

Appendix 29: 2022 Technical Analysis
to Support Response to NIRB PC No.
006 T&C No. 68



Memo

To	Agnico Eagle Mines Limited
From	ERM Consultants Canada Ltd.
Date	24 March 2023
Reference	0671789-01
Subject	Technical Analysis to Support Response to NIRB PC No. 006 T&C No. 68 on Understanding Potential Cumulative Effects of Shipping to the Meliadine Mine

1. INTRODUCTION AND BACKGROUND

The Meliadine Mine is owned and operated by Agnico Eagle Mines Limited (Agnico Eagle), and is located in the Kivalliq region of Nunavut, approximately 25 km north of Rankin Inlet (Figure 1-1). Agnico Eagle Mines Limited (Agnico Eagle) contracts the shipping company Groupe Desgagnés to ship cargo and Woodward Group and Companies (Woodward) to ship fuel from Bécancour, Quebec for Meliadine Mine operations.

Shipping is carried out predominantly during the open water season (typically from July to late October or mid-November) and follows the recommended shipping routes presently in use for the annual sea lift to Rankin Inlet and other Kivalliq communities. The shipping route study area extends through Hudson Strait and across Hudson Bay to Rankin Inlet, with vessels anchoring either outside or inside Melvin Bay (Figure 1-2).

Agnico Eagle holds Project Certificate (PC) No. 006 for the Meliadine Mine from the Nunavut Impact Review Board (NIRB). PC No. 006 includes Term and Condition (T&C) No. 68, which states:

The Proponent shall demonstrate consideration for the potential cumulative effects of other development projects and shipping activities (including community resupply) when assessing their cumulative effects on marine birds in the Hudson Strait, in its annual report.

This memo is intended to support Agnico Eagle in addressing T&C No. 68. It presents an analysis of vessel traffic in Hudson Strait and Hudson Bay to review the Meliadine Mine's contribution to vessel activity in the area, and the results of a literature review conducted on vessel activity and marine bird mitigation in the study area.

