

ARCTIC SHIPPING DEVELOPMENTS

FOR

WORLD WILDLIFE FUND CANADA



August 2012

**The Mariport Group Ltd
PO Box 2295
Digby, NS, B0V 1A0**

CONTENTS

Glossary of Terms

- 1. Background**
- 2. Executive Summary**
- 3. Development Areas**
 - 3.1 Community Re-Supply**
 - 3.2 Mining**
 - 3.3 Oil and Gas**
 - 3.4 Churchill Grain**
 - 3.5 Marine Tourism**
 - 3.6 Northwest Passage**
- 4. Vessel Traffic Summary and Projections**
 - 4.1 Traffic at 2010**
 - 4.2 Traffic to 2020**
 - 4.3 Traffic to 2030**
- 5. Annexes**
 - 5.1 Community Population**
 - 5.2 Nutrition North**
 - 5.3 Shipping via the Hay River/Mackenzie River Route and via Churchill**
 - 5.4 Estimating Re-Supply Cargo Quantities for Mining Ventures**

GLOSSARY OF TERMS

AHTS	Anchor Handling Tug Supply
ASPPR	Arctic Shipping Pollution Prevention Regulations.
BIPAR	Bathurst Inlet Port and Road
CIF	Cost, insurance, freight
CMAC	Canadian Marine Advisory Council
CWB	Canadian Wheat Board
DWT	Dead Weight
EIS	Environmental Impact Statement
Fob	Free on board
Grt	Gross register tonnage
GN	Government of Nunavut
IMO	International Maritime Organisation
NEAS	Nunavut Eastern Arctic Shipping
NIRB	Nunavut Impact Review Board
NSSI	Nuanvut Sealift and Supply Inc.
NTCL	Northern Transportation Company Ltd.
NWT	Northwest Territories
OBO	Ore, Bulk, Oil
POL	Petroleum, Oil, Lubricants
RFP	Request For Proposal
StatsCan	Statistics Canada
Tpa	Tonnes per annum
ULSD	Ultra Low Sulphur Diesel
VBN	Voisey's Bay Nickel

1. BACKGROUND

With the Arctic warming at twice the global average rate, the rapid reduction in sea ice extent, duration and thickness is, in effect, creating a new ocean. The Arctic Ocean is unique among the world's oceans when it comes to future scenario planning. The main driver of future development scenarios in the Arctic will be global economics (commodity prices) and to a lesser extent climate change and the increased accessibility of Arctic waters as a direct result of climate change. These economic pressures and new ocean will present numerous development opportunities, and attendant risks.

Although outside of the Arctic region, information has also been included on the Voisey's Bay Nickel mine (VBN) in Labrador, and the nearby community of Nain. The mine has to contend with significant seasonal ice, which can be considered very similar to Arctic conditions.

2. EXECUTIVE SUMMARY

2.1 The objective of the study is to provide an assessment of developments in Canada's Arctic that will lead to marine traffic and to suggest what that traffic might be in 2020 and 2030 in terms of numbers of voyages and types and sizes of ships. A base year is provided.

Traffic at 2010

2.2 Community dry cargo traffic in 2010 is summarized on p42 and in Table 16 on p45.

- In 2010, three companies provided community service in the Eastern and Western Arctic: NEAS with four ships, NSSI with five and NTCL with a fleet of tugs and barges deployed mainly in the Western Arctic, but with some equipment in Hudson Bay.
- Community dry cargo traffic was particularly heavy in 2010 and in addition to the Eastern Arctic fleets of NEAS, NSSI and NTCL, there were three chartered vessels and two chartered tug barge combinations that undertook one trip each.
- The Canadian flag fleet of nine vessels undertook a total of 27 trips to Nunavut and Nunavik. Those trips included one voyage by each of NEAS and NSSI to the Western Arctic from the Montreal area. See p16 for a list of ships in the fleet.
- In addition to the vessel fleet, NTCL undertook ten trips out of Churchill using Moosonee Transport's tug *Hudson Bay Explorer* and their own tug *Pat Lyall*, together with an unknown number of barges.
- NTCL provided a barge service out of Richmond (BC) using a single barge, the NT 12000 and their tug *Alex Gordon*. In addition to community cargo, this barge also carried cargo for Newmont's Hope Bay mine.
- NTCL also ran six barge trips from Tuktoyaktuk to Western Arctic communities using their tugs *Edgar Kotokak* (two trips), *Nunakput* (two trips), *Pisurayak Kootook* (two trips in combination with Northwarning System fuel deliveries).

- A typical shipload is shown in the following photograph.

NSSI' mv Anna Desgagnes loaded and ready to leave port



Photograph from NSSI Web Site

NTCL's tug and barge activities in the Western Arctic are exemplified in the following photograph.

NTCL Beach delivery of fuel and dry cargo



Mariport file photograph

- Nain, in Labrador, is served by weekly calls by the Passenger Cargo ship *Northern Ranger* and bi-weekly calls by the freight vessel *Astron*. Traffic commences mid/late June and ceases in November. Start and finish dates are dictated by ice conditions.

2.3 Mine re-supply dry cargo traffic is summarized on p44 and in Table 16 on p45.

- NSSI carried most dry cargo for mine operations with one dedicated trip from Becancour to Robert's Bay in the Western Arctic and four dedicated trips to Baker Lake for Agnico-Eagle, also from Becancour.
- In addition, the company chartered two tugs (*Atlantic Beech* and *Elm*) and two barges (*Atlantic Marlin* and *Swordfish*) from Atlantic Towing for service to Baker

Lake, and one small Canadian flag container ship (*Dutch Runner*) also to Baker Lake.

- NEAS combined a trip to Milne Inlet for Mary River with community calls. Some Nunavik community trips also included calls at Deception Bay for either Xstrata Nickel or Nunavik Nickel.
- NSSI combined their community trip to the Western Arctic with a call at Robert's Bay for Newmont.
- Voisey's Bay Nickel Mine (VBN) traffic to and from their port in Edward's Cove in 2010 was atypical due to a strike that commenced September 2009 and did not finish until January 2011. Typical activity is about 12 trips by the ice breaking cargo ship *Umiak 1* hauling about 350,000tonnes nickel concentrate to Quebec and 5-6 Foreign flag vessels shipping 170,000tonnes of copper concentrate to offshore refiners. Inbound logistics are containerised and carried by the *Umiak 1*.

2.4 Community Petroleum Product (POL) re-supply is summarized on p43.

- There are two companies involved: Woodward of Goose Bay, Labrador, and PetroNav (a Desgagnes subsidiary). See Table 7 on p17 for the current Arctic tanker fleet.
- Woodward undertook 14 trips to Nunavut communities in the Eastern and Western Arctic with four tankers, while Petronav undertook six trips to Nunavik with two tankers.
- In addition, the offshore tanker *STX Ace 10* provided service to Iqaluit, probably on charter to Woodward.
- NTCL barges provided service to NWT communities in the Western Arctic in combination with dry cargo. They also lightered POL from the mt *Marilee* anchored off Tuktoyaktuk. Some of this cargo may have been for Newmont's Hope Bay mine.
- Nain, in Labrador, received three calls by the Woodward tanker *Mokami*.

2.5 Mine POL re-supply is summarized on Page 44.

- Woodward chartered the international flag tanker *CPO Germany* for service to Agnico Eagle at Baker Lake. The ship anchored outside Chesterfield Narrows and cargo was transferred by the *Dorsch* and the *Nanny*.
- Xstrata Nickel were re-supplied by the mv *Arctic*, reportedly with 5,000m³ POL on each of six trips. Petronav's two tankers also called Deception Bay and could have delivered POL to either Nunavik Nickel or Xstrata.
- The mt *Primrose* with 20,000m³ ULSD was frozen in over the 2010/11 winter to serve Newmont's Hope Bay mine. The tanker was in Robert's Bay from September 2010 to September 2011, when it sailed eastbound to the Atlantic.
- VBN needs are met by the *Umiak 1* hauling up to 5,000tonnes of POL each northbound trip.

2.6 There were eleven small cruise ships operating in the Eastern Arctic in 2010, making an estimated 18 revenue voyages. Three of these ships made a Northwest Passage transit.

2.7 Twenty-two ships called Churchill, for grain, ranging in size from 46,000 tonnes to 12,000 tonnes. A total of 660,000 tonnes of grain was shipped.

2.8 As far as we are aware, there was no oil and gas activity in the Western Arctic.

Traffic to 2020

2.9 Community shipping traffic to 2020 is summarized on p46 and in Table 17 on p48. It is expected that some of the existing dry cargo fleet will continue in operation, although most ships will be quite old and some scrapping and replacement is expected.

- Community dry cargo re-supply will require 32 sailings out of the Montreal area.
- In addition to service from Montreal, there will likely be two or three sailings from Churchill to meet Kivalliq community demand.
- Comments made above relative to the age of the dry cargo fleet applies equally to the tanker fleet in 2020. We expect 25-30 trips from southern refineries to the Eastern Arctic. The Western Arctic might be served by a single international flag tanker and regional transshipment by small tanker or tug and barge.
- Nain requirements will continue to be met by a combination of passenger/cargo ferry operations and freight services out of a Newfoundland port for dry cargo. POL needs will remain with 2-3 small tanker visits. Because of age, the existing ships may have been replaced.

2.10 Mining company traffic is expected to increase significantly over the 2010 level of activity. See p42 and Table 13 on p43. We expect:

- 30-35 outbound dry cargo voyages ranging in size from 30-60,000dwt hauling 2,000,000 tonnes of iron ore, and 300,000 tonnes of concentrates on a seasonal basis.
- This activity will require 14 inbound trips with POL using tankers of 10-45,000dwt, and 23 inbound dry cargo voyages ranging in size from 5,000tonne tug/barge combinations to ships of 12-15,000dwt.
- VBN traffic will be the same as current, except that the 12 annual Nickel shipments will go to the Hydromet treatment plant at Long Harbour. There will continue to be 5-6 offshore shipments each season with copper concentrate. It is expected that logistics needs will continue to be met by the *Umiak 1* on northbound trips.

2.11 Churchill grain will, at best, see 15-20 ship calls and move 500,000 tonnes of grain unless its endemic cost problems are addressed, and/or a major grain house sees a shipping opportunity and takes a controlling position.

