant for regulatory requirements). What is important from the point of view of NIS/AIS prevention and ballast water management, is the last port of call and the origin of ballast water to be discharged (known as ballast history). Further to this, research has demonstrated that vessels moving ballast water between ports within Canadian waters (foreign or Canadian flagged), particularly between different regions (e.g., Atlantic and Arctic) can pose a significant risk for introduction of AIS (Chan et al. 2012, Casas-Monroy et al. 2014, Laget 2017, Tremblay 2017). Risk for these vessels can be reduced substantially by implementing DFO's continued recommendation that all vessels be required to conduct exchange and treatment as a combination method.

DFO notes that risk for introduction of AIS can be reduced further through vessels conducting exchange in appropriate locations, such as proposed alternate ballast exchange zones for the eastern Arctic that were identified through science-based risk assessment (DFO 2015b, Stewart et al. 2015, Goldsmit et al. 2019a).

DFO is concerned about the lack of monitoring by Baffinland to test and assess the mitigation for release of NIS/AIS into the aquatic environment. DFO notes an early response plan (similar to an oil spill response plan) should be developed with applicable regulators and local communities so that, should an NIS/AIS be detected, significant environmental effects or major change to species composition could be avoided. DFO notes that the early response framework developed by Locke et al. (2011), may be a good reference for developing this type of plan.

DFO notes that Baffinland does not assess what potential biological and ecological effects may occur and the risk of AIS establishment and that a proper assessment of ballast discharge, which identifies the high risk species or groupings of species of concern, should be conducted. These species may include, but not be limited to any NIS/AIS that have been detected in the course of past AIS/MEEMP monitoring, and should be

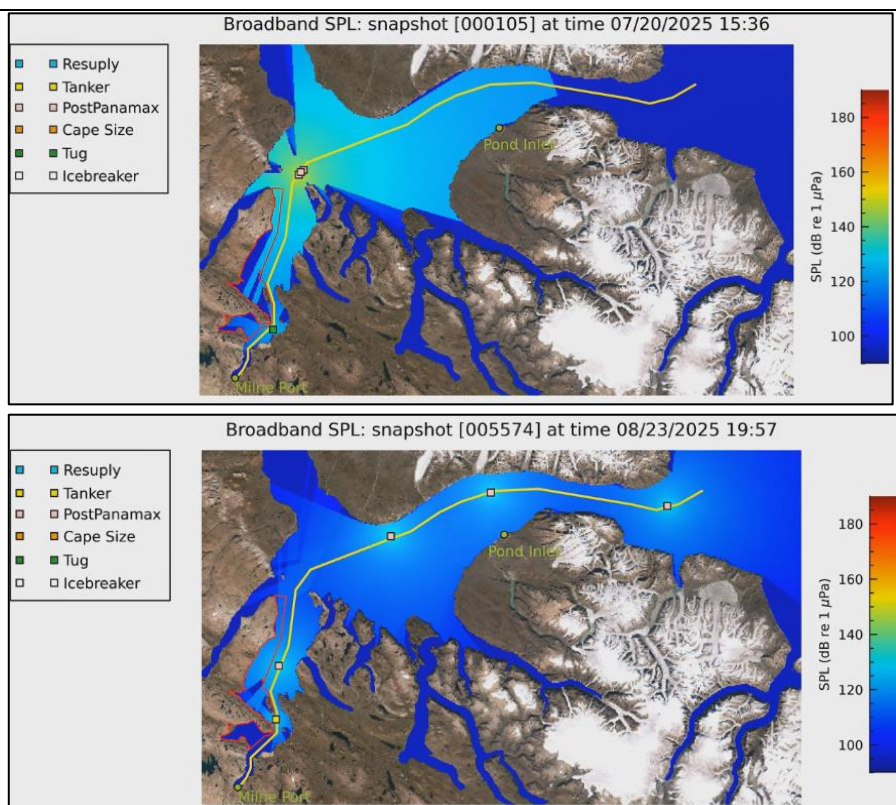
	<p>updated in the event that new NIS/AIS are detected in future monitoring. With this information, Baffinland could then develop rapid response plans for these high risk species/groups of concern which would be based on species-specific information such as life cycle and what management actions, if any, could be undertaken. Some examples of response plans are the United States Parks Service, the Grand Portage Band of Lake Superior Chippewa's Emergency Prevention and Response Plan for Viral Hemorrhagic Septicemia and the International Joint Commission's Aquatic Invasive Species Rapid Response Policy Framework Work Group's policy framework.</p> <p>DFO notes that it's important not to overlook the fact that the risks of AIS arrival are high (TSD21, Section 4). DFO notes that given that prevention (open ocean ballast water exchange) is already included in the risk assessment, and the effectiveness of treatment is not yet known (and likely not 100% effective), the risks associated with AIS will likely remain high throughout Phase 2.</p>
<b>Recommendation / Request</b>	<p><b>Recommendation 3.10:</b></p> <p>With current level of information provided, DFO is not able to adequately assess the risk of ballast water release on the spreading of unwanted species in the project area. In order to DFO properly assess the ballast release, DFO recommends that Baffinland, prior to issuance of the project certificate and issuance of authorizations, provide the following:</p> <p><b>3.10.1</b> The ballast water dispersion model and analyses be complete.</p> <p><b>3.10.2</b> All project vessels use ballast water treatment plus exchange strategy</p> <p><b>3.10.3</b> Monitoring of all ballast water discharges for compliance with Regulations D-1 and D-2, which includes a provision requiring the ballast water of each ship is tested to confirm that it meets Canadian requirements for salinity (at least 30 ppt) and number of viable organisms (Regulation D-2) prior to discharging.</p> <p><b>3.10.4</b> A monitoring plan which includes biological sampling of ballast water and hull fouling for all arriving ships (not just foreign flagged vessels) to evaluate the number and types of organisms being discharged, and more intensive seasonal sampling for marine fish and invertebrates.</p>

	<p><b>3.10.5</b> An assessment of potential biological and ecological effects of ballast discharge and identification of the high risk species or groupings of species of concern. These species may include, but not be limited to any NIS/AIS that have been detected in the course of past AIS/MEEMP monitoring, and should be updated in the event that new NIS/AIS are detected in future monitoring.</p> <p><b>3.10.6</b> An early response plan (similar to an oil spill response plan) be developed with applicable regulators and local communities so that, should an NIS/AIS be detected, significant environmental effects or major change to species composition could be avoided.</p>
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### 3.11 Marine Cumulative Effects