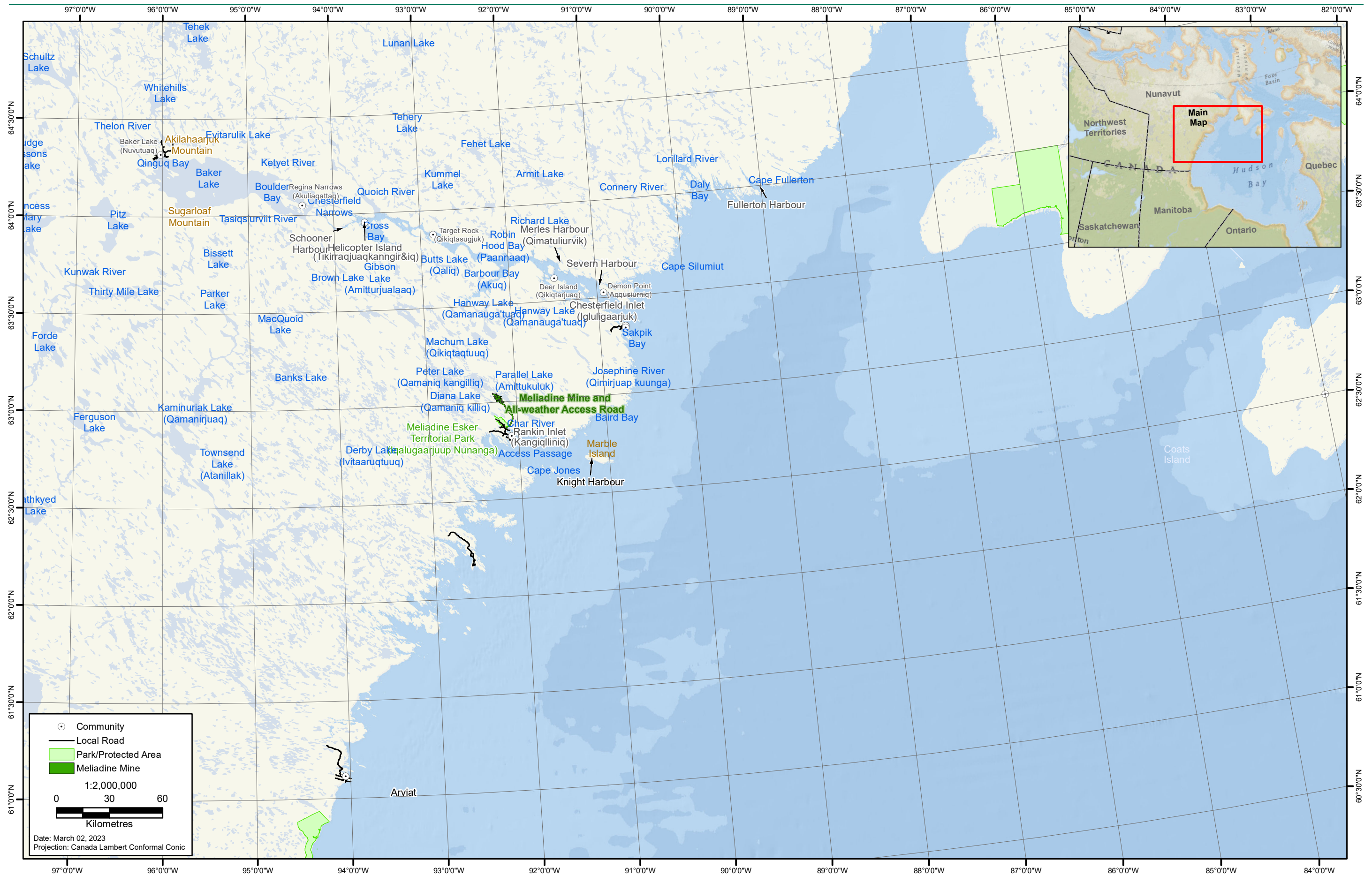


Figure 1-1: Meliadine Mine Location

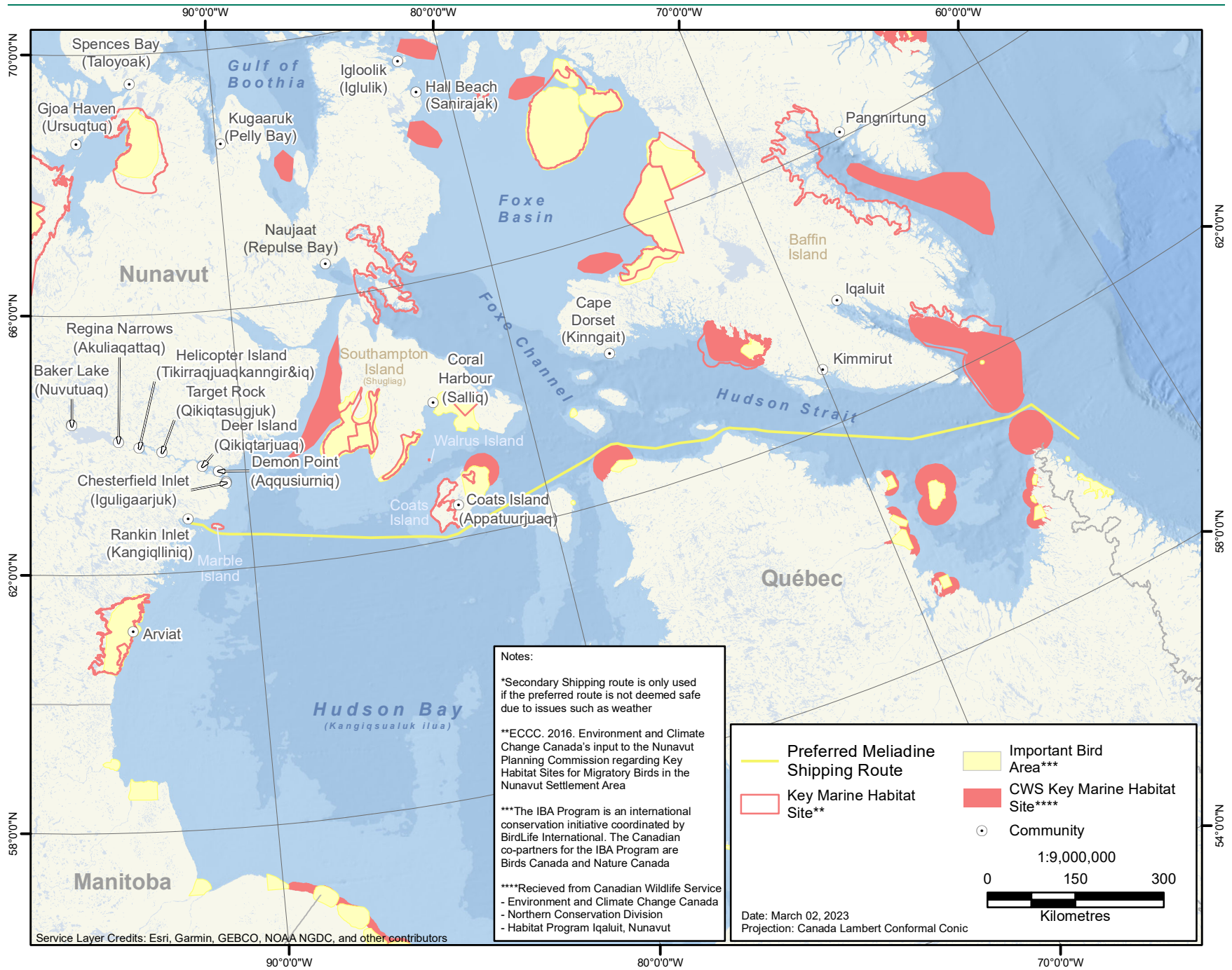


Figure 1-2: Shipping Route Study Area, Meliadine Mine

2. METHODS

To demonstrate consideration for the potential cumulative effects of other development projects and shipping activities (including community resupply) when considering cumulative effects on marine birds in the Hudson Strait, two approaches were taken:

1. A vessel track analysis was undertaken to determine how many vessels travel within the study area (i.e., Hudson Strait and Hudson Bay), what types of vessels, and the proportion attributed to Meliadine.
2. A literature review was undertaken to determine what mitigation and monitoring measures other shipping activities are conducting (e.g., other development projects, community resupply, cruise ships) to minimize effects to marine birds in the study area.

An analysis of the cumulative effects on marine birds in the study area is outside the scope of Meliadine's NIRB Annual Reporting requirements. The selection of a method to conduct a cumulative effects assessment depends on data availability, ease of use, and on the questions that the assessment is attempting to answer (Pickard et al. 2019). This memo does not attempt to assess the cumulative effects of shipping on marine birds, as this would require regional marine bird data, mortality data and vessel traffic data over multiple years. Instead, this memo primarily identifies the amount and type of marine vessel traffic in the study area, and the proportion of this vessel traffic attributed to Meliadine.

2.1 Vessel Track Analysis

Agnico Eagle provided ERM a list of vessel names and dates of delivery for shipments to the Meliadine Mine. Each vessel is required by Transport Canada to transmit Automatic Identification System (AIS) data via a transceiver on board. These data are used by other vessels and Vessel Traffic Services (VTS) to monitor vessel movements. ERM acquired archived AIS data from Vesseltracker, a commercial AIS supplier that aggregates AIS data from satellite and shore-based stations. These data vary in frequency based on distance from shore, location of shore-based stations, and position of satellites. In some cases, AIS position data is available on an hourly or sub-hourly basis, but in other cases, position data can be 12 hours or more between fixes.

As per Transport Canada regulations (Transport Canada 2021), only vessels greater than 20 m are required to use Class A AIS transmitters. Class A AIS transmitters are captured by the Vesseltracker platform. Vessels that are 8 m in length, or carry greater than 12 passengers, are required to be equipped with Class A or Class B AIS; therefore, smaller vessels that are equipped with Class B transmitters are not captured by this analysis. Vessels under 8 m, or 26 feet, include most private boats from communities and many private and commercial fishing vessels in the area.

Tracks for all vessels that transmit AIS data (including Meliadine, other development projects, cruises, community resupply, etc), that entered Hudson Strait and/or Hudson Bay during Meliadine's shipping season (July 1 through November 15) were downloaded from the Vesseltracker platform (2022). All vessel tracks were plotted using ArcGIS 10.8.1 to indicate what proportion of vessels supply Meliadine. Number of trips was indicated by the presence of a vessel within the study area by month. Some of the trips include entering and leaving the study area, however others are only one-way trips if they entered/exited during different months.

A heat map was created using the point locations of the vessels to show the density of vessel tracks within the study area during the shipping season. To create the heat map, all vessel tracks that were not stationary (defined as any vessel with a speed greater than 4 knots) were included in the analysis. In addition, tugs were excluded, as these vessels constantly move back and forth at one location (e.g., between Helicopter Island and Baker Lake for the Meadowbank Mine and Baker Lake community resupply vessels), which skewed the results of the density analysis by omitting the high-density vessel traffic routes (e.g., Hudson Strait) and only showing Chesterfield Inlet to Baker Lake, and Iqaluit as high-density routes. These routes are still considered to have dense vessel traffic, even with the removal of the tugs, ensuring the patterns of vessel traffic are still accurately presented.

2.2 Literature Review

A literature review was completed of publicly available documents for other development projects and other shipping activities in Hudson Strait (e.g., community re-supply vessels, government vessels, cruise ships, and fishing vessels, where the data are available). Types of vessels and mitigation being conducted by other development projects and other industries were reviewed to compare with Agnico Eagle's mitigation.

3. RESULTS

3.1 Vessel Tracks

Vessels that travelled within the study area during Meliadine's shipping season (July 1 to November 15) were downloaded from the Vesseltracker platform in January 2023. A single voyage, or trip, was determined as each time a single vessel entered and exited the study area. Overall, there were 219 trips within the study area between July 1 and November 15, 2022. The frequency of trips was relatively constant between July and November, with between 35 and 49 trips per month (Table 3.1-1, Figures 3.1-1 to 3.1-5). Of the 219 trips during the 2022 shipping season, 14 trips (6%) were attributed to Meliadine (Figure 3.1-6). It is important to note that information presented in Figures 3.1-1 through 3.1-5 is based on AIS data, and therefore vessels that do not use the AIS system (e.g., small recreational boats) are not represented in these maps.