2.12 Marine tourism may see the same number of revenue voyages as in 2010 – eighteen, but with fewer ships.

2.13 Oil and gas activities will be primarily seismic work, with some drilling. Ship sizes will range from about 4,000dwt AHTS vessels servicing the rigs, to possibly 1 x 45,000dwt tanker bringing in POL. We do not expect any outbound crude oil or gas shipments. Most activity will be internal using Tuktoyaktuk as a base.

Traffic to 2030

2.14 Community traffic to 2030 is summarized on p50 and in Table 20 on p53.

- Only the newer Desgagnes ships are expected to be in operation by this date and other ships will have needed replacement, probably with somewhat larger ships.
- We expect that there will continue to be 32 trips from southern ports to support dry cargo needs.
- Depending on vessel size in the tanker fleet and community demand for POL, we would expect 25-35 trips from southern refineries.
- Nain requirements will not change from 2020, with a combination of weekly passenger freight and bi-weekly cargo vessel calls to meet dry cargo needs and 2-3 small tanker visits for POL.

2.15 Mine activity is summarized in Table 19 on p52.

- We expect Mary River to be fully operational by 2030 and its traffic will dominate Canadian Arctic shipments. Other mines are expected to be operational as well. We expect traffic to be in the range 30-39,000,000tonnes of iron ore and concentrates outbound. This will involve 230-300 voyages in ships of 30-185,000dwt.
- To support this activity, we expect 14-16 tanker loads of POL in ship sizes between 20-55,000dwt, and 30-36 dry cargo loads in ship sizes of 15-17,500dwt.
- Depending on the success, or otherwise, of ongoing exploration, VBN may have closed by 2025; in this case there will be zero traffic to Edward's Cove. If the mine is still in operation, activity levels will remain 12 trips by the *Umiak 1*, and 5-6 visits by offshore vessels for copper concentrate. Logistics will continue to be hauled northbound by the *Umiak 1*.

2.16 Churchill may have closed by 2030, but if it continues in operation, we do not expect more than 500,000tonnes of grain and 15-20 ships. The same qualifications as for 2020 apply.

2.17 Marine tourism will probably see the same number of revenue trips as in 2020: viz. 18, but probably with increased NWT transits and more ships.

2.18 Oil and gas activity will continue, but there should be a start of regular seasonal crude shipments. We expect 2 dry cargo shipments from offshore, as well as 2 tanker loads of POL inbound. Outbound we expect a start to crude shipment with 100,000tonnes in two 50,000dwt shiploads.

Other Arctic Issues

- 2.19** We do not expect significant traffic through the Northwest Passage; see Page 32. There may be vessel transits of opportunity, but available draft will limit its attractiveness compared with the Northeast Passage or Northern Sea Route through Russia's Arctic.
- 2.20** We do not expect the Mackenzie Gas Pipeline to go ahead. If it did, then construction traffic would involve modules (28,000tonnes), pipe and drilling equipment (14,000tonnes) and POL (50,000tonnes). Total traffic would be in the order of 6-8 trips to Tuktoyaktuk.
- 2.21** Quebec's Plan Nord is too ill-defined at present to include in any forecasts. It will undoubtedly have an impact on Nunavik, but most activity may be focused on shipping via the Quebec North Shore.

3. DEVELOPMENT AREAS

The areas covered in the following analysis are those that are expected to generate marine traffic in the Canadian Arctic. An outline of current activity is provided, together with expected development scenarios. With each scenario an indication is offered as to probable traffic levels, types and sizes of vessels. The time frame for forecasts and development expectations is to 2020 and 2030. The base year is 2010.

3.1 COMMUNITY RE-SUPPLY

There are 43 wholly marine communities served in the Canadian Arctic of which 26 are in Nunavut; 14 in Nunavik (Northern Quebec) on the south shore of Hudson Strait and on the Eastern coast of Hudson Bay; and three in Northwest Territories (NWT). There are a further five NWT communities in the Mackenzie River Delta region that may be served by ships, although with transshipment to barges from ocean delivery. At present they are served by road and by tug and barge flotilla down the Mackenzie River. Other NWT river communities can only be served either by tug and barge during the open water season, or winter road. A major issue for all Arctic communities is that there are no port facilities; all cargo must be handled from ships at anchor by lighterage.

A brief discussion regarding Nunavut, Nunavik, NWT communities and Nain in Labrador, population and demand for dry goods and POL follows. Population is detailed in Annex 5.1.

A map showing Arctic marine communities is at Fig 1

FIGURE 1 – ARCTIC COMMUNITIES



Dry Cargo

The following assessments are provided relative to dry cargo current, and projected future demand, in each of the three Arctic areas and Nain. Quantities are provided in cubic metres (m³) for both dry cargo and Petroleum Products (POL). This gives a better assessment of ship utilization. Dry Cargo generally needs 3.5-4.0m³ per tonne, and ships will cube out before they are at their marks. For example, a typical dry cargo ship used in annual re-supply is about 12,000dwt, but will only have about 5,000tonnes of cargo on board when all space is used. The situation is not as extreme with POL, but the refined products shipped are relatively low density.

Nunavut Communities

Community population is given in Annex 5.1. For administrative purposes, as well as re-supply, they are divided into three groups:

- Kivalliq – which covers seven communities on the west side of Hudson Bay. Because of its location, Sanikiluaq is re-supplied as a separate region.
- Qikiqtaaluk – which covers twelve communities on Baffin Island and in the Foxe Basin as well as Grise Fjord and Resolute Bay in the high Arctic.

Because of its location, the Kitikmeot community of Kugaaruk is served for re-supply as part of the Qikiqtaaluk region with transshipment to CCG icebreakers at Nanisivik.

- Kitikmeot – which comprises six communities in the Western Arctic.

Indicative cargo quantities for communities in 2010¹ are given in Table 1 below.

Cargo demand correlates very strongly with population and because of the unreliability of StatsCan data for Arctic ports, Mariport has generally used population as the basis for cargo quantities. The primary factor that modifies these base line quantities is investment in new facilities. For example, Rankin Inlet received significantly more cargo during the 2010 & 2011 seasons than base line due to construction of a new correctional facility (additional cargo is expected during 2012) and a new trades school. One of the biggest shippers in the Territory is Nunavut Housing Corporation, which moved about 30,000m³ in 2010.

Demand in Iqaluit during 2012 and 2013 may be higher than normal because the Airport is being upgraded.

Community population changes are outlined in Annex 5.1. Iqaluit, being the capital of Nunavut, consumes far more product on a per capita basis than Mariport's planning quantities; we have therefore used 2010 demand² and population as a basis for projecting future year needs. Thus separating out demand in 2010, the following may offer an indication of how community based demand for goods will grow. There could be added growth with a switch from air to marine transportation resulting from Nutrition North support policies (see Annex 5.2).

¹ Taken from GN Dry Cargo RFP, posted on GN Tenders site in November 2011.

² In 2010, there were no specific projects that would have materially increased demand over a typical year.

TABLE 1 – NUNAVUT DRY CARGO RE-SUPPLY IN 2010

Re-Supply Region and Community served	Total cargo cube Estimate 2010	GN Cargo only 2010
AREA A – HIGH ARCTIC		
1. Arctic Bay		2,600
2. Qikiqtarjuaq (Broughton Island)		2,700
3. Clyde River		5,700
4. Grise Fjord		750
5. Kugaaruk (Pelly Bay)		2,600
6. Pond Inlet		4,100
7. Resolute Bay		780
TOTAL	40,000m³	19,230 m³
AREA B – FOXE BASIN		
1. Igloodik		7,200
2. Hall Beach		2,700
3. Repulse Bay		3,200
TOTAL	20,000m³	13,100
AREA C – IQALUIT		
TOTAL	90,000m³	25,400 m³
AREA D – SOUTH BAFFIN		
1. Cape Dorset		5,600
2. Kimmirut (Lake Harbour)		1,200
3. Pangnirtung		5,400
TOTAL	20,000m³	12,200 m³
AREA E – KIVALLIQ		
1. Baker Lake		5,500
2. Chesterfield Inlet		850
3. Rankin Inlet		10,700
4. Whale Cove		1,500
5. Arviat		7,200
6. Coral Harbour		2,900
7. Sanikiluaq (Belcher Islands)		4,700
TOTAL Exit Montreal Area		33,350 m³
TOTAL Exit Churchill & Winnipeg		28,500 m³
TOTAL all KIVALLIQ	75,000m³	
AREA G - KITIKMEOT		Exit Hay River & Richmond BC ³
Cambridge Bay		7,800
Kugluktuk (Coppermine)		6,300
Gjoa Haven		4,000
Taloyoak (Spence Bay)		5,700
Umingmaktok		None reported
Bathurst Inlet		None reported
TOTAL	45,000m³	23,800 m³
TOTAL ALL COMMUNITIES	290,000m³	155,580m³

Adapted from GN Dry Cargo RFP posted on GN tenders website November 2011.

³ Note that the Kitikmeot region was only served out of Richmond BC for two season, 2009 and 2010

TABLE 2 – NUNAVUT CURRENT AND FUTURE DEMAND FOR DRY GOODS BY SEA

Location	Pop. 2010	Demand m³ 2010, Tab 1	Estimated⁴ Demand m³	Pop. 2020	Estimated Demand m³	Pop. 2030	Estimated Demand m³
Iqaluit	7,054	90,000	90,000	8,977	114,535 ⁵	12,000	153,000
Rest of Nunavut	26,135	200,000	201,240	30,545	235,197	35,900	275,000
Total	33,189	290,000	291,240	39,522	349,732	47,900	428,000

Table 2 above gives our estimate of current dry cargo demand, and best estimates for demand by 2020. Estimates to 2030 assume a continued growth of Iqaluit, continued strong growth in the Kivalliq region, but slightly reduced growth for the rest of Nunavut compared with historical levels

NWT Communities

NWT dry cargo demand, based on population, is not expected to change significantly to 2020, and will remain at an estimated 7,000m³ for the coastal communities of Sachs Harbour, Ulukhaktok and Paulatuk. Including the Delta communities would increase dry demand to about 46,000m³ of goods. Again, there could be some increases as a result of changes in Nutrition North policies. Looking further out to 2030, it is difficult to see developments that would lead to significant growth in population and thus re-supply demand.