<b>Review Comment Number</b>	3.11 Cumulative Effects
<b>Subject/Topic</b>	Cumulative effects assessment and impacts resulting from cumulative project impacts
<b>References</b>	<ul style="list-style-type: none"> <li>• TSD 27</li> <li>• Knight Piésold Consulting's Memorandum to TSD27 – Cumulative Effects Assessment, Section 4.3, p. 19–23.</li> <li>• Disposition Table from the June 2019 Technical Meeting for the Mary River Project Phase 2 Development</li> <li>• Revised Addendum to Technical Supporting Document 27 - Cumulative Effects Assessment. August 26, 2019. Section 4.3.3, Pg. 36</li> <li>• DFO. 2019a. Science Review of the Phase 2 Addendum to the Final Environmental Impact Statement for the Baffinland Mary River Project. DFO Can. Sci. Advis. Sec. Sci. Resp. 2019/015.</li> <li>• Baffinland Iron Mines Corporation. August 15, 2019. Animation of Simulated Vessel Movements with Estimated Sound Field</li> </ul>
<b>Summary</b>	<p>Baffinland presents information on the cumulative effects to marine mammals in TSD 27 and Knight Piésold Consulting's Memorandum to TSD27 – Cumulative Effects Assessment, Section 4.3, p. 19–23.</p> <p>DFO notes that in the Disposition Table from the second Technical Meeting in June 2019, Baffinland committed to <i>“review Section 4.3.2 of the Cumulative Effects Assessment and if necessary, provide more detailed references, literature and monitoring program details leading to conclusions on potential for Narwhal cumulative effects.”</i> Baffinland then</p>

	<p>provided the 'Revised Addendum to Technical Supporting Document 27 - Cumulative Effects Assessment' on August 26, 2019.</p> <p>Baffinland also states on page 20 of the CEA that <i>"The addition of 23 cruise ships in future years to summer ship traffic in Eclipse Sound and Baffin Bay suggests that some interaction (overlap in noise fields when passing) will potentially occur between cruise ships and Mary River ore traffic. The expected transit distance if it does occur will be several hundred metres at minimum. The frequency and magnitude of these potential interactions are small and are not expected to result in cumulative noise effects to marine mammals"</i>.</p> <p>Page 36 of the Revised Addendum to TSD 27 under section 4.3: Cumulative Effects to marine mammals, Baffinland concludes that <i>"With the effective implementation of mitigation, the residual disturbance effects on narwhal from cumulative underwater noise sources are predicted to be moderate in magnitude (Level II), confined to the LSA (Level I), intermittent (Level II) in frequency, short-term (Level I) for pile driving and medium-term (Level II) for shipping, and fully reversible (Level I). The residual environmental effect is predicted to be not significant."</i></p>
<b>Importance of issue to the impact assessment process</b>	It's important to have a cumulative combined impact assessment on marine mammals, to fully understand and review project impacts.
<b>Detailed Review Comment</b> <ul style="list-style-type: none"> <li>4. <b>Gap/Issue</b></li> <li>5. <b>Disagreement with conclusion</b></li> <li>6. <b>Reasons for disagreement with conclusion</b></li> </ul>	<p>In regard to the <i>"23 cruise ships in future years"</i> (Knight Piésold Consulting MemorandumTSD27–Cumulative Effects Assessment,p.20), DFO is concerned that although the frequency of these interactions may be low, when they do occur they will be occurring for extended periods of time over 100's of meters. DFO Science requires clarification from Baffinland on how they expect marine mammals will respond to this disturbance.</p> <p>DFO notes that noise will have a negative impact on marine mammals. The large number of vessels transiting from the Milne Port and those awaiting entry may deter whales from entering Eclipse Sound. This highlights the concern that narwhal will be impacted by continuous noise. The cumulative noise soundscape is a necessary component of the cumulative effects assessment. DFO notes Baffinland's provided vessel traffic animation and the limited availability for quiet times due to the proposed amount of shipping. Below are two snapshots from the animation, one at the beginning of the shipping season mid-afternoon with ice-breaking and one mid-season in the evening with no ice-breaking.</p>



Before making a proper review of the noise due to vessel traffic in the area, DFO notes that additional sources should be incorporated to adequately address the total noise along the shipping route. DFO notes the vessels included in the animation are all related to the project, but it is not reflective of the total noise. DFO notes that additional vessels could limit the amount of quiet space available, even further. Additional vessels to consider could include cruise ships and an exercise in estimating all other possible ships in the area such as Canadian Coast Guard ships.

Baffinland states that they evaluated the Cumulative Impacts of the project on marine mammals. However, DFO notes that Baffinland has not provided an evaluation of the impacts cumulatively. Baffinland's conclusion of cumulative impacts to narwhal reads: "*residual disturbance effects on narwhal from cumulative underwater noise sources*" (Revised Addendum to TSD 27, s.4.3.3, pg. 36). DFO notes that this statement only considers underwater noise sources. DFO is concerned that marine mammals will be impacted by noise from shipping and project construction, but also by icebreaking, potential oil spills, etc. and not only in the RSA. It's important that Baffinland provide a thorough analysis and assessment examining all the combined impacts, not individual (DFO 2019a), of all the project activities inside and outside the study areas.

<b>Recommendation/Request</b>	<p><b>Recommendation 3.11:</b> DFO recommends that:</p> <p><b>3.11.1</b> All iron ore carriers related to the Baffinland Project, stop and reduce noise when cruise ships are in the area.</p> <p><b>3.11.2</b> Baffinland conduct a thorough cumulative effects analysis and assessment examining all the combined impacts of all the Project activities inside and outside the study areas. This should include a final assessment on the expected available quiet time during the shipping season and whether the Phase 2 development will in fact result in continuous noise through the shipping route.</p>
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### 3.12 Freshwater Watercourse Crossings

<b>Review Comment Number</b>	3.12 Watercourse crossings
<b>Subject/Topic</b>	Locations and types of proposed watercourse crossings
<b>References</b>	<ul style="list-style-type: none"> <li>• DFO Technical Review Comments to the Nunavut Impact Review Board (NIRB), March 7, 2019. Technical comments 3.10.1 and 3.10.3.</li> <li>• Updated Application for Amendment No. 2 of Type A Water Licence, Attachment 13.2: North Railway Freshwater Habitat Survey, Appendix 1, Table A1-1</li> <li>• Updated Application for Amendment No. 2 of Type A Water Licence, Attachment 13.1, Appendix 2: List of North Rail Infrastructure Interactions with Fresh Water, Table A2-1</li> <li>• Updated Application for Amendment No. 2 of Type A Water Licence, Attachment 13.3: North Railway Catchments</li> <li>• Updated Application for Amendment No. 2 of Type A Water Licence, Attachment 13.1 appendices: Project Infrastructure Interactions With Fresh Water Streams and Ponds</li> <li>• Updated Application for Amendment No. 2 of Type A Water Licence, Attachment 13.8: North Railway Bridge Drawings, pg. 7-10 of 32 (Adobe PDF)</li> <li>• DFO Information Requests (IRs) to the Nunavut Water Board (NWB), May 14, 2019. DFO IR 1b.</li> <li>• Baffinland Iron Mines Technical Meeting No. 2 Disposition Table as of July 3, 2019, Appendix A of the July 4, 2019 correspondence to NIRB. DFO 3.10.3, page 8 of 23 (Adobe PDF)</li> </ul>