Table 3.1-1: Number of Vessels in Hudson Strait and Hudson Bay from July through November, 2022

Month	No. of Vessel Tracks	No. of Vessels Servicing Meliadine	% of Vessels Servicing Meliadine
July	49	3	6
August	45	3	7
September	43	3	7
October	47	4	9
November	35	1	3
Total	219	14	6

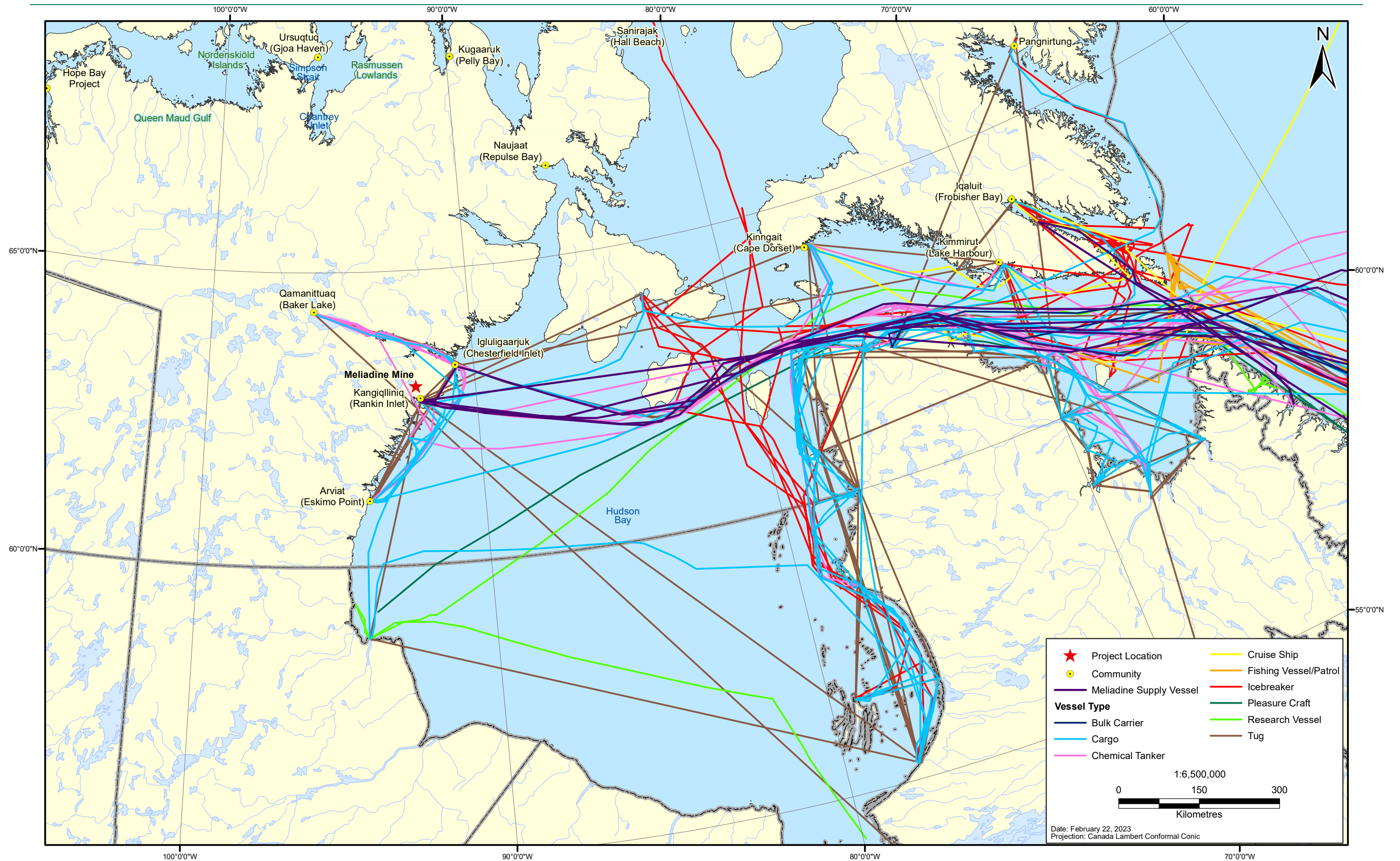


Figure 3.1-1: Vessel Traffic in Hudson Strait and Hudson Bay, July 2022

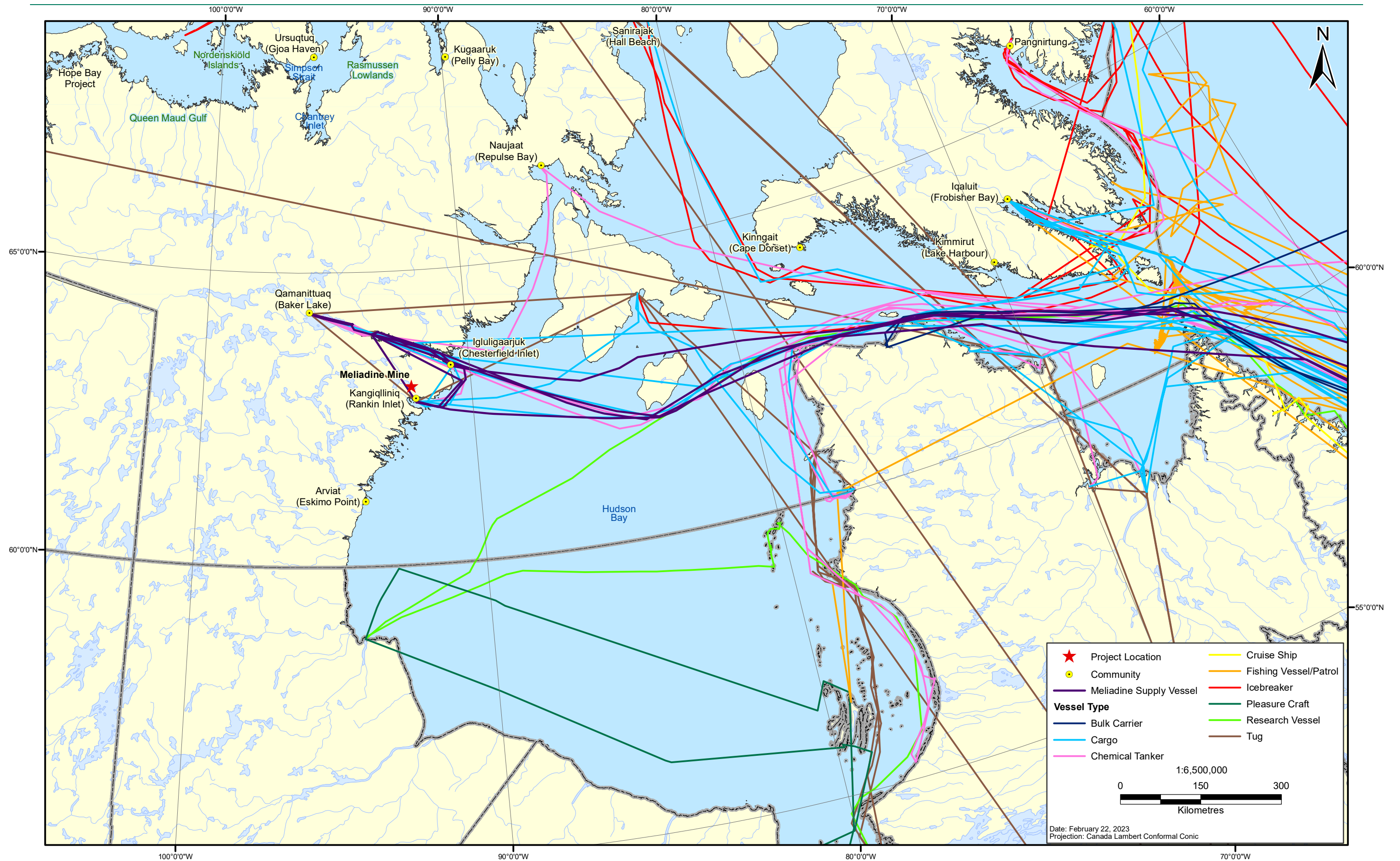


Figure 3.1-2: Vessel Traffic in Hudson Strait and Hudson Bay, August 2022