TABLE 3 – NWT ESTIMATED DEMAND FOR DRY GOODS BY SEA

Location	Pop. 2010	Estimated Demand m³ 2010	Pop. 2020	Estimated Demand m³ 2020	Pop. 2030	Estimated Demand m³ 2030
NWT	917	7,000	912	7,000	900	7,000

Nunavik Communities

Dry cargo demand in Nunavik is estimated to grow from 93,000m³ in 2010 to about 123,000m³ by 2020. Numbers are based solely on planning quantities and population and as noted above could increase somewhat as a result of changes in Nutrition North policies. Population in Nunavik is not likely to grow at quite the rate it has over the last decade, leading to a forecast of about 150,000m³ dry cargo demand by 2030.

⁴ Mariport’s quantity estimates are 2.2 tonnes per capita at 3.5m³ per tonne or 7.7m³ per capita. Based on 2010 data, Iqaluit demand is presumed to remain at 12.75m³ per capita. Note the proximity of 2010 figures and Mariport’s estimates.

⁵ Iqaluit will face some serious capacity issues prior to 2020. Beach discharge is only possible 2 hours either side of high water, and with practical season length for cargo work dictated by when the beach is clear of ice at the beginning of the season to hours of darkness and low temperatures at end of season, there is a limit to how much cargo can reasonably be discharged from ships at anchor.

TABLE 4 – NUNAVIK CURRENT AND FUTURE DEMAND FOR DRY GOODS BY SEA

Location	Pop. 2010	Estimated Demand m³ 2010	Pop. 2020	Estimated Demand m³ 2020	Pop. 2030	Estimated Demand m³ 2030
Nunavik	12,089	93,000	16,032	123,000	19,500	150,000

Labrador Communities

Population in Nain has not changed significantly over the last decade, thus dry cargo demand is not expected to change from current levels an estimated 7,500m³ dry cargo. There do not appear to be any significant influences on local population, despite to proximity of the community to Voisey’s Bay Nickel Mine. Consequently, we expect similar levels of demand in 2020 and 2030. Dry cargo service to Nain is quite different from service to Arctic communities. Nain receives weekly seasonal service from Happy Valley/Goose Bay by the *Northern Ranger*, and bi-weekly freight service from Lewisport by the *Astron*. The community has a dock, and marine services are heavily subsidised by the Province of Newfoundland and Labrador.

Petroleum Products

Indicative quantities are not as accessible as dry cargo, and planning quantities are less easy to determine because volumes depend on a number of factors. Population does influence demand, but there is not the same strong correlation. The following is Mariport’s best estimate of current demand by region. Most of this data is drawn from in-house resources.

Cargo quantities for Diesel and Gasoline will grow in line with both population and economic strength. The demand for Jet A1 depends, primarily, on air traffic. Air traffic for most communities may not change much if current load factors are low and increased enplanements simply fill out existing seats. Some communities, such as Resolute and Iqaluit have an international refuelling business, and some such as Rankin Inlet, Cambridge Bay, Inuvik and Kuujuaq are regional hubs. Air freight business also affects demand, although there will some shift from air to marine as a result of changes in the Food Mail programme under the new Nutrition North policy.

Table 5 below gives estimated Nunavut demand for petroleum products by community and grade for 2010. The Government of Nunavut has recently issued an RFP for Petroleum Product Service to Eastern Arctic communities. This RFP includes information regarding proposed deliveries during 2012. The problem with a single year is that it does not necessarily represent average year demand by a community. For example, if tanks had been drawn down because of a cold winter, or insufficient fuel delivered the previous season, then deliveries may be higher than usual. Conversely if there had been a mild winter, or tanks had been overstocked the previous season, then deliveries would be lower than normal.

Based on proposed total delivery quantities for 2012 of 179,015m³ for the Eastern Arctic (from the RFP), plus Mariport estimates for the Kitikmeot region or 27,000m³, total demand for Nunavut would be 206,015m³ versus an all-community total of 207,600m³ from Table 5.

RFP is not clear whether the 2012 volumes given include or exclude Qilliq Energy; it is Mariport's belief that up to 40,000m³ of diesel needs to be added to the total for 2012 power generation.

TABLE 5
ESTIMATED 2010 NUNAVUT PETROLEUM PRODUCT DEMAND m³

COMMUNITY SERVED	Diesel	Jet A1	Gasoline
AREA – HIGH ARCTIC			
1. Arctic Bay	4,000	1,000	600
2. Qikiqtarjuaq (Broughton Island)	2,500	300	300
3. Clyde River	4,500	nd	350
4. Grise Fjord	1,500	100	150
5. Kugaaruk (Pelly Bay)	3,500	1,200	350
6. Pond Inlet	7,500	2,000	750
7. Resolute Bay	4,500	2,500	450
TOTAL	28,000	7,100	2,950
AREA B – FOXE BASIN			
1. Igloolik	6,000	1,200	700
2. Hall Beach	4,500	1,600	400
3. Repulse Bay	2,000	nd	300
TOTAL	12,500	2,800	1,700
AREA C – IQALUIT			
TOTAL	31,000	23,000	5,000
AREA D – SOUTH BAFFIN			
1. Cape Dorset	5,000	500	300
2. Kimmirut (Lake Harbour)	2,000	nd	350
3. Pangnirtung	6,500	1,500	1,100
TOTAL	13,500	2,000	1,750
AREA E – KIVALLIQ			
1. Baker Lake	9,000	nd	1,500
2. Chesterfield Inlet	2,000	nd	300
3. Rankin Inlet	11,000	6,200	2,000
4. Whale Cove	2,000	nd	200
5. Arviat	6,000	nd	1,000
6. Coral Harbour	3,500	600	300
7. Sanikiluaq (Belcher Islands)	3,500	nd	200
TOTAL all KIVALLIQ	37,000	6,800	5,500
AREA G - KITIKMEOT			
Cambridge Bay	7,000	1,900	1,100
Kugluktuk (Coppermine)	5,000	1,000	1,000
Gjoa Haven	5,000	800	600
Taloyoak (Spence Bay)	2,500	800	300
Umingmaktok	0	0	0
Bathurst Inlet	0	0	0
TOTAL	19,500	4,500	3,000
TOTAL ALL COMMUNITIES	141,500	46,200	19,900

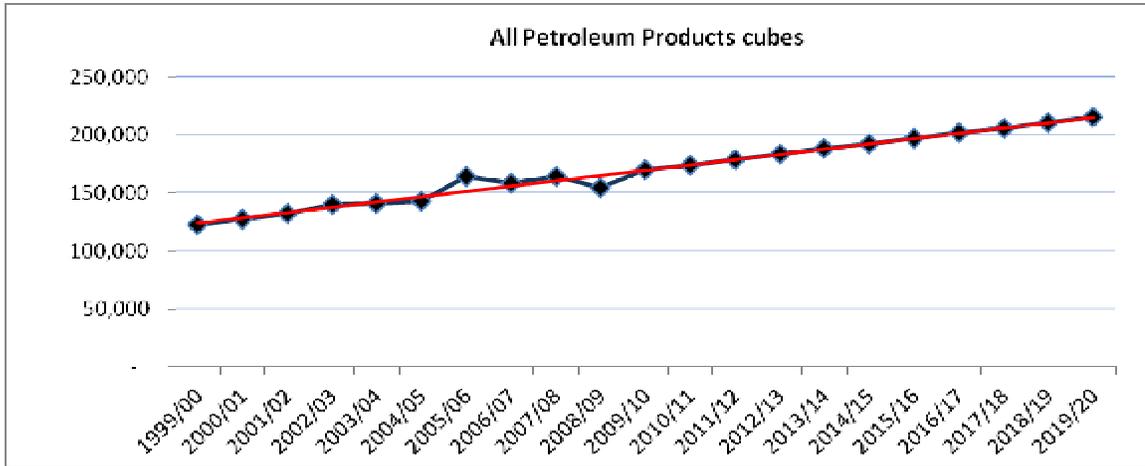
Petroleum Product Re-supply is not organised in the same way as Dry Cargo. However, for comparison purposes, the same community layout has been used.

Diesel includes quantities for community use and Qilliq Energy for power generation.

Estimates by Mariport based on 2008/09 Community data and 2006/07 Qilliq Energy data

The following chart suggests the growth in volume of POL needs for Nunavut. This trend excludes demand for Nunavut Power (Qilliq Energy). However, the current

FIGURE 2 DEMAND TREND FOR NUNAVUT PETROLEUM PRODUCTS
Excludes demand for Power Generation⁶



Based on the trend line forecast in Figure 2 above, community consumption by 2020 is expected to be in the order of 260,000m³, including an allowance for power generation requirements. Assuming that overall demand continues to grow at historic rates, then demand by 2030 would be in the order of 340,000m³, again including an allowance for power generation.

Separating out the Western Arctic, i.e. the Kitikmeot region, then current community demand, from Table 5, is 27,000m³. Using population growth as the driver for POL demand suggests that demand by 2020 would be about 32,000m³ and 37,000m³ by 2030. The balance of demand in the Eastern Arctic in 2020 and 2030 would be 228,000m³ and 303,000m³ respectively.

NWT Communities

We have no good basis for predicting current or future demand for the three NWT coastal communities, or the Delta region⁷. We understand that Imperial Oil provides product to Inuvik and Aklavik, and that at least some Jet A1 is contracted by Public Works and Government Services Canada for Inuvik, they also contract POL for delivery to North Warning Stations in the Western Arctic.

Based on in-house data from previous years, the three coastal communities⁸ may have a demand of 5-6,000m³ as of 2010, and presuming a stable population, demand will not change by much, and could be in the 6-7,000m³ range by 2020. Demand by 2030 probably would not exceed 10,000m³. We do not have a basis for providing an estimate for the Delta communities.

⁶ Base data from Mariport files, believed to exclude diesel for power generation

⁷ Tuktoyaktuk, Aklavik, Inuvik, Fort McPherson, Tsiighetchic

⁸ Sachs Harbour, Ulukhaktok, Paulatuk

Nunavik Communities

Based on comments from the Operations Manager of PetroNav at the spring 2010 CMAC Northern⁹, demand in 2009 was probably in the order of 54,000m³. PetroNav has the contract to serve Nunavik communities (currently managed by Shell). Nunavik does not have the same kind of Jet A1 demand that Nunavut has in Iqaluit, and only has a single hub in Kuujjuaq.

At 54,000m³, demand is very similar to the Kivalliq region of Nunavut, which has a single hub airport – Rankin Inlet – but a significantly smaller population. 2010 estimated demand for the Kivalliq is 49,300m³; the GN RFP figure for 2012 is 56,000m³. Based on population growth and the figure derived in the first paragraph above, demand in 2020 would probably be in the range 60-70,000m³. Demand to 2030 may be in the order of 70-80,000m³.