	<ul style="list-style-type: none"> <li>• DFO Technical Review Comments to the NWB, July 2019, Technical Comment 3.1, recommendation 3.1.1</li> <li>• Baffinland Iron Mines Corporation. August, 2019. Technical Comment Responses, Application to Amend Type A Water Licence 2AM-MRY1325, Phase 2 Proposal – Mary River Project: DFO 3.1.1</li> </ul>
<b>Summary</b>	<p>In DFO's technical review comments submitted to the Nunavut Impact Review Board (NIRB) ( Technical Comment 3.10.1), DFO-FFHPP recommended <i>"Baffinland clarify when they will provide the short-list of crossings that are better suited to alternatives to CSP culverts, and provided specific details on what the short list will contain (e.g. method for the ranking and selection of options)."</i> DFO notes that Baffinland has provided an updated list of crossing in: Table A1-1 (Appendix 1 of the North Railway Freshwater Habitat Survey: attachment 13.2) of the Updated Application for Amendment No. 2 of Type A Water Licence <i>"list of crossings, cuts, encroachments/infills and bridges and 2018 fish habitat designations"</i> and Table A2-1 (Appendix 2 of the Project Infrastructure Interactions with Fish Habitat: attachment 13.1) of the Updated Application for Amendment No. 2 of Type A Water Licence: <i>"List of North Rail Infrastructure Interactions with Fresh Water."</i></p> <p>In DFO technical comment recommendation 3.1.1 to the Nunavut Water Board, DFO-FFHPP recommended that <i>"Baffinland provide rationale for the selection of crossing infrastructure for fish bearing watercourses. DFO-FFHPP notes this can be provided to DFO as part of the Proponent's 'DFO Request for Review' submission and/or Application for Fisheries Act authorization, during DFO's regulatory phase."</i></p> <p>Baffinland's response to DFO technical comment 3.1.1 as part of the NWB process, states <i>"As follow-up to the June 2019 NIRB technical meetings, Baffinland issued a July 2, 2019 memo by Knight Piésold (Additional Information on Fish Habitat Interactions), provided as Attachment 03 to this response."</i></p>
<b>Importance of issue to the impact assessment process</b>	It's important to have complete information for all proposed watercourse crossings, in order to adequately assess all potential impacts to fish and fish habitat resulting from watercourse crossings.
<b>Detailed Review Comment</b> <ol style="list-style-type: none"> <li>1. <b>Gap/Issue</b></li> <li>2. <b>Disagreement with conclusion</b></li> </ol>	DFO-FFHPP acknowledges that Baffinland has provided an updated crossing list in Table A2-1 in Appendix 2 of the Project Infrastructure Interactions with Fish Habitat: attachment 13.1. However, DFO-FFHPP notes that Baffinlands method for the ranking and selection of options have not yet been provided. DFO-FFHPP submits that having a full understanding how options were ranked to inform the crossing-type

<b>3. Reasons for disagreement with conclusion</b>	<p>selection assist in the determination of the necessity and adequacy of watercourse crossings over fish bearing watercourse crossings.</p> <p>DFO recognizes that Baffinland has selected culvert sizing based on the 1:200 year flood event and freeboard, with culverts over fish-bearing watercourses having a minimum culvert diameter of 1000 mm. However, DFO notes that for culverts constructed in the location of the Mary River project, considering the potential for extreme flows during freshet and the high level of difference between culverts, that culvert selection will need to be based on site specific conditions. Using the 1:200 year flood event return period, will not necessarily be appropriate for all culverts. Baffinland has also indicated their intent to incorporate baffles, when fish passage is a concern. DFO-FFHP is not clear what circumstances/ criteria will be used by Baffinland to determine when fish passage is a concern, and when baffles ( or other mitigations) are needed. For example, will fish passage concerns be identified via regular onsite monitoring at each of the watercourse crossings during freshet (or other high precipitation events) or will fish passage concerns be identified through modelling exercises. DFO-FFHP is concerned that fish passage issues may not be identified in time to develop and implement appropriate mitigation measures to prevent impacts to migrating fishes/fish requiring movements within the watercourse to complete life history strategies. DFO FFHP therefore submits that watercourse crossings need to be designed to <i>ensure</i> site-specific fish passage for all species of fishes requiring a migration within watercourses. This also includes having an robust field-based monitoring and mitigation implementation plan.</p> <p>DFO-FFHP continues to note that fish passage criteria can be discussed during DFO's regulatory phase and submitted as part of the Baffinland's 'DFO Request for Review' submission and/or Application for <i>Fisheries Act</i> authorization, should the project be approved.</p>
<b>Recommendation/Request</b>	<p><b>Recommendation 3.12:</b></p> <p>If the Project is approved, DFO-FFHP recommends Baffinland, during DFO's regulatory phase, provide rationale for the selection of crossing infrastructure for fish bearing watercourses.</p>