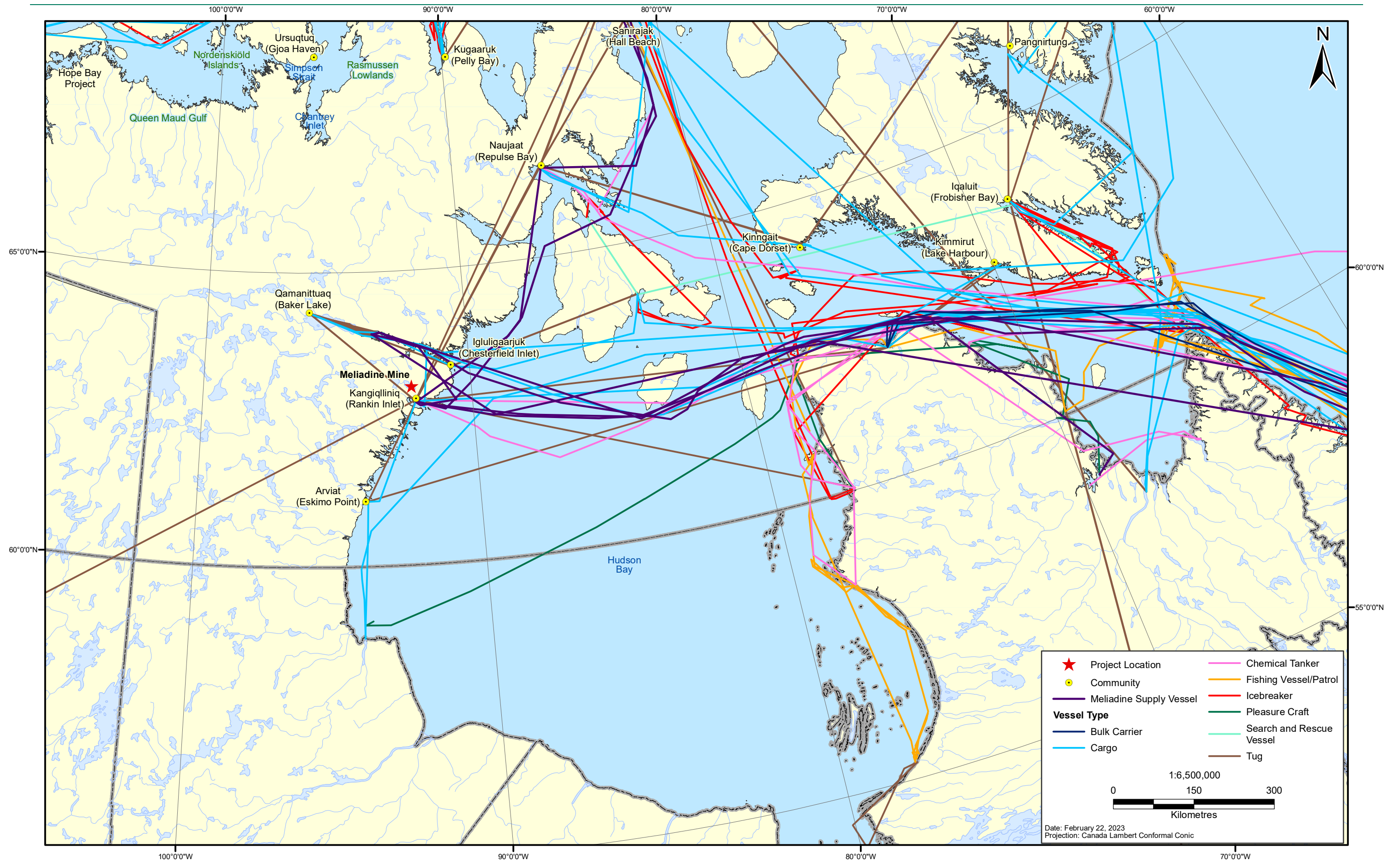


Figure 3.1-3: Vessel Traffic in Hudson Strait and Hudson Bay, September 2022

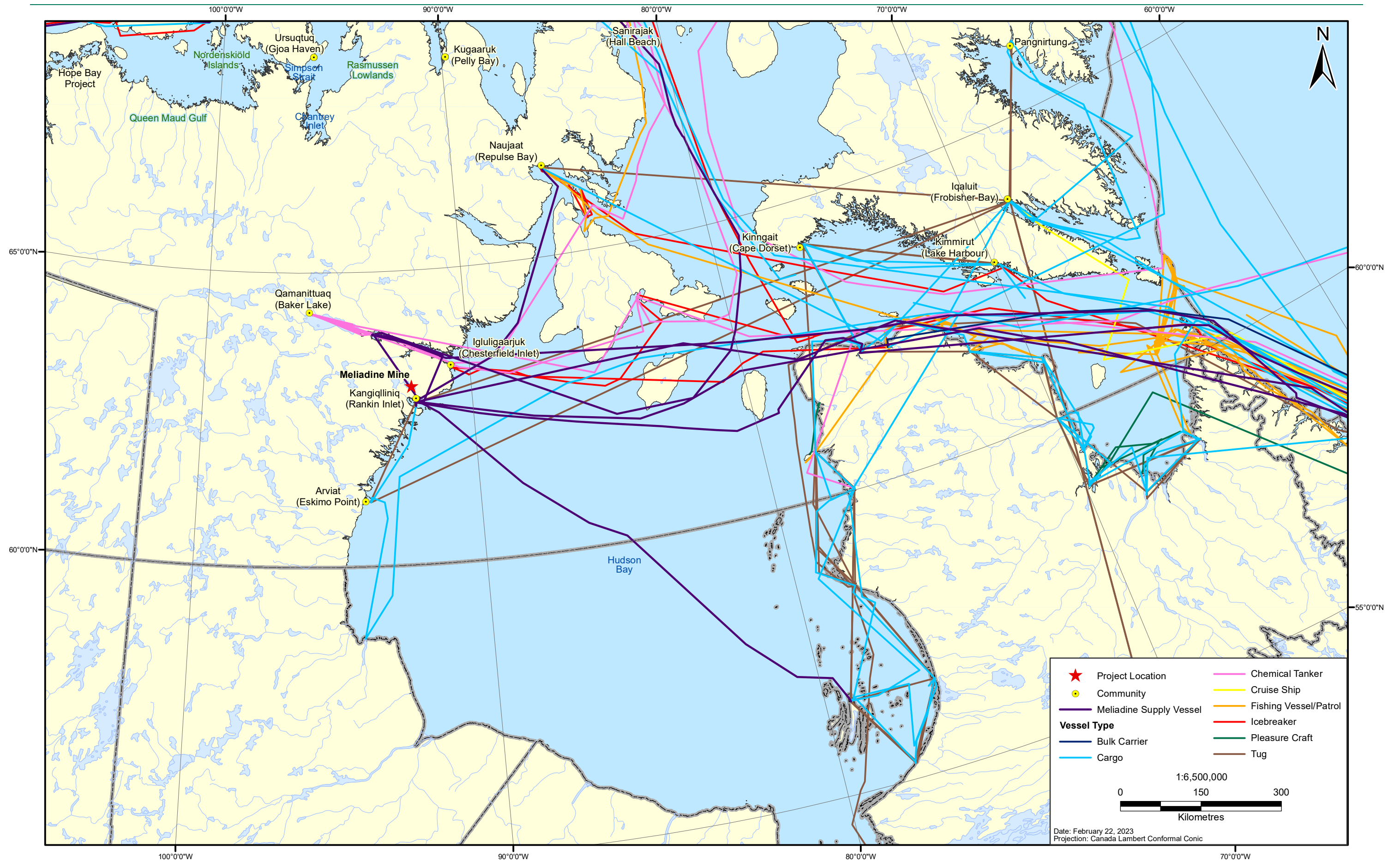


Figure 3.1-4: Vessel Traffic in Hudson Strait and Hudson Bay, October 2022

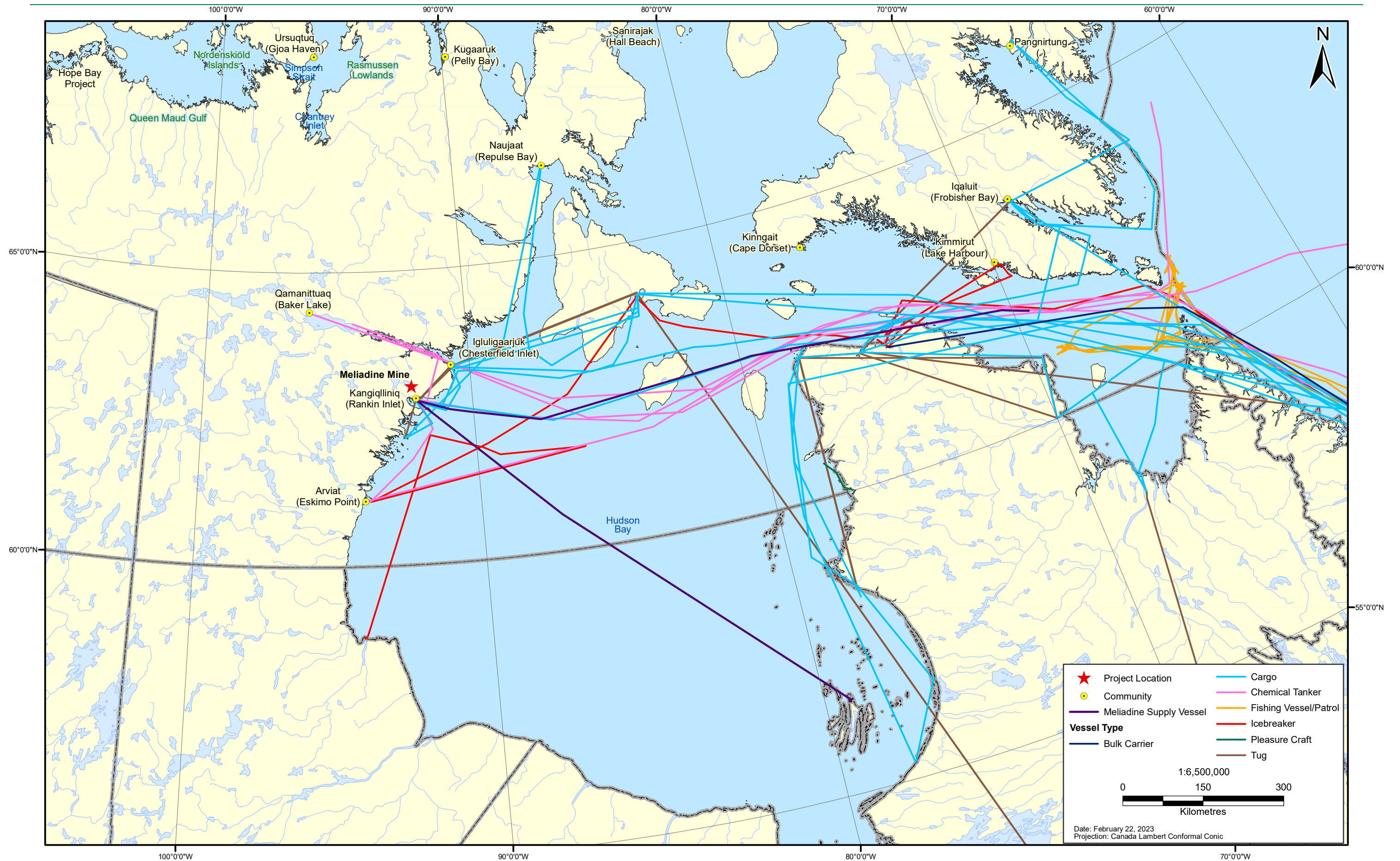


Figure 3.1-5: Vessel Traffic in Hudson Strait and Hudson Bay, November 2022

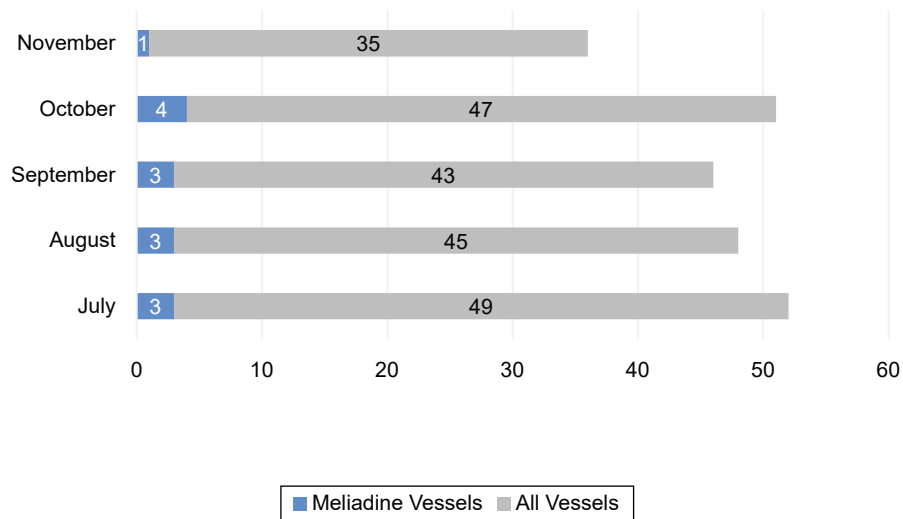


Figure 3.1-6: Number of Vessels in Hudson Strait and Hudson Bay from July through November, 2022

The 219 vessel tracks where AIS data were available were examined further to determine the types of vessels present in the study area. Each vessel name and IMO were investigated to determine vessel type. The vessels were classified into 11 categories, summarized in Table 3.1-2. The majority of vessels identified within the study area were tugs/barges (37%), followed by general cargo vessels (26%), and fuel tankers (12%; Figure 3.1-7).