Labrador

We have no data on demand for Nain, but based on communities of similar size in Nunavut, we expect POL demand to be in the order of 3,000m³ annually. As we do not expect population to grow, this demand will remain the same through 2020 and 2030.

Moving Dry Goods to the Communities

The primary carriers for dry cargo shipments to Nunavut and Nunavik are the Quebec based shipping companies Nunavut Eastern Arctic Shipping (NEAS) and Nunavut Sealink and Supply Inc. (NSSI). NEAS is a joint venture between Logistec and Northern Stores, while NSSI is a joint venture between Desgagnes Transarctik and the regional Co-Ops. The fleet is given in the table below:

All the ships carry tugs and barges as part of their deck cargo to handle lighterage of cargo from ship to shore. Cargo is delivered to the high water mark.

Figure 3 Cargo discharge on a good day



Photograph of mv *Anna Desgagnes* from NSSI Web site

⁹ The quantity noted was 68,000m³, but included one ship load of fuel to Deception Bay for Xstrata. We have deducted 14,000m³, 95% of the capacity of the *Maria Desgagnes*, which made the call.

Figure 4 Sometimes weather conditions are not cooperative for discharge



Photograph from NEAS presentation at CMAC Northern

Fleet Capacity – Dry Cargo

The dry cargo ships, typically, have a 150-day operating season extending from the third week in June when ships start loading to the third week in November when cold and darkness makes it difficult to handle lighterage activities.

NEAS vessels have been found to operate on a 50-day rotation while NSSI operate on 40-day rotations¹⁰. Both carriers integrate Nunavik calls with calls in Nunavut, managing tide, ice and weather by jumping between communities to make the best of operating conditions. This means that, technically, NEAS has the ability to move 150-160,000m³ each season after allowing for broken stowage, and space occupied by lighterage equipment. NSSI, on the same basis has the capacity to handle 320-370,000m³ depending on how its ships are deployed. These ships are also used to handle project cargo for mining operators, thus depending on the level of activity there may be a need to charter in support equipment. NSSI has done this in previous seasons, but the addition of a further vessel to the fleet in 2012, the *Claude A Desgagnes*, will diminish that need.

¹⁰ Mariport analysis of 2008 shipping season.

TABLE 6 – THE ARCTIC DRY CARGO FLEET¹¹

Owner	Ship Name	Ice Class	Built	Dwt	Cubic Capacity	Draft @ full load	Container Capacity	Lift Capacity
NEAS	Aivik	BV III	1980	4,860	12,500	5.92m	280	2x155t
	Avataq	LR 1	1989	9,587	16,500	8.54m	567	2x50t
	Qamutik	LR1	1994	12,754	20,000	8.52m	730	3x60t
	Umiavut	LR1	1988	9,587	16,500	8.51m	567	3x50t
NSSI¹²	Anna Desgagnes	BV 1	1986	17,850	25,000	10.00m	553	Up to 125t
	Camilla Desgagnes	LR1A*	1982	7,340	20,000	6.86m	399	1x45t
	Rosaire A Desgagnes	LR1A	2007	12,744	20,000	8.00m	665	2x120t
	Sedna Desgagnes	LR1A	2009	12744	20,000	8.00m	665	2x180t
	Zelada Desgagnes	LR1A	2009	12,744	20,000	8.00m	665	2x180t

Ice class: BV = Bureau Veritas, LR = Lloyds Register. LR1A*: 1A Super, the highest Baltic ice class.

Moving Petroleum Products to the Communities

Tankers most commonly used in Arctic re-supply are given in Table 7, following. Woodward currently has a contract with the Government of Nunavut to re-supply the Kitikmeot region as well as the Eastern Arctic. PetroNav has a contract to re-supply Nunavik. Both companies have other contracts with mines; Petronav with Xstrata at Deception Bay and Baffinland at Milne Inlet. Woodward re-supply Agnico Eagle at Baker Lake using international flag tankers as far as Helicopter Island and then tranship to one of their smaller tankers to run through Chesterfield Narrows to Baker Lake.

PetroNav has other vessels in its fleet that are ice capable and could be used for Arctic re-supply. Algoma Tankers also has a number of ice capable vessels, but has not been involved in Arctic re-supply.

¹¹ Because there is no winter business, most of these ships are flagged out into international trade between mid November and end June.

¹² Desgagnes added another ex Beluga F Class ship to their fleet on 20th July 2012, the *Claude A Desgagnes*

TABLE 7– THE ARCTIC TANKER FLEET¹³ (vessels commonly used)

Owner	Ship Name	Ice Class	Built	Dwt	Cubic Capacity	Draft @ full load	Tanks
Woodward	Alsterstern	LR1A	1994	16,436	19,295	8.6	6
	Dorsch	LR1A	1980	10,556	12,372	8.31	20
	Havelstern	LR1A	1994	16,810	19,295	8.6	6
	Mokami	LR1A*	1989	2,853	3,230	4.9	
	Nanny	LR1A	1993	9,069	10,721	7.8	10
	Tuvaq	LR1A*	1977	16,420	16,000	9.5	nd
Petronav	Jana ¹⁴ Desgagnes	LR1A	1993	10,345	10,596	8.4	8
	Maria Desgagnes	LR1A	1994	12,991	14,866	9.0	10

LR1A* is 1A Super, the highest Baltic ice class.

Fleet Capacity – Petroleum Products

A major influence in POL capacity is the source refinery for the different products. These are not standard specification fuels, and may need special refinery runs and/or significant additives to counter temperature effects, low humidity and long-term storage in adverse conditions. Product has been lifted in the past from refineries in the US Eastern and Gulf Seaboards as well as Europe. Lately, product for the Eastern Arctic has come from the Come-by-Chance, while Shell has shipped from its Montreal refinery to Nunavik. In 2010, three of Woodward’s tankers averaged about 40 days per voyage, loading out of Newfoundland. The *Maria Desgagnes* achieved the same port rotation of 40 days on voyages out of Montreal, but on shorter routes to Nunavik, while the *Jana Desgagnes* averaged 30 days on similar voyages.

The Woodward fleet probably has a capacity of 275-300,000m³, while the PetroNav fleet has significant additional capacity if more vessels are brought into Arctic service. If US or European refineries are tapped for product, then non-Canadian flag ships can be used (and were in previous years), reducing the demand for Canadian tankers.

Total community demand for petroleum products by 2020 in Nunavut and Nunavik, including an allowance for power generation, is estimated to be in the range 285-300,000m³, at the high end. Projected demand is well within the capability of the existing tanker fleet, although the age of the Woodward fleet would be of concern, with three ships 40 years old. Looking to 2030, demand for community support is estimated to be in the range 375 – 400,000m³; such demand and time frame would require reinvestment in the Canadian tanker fleet.

¹³ Because winter business is available, these ships remain in Canadian flag year round.

¹⁴ Two sister ships built 1992, identical characteristics

Ships providing service to the Labrador community of Nain are given in the following table.

TABLE 8 SHIPS SERVING NAIN

Ship Names and Type	Dwt	LOA m	Draft m	Built
<i>Northern Ranger</i> ¹⁵ Pass./freight	?	72	4.25	1986
<i>Astron</i> Freight	1,910	82	4.79	1971
<i>Mokami</i> Tanker	2,853	97	4.9	1989

3.2 MINING

The Canadian Arctic only has two operating marine-served mines at present. One is the Meadowbank operation of Agnico-Eagle, 60km west of Baker Lake in the Kivalliq region. The other is Xstrata Nickel that ships through Deception Bay in Nunavik. The VBN mine in Labrador is at 56°N, and is well south of the Arctic, however, seasonal ice conditions require ice breaking vessels for extended season service.

All other projects are at various stages of development and the following provides the most recent information available to Mariport, together with best estimates as to development prospects, support requirements and, where appropriate, outbound quantities of product.

Operating Mines

- **Meadowbank – Nunavut** The mine is owned and operated by Agnico-Eagle and is 70km north of Baker Lake.

Logistics support activities are contracted to Desgagnes Transarctik and involve four full shiploads of cargo using one of Desgagnes Beluga F series¹⁶ heavy lift vessels plus two barge loads of cargo using Atlantic Towing’s Arctic class barges. All of this cargo is loaded at Becancour and delivered to Baker Lake. The barges are able to go direct, tide permitting, through Chesterfield Narrows. The ship is offloaded from anchor at Helicopter Island to one of the barges and cargo is then lightered to Baker Lake.

Petroleum products are managed by Woodward who source fuel (mainly diesel) offshore, bringing a tanker of about 40,000dwt into the Helicopter Island anchorage, where cargo is then transhipped using one of their smaller tankers. Outbound gold is shipped by air as cargo in inbound mine supply aircraft.

The mine is operating at an enhanced milling rate as a means of offsetting poorer gold grades than expected¹⁷, and as a result, it is expected that the ore reserve will be exhausted by 2017, rather than the original close date of 2020. Unless economically recoverable reserves are found to keep the mine operational, activity will cease at Baker Lake, but an equivalent shipping activity will

¹⁵ 131 passenger capacity. Freight capacity not known.

¹⁶ The *Rosaire A. Desgagnes* is an F240 type, the *Sedna* and *Zelada Desgagnes* are F360 types.

¹⁷ The mine reportedly made a loss in 2011 due to higher than expected operating costs and poorer grades than expected.

commence through Melvin Bay in support of the Meliadine deposit. It is presumed that Meadowbank will have closed by 2020, and Meliadine will be operational, with the same level of support activity.

- **Xstrata Nickel - Nunavik** The mine was originally developed by Falconbridge as the Raglan Deposit and is a rich nickel/cobalt/copper bearing ore body in the Smith Belt in Nunavik. Operation commenced in 1998 with an expected 30-year life. As milling rates have been raised considerably from the original 130,000tpa of concentrate production, the mine may close earlier. However, new resources are often identified, and the mine may operate for 30 years.

Xstrata have invested significantly in the operation that now ships 150,000tpa of nickel concentrate to Quebec City for raiiling to Sudbury for processing. Further upgrades are planned and the concentrates should enable the mine to ship about 180,000tpa commencing in 2016.

The mv *Arctic* has been the primary carrier for product southbound as well as some dry cargo and POL needs northbound¹⁸. Both NEAS and NSSI carry cargo for Xstrata into Deception Bay, but quantities are not known. Mariport estimates about 75,000m³ dry cargo in an average season. This may rise with increased milling.