### 3.13 Freshwater Fish Passage

<b>Review Comment Number</b>	3.13 Fish Passage
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<b>Subject/Topic</b>	Watercourse crossings: high velocity predictions and impacts to fish passage
<b>References</b>	<ul style="list-style-type: none"> <li>• Surface Water Assessment (TSD 13): Section 2.5.2. (p. 16); Section 2.5.3 (p. 19); Section 2.6 (p. 21 Appendix D, (p. 1 -6; D-1 to D-6); Appendix D, Figure 1 (p. D-7); Appendix D, Appendix A, Figures A9-A12 (pages D-18 to D-21); Appendix D, Appendix B (p. B-1 to B-2)</li> <li>• Freshwater Biota and Habitat Assessment (TSD 14): Section 2.2.2 (p. 7-8); Section 2.5, Table 2-3 (p. 14); Section 2.5.1.2 (p. 19- 24); Appendix 1: Table 2-1 (p. 7); Section 4.2.3.2 (p. 31-32); Attachment 3, Table A3-1 (p. 117 to 120)</li> <li>• Conceptual Freshwater Offsetting Plan (TSD 15): Section 5.3.2 (p. 19)</li> <li>• DFO Technical Review Comments to the Nunavut Impact Review Board (NIRB), March 7, 2019. Technical comments 3.10.4 and 3.11.2.</li> <li>• Baffinland Iron Mines Technical Comment Responses, March 25, 2019. DFO 3.10.4 on page 40, DFO 3.11.2 on page 42, DFO 3.10.1 on page 37.</li> <li>• Email Correspondence from Baffinland to the Nunavut Water Board, April 30, 2019.</li> <li>• Updated Application for Amendment No. 2 of Type A Water Licence, Attachment 7.2: North Railway Design Criteria, page 23, sections 7.1.1, 7.2.1.5, 7.2.1.6, and 7.2.3.</li> <li>• Updated Application for Amendment No. 2 of Type A Water Licence, Attachment 13.7: North Railway Arch Bridges Hydraulic Assessment, section 8.6, page 32</li> <li>• DFO Information Requests (IRs) to the Nunavut Water Board (NWB), May 14, 2019. DFO IR 1a.</li> <li>• DFO Technical Review Comments to the NIRB, March 2019, Technical Comment 3.10, recommendation 3.10.4</li> <li>• DFO Technical Review Comments to the NWB, July 2019, Technical Comment 3.1, recommendation 3.2.1, DFO 3.2.4</li> <li>• Baffinland Iron Mines Corporation. August, 2019. Technical Comment Responses, Application to Amend Type A Water Licence 2AM-MRY1325, Phase 2 Proposal – Mary River Project: DFO 3.2.1, DFO 3.2.4</li> </ul>
<b>Summary</b>	<p>Baffinland has identified several potential fish passage issues associated with the proposed watercourse crossings, diversions, and encroachments that are a part of the Project. For example: <i>“Of 145 stream crossings in known or potential Arctic char habitat, .....124 crossings may present barriers to fish passage.”</i> (TSD 13, Section 2.5.2 Increased Flow Velocity at North Railway Watercourse Crossings (p. 16). With respect to the Tote Road watercourse crossing issues Baffinland also states: <i>“Most fish passage issues identified in the annual monitoring surveys was effectively mitigated. However, issues at some crossings have persisted and will</i></p>

	<p><i>require additional mitigation to rectify, including persistent perches and excessive road sedimentation”, further stating in TSD 14, section 2.5.1.2 (p. 23): “for long culverts, especially in combination with high gradients, maintaining water velocities that fish can manage for the time it takes to pass through a culvert <u>may not be possible</u>” (emphasis added). This contradicts Baffinlands conclusion : “With implementation of design and mitigation measures, effects of culvert installations on fish passage are assumed to be negligible” (TSD 15, s.5.3.2, p. 19).</i></p> <p>In DFO’s technical review comments to the NIRB (TC 3.10.4), DFO-FFHPP recommended that <i>“Baffinland clarify when they will provide updated hydrological modelling, and provide specific details on what updated modelling will entail.”</i> Baffinland responded that <i>“This information will be provided in the supplemental information package to support water licensing and an application for a Fisheries Act authorization referenced in response to DFO 3.10.1 (in this submission).”</i> (Response to DFO comment 3.10.4).</p> <p>In an email correspondence from Baffinland on April 30 Baffinland noted <i>“Additional information necessary for fisheries offset authorizations but not necessary for water licensing will be available by May 31st and includes:</i></p> <ul style="list-style-type: none"> <li><i>• Updated Hydrological Assessment – An updated hydrological assessment is being completed for any remaining stream diversions, and culverts will be re-assessed for fish passage using actual rather than the previously assumed gradients”</i></li> </ul> <p>In DFO technical comment recommendation 3.2.1 to the Nunavut Water Board, DFO-FFHPP recommended that <i>“Baffinland clarify when they will provide updated hydrological modelling.”</i></p> <p>Baffinland’s response to DFO technical comment 3.2.1 as part of the NWB process, states <i>“Updated hydrological modelling is presented in a June 18, 2019 memo by Knight Piésold provided as Attachment 04 (Fish Passage Risk Assessment of Water Crossings and Stream Diversions). Baffinland is undertaking an engineering review of crossings assessed by KP to be high risk of being a barrier to fish passage, and the outline of a fish passage monitoring program is provided as Attachment 05 (Proposed North Railway Aquatic Monitoring Programs).”</i></p>
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	<p>DFO-FFHPP notes that Baffinland has identified the potential cumulative aspects of their assorted works, undertakings and activities. In TSD 14 (s.2.5, p. 22), Baffinland states: <i>“In some instances, the road and rail crossings will effectively become one installation. In these cases, fish passage may be impeded by the cumulative effect of the road and rail crossings”</i>.</p> <p>In DFO technical comment recommendation 3.2.4 to the Nunavut Water Board, DFO-FFHPP recommended that <i>“Baffinland provide further information in regard to the potential cumulative impacts of all crossings on flow and fish passage (short-term and permanent; Tote Road, North Rail and Temporary Access Roads), including clear identification of crossings that occur on the same waterbody.”</i></p> <p>Baffinland’s response to DFO technical comment 3.2.4 as part of the NWB process, states <i>“North/South Consultants Inc. conservatively assumed in Attachment 13.1 of the Application that rail crossings that are located &lt;20 m from an existing Tote Road culvert are locations where two culverts in proximity could be a potential barrier to fish passage. Within Attachment 04 of this response (Additional Information on Fish Habitat Interactions), these locations are identified in Table 1 and are shown on the detailed railway figures (Figures 4 to 36).”</i></p>
<b>Importance of issue to the impact assessment process</b>	<p>Fish require access to habitat and the ability to move among habitat types to complete one or more life processes, as such, it’s important that all crossings or other structures allow for fish passage, for all flow scenarios and all life stages.</p>
<b>Detailed Review Comment</b> <b>4. Gap/Issue</b> <b>5. Disagreement with conclusion</b> <b>6. Reasons for disagreement with conclusion</b>	<p>DFO-FFHPP notes that fish-passage issues have previously occurred along the Tote Road, for example resulting from high-velocities in undersized culverts or from insufficient number of culverts (TSD 14, s.2.2.2; p. 7-8). In the absence of a comprehensive “lessons learned” (for the tote road crossings) and/or a strategic analysis of what will be done differently to ensure the fish-passage issue will be mitigated, avoided and addressed, DFO-FFHPP remains concerned that fish passage issues will not be adequately avoided or mitigated for the proposed watercourse crossings, diversions, and encroachments.</p> <p>DFO notes that some of Baffinland’s proposed the diversions, such as CV-1-7 to CV-1-9 diversion in attachment 4 of Baffinland’s responses to NWB technical comments, will likely result in impacts to fish habitat by removing connectivity to ponds and other watercourses that may provide important seasonal habitat for resident fish. These habitat impacts should</p>