Table 3.1-2: Types of Vessels Transiting through Hudson Strait and Hudson Bay, July through November, 2022.

Vessel Type	No. of Trips
Bulk Carrier	7
General Cargo	56
Chemical/Fuel Tanker	27
Cruise Ship	3
Government Fishing Patrol	3
Fishing Vessel	19
Government Icebreaker	13
Pleasure Craft	8
Research Vessel	2
Government Search and Rescue Vessel	1
Tug/Barges	80
Total	219

In 2022, 14 vessels supplied the Meliadine Mine, which included 10 cargo vessels and four fuel tankers. This represents 18% of the cargo vessels, and 15% of the fuel tanker within the study area (Figure 3.1-8).

The density of vessel tracks in the study area was plotted using a heat map to determine areas with the highest number of vessels within the study area. Vessels that were stationary were excluded from the analysis to omit areas where vessels were anchored, but still transmitting AIS data. In addition, due to the nature of tug/barge movement (i.e., constant short-duration return trips at ports), tugs and barges were removed from the density analysis to ensure the shipping routes with the highest density of vessel traffic were represented on the maps, rather than port locations with tug and barge operation (e.g., Baker Lake, Iqaluit, Rankin Inlet, Inukjuak). Vessel track data in 2022 demonstrates a high density of vessel traffic within Hudson Strait (Figure 3.1-9), as well as Frobisher Bay (near Iqaluit) and Chesterfield Inlet (near Baker Lake).

To investigate the final destination of the vessels, the bulk carrier, general cargo, and chemical tankers were examined further. Of the 90 trips that were completed by these three types of vessels (Table 3.1-2), 25 vessels travelled to Agnico Eagle's two Divisions (seven to Meliadine, 11 to their Meadowbank Division near Baker Lake, and another seven to both Meadowbank and Meliadine) and approximately 11 appeared to transit through the study area (approximately seven of which travelled north through Foxe Bay, and approximately four travelled north of Baffin Island). The remaining 54 trips appear to report to various communities in Hudson Bay (see Figures 3.1-1 to 3.1-5).

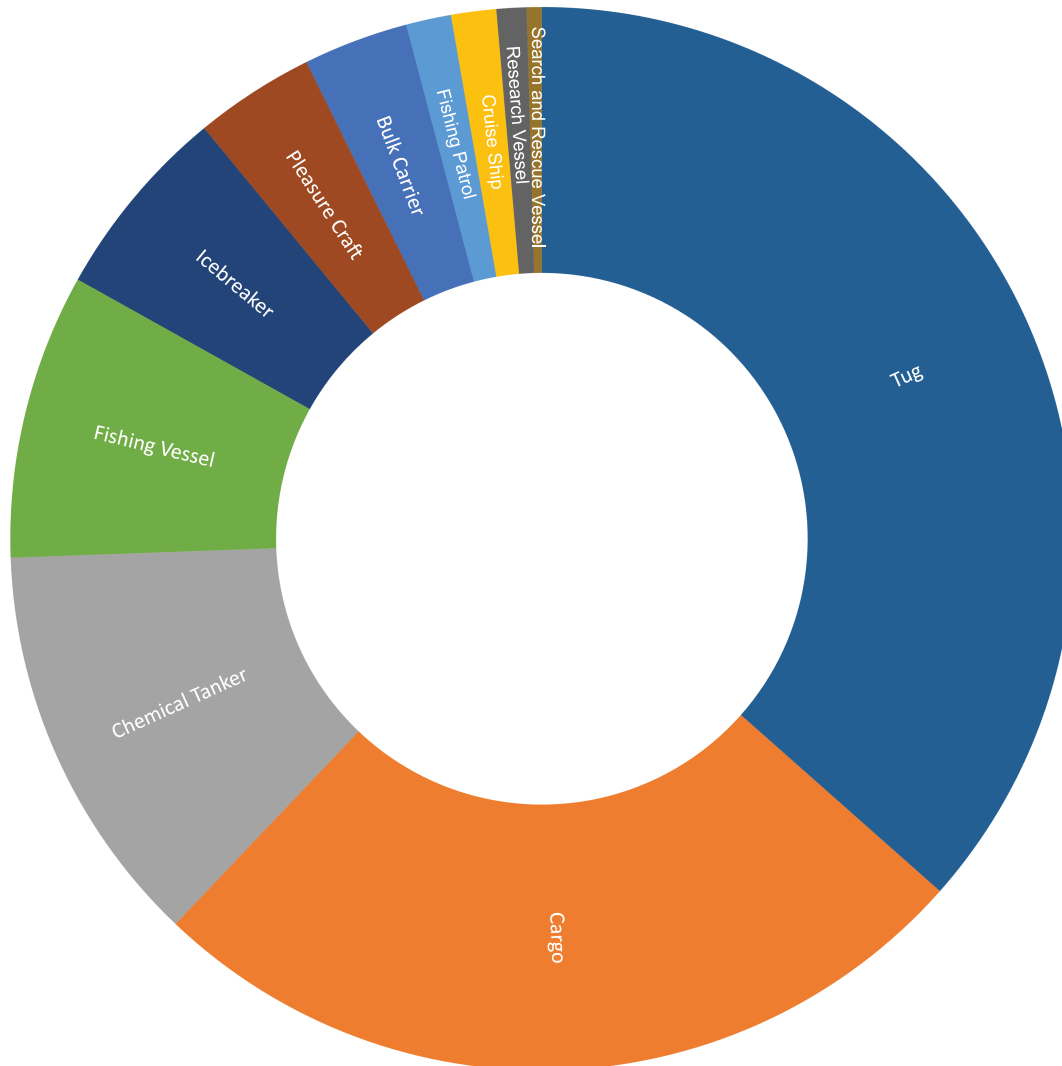
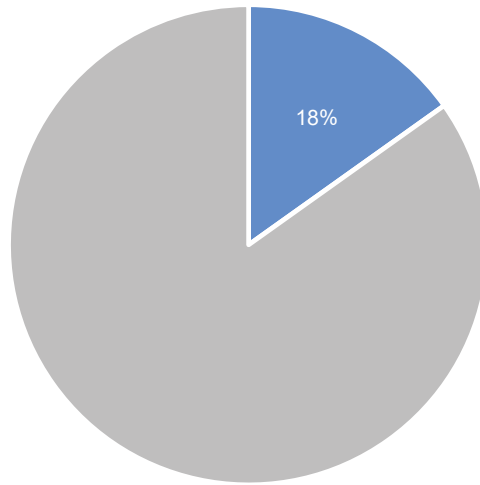


Figure 3.1-7: Vessel Types in Hudson Strait and Hudson Bay, July to November 15, 2022

Cargo



Chemical Tanker

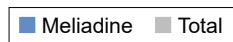
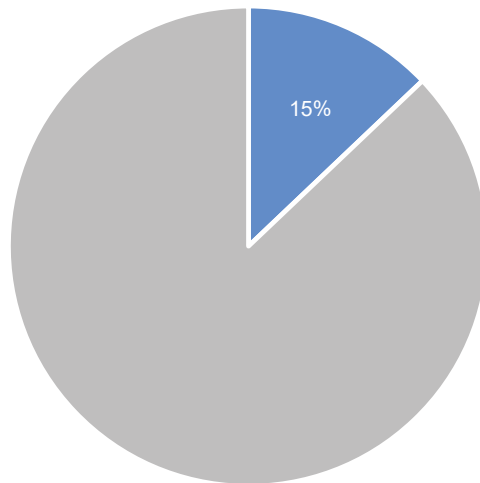