It is not known whether milling rates would rise further, but for planning purposes, it will be assumed that the mine will remain operational to 2028, and that shipping quantities will be of a level to support the 180,000tpa milling rate. Thus for 2020, dry goods needs will be assumed at 85,000m³ and fuel at 40,000m³. It will be assumed that the mine has closed by 2030.

- *Voisey's Bay Nickel Mine – Labrador*

Figure 5 Map showing Location of Voisey's bay Nickel Mine



From VBN web site

This massive deposit was found, accidentally, in 1993 by two diamond prospectors and the rights were sold on, in 1996, to Inco who developed the deposit. Inco were acquired by Vale, a Brazilian miner, in 2006. Mining began in 2005, with the first nickel concentrate shipment in November 2005.

¹⁸ Reportedly the mv *Arctic* brings 5,000m³ ULSD each trip.

The deposit consists of several areas, the main resource being the “ovoid” which contains about 32m tonnes of ore grading 2.82%Ni, 1.54%Cu, .14% Co, and which is being mined by conventional open pit techniques. There are additional reserves, but these will require a move to underground mining.

Actual shipment levels, in terms of tonnes of concentrate, are not known, but the following information is available relative to contained metal:

Table 9 Metal Content of VBN Concentrate

	2010 ¹⁹	2011
Nickel (Ni)	48,300	69,000
Copper (Cu)	36,800	51,000
Cobalt (Co)	524	1,585

Concentrate is, apparently, produced in three grades:

Table 10 Concentrate Grades shipped from Edward’s Cove

	Nickel	Copper	
High grade	24%	.5%	Shipped to Canada via Quebec for processing
Middle grade	14-16%	4-6%	
Export grade	.5%	30%	Shipped offshore

Based on a Vale document that implies average Ni grades in Canadian shipped concentrate of 20%, the probable 2011concentrate movement in domestic trade would be 345,000 tonnes. Based on copper concentrate values, offshore shipments were probably 170,000 tonnes. It should be noted that actual volumes shipped will vary somewhat depending on moisture content.

These volumes fit reasonably well with indications from planning documents for the mine of about 400,000tpa of nickel concentrate and 150,000tpa of copper concentrate to offshore refineries.

The ovoid has an estimated life of 14 years and will be exhausted by 2019. However, overall mine life is estimated at 20-30 years, based on known and inferred reserves. Thus the mine might be expected to close in the 2025-2035 range.

Information regarding inbound logistics and fuel is sparse, except that all supplies are containerized and backhauled in the concentrate vessels(s), which also bring in fuel requirements at 5,000 tonnes/voyage. There is a suggestion that 20 voyages²⁰ would be needed to meet fuel needs, but in 2006 it was reported that the mine used 30,000m³ diesel and 35m³ gasoline.

Mine shipments are subject to a protocol agreed with the local Innu so that shipping minimized impact on their use of the ice for travel when hunting and fishing, as well as not interfering with seal breeding. Although the deposit and

¹⁹ Shipments during 2010 would be atypical because of the strike that began August 2009 and did not finish until January 2011.

²⁰ We believe this number of trips, at 5,000 tonnes/trip to be high. The 2006 POL volumes appear realistic and we would not expect more than 50-60,000m³ POL demand at current milling rates.

mine is referred to as Voisey’s Bay, shipping is actually to and from Edward’s Cove. See below for dates:

During the Jan22-Apr 06 period, ship tracks are marked with poles, and pontoon bridges are provided at two locations. Locals can call to check whether crossings are safe, or unsafe, at different locations. Information on vessel arrivals and transit dates is posted on the mine website and the crossing locations have an indicator as to safe or unsafe to cross.

Table 11 Calendar for VBN²¹ Shipments

May 22-Dec 06	Nickel, copper, other shipments
Dec 07-Jan 21	No shipping
Jan 22-Apr 06	4 nickel shipments only
Apr 07-May 21	No shipping

As part of the development agreement with the Province, Inco agreed to build a processing plant in Newfoundland for the nickel. A small-scale plant (1:100 scale) was established at Argentia to demonstrate a hydromet process for converting the nickel concentrate into nickel and cobalt metal. This plant ran from October 2005-June 2008. Construction of the full scale hydromet plant began at Long Harbour in 2009 with completion scheduled for February 2013. At this point, shipments of nickel concentrate to Quebec will cease and all product will move to Long Harbour.

Shipping Activity 2010

Because of the strike that began in August 2009 and did not end until January 2011, shipping activities during 2010 would not be representative of normal operations. Mariport did identify seven voyages of the *Umiak 1* which probably accounts for the nickel activity. Mariport identified three additional Fednav vessels that called. Vessel tracking may have missed one voyage of the *Umiak 1* and probably one additional vessel calling for copper concentrate. Normal activity, based on estimated shipment levels, would be 12-14 calls by the *Umiak 1* and 5-6 calls by other vessels for copper concentrate.

In 2011, Mariport recorded ship calls at Edward’s Cove shown in Table 12 following. The *Umiak 1* appeared to make 12 calls at Voisey’s Bay. The *Federal Pioneer* and *Power* may have brought logistics for mine operations and expansion into underground operations, as well as taking concentrate outbound. The other vessels would have ballasted inbound.

²¹ As part of the land use agreement, no fuel is to be shipped when landfast ice is present. Dates are not given, but presumed to be Dec 06-May 21.

Table 12 Vessels Calling at Edward’s Cove in 2011

	Dwt	Ice Class
Federal Elbe	37,038	1C
Federal Leda	37,038	1C
Federal Pioneer ²²	17,450	1A
Federal Power	17,451	1A
Federal Weser	37,038	1C
Neptune Pioneer	55,921	- nd -
Umiak 1	31,992	AC4

Shipping Activity to 2020

We do not expect material changes in milling rates and thus ship calls would continue to be 5-6 per year for copper concentrate and 12-14 visits by the *Umiak 1*. No other traffic is expected, based on past experience.

Shipping Activity to 2030

It is possible that the mine may close around 2025, if additional reserves containing an economic grade of product are not found. If the mine continues in operation, then current traffic levels would be maintained.

Mines in Development

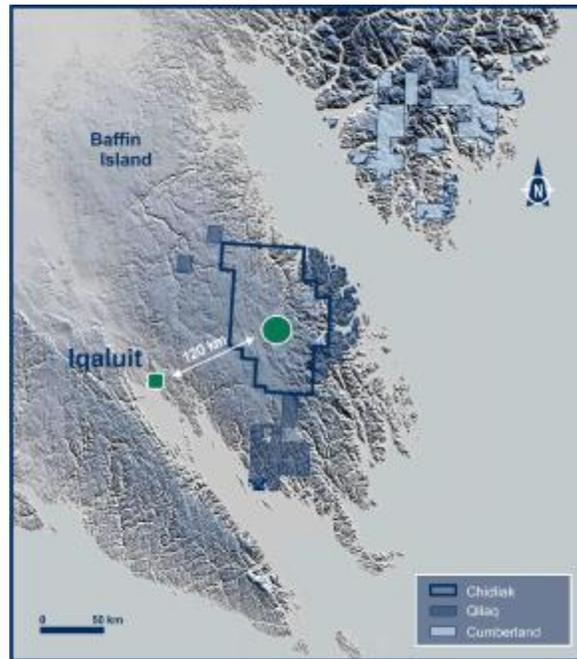
Nunavut

- ***Chidliak Diamond Prospect.*** Peregrine Diamond Mines is prospecting in Baffin Island, and the Chidliak prospect is their most advanced exploration area. The company recently purchased the 51% that BHP owned for \$9m plus a 2% royalty. They are planning to spend about \$10m on advanced exploration in 2012, in preparation for bulk sampling during the 2013 season. Re-supply is through Iqaluit, and a drill rig is being shipped in for transfer to the site. See the map on the following page for prospect location relative to Iqaluit.

With environmental and related reviews, it is most unlikely that the mine would be operational by 2020, even if the prospect proved to be economically recoverable. Support would continue through Iqaluit. If the diamond mine appears viable, then it could be operational by 2030, but it is unlikely that Peregrine could manage it without a major mining, or diamond partner. They would also likely seek a landing site on Cumberland Sound to support the operation. It is assumed that the mine will be operational by 2030. Logistics needs and fuel may be in the order of 15,000tonnes and 50,000m³. See Annex 5.4 for the derivation of these numbers.

²² No longer in Fednav’s fleet list.

Figure 6 – Peregrine Diamonds Chidliak Project



Mine location from Peregrine Diamond's web site

- **Meliadine Mine** This is a gold mine of equivalent size to Meadowbank and is owned by Agnico-Eagle. It is 24km north east of Rankin Inlet and NIRB approval has recently been obtained to build a 24km all-weather access road. Construction is expected to be completed by 2013 and will involve three bridges. Cost estimate is \$21m.

Agnico - Eagle expects to start production by 2016/17. Similar logistics and POL demand can be expected to the Meliadine property and this will be shipped in through Melvin Bay and Access Passage. It is possible that a dock will be built to handle the ship/shore interface, although lighterage activities would be a considerable improvement on those for Meadowbank. Mine life is estimated at 10 years.

It is assumed that Agnico - Eagle will transfer operations from Meadowbank to Meliadine prior to 2020, but the mine will close about 2027 due to resource depletion.

- **Kiggavik Mine** France's AREVA is developing this uranium mine which is west of Baker Lake between Schultz and Princess Mary Lake, approximately 80 km west of Baker Lake. See the map on the following page. As with a gold mine, product (in this case yellow cake) would be shipped out by air while mine logistics and POL would be brought in by ship.

AREVA have stated that the earliest date for a decision is 2015 with start up by 2017. This may slip as their draft EIS to NIRB was rejected and a revised version was only submitted in April 2012. Re-supply needs depend on mining intensity

and also whether AREVA elect to ship sulphuric acid from the south or manufacture on site.