	<p>be quantified, and flow modeling for the channel diversions needs to be provided. DFO notes that should the project be approved to proceed, DFO-FFHPP will require complete flow and velocity modelling / predictions and accurate accounting of all habitat losses as part of Baffinland's Request for Review or Application for <i>Fisheries Act</i> Authorization.</p> <p>DFO-FFHPP remains concerned about the cumulative impacts of multiple water crossings on the same waterbodies and the particular concern of increased velocity through these multiple crossings. DFO notes that in response to DFO technical comment to the NWB, recommendation 3.2.4, Baffinland provides information on watercourses that have culverts within 20 m of each other. DFO notes this information does not fully consider all watercourse crossings, nor does it identify clear cumulative impacts other than potential for fish passage issues for crossings in close proximity.</p>
<b>Recommendation/Request</b>	<p><b>Recommendation 3.13:</b> If the Project is approved, DFO-FFHPP recommends that, during the Regulatory phase, Baffinland:</p> <p><b>3.13.1</b> Analyze monitoring reports related to the Tote Road existing watercourses crossings and provide comprehensive "lessons learned" report (for the Tote Road crossings) that would include strategic analysis of what will be done differently to ensure the fish-passage issue will be mitigated, avoided and addressed</p> <p><b>3.13.2</b> Provide updated hydrological assessment of proposed watercourses crossings that includes, but is not limited to, crossing selection and design criteria, flow rates, velocities and discharge.</p>

### 3.14 Freshwater Water Withdrawal

<b>Review Comment Number</b>	3.14 Water Withdrawal
<b>Subject/Topic</b>	Proposed new water withdrawal sites from various lakes and streams along the North Railway
<b>References</b>	<ul style="list-style-type: none"> <li>• FEIS addendum, Surface Water Assessment (TSD 13); Sections 2.1.1, 2.4, 2.5 &amp; 4.0 of Appendix C</li> <li>• FEIS addendum, Surface Water Assessment (TSD 13); Appendix D, Figure 1, p. D-7</li> <li>• DFO Technical Review Comments to the Nunavut Impact Review Board (NIRB), March 7, 2019. Technical comment 3.12.2</li> </ul>

	<ul style="list-style-type: none"> <li>• Baffinland Iron Mines Technical Comment Responses, March 25, 2019. DFO 3.12.2, page 43</li> <li>• Fresh Water Supply, Sewage, and Wastewater Management Plan, attachment 23 of the Updated Application for Amendment No. 2 of Type A Water Licence, Document #: BAF-PH1-830-P16-0010. Section 4.2, pg. 18.</li> <li>• DFO Technical Review Comments to the NWB, July 2019, Technical Comment 3.1, recommendation 3.3.2, 3.3.3, 3.3.4</li> <li>• Baffinland Iron Mines Corporation. August, 2019. Technical Comment Responses, Application to Amend Type A Water Licence 2AM-MRY1325, Phase 2 Proposal – Mary River Project: DFO 3.3.2, DFO 3.3.3, DFO 3.3.4</li> </ul>
<b>Summary</b>	<p>Baffinland has indicated their monthly cumulative water withdrawal (Section 4.2, page 18 of the updated Fresh Water Supply, Sewage, and Wastewater Management Plan, attachment 23 of the Updated Application for Amendment No. 2 of Type A Water Licence) stating <i>“Monthly cumulative withdrawals from lakes represent less than 10% of the monthly outflow, unless site specific conditions indicate that a greater water withdrawal will not be significant in the context of fish bearing habitat (i.e. Camp Lake).”</i></p> <p>DFO-FFHPP notes the following in regard to the proposed new water withdrawal locations: <i>“Thresholds were identified and applied for fish-bearing and non-fish-bearing waters (KP, 2014). For fish-bearing streams, the removal of 20% of the 10-year dry unit runoff (1.03 L/s/km<sup>2</sup>) was identified as an environmentally protective threshold” and “Streams confirmed not to be fish habitat typically feed a downstream reach or collecting stream that is fish habitat. In these instances, the subject stream is only one contributor to the flow in the downstream fish habitat stream. Therefore, a higher threshold of 40% of the 10-year dry unit runoff (1.03 L/s/km<sup>2</sup>) was used.”</i>(TSD 13, App. C, s.2.4, p. 5)</p> <p>In DFO technical comment recommendation 3.3.3 to the Nunavut Water Board, DFO-FFHPP recommended that <i>“Baffinland conduct a thorough localized assessments on the waterbodies selected for water withdrawal in order to adequately assess the potential impacts on the fish habitat resulting from 20% of the 10-year dry unit runoff water withdrawal on fish-bearing watercourses and connecting waterbodies. This assessment should include, but not be limited to, an assessment of the effects to littoral/shore/riparian areas from the proposed water withdrawal, the specific withdrawal locations proposed for each waterbody including fish</i></p>

*habitat in the area and updated rationale on how this level of withdrawal will be environmentally protective threshold. DFO-FFHPP notes this information can be provided as part of the Proponent's 'DFO Request for Review' submission and/or Application for Fisheries Act authorization, during DFO's regulatory phase."*

In DFO technical comment recommendation 3.3.4 to the Nunavut Water Board, DFO-FFHPP recommended that *"Baffinland provide additional rational/ assessment to support the assertion that 40% of the 10-year dry unit runoff water withdrawal from non-fish-bearing streams will not negatively affect downstream fish-bearing waterbodies. DFO-FFHPP notes this information can be provided as part of the Proponent's 'DFO Request for Review' submission and/or Application for Fisheries Act authorization, during DFO's regulatory phase."*

Baffinland's response to DFO technical comment 3.3.3 and 3.3.4 referenced the response to 3.3.1 as part of the NWB process, states *"At the second NIRB technical meeting in June 2019, Baffinland committed to providing more details on fish habitat features and potential effects to littoral areas at proposed water withdrawal locations (DFO technical review comment 3.12.2 in NIRB review process). A detailed water withdrawal plan will be provided that includes fish habitat information and that considers the DFO's 2013 Environmental Flow Requirements guideline as part of Baffinland's Request for Review and/or Application for a Fisheries Act authorization."*