Figure 3.1-8: Proportion of Cargo Vessels sand Fuel Tankers Supplying Meliadine Mine Relative to the Total Number of Vessels, July through November, 2022

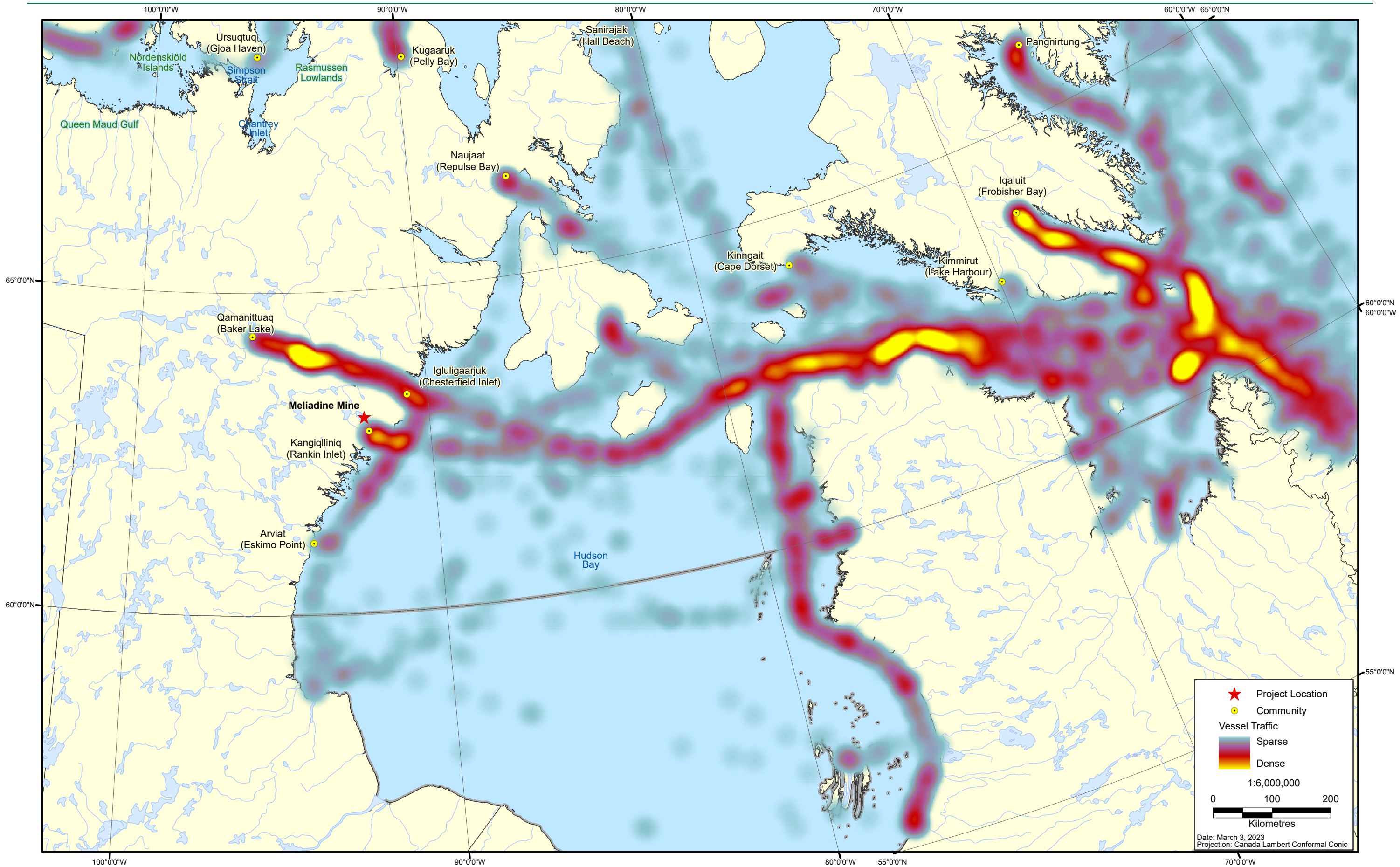


Figure 3.1-9: Heat Map of Vessel Traffic in Hudson Strait and Hudson Bay, July-November 2022

3.2 Literature Review

The literature review consisted of a review of publicly available government literature, academic journal articles, and documents available on the NIRB registry. The focus of the literature review was on trends in vessel traffic in the area, the types of vessels in the study area, as well as the mitigation and monitoring for marine birds required by vessels in the study area. The following subjects were explored when completing the literature review:

- Resource development projects with overlapping shipping routes to Meliadine;
- Community resupply vessels;
- Government vessels (e.g., Department of Fisheries and Oceans Canada (DFO), coast guard, research vessels, military vessels);
- Tourism/cruise ships;
- Recreational vessels; and
- Fishing vessels.

The literature review provided information on historical trends of vessel traffic in the Arctic; however, there was limited information pertaining to the mitigation and monitoring requirements for vessels other than resource development projects. The following sections summarize relevant information obtained from the literature review.

3.2.1 Trends in Vessel Traffic

A number of studies focused on, or contained information of past shipping trends in the Arctic or Canadian Arctic and statistical information on shipping vessels and voyages in the Canadian Arctic.

Vessel traffic in Hudson Bay, James Bay, Foxe Basin, and Hudson Strait has been increasing over the last 30 years, with an estimate of approximately 80 voyages/trips per year between 1990 and 1995, to approximately 160 to 180 trips per year between 2010 and 2015 (Andrews et al., 2018). The vessel traffic data used from 2022 for this report indicate 219 trips, illustrating a further increase in vessel traffic since 2015. Between 1990 and 2015, general cargo vessels were responsible for 27% of vessel traffic (Andrews et al., 2018), compared to 26% in 2022, using the downloaded vessel tracker data for this study (Section 3.1). Therefore, it appears as though the percentage of general cargo vessels has remained the same. Between 1990 and 2015, bulk carriers were responsible for 23% (compared to 3% in 2022), and tankers (likely carrying diesel fuel for re-supply) were responsible for 19%, compared to 12% in 2022 (Table 3.1-2 and Figure 3.1-7).

Traffic data from numerous sources reviewed in Andrews et al. 2018 (Judson, 2010; Étienne et al., 2013; Canadian Coast Guard, 2015; Dawson et al., 2016) indicate that most shipping traffic enters and leaves the study area via Hudson Strait. These movement patterns concentrate traffic in Hudson Strait, which has the highest traffic volumes in the study area and had average traffic densities nearly twice as high as any other region in the Canadian Arctic between 1991 and 2008 (Judson, 2010). The summary of cumulative vessel traffic in 2022 also demonstrates a higher density of vessel traffic within Hudson Strait (Figure 3.1-9).