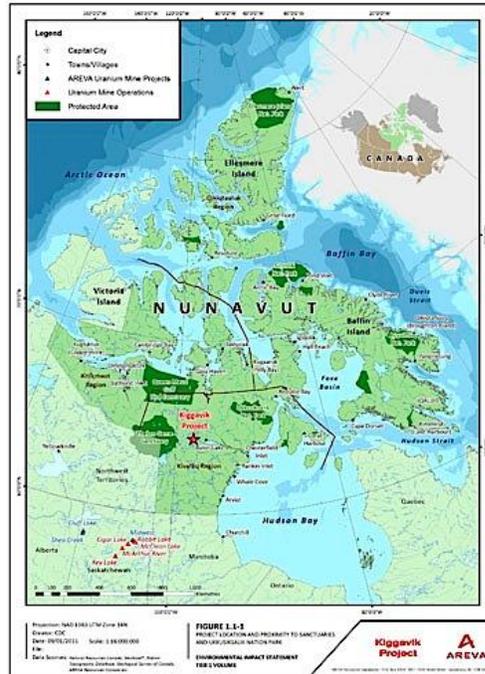
Mine life depends on the production rate. AREVA have given a production rate range of 2,000 to 4,000tpa, which translates to a mine life of 13 –25 years. Assuming start up is achieved in 2017, the mine would close within the range 2030 to 2042.

Indicative supply volumes are not known, but early work²³ (mid 1980's) suggested the following quantities:

Sulphuric Acid	10-15,000tpa
Fuel	8-10,000tpa
Logistics	5-7,000tpa

If sulphur were to be shipped to an onsite acid plant, then the acid would be substituted by 3-5,000tpa of dry sulphur. We will presume that this is for the lowest production rate, with double the quantities for the higher rate. The fuel and logistics needs from the reference appear to be on the low side compared with other projects. We will assume that the mine is in a start up period by 2020, operating at 2,000tpa yellow cake output, consuming 20,000m³ POL, and two shiploads of logistics material each season. By 2030, we will assume that the milling rate is at the high end, with 40,000m³ POL and three shiploads of dry goods.

Figure 7 – AREVA’s Uranium Project at Kiggavik



Map from AREVA web site regarding the mine site

²³ Report in Mariport’s files *Lone Gull Transport and Environmental Study*, February 1986, Acres International Ltd. on behalf of Urangesellschaft Canada Ltd.

- **Mary River** While the deposit has been known since the 1960's, it has taken until the current period for iron ore prices to reach a level where there is a sufficient margin to consider developing a mine. The resource is unusual for Canadian iron ore, in that unlike ore in the Labrador Trough it has a high iron content (65%), and can be shipped as run of mine, rather than needing to be upgraded.

The ore deposit is, however, remote from the coast, and the preferred shipping approach has been a rail line to a port at Steensby Inlet in Foxe Basin. Currently all support is through Milne Inlet in Eclipse Sound. A test shipment of 113,217 tonnes of ore was moved through Milne Inlet in 2008 to European steel mills. It is expected that mine support will continue to be through a dock here.

The project has been moving through the permitting process and NIRB have ruled, as of February 2012, that the EIS complies with guidelines. There are several additional steps and Nunavik has filed a protest that shipping through Hudson Strait needs to be assessed through their own environmental process. The shipping route (see Fig 7 following), keeps to the Nunavut shore and thus their protest could feasibly be rejected.

Timing is not propitious for an early go-ahead for the mine as there are a number of outside influences that would affect the decision:

1. The steel industry is facing a rough period at present with the outlook in Europe being particularly grim. ArcelorMittal closed a steel plant in Belgium and one in France recently and has been idling other operations.
2. The poor industry outlook is reflected in ArcelorMittal's stock price which has fallen to \$15.52 from a high of \$35.32 a year ago.
3. The company is already committed to a major expansion of concentrator facilities for their owned Quebec Cartier Mine. Investment will be about \$1.2bn.
4. The company is investing \$1.4bn in expansion of a mine in Liberia, with the bulk of the funding needed in the 2012-2015 period.

Figure 8 – Proposed Shipping Route from Steensby Inlet



Mary River Shipping Route from Nunatsiak News

Investment for the mine in Baffin Island would be in the order of \$4bn, of which the railway to Steensby Inlet is about \$1.5bn, and the earliest all approvals would be obtained would be end 2012. The build out time for the mine is estimated at 3-4 years, thus the earliest the mine could be on line is 2015, although there is a possibility they would ship some ore on a seasonal basis through Milne Inlet, where a port to support construction activities would be built.

In early 2012, the company announced that they would step back from a planned “pre-production” activity ramp up because of opposition by various parties and issues with over wintering fuel at Steensby Inlet.

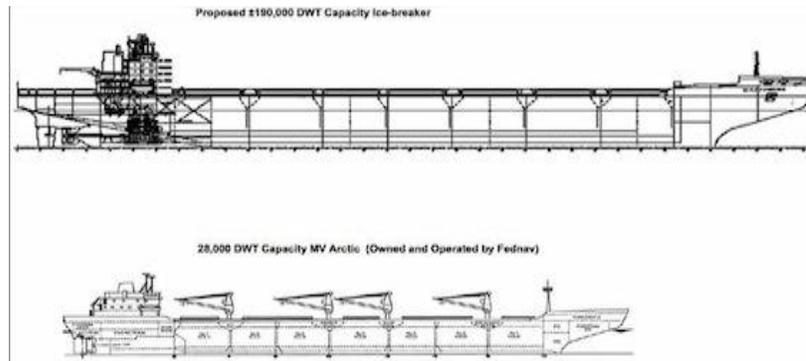
Planned shipping is in the range 18-21 mtpa over a 20-25 year mine life. Ship sizes are shown at 185,000dwt with operation on a year-round basis. No information is available on mine logistics and POL consumption. It is likely that the mine would bring some of its logistics needs, and potentially all of its fuel from offshore locations, with only small amounts sourced in southern Canada. This was how the Polaris and Breakwater (Nanisivik) mines operated during the time they were in production from the early 1980’s to closure 20 years later.

Technical details for the ships, as provided by Fednav, are as follows:

LOA	330m
Beam	50m
Depth	27m
Draft	20m
Speed	14.5kts in open water, 7kts in 1-2m level ice; 3kts in 2.0m level ice
Cargo DWT	185,000 tonnes
DWT	200,000 tonnes
Power	2 x 31,000kw.

It has not been made clear whether the ships would be straight ore carriers or would be OBO's, (ore/bulk/ore) like the mv *Arctic*.

Figure 9 - Profile of Proposed Ships for Mary River



Ship profile compared with the mv *Arctic*

Proportions have been corrected from the original image carried in Nunatsiaq News

Based on 18m tpa shipping rate, and the ships indicated, suggests that there would be two loaded trips each week needed to fulfil demand. This would mean four vessel trips (two inbound and two outbound) or one transit every 1.75 days. This timing fits with indications from Fednav, which suggests that the ships would not be OBO's as this would reduce productivity and require additional investment at Steensby to provide treatment for slops.

Our expectations are that the mine may be in a preproduction phase by 2020, shipping about 2m tpa²⁴ via Milne Inlet using market vessels on a seasonal basis. Vessel size would not likely exceed Panamax, with part load at the re-supply dock and top off in the bay. Based on the discussion in Annex 5.4, we would expect fuel requirements to meet the posited 2020 activity to be 30,000m³ per annum, with dry cargo support of two to three vessels on a seasonal basis. As the mine would still be in a build out phase, additional dry cargo activity would be involved (rail line construction etc), as well as operational fuel for this activity. We would expect an additional two to three ships each season to Steensby Inlet with construction supplies, plus an additional 10,000m³ fuel.

By 2030, we would expect the mine to be in full operation, with 18m tpa ore being shipped via Steensby Inlet. Fuel requirements are estimated (see Annex 5.4) at 50,000m³ pa POL²⁵ and five monthly dry cargo shipments via Milne Inlet.

- **Roche Bay Iron Ore** This is a magnetite project on the Melville Peninsula with ready access to tidewater near Hall Beach. While the project has been in exploration for many years, it still seems to be some way from production,

²⁴ There have been suggestions of 3-5m tpa, but the open zone season for Pond Inlet for a Type B vessel is only 69 days, with little variation either at start or end of season; the variation would only add 22 days. This is felt to be too short a season to enable ships to be loaded and dispatched to meet more than a 2m tpa volume. Pond Inlet is one of the very few locations where climate change has had almost no impact on seasonality of access.

²⁵ Information has not been provided as to whether POL would be imported through Milne or Steensby Inlet. Indications are that the re-supply dock for dry cargo would be at Milne Inlet.

although a Chinese company – XinXing Ductile Iron Pipes indicated that they could put \$1bn into the project. While it is a major deposit, it is relatively low grade. The product can be readily upgraded using a dry milling process to about 70% Fe, and there has been some discussion about establishing a briquetting operation (this would produce a 95% Fe product for direct charging to furnaces). There have been no recent announcements as to progress.

Given the above, and the need to go through the permitting process, it is unlikely that the mine would be operational by 2020. Investment needs are not known, but unlike the Mary River project the mine would not need a railroad to deliver ore to a port site; this would reduce investment needs significantly.

It is entirely possible that the mine could be operational at a low level of throughput (under 10m tpa) within the 2030 timeframe. If this were the case, we would suggest that about 40,000m³ POL and two to three shiploads of dry cargo supplies each season would be needed. Similar ships to Mary River would be needed, and at 10m tpa, some 54 calls per year would be needed. If the concentrate was briquetted, then the equivalent annual quantity would be about 7.5m and smaller ships might be used, possibly Panamax types. This would increase ship transits to 125 per annum. This would increase POL needs, although dry cargo shipments would probably remain the same.

- **Hackett River** This zinc/silver prospect was sold by Sabina Gold and Silver to Xstrata in 2011. However, there has been no information from Xstrata since June 2011 and development details are unknown at this time.

Without indications from the company as to their intentions regarding the prospect, it is difficult to assess whether the resource would be developed, or simply banked. The resource is reasonable in terms of grades, 4.5-4.7% and contains significant silver, gold and copper. Zinc prices, although off from historic highs have recovered well and maintained a level close to \$1,000/lb. See chart below.

Xstrata does have good experience with the Raglan project in Nunavik, so may have reasonable confidence in developing the mine. However, going ahead may depend on BIPAR²⁶, and if Sabine move ahead with a limited version of it, Xstrata may find it worthwhile to tie in their project. Given the uncertainties and permitting, there is little likelihood of the project moving ahead before 2020, but high probability by 2030.

We would expect inputs and outputs to be in line with current activity at Xstrata Nickel in Deception Bay; 20,000m³ POL and a similar quantity of dry cargo support.