In DFO technical comment recommendation 3.3.2 to the Nunavut Water Board, DFO-FFHPP recommended that *"Baffinland clarify what site specific conditions would indicate, that a greater water withdrawal than 10% in proposed withdrawal lake sites, would not be significant in the context of fish bearing habitat."*

Baffinland's response to DFO technical comment 3.3.2 as part of the NWB process, states *"Each of the identified lakes will meet the threshold of 10% reduction of outflow under all flow conditions including 10-year return period low flow conditions that can be experienced during the month of September. The only exception to this is Camp Lake, which meets the 10% reduction of outflow threshold under mean flow conditions but not under low flow conditions. Under the 10-year low flow condition, however, a reduction of up to 27% of lake outflows could occur (Table 4), warranting further evaluation and consideration of potential effects to fish and fish*

	<p><i>habitat. While the proposed water withdrawal in Camp Lake will exceed the 10% lake outflow reduction threshold under the 10-year low flow condition, there are site-specific conditions to be considered. The outflow stream of Camp Lake reports to Mary Lake. The stream is broad and shallow and has been observed on multiple occasions (and various flow conditions) to lack connectivity. The proposed water withdrawal can be expected to increase the frequency at which natural lack of connectivity occurs between the two lakes. Limited movement of adult Arctic Char occurs through this stream, and consequently, this stream was not identified as critical fish habitat (North/South Consultants Inc., 2012). As such, a reduction in flow of 27% of the 10-year low flow is not expected to cause fish stranding or meaningful effects to fish or fish habitat (North/South, 2014)."</i></p>
<b>Importance of issue to the impact assessment process</b>	Water withdrawal from water bodies has the potential to have a negative impact on fish and fish habitat.
<b>Detailed Review Comment</b> <ol style="list-style-type: none"> <li>1. <b>Gap/Issue</b></li> <li>2. <b>Disagreement with conclusion</b></li> <li>3. <b>Reasons for disagreement with conclusion</b></li> </ol>	<p>Decreases in waterbodies have the potential to have negative impacts on fish and fish habitat by potentially reducing littoral zones and under-ice over wintering habitat; these are important habitats for various life stages of many fishes. Decreasing flows/discharge in streams/watercourses has the potential to impact affect the downstream catchment areas, regardless if the source streams are non fish-bearing as supported by Baffinland's statement: "<i>Streams confirmed not to be fish habitat typically feed a downstream reach or collecting stream that is fish habitat</i>" (TSD 13, App. C, s.2.4, p. 5). DFO-FFHPP will require a detailed water withdrawal plan that includes an in- depth risk analysis informed by site specific fish and fish habitat features for the waterbodies chosen for water withdrawal as part of any 'DFO Request for Review' submission, in order to properly assess the potential impacts.</p> <p>DFO notes that Baffinland has committed to providing an updated water withdrawal plan, DFO will await this plan in order to review. DFO notes this can be provided as part a Request for Review or Application for <i>Fisheries Act</i> Authorization, should the project be approved.</p> <p>DFO-FFHPP continues to be concerned with the use of 20% and 40% thresholds for water withdrawal and the limited data available to support the conclusion that these thresholds are environmentally protective as stated by Baffinland: "<i>removal of 20% of the 10-year dry unit runoff (1.03 L/s/km<sup>2</sup>) was identified as an environmentally protective threshold</i>" (TSD 13, App. C, s.2.4, p. 5). DFO-FFHPP refers to the 2013 Canadian Science</p>



	<p>Advisory Secretariat (CSAS) report (DFO 2013) 'Framework For Assessing the Ecological Flow Requirements to Support Fisheries in Canada.</p> <p>DFO notes Baffinland's statement that <i>"The stream is broad and shallow and has been observed on multiple occasions (and various flow conditions) to lack connectivity. The proposed water withdrawal can be expected to increase the frequency at which natural lack of connectivity occurs between the two lakes. Limited movement of adult Arctic Char occurs through this stream, and consequently, this stream was not identified as critical fish habitat"</i>. DFO notes that although fish use of the stream may be limited or seasonal, connectivity of these two lakes may prove to be important depending on habitat availability and cumulative impacts from having so many watercourses impacted. Additionally, even if not deemed critical fish habitat, Baffinland will be required to ensure that fish habitat is not further impacted by increased water withdrawals. Unless fish use of Camp Lake is none or if fish habitat in the lake is actually marginal, 27% water withdrawal is not appropriate. DFO notes that DFO will work with Baffinland during DFO's regulatory phase, to ensure no additional impacts to fish habitat occur due to water withdrawal.</p>
<p><b>Recommendation/Request</b></p>	<p><b>Recommendation 3.14:</b> DFO recommends that Baffinland:</p> <p><b>3.14.1</b> Provide detailed water withdrawal plan that includes an in-depth risk analysis informed by site specific fish and fish habitat features for the waterbodies chosen for water withdrawal as part of any 'DFO Request for Review' submission.</p> <p><b>3.14.2</b> Conduct a thorough localized assessments on the waterbodies selected for water withdrawal in order to adequately assess the potential impacts on the fish habitat resulting from 20% of the 10-year dry unit runoff water withdrawal on fish-bearing watercourses and connecting waterbodies. This assessment should include, but not be limited to, an assessment of the effects to littoral/shore/riparian areas from the proposed water withdrawal, the specific withdrawal locations proposed for each waterbody including fish habitat in the area and updated rationale on how this level of withdrawal will be environmentally protective threshold.</p> <p><b>3.14.3</b> Provide additional rational/ assessment to support the assertion that 40% of the 10-year dry unit runoff water withdrawal from</p>



	non-fish-bearing streams will not negatively affect downstream fish-bearing waterbodies.
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### 3.15 Additional References

- Cott, P. and Hanna, B. 2005. Monitoring Explosive-Based Winter Seismic Exploration in Waterbodies, NWT 2000-2002. Department of Fisheries and Oceans. Offshore Oil and Gas Environmental Effects Monitoring: Approaches and Technologies. P. 493-510.
- DFO (Fisheries and Oceans Canada). (2010). DFO Protocol for Winter Water Withdrawal from Ice-Covered Waterbodies in the Northwest Territories and Nunavut. 3 p.
- DFO. 2013. Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/017.
- DFO. 2019a. Science Review of the Phase 2 Addendum to the Final Environmental Impact Statement for the Baffinland Mary River Project. DFO Can. Sci. Advis. Sec. Sci. Resp. 2019/015.
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## 4 Summary of Recommendations