3.2.1.1 *Community Resupply Vessels*

The seasonally ice-covered waters of Hudson Bay, James Bay, Foxe Basin, and Hudson Strait are bordered by 39 communities with a total population of roughly 50,000 people (Andrews et al., 2018). Most of these communities in the region (29 communities, roughly 27,000 people) can be accessed only by sea or air. Community re-supply is one of the main shipping activities in the Arctic, as navigation is sometimes the only way to supply communities with the goods and materials needed throughout the year (Engler and Pelot, 2013). According to Transport Canada information (in Andrews et al., 2018), the following companies provide community re-supply in the Eastern Arctic:

- Nunavut Sealink and Supply Inc. (NSSI), its Managing Partner, Desgagnés Transarctik Inc. (DTI), and associate company Taqramut Transport Inc. (TTI);
- Nunavut Eastern Arctic Shipping Inc. (NEAS); and
- Woodward Group.

In a study conducted by Mariport Group Ltd. In 2007, it was estimated that the 2007 shipping demand involved 20 to 22 seasonal vessel trips of dry-cargo and approximately 15 vessel trips of fuel per year to communities in the eastern Arctic (includes Kivalliq, Kitikmeot, and Qikiqtaaluk regions). It was projected in 2007 that by 2020, annual re-supply demand would require 23 to 25 dry-cargo ship trips per year and 25 to 30 fuel tanker trips per year as a result of increases in population (Mariport Group Ltd. 2007). The vessel track analysis in Section 3.1 of this memo was not able to identify with certainty specific vessels that were supplying communities, therefore cannot provide an accurate number of community re-supply vessels for 2022. However, it can be estimated that of the general cargo, chemical tanker, and bulk carriers (which made up a total of 90 trips in 2022), approximately 54 trips (approximately 60%) were likely community resupply trips.

3.2.2 *Mitigation for Marine Birds*

In the Meliadine FEIS (Volume 8; Agnico Eagle 2014) it was predicted that marine birds would likely be the most adversely affected wildlife receptor from a worst-case diesel fuel spill event in the marine environment. The magnitude of a worst case diesel fuel spill on marine bird health and mortality risks and bird habitat was considered to be high, since the spill was projected to result in mortalities of SARA-listed marine bird species, such as Ross's gull and the Ivory gull and could impact large populations of migratory birds. The primary concern for marine birds along the shipping route is the potential for a fuel spill. Meliadine has not had any major fuel spills to date.

3.2.2.1 *Mitigation and Monitoring: Meliadine*

Movement of goods to the Meliadine Mine from the south is regulated by a number of existing international, federal and territorial acts and best management practices, including the *Canada Shipping Act* and the *Arctic Waters Pollution Prevention Act* and is overseen by Transport Canada. The NIRB also requires specific mitigation and monitoring and provides oversight based on conditions of PC No. 006. Agnico Eagle is required to report to the NIRB annually on its mitigation and monitoring programs.

Mitigation measures include the development of standard plans for shipping in the Canadian Arctic. These include:

1. The Shipping Management Plan. Standard mitigation measures employed by Agnico Eagle are included in the Shipping Management Plan (Agnico Eagle 2022a), which is written in accordance with federal legislation: *Canada Shipping Act* and the *Arctic Waters Pollution Prevention Act*. These standard measures include:
 - a. Marine navigational safety;
 - b. Accidents and collisions;
 - c. Spill prevention and response;
 - d. Pollution prevention measures;
 - e. Ballast water management;
 - f. Waste management;
 - g. Radio equipment and communications; and
 - h. Occupational health and safety.
2. Management plans to manage fuels and provide response in case of a spill, including:
 - a. A Shipboard Oil Pollution Emergency Plan (SOPEP);
 - b. An Oil Pollution Emergency Plan (OPEP);
 - c. A Spill Contingency Plan; and
 - d. An Emergency Response Plan.

Group Desgagnés, the shipping contractor, has also instituted a series of additional mitigation measures aboard their vessels, including:

- All vessels are Green Marine certified.
- Ballast water is taken on in Nunavut, pumped out in Montreal.
- No oily water released north of 60°.
- All sewage treated in certified sewage treatment system.
- Cleaning chemicals used on board are enviro friendly.

In addition to the standard mitigation measures required by legislation and conducted as best practice by the vessel contractor, Agnico Eagle conducts additional mitigation to meet NIRB requirements and address community and regulator concerns. These include:

- Mitigation for marine birds along the shipping route (Agnico Eagle 2022b).
- Monitoring for marine birds along the shipping route (Agnico Eagle 2022b).
- Additional mitigation for potential fuel spills.

3.2.2.2 *Mitigation and Monitoring: Other Vessels*

A literature review of mitigation measures required by other vessels, such as community resupply vessels, fishing vessels, or other government vessels was completed. Specific mitigation or monitoring guidelines for individual activities (e.g., community resupply or government vessels) did not lead to any results; therefore, it is unknown what mitigation and monitoring is being conducted by these vessels to minimize effects to marine birds. However, in 2018, Transport Canada released general guidelines for passenger vessels operating in the Arctic (Transport Canada 2018). These general guidelines must be followed by vessels operating in the Arctic and include measures related to grey water discharge, underwater noise, and wildlife viewing (Transport Canada 2018).

Other mineral development projects that have shipping within Nunavut waters, such as Hope Bay and Baffinland Mary River Project, have similar mitigation and monitoring requirements as Meliadine; however, neither of these projects have overlapping shipping routes with Meliadine, as they travel north of Baffin Island. For example, the Shipping Management Plan for Hope Bay has min 500 m setback distance as a measure to prevent harm to seabirds, while traversing identified sensitive habitats, and requires reporting incidents with marine birds during shipping (Agnico Eagle 2023).

A ship-based observer program is established by the Baffinland Iron Mines Corporation for the Mary River Project. This program observes responses from narwhals and other marine mammals to shipping activities from the icebreaker MSV *Botanica* in Milne Inlet and Eclipse Sound. Seabird information is also collected during shipping. Baffinland Mary River Project has also contributed to an ECCC study on seabirds at Coats Island in Hudson Bay (Baffinland 2022).

In addition to mitigation measure required by resource development projects, an application for a cruise ship was obtained from the NIRB registry, where a tourism cruise company completed an EIA for operations in Arctic waters (Silversea Cruise Ltd. 2017). The cruise ship also obtained an ECCC permit to enter migratory bird sanctuaries for the purpose of wildlife viewing (ECCC 2018).

4. CONCLUSIONS

Overall, Meliadine's contribution to the overall vessel traffic in the study area in 2022 is approximately 6%. The majority of vessels with AIS tracks in 2022 are tugs/barges, followed by general cargo ships, and fuel tankers. Most of these vessels are servicing communities, as well as the Meliadine and Meadowbank Mines.

Agnico Eagle is currently conducting mitigation and monitoring programs on marine wildlife as part of the shipping activities. Agnico Eagle's shipping route has been modified to avoid haul outs and seabird colonies and when weather and safety allow, in response to community concerns to avoid seabirds between Southampton and Coats Islands. As a result, the vessels remain well away from known concentrations of marine wildlife and defined-important habitat. In addition, Agnico Eagle's mitigation and monitoring measures to avoid impacts to seabirds are heavily monitored and reviewed annually by the NIRB and federal interveners (Department of Fisheries and Oceans, Environment and Climate Change Canada, Government of Nunavut, Transport Canada). Agnico Eagle also continues to engage in consultation with coastal communities in the area. For example, in May 2022, a Shipping Consultation Meeting was held in Coal Harbour, Arviat, and Whale Cove, hosted by Agnico Eagle, to address any concerns the community may have regarding shipping.

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