²⁶ Bathurst Inlet Port and Road project. See discussion on the following page under Sabina Gold and Silver

Figure 10 Zinc Spot Prices per Lb
5 Year Zinc Spot



- **Hope Bay** Newmont's Hope Bay mine was unexpectedly put on hold at the beginning of 2012. The gold mine is in the late stages of development with milling machinery reportedly booked for shipment from South Africa, Philadelphia and Becancour for delivery during the 2012 season. Prefabricated mine accommodation was reportedly in place in the Vancouver area, again with shipment planned during 2012 for start up during 2013.

Figure 11 – Hope Bay Camp Site and Port at Robert's Bay



Photo from Northern News Services February 6, 2012

Newmont is reported to have spent \$2.1bn to get the mine this far, although there were also reports that this cost had been far higher than budgeted and may have adversely affected expected profitability. The Nunatsiq News, in a report on 16th January 2012, suggested that the Kitikmeot Inuit Association (KIA), which was in negotiation over land tenure and other issues for Phase 2 expansion of the mine, may have asked too much. The KIA has benefitted from about \$60m/year in contracts and related income from the mine during its development.

Expected shipping needs were 15,000m³ ULSD, 1-1,500M³ Jet A1 and 25,000m³ each season from Becancour. Recent fuel needs were largely met from a shipment (quantity not known) delivered in a tanker that was lightered off Tuktoyaktuk, and a further tanker load of 20,000m³ frozen in over the 2010/11 winter and transferred to tankage during 2011. Some top up was understood to have been bid during the 2011 season.

Although Newmont have indicated questions regarding the mineralization and location of the gold seam as an issue, we find it hard to understand how a project could have moved this far into the development process with such a fundamental flaw in the planning. However, other Newmont projects also have issues; for example, their \$4.8bn Conga gold project in Peru has serious local opposition to its development.

We would expect the mine to be operational by 2020, although possibly not owned by Newmont. The mine would probably move to a phase 2 milling rate before 2030, with double POL and dry cargo inputs.

- ***Sabina Gold and Silver*** Sabina is moving ahead with its Back River gold property, although they retain a royalty interest in the silver component of the Hackett River property.

In moving the project forward they have acquired all intellectual property and rights associated with the Bathurst Inlet Port and Road project (BIPAR) that was originally conceived as a solution to development bottlenecks associated with Izok and High Lake. BIPAR may also facilitate development of Hackett River. Other operations that could benefit are the Lupin²⁷ and Ulu gold properties, which were recently acquired by Elgin Mining from MMG Canada. Elgin expect to re-supply from the south, but BIPAR could materially affect the economics of these properties.

Given the permitting process that is still needed, we would not expect Sabina to be operational by 2020. It should be operational by 2030, with inputs similar to Hope Bay at 2020.

- ***Izok Lake*** The Izok, High Lake, Gondor and Hood copper/lead/zinc²⁸ prospects are now owned by Chinese controlled Mineral and Metals Group. A pre-feasibility study was undertaken in 2011, but a full feasibility study will not likely be completed before 2013, and best-case development appears to be not before 2020.

The key constraint is proximity to tidewater and the BIPAR project was conceived to help the mine get around the problems of direct access to the Coronation Gulf, which needs a 350km road. However, BIPAR did not link Izok and High Lake and has been rejected by the new owners as a solution to their

²⁷ Lupin was operational between 1985 and 2005, when it closed due to low gold prices. Ulu is an advanced exploration project with good prospects. The area was actively explored between 1986 and 2006. Both operations have extensive infrastructure in place and Lupin could be brought into operation relatively quickly.

²⁸ There is also significant silver and gold in some of the deposits.

logistics issues. The company is going ahead with a plan developed by Wolfden Resources, the last Canadian owner of the two properties, which was to build a mill at Izok Lake, a port at Grays Bay and mine both deposits at the same time. Mine life is given as 20 years, but there have been no indications as to a potential start date. Production would be most unlikely prior to 2020, but is feasible by 2030.

No details have been given relative to shipping, but earlier concepts developed by Minnova involved seasonal shipping in the range of 300-400,000tp of Zinc/Copper/ Lead concentrates using 50,000dwt vessels, possibly with transshipment in Nuuk, Greenland. Information on MMG's web site suggests that production could be as high as 650,000tpa, at an ore milling rate of 2m tpa.

Thus by 2030, we would expect the operation to be consuming 30-50,000m³ POL and 75-100,000m³ dry cargo between the two output levels. Ships to serve the mine will be limited in size due to draft constraints both for Eastern and Western shipments. At 400,000tpa shipping level, eight shipments at 50,000tonnes would be needed; at the higher level, thirteen shipments would be needed. Ships would trade both east and west depending on markets, and location of toll smelters.

Northwest Territories

- ***Darnley Bay Resources*** As yet it is not known what mineralization creates the massive magnetic anomaly southwest of Paulatuk in NWT. The suggestion is that the area includes mineralization similar to the Sudbury area, i.e. nickel. This project is many years in the future and unlikely to be developed prior to 2020.

Nunavik

- ***Nunavik Nickel*** This property was originally developed by Canadian Royalties and is a major nickel deposit in the Smith Belt in Northern Quebec. Shipping would be via Deception Bay although over a different dock than that used by Xstrata Nickel.

Canadian Royalties was acquired by a joint venture of JilinJien Nickel Industry Co., through Jien Canada Mining and Goldbrook Ventures Inc. in January 2010. Goldbrook sold their 25% interest to Jien Canada in January 2012.

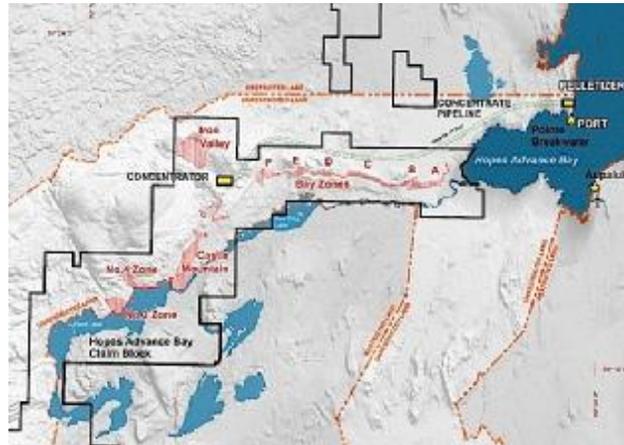
In 2010, \$122.4m was budgeted, with a plan to start mining in 2012 and shipping in 2013. Mine life indications are 18 years. However, problems developed with the proposed dock location and the site had to be moved 800m. A new EIS is needed and has not yet been approved, so the timetable will probably slip at least one year, if not two.

When operational, the mine will probably require the same kind of inputs in terms of dry cargo and POL as Xstrata Nickel's operation. It is entirely likely that the mine can still be in production by 2020 at a 120,000tpa concentrate level, with inputs similar to those for Xstrata as of 2010.

- ***Ungava Bay Iron Ore*** There are several iron ore projects in Quebec that have been spurred by Chinese demand and extraordinary iron ore prices. All of these projects are in the northern extension of the Labrador Trough. Some, like Lac

Otelnuk, may never get beyond promotion because of the need for extensive rail work to tie into Sept Iles or Port Cartier for shipping.

Figure 12 Ungava Bay Iron Ore Mine and Port Location



Map from Nunatsiaq News

Ungava Bay Iron Ore, although still a long way from development, may have better prospects because of its proximity to tidewater at Cape Hopes Advance. Originally the deposit was explored and drilled in the 1950's, and a mine reportedly operated for a time in the 1960's. The company has actively drilled the property in 2011, retained Fednav to look at shipping and is expecting a pre-feasibility report in September 2012. The ore is typical of Labrador trough grades at about 33% Fe, but can be readily concentrated to about 65% Fe making it similar to that shipped through the Quebec North Shore.

Figure 13 – Labrador Trough Location



Map from Ungava Iron Ore web site

The mine would not be operational by 2020, but there is a good possibility that it could be running by 2030 at around 10m tpa. If it is, then inputs would be expected (see Annex 5.4) at 50,000m³ pa POL and five monthly dry cargo shipments. As the ore would need concentration and shipment as pellets, more input would be needed, in terms of grinding balls and pellet production.

- *Plan Nord* Quebec’s recently announced Plan Nord will have an impact on Nunavik, but few details are publicly available. Consequently it is not possible to suggest what, if any, activity will occur by 2020 or 2030

3.3 OIL AND GAS

i) Oil Exploration and Development

Canada has not shipped crude oil from the Canadian Arctic since Panarctic shut in the Bent Horn field in 1996. The crude was light and of high quality; it was successfully tested in the Resolute Bay power station.

There has been comparatively little activity in the Beaufort – or other Arctic regions – since the Macondo blowout in 2010, and the ensuing review of safety requirements. Now new guidelines have been made available, Imperial and BP, who acquired properties in 2007 & 2008 respectively, are evaluating future exploration. Seismic work has been ongoing, but physical exploration now has an extended target range of 2019-2021.

Chevron has an interest in a Beaufort Sea parcel, with Statoil, that was awarded in 2010 and seismic work is scheduled for 3Q 2012. Future activity will depend on the seismic results. Currently there are no offshore drilling applications before the NEB and new applications may take some time to be developed as the oil companies feel that some of the new requirements are infeasible and need further negotiation.

In April 2012, Aboriginal Affairs and Northern Development Canada invited bids for six more Beaufort Sea parcels with a closing date of 6th September. In view of the uncertainty associated with the drilling process under the proposed new guidelines, it is difficult to say when any activity will occur. Currently, crude oil prices and prospects may also encourage companies to delay spending until late in the development window.

The following table gives a recent overview of possible activity within the study time frame. Note that at least some of this activity is dependent on the Mackenzie Gas Pipeline (MGP). Indicative support activities, from the same resource suggested that 2-3 ice breakers needed to be on site, and 2-3 supply ships per rig would be needed. It was also suggested that one supply vessel could be replaced by an on station “wareship.” One fuel tanker would be needed, but no size was given and no support volumes indicated.