Marine Environment		
1. Marine Alternative Shipping Routes		
1	Ref. 3.1	<p><b>Recommendation 3.1:</b> DFO recommends that Baffinland:</p> <p>In consultation with affected Inuit communities, conduct a thorough environmental assessment prior to use of any additional/alternative routes through the Northwest Passage, outside of the current approved shipping route, including Navy Board Inlet.</p> <p>The assessment should include:</p>

		<p><b>3.1.1</b> Clarification whether Baffinland intends to use the alternative routes including the Northwest Passage at any point as part of Phase 2, or whether the alternatives would be solely reserved for future development and will be assessed at such a time, that Baffinland would seek approval for said development.</p> <p><b>3.1.2</b> Consideration of a larger proportion of the potentially impacted populations for each species along the alternate route, to adequately reflects the increase of use.</p> <p><b>3.1.3</b> An updated monitoring plan, which would include monitoring shipping through all alternative routes utilized for the Mary River Project, prior to usage of any additional routes outside the current approved shipping route.</p>
<b>2. Marine Vessel Traffic</b>		
<b>2</b>	Ref. 3.2	<p><b>Recommendation 3.2:</b> In order for DFO to adequately assess the project's marine vessel traffic, DFO requires that Baffinland clarifies:</p> <p><b>3.2.1</b> The number of escorted vessels that will be permitted at any one time into the RSA</p> <p><b>3.2.2</b> The rationale for the maximum of 176 ore carrier transits</p>
<b>3. Marine Impact of Shipping - Vessel Strikes</b>		
<b>3</b>	Ref. 3.3	<p><b>Recommendation 3.3:</b> DFO is concerned that the present level of assessment may not be adequate to fully assess the effects of the vessels strikes on whales and other marine mammals. In order for DFO to adequately assess the effects of vessel strikes on marine mammals, Baffinland, working cooperatively with DFO, shall re-assess the impact of vessel strikes on bowhead whales and re-evaluate the significance of ship strikes related to the project (including inside and outside the RSA) and should consider other marine mammals (e.g., Killer whale, Sperm whale, Fin whale) that would potentially be entering the RSA in summer during the open water shipping season and risk of vessel strikes. The assessment shall include the knowledge and observation of Inuit hunters and trappers.</p>
<b>4. Marine Environment: Shipping Season</b>		
<b>4</b>	Ref. 3.4	<p><b>Recommendation 3.4:</b> In order for DFO to properly assess the impact of the shipping season on ice formation, DFO recommends that Baffinland provides environmental conditions and ecological factors criteria used to determine yearly opening and closing of the shipping season, along with the monitoring plan to determine if ice-breaking in the</p>

		shoulder season will have an impact on ice formation and that Baffinland report annually on the determination of opening and closing the shipping season.
<b>5. Marine Impacts to Pinnipeds: Shoulder Season Shipping and Ice-breaking</b>		
5	Ref. 3.5	<p><b>Recommendation 3.5:</b></p> <p>DFO is concerned about the impacts to pinnipeds and disagrees with Baffinland's conclusions that effects will be non-significant. As such, DFO overall recommends Baffinland implement the most conservative mitigation measure and avoid shipping during the shoulder seasons and ice-breaking activities; only ship during the open water season.</p> <p>If the Project is approved as proposed, DFO recommends that Baffinland:</p> <p><b>3.5.1</b> Uses walrus haul out buffer zone guidelines set by the US Fish and Wildlife Service (USFWS) and the US Federal Aviation Administration (FAA).</p> <p><b>3.5.2</b> Avoid icebreaking where and when seal density is relatively high. These areas occur in closed embayments and inlets where landfast ice exists</p> <p><b>3.5.3</b> Provide an estimate of how many ringed seals are in Eclipse Sound, and re-evaluate the percentage of affected seals using available region and water-body specific abundance estimates.</p> <p><b>3.5.4</b> Implement 300m proposed buffer zone for seals as there currently is for polar bears and walruses.</p> <p><b>3.5.5</b> Avoid shipping during the shoulder seasons and ice-breaking activities and only ship during the open water season.</p> <p><b>3.5.6</b> Prepare a monitoring plan, with an appropriate survey methodology (e.g., Wilson et al. 2017), for the purpose of documenting and reporting any mortalities due to icebreaking and shoulder season shipping activities or otherwise.</p>
<b>6. Marine Impacts to Cetaceans: Shoulder Season Shipping and Ice-breaking</b>		
6	Ref. 3.6	<p><b>Recommendation 3.6:</b></p> <p>DFO is concerned that the lack of defensible information makes the assessment of the effect of shipping on cetacean difficult and highly uncertain. As such DFO recommends that, for the time being, Baffinland maintain the current level of shipping and avoid shipping during the shoulder seasons and ice-breaking activities. Before any increase in shipping is considered, Baffinland should provide further information and provide further mitigation options in an updated shipping management plan as follows:</p>

		<p><b>3.6.1</b> An estimate of the percentage of narwhal that could exhibit disturbance and avoidance behavior regularly depending on the icebreaking scenarios.</p> <p><b>3.6.2</b> Mitigation measures to address this concern that frequency of entrapments will increase over natural levels due to icebreaking in the fall shoulder season (e.g., no icebreaking while narwhal migrate into and out of Eclipse Sound).</p> <p><b>3.6.3</b> Clarify what the 'Eclipse Sound complex' refers to and provide justification for not including the Pond Inlet area in this statement.</p> <p><b>3.6.4</b> Re-evaluation of the potential effects using the most recent stock size estimate.</p> <p><b>3.6.5</b> Re-evaluation of the extent beyond the local study area (LSA) and within the RSA, the magnitude and the reversibility of the impacts of ice entrapment on narwhals.</p> <p><b>3.6.6</b> Short and long term monitoring of potential effects of shipping on cetaceans, potentially including multi-year aerial surveys for determination of the residual environmental effect of ice entrapment.</p>
<b>7. Marine Acoustic Modelling</b>		
<b>7</b>	Ref. 3.7	<p><b>Recommendation 3.7:</b> DFO is concerned that the Baffinland provided acoustic modelling does not fully allow DFO to assess cumulative sound level and the assessment of the effect of the sound on marine mammals.</p> <p>DFO-FFHPP recommends that Baffinland:</p> <p><b>3.7.1</b> Clarify on how NL1 was calculated and on how LSR was calculated for ambient noise, providing rationale for the modifications to the equation from Pine et al. (2018), and providing an example of how LSR is calculated.</p> <p><b>3.7.2</b> Conduct a modelling exercise to calculate the LSR associated with the proposed increased transits. Including modelling in other parts of the Regional Study Area including Milne Inlet and Eclipse Sound.</p>

		<p><b>3.7.3</b> Provide new calculations based on the new guidelines (Southall et al. 2019) or provide comments on the difference in methods and results between the older and newer methods, as well as consider temporary threshold shift (TTS) and not just permanent threshold shift (PTS), where relevant.</p> <p><b>3.7.4</b> Provide long term monitoring plan to verify the prediction of the sound propagation modelling and its potential effects on the populations of marine mammals.</p>
<b>8. Marine Acoustic Disturbance</b>		
8	Ref. 3.8	<p><b>Recommendation 3.8:</b> In order to better assess the effect of noise on whale populations, DFO recommends that, before the Project is approved, Baffinland:</p> <p><b>3.8.1</b> Provide an assessment of the percentage (%) of time that narwhals will be exposed to noise under the Phase 2 proposal shipping scenario.</p> <p><b>3.8.2</b> Re-evaluate the impact of masking on narwhal noting the evidence that narwhals will get close enough to vessels to experience masking effects.</p> <p><b>3.8.3</b> Re-evaluate the level of the impact of masking from icebreaking on narwhal and provide supporting evidence, justification, and rationale for their conclusions.</p> <p><b>3.8.4</b> Commits to additional acoustic monitoring related to icebreaking beyond 2019 regardless of if Phase 2 is approved or not, to verify predictions and better inform/refine ongoing monitoring, mitigation, and adaptive management</p>
<b>9. Marine Mammal Observation</b>		
9	Ref. 3.9	<p><b>Recommendation 3.9:</b> DFO recommends that:</p> <p><b>3.9.1</b> All project related vessels (e.g., icebreakers, escort vessels, ore carriers) have MWOs present for the entire shipping season (e.g., port to port). If this not logistically possible, an alternative plan should be developed by Baffinland to monitor presence and behavior of marine mammals.</p> <p><b>3.9.2</b> Baffinland provide the “<i>standard instructions to operate their vessel in a manner that avoids separating an individual member(s) of a group of marine mammals from other members of the group</i>” for DFO to review.</p>
<b>10. Marine Environment: Ballast Water and Non-indigenous Species</b>		

10	Ref. 3.10	<p><b>Recommendation 3.10:</b> With current level of information provided, DFO is not able to adequately assess the risk of ballast water release on the spreading of unwanted species in the project area. In order to DFO properly assess the ballast release, DFO recommends that Baffinland, prior to issuance of the project certificate and issuance of authorizations, provide the following:</p> <p><b>3.10.1</b> The ballast water dispersion model and analyses be complete.</p> <p><b>3.10.2</b> All project vessels use ballast water treatment plus exchange strategy,</p> <p><b>3.10.3</b> Monitoring of all ballast water discharges for compliance with Regulations D-1 and D-2, which includes a provision requiring the ballast water of each ship is tested to confirm that it meets Canadian requirements for salinity (at least 30 ppt) and number of viable organisms (Regulation D-2) prior to discharging.</p> <p><b>3.10.4</b> A monitoring plan which includes biological sampling of ballast water and hull fouling for all arriving ships (not just foreign flagged vessels) to evaluate the number and types of organisms being discharged, and more intensive seasonal sampling for marine fish and invertebrates.</p> <p><b>3.10.5</b> An assessment of potential biological and ecological effects of ballast discharge and identification of the high risk species or groupings of species of concern. These species may include, but not be limited to any NIS/AIS that have been detected in the course of past AIS/MEEMP monitoring, and should be updated in the event that new NIS/AIS are detected in future monitoring.</p> <p><b>3.10.6</b> An early response plan (similar to an oil spill response plan) be developed with applicable regulators and local communities so that, should an NIS/AIS be detected, significant environmental effects or major change to species composition could be avoided,</p>
<b>11. Marine Cumulative Effects</b>		
11	Ref. 3.11	<p><b>Recommendation 3.11:</b> DFO recommends that:</p> <p><b>3.11.1</b> All iron ore carriers related to the Baffinland Project stop and reduce noise when cruise ships are in the area.</p>

		<b>3.11.2</b> Baffinland conduct a thorough cumulative effects analysis and assessment examining all the combined impacts of all the Project activities inside and outside the study areas. This should include a final assessment on the expected available quiet time during the shipping season and whether the Phase 2 development will in fact result in continuous noise through the shipping route.
<b>Freshwater Environment</b>		
<b>12. Watercourse Crossings</b>		
<b>12</b>	Ref. 3.12	<b>Recommendation 3.12.</b> If the Project is approved, DFO-FFHPP recommends Baffinland, during DFO's regulatory phase, provide rationale for the selection of crossing infrastructure for fish bearing watercourses.
<b>13. Fish Passage</b>		
<b>13</b>	Ref. 3.13	<p><b>Recommendation 3.13:</b> If the Project is approved, DFO-FFHPP recommends that, during the Regulatory phase, Baffinland:</p> <p><b>3.13.1</b> Analyze monitoring reports related to the Tote Road existing watercourses crossings and provide comprehensive "lessons learned" report (for the Tote Road crossings) that would include strategic analysis of what will be done differently to ensure the fish-passage issue will be mitigated, avoided and addressed</p> <p><b>3.13.2</b> Provide updated hydrological assessment of proposed watercourses crossings that includes, but is not limited to, crossing selection and design criteria, flow rates, velocities and discharge.</p>
<b>14. Water Withdrawal</b>		
<b>14</b>	Ref. 3.14	<p><b>Recommendation 3.14:</b> DFO recommends that Baffinland:</p> <p><b>3.14.1</b> Provide detailed water withdrawal plan that includes an in-depth risk analysis informed by site specific fish and fish habitat features for the waterbodies chosen for water withdrawal as part of any 'DFO Request for Review' submission.</p>

		<p><b>3.14.2</b> Conduct a thorough localized assessments on the waterbodies selected for water withdrawal in order to adequately assess the potential impacts on the fish habitat resulting from 20% of the 10-year dry unit runoff water withdrawal on fish-bearing watercourses and connecting waterbodies. This assessment should include, but not be limited to, an assessment of the effects to littoral/shore/riparian areas from the proposed water withdrawal, the specific withdrawal locations proposed for each waterbody including fish habitat in the area and updated rationale on how this level of withdrawal will be environmentally protective threshold.</p> <p><b>3.14.3</b> Provide additional rational/ assessment to support the assertion that 40% of the 10-year dry unit runoff water withdrawal from non-fish-bearing streams will not negatively affect downstream fish-bearing waterbodies.</p>
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