TABLE 8 - SUMMARY OF OFFSHORE OIL & GAS ACTIVITY 2012-2027²⁹

Activity	Predicted Timing or Intensity
2D Seismic Surveys	- sporadic 1 or 2 per year
3D Seismic Surveys	- on each well a few years prior to drilling
Well site Seismic Surveys	- prior to spudding each well
Mackenzie Gas Project	- start-up 2018
Discovered Offshore Gas tie-ins to MGP	- first tie-in 2025, 1 or 2 per year after
Shallow Shelf Exploration Wells	- one or two per year starting in 2016
Deep Shelf and Slope Exploration Wells	- first well 2018, next wells 2021 and 2025
Shallow Shelf Oil Production	- first potential drilling/construction 2020

Despite the recent date of the reference from which Table 8 is drawn, it makes no reference to the impact of the Macondo blow out on timelines for Canadian Beaufort development, and does not refer to the extensions granted on existing licences. Also, no rationale is given for the start up of the MGP, despite low gas prices. The table will therefore be treated as a high case scenario for development.

In American waters, Shell will deploy the *Kulluk*, towed by their new icebreaking, anchor handling supply vessel *Aiviq* to the Alaskan Beaufort, while the drill ship *Noble Discoverer* will work in the Chukchi Sea. In addition, the *Klamath*, and oil spill response vessel, the *Arctic Challenger*, spill containment vessel and two ice class support vessels *Fennica* and *Nordica* are heading north. Actual deployment of the support vessels is not available.

In terms of support activity and volumes, information provided to Mariport regarding seismic activity indicated that POL demand was about 3,000m³ each season, with very little additional support needed. Working from the proposed fleet activity supporting drilling operations we will presume as follows:

2 ice class AHTS type (about 4,000dwt) for mud and POL deliveries and other supplies, seasonal support out of Tutoyaktuk with 20,000m³ materials. Other vessels as indicated from the Alaskan reports above.

ii) Gas Exploration and Development

The Mackenzie Gas Pipeline has dominated attention on gas prospects in the Canadian North, although it would have very little impact on Arctic shipping. A little reported project, that may have a much bigger influence, is that Kogas Canada (Kogas) acquired a 20% share in MGM Energy’s two Umiak wells in the Mackenzie Delta, North of Inuvik. Part of the purchase price was contingent on the development of the MGP, or any other project to commercialize production. Kogas officials visited Inuvik and Tuktoyaktuk in 2011 and suggested the company might develop an LNG facility at Cape Bathurst. Kogas also has a major investment with Encana, in British Columbia shale gas with potential export via an LNG plant at Kitimat.

²⁹ *Oil and Gas Exploration and Development Activity Forecast Canadian Beaufort Sea 2012-2027* for Beaufort Regional Environmental Assessment and Aboriginal Affairs and Northern Development Canada Lin Callow, LTLC Consulting in association with Salmo Consulting Inc. April 2012

The Mackenzie Gas Pipeline, although approved, may not proceed given the emergence of shale gas and the likely long-term depression of natural gas prices in North America. In early 2012, the five-member consortium announced funding cutbacks and closure or downsizing of regional offices. The consortium has until the end of 2013 to make a decision, but the opportunity to ship gas to the Far East via the Arctic may present an opportunity to salvage value from the gas fields.

If the MGP should go ahead, most materials would flow from the south, but gas-processing facilities could be prefabricated and shipped in by barge. As well, most of the fuel requirements and some logistics could be moved via Point Barrow³⁰

A more elegant solution to the MGP conundrum, although unlikely to meet serious consideration by the oil companies, is to build a Gas to Liquids (GTL) train at Point Bathurst and tap into the growing demand for petroleum products in the Arctic – and particularly in the Western Arctic.

The product slate can be readily “tuned” to the regional demand mix and the economics of such an operation would be very different from those of other market GTL operations. POL delivered into the Arctic is high cost, has to meet unique specifications for Arctic use and presents problems relative to sourcing and delivery. Such an operation could tie in very well with the BIPAR project and feed product from the north into the Slave Geologic Province offering the potential for reduced costs and supply surety. As one of the major operational costs for northern mines is ULSD, a regional supply point that offered even small savings could be of significant benefit.

Fuel demand in the Eastern and Western Arctic, as well as potential via BIPAR, was estimated at 500,000m³ pa³¹. Shipping product as a higher hydrocarbon, rather than LNG, also materially reduces transportation costs, given that two 25,000dwt tankers with, say, diesel can move as much energy as one 135,000m³ LNG tanker, and at a fraction of the cost.

3.4 CHURCHILL GRAIN

Canada’s Arctic port commenced life as a political child of Prairie (Manitoba and later Saskatchewan) and Dominion Government negotiations. The port has remained a political rather than a practical part of Canada’s port infrastructure, and exports through it have never achieved expectations.

There have been many reasons for this, including high insurance rates for vessels that make the trip to Churchill, an unwillingness of customers to fix vessels into unfamiliar territory and a reluctance of the Canadian Wheat Board to aggressively move into CIF sales rather than their preferred option of sales f.o.b. load port.

³⁰ 50,000 tonnes POL, 14,700 tonnes drilling equipment, 28,000 tonnes modules. From *Mackenzie Preliminary Risk Analysis, July 2006*, Mariport Group Ltd. for Transport Canada Marine Safety.

³¹ *Transportation Fuels for the Arctic*. Christopher Wright & Kobus Terblanche, POAC 2001, Ottawa.

When the port was first mooted in the 1880's, and through to when it was actually completed in 1929³², the focus of wheat shipment from Canada was the UK, specifically the port of Liverpool. To a large extent this focus continued until the introduction of the Common Agricultural Policy in Europe in 1967 and the eventual rise of European wheat production that effectively denied Canada (and the USA) an Atlantic wheat market.

The highest volume of grains shipped through the port was 728,000tonnes in 1977³³. More recently quantities have been around 500-600,000 tonnes significantly below capacity of 1.2m tpa. Recognizing the importance of the CWB to traffic at the port, the federal government recently announced a five-year, \$25m Churchill Port Utilization Program that will allocate up to \$5m pa. In 2012, grain handlers can get a \$9.00/tonne incentive for shipping eligible grains through the port.

A concept put forward some years ago, to develop business at the port, was the Arctic Bridge, see Figure 14 below. The proposal was to link the Russian port of Murmansk with the Prairie provinces via Churchill, based on the attractions of shorter shipping distances of 3,763nm versus 5,030nm via Thunder Bay. However, only one shipment took place in 2007. This was an inbound cargo of fertilizer from Russia, but despite expectations of growing Arctic Bridge trade, further business has not materialized.

Figure 14 Arctic Bridge Visualization



Image from <http://www.arcticbridge.com/>

Numbers of ships through the port vary depending on the quantity as is shown in the following table.

³² A token 1,800kg shipment of wheat was made in September 1929, but the first commercial shipments did not take place until 1931, when two shipments totalling 14,730 tonnes were successfully delivered to Liverpool.

³³ 710,000 tonnes Wheat plus 18,000 tonnes Barley

TABLE 13- CHURCHILL GRAIN EXPORTS³⁴

Year	Wheat Board	All Grain	# Ships
2011	449,673	512,781	17
2010	603,352	658,948	22
2009	529,391	529,391	18
2008	424,388	424,388	15
2007	620,709	620,709	20
2006	384,162	488,754	13
2005	353,361	466,785	15
2004	360,510	400,010	14
2003	470,674	615,394	20
2002	279,270	279,270	9
2001	411,883	478,203	15
2000	524,459	710,578	27

Ships, generally, are international flag and only one Canadian flag ship is known to have loaded grain: 12,000 tonnes in the *Kathryn Spirit* in 2007, for Halifax.

From 1975 until 2003, Churchill was the preferred port of loading for dry cargo and petroleum products for the Kivalliq region. Some re-supply cargo continues to flow through Churchill, but is being replaced by Montreal as the preferred port of loading due to inland costs. Petroleum products have, in previous years, been temporarily stored in Churchill for regional delivery, but high cost of tankage (4¢/litre) has had a significant negative impact on prospects.

Future Prospects

Whether the port has a future beyond 2017, when the current funding runs out, depends partly on politics but mainly on whether there is a willingness to tackle the endemic problems of the port.

- High inland costs – short line railroad
- High handling costs – no resident stevedore operation
- High insurance costs - underwriters do not understand Arctic risks
- Difficulty in handling Panamax size vessels, which are key in the grain trades

Add to this the loss of the CWB and its ability to manage grain delivery and shipping related issues, and the commercial case for the future of the port is poor.

The port will probably limp through to 2020, but with little prospect of moving more than 500,000 tpa, or 15-20 ship loads. By 2030 it is difficult to do other than suggest 15-20 ships per year as a maximum, to effectively zero traffic as a minimum.

³⁴ From data in Mariport's files.

3.5 MARINE TOURISM

Cruise ships that have visited the Canadian Arctic in the past are listed in the following table. It should be noted that these vessels are generally small by international standards, with very few being built. Larger cruise ships tend not to have an ice class that would give confidence to underwriters in covering risk.

Cruise tourists for the Canadian Arctic are generally interested in the history of the region as well as regional arts and crafts, but this is not a mass-market region.

Some turnaround trips are undertaken, but because of regulatory aspects and costs associated with Canada-to-Canada voyages, trips will originate in, say, Nuuk in Greenland and terminate in Churchill with a return voyage having the same ports of call. Demand is usually satisfied by such itineraries and ships will not usually undertake more than two trips.

The Northwest Passage has been a draw for certain operators – usually Hapag-Lloyd with either (or both) the *Hanseatic* and the *Bremen*. 2012 may see the largest vessel ever to make a passage with *The World* scheduled to undertake the transit, see foot of Table 10 for details on this ship. The route is not clear as their website does not show the ship proceeding through either of the two normal passages, only a northern route through waters that would not be ice-free.

There have been two grounding incidents involving cruise ships in the Canadian Arctic:

- In 1996, the *Hanseatic* grounded on a shoal in Simpson Strait while on a passage between Gjoa Haven and Resolute. The primary cause was reliance on a buoy, which had been left over from the previous season, and had been shifted by ice during the winter.
- In 2010, the *Clipper Adventurer* grounded while on passage between Port Epworth and Kugluktuk. The vessel bridge team believed they were following an original survey track (probably dating from the 1960's) but drifted off it by only a few seconds in a location where a major shoal had been reported subject to a Notship ship in 2007. The vessel had an older version of the chart on board, which did not show the shoal. The Transportation Safety Board found fault with the ship because charts had not been updated. However, it also found fault with CCG for not pro-actively providing essential information to ships transiting the Arctic.

There have been no incidents involving ice of which Mariport is aware. The ms *Explorer*, which was an occasional visitor to the Canadian Arctic, sank in the Antarctic in a ship/ice interaction, and the ms *Polar Star* was also damaged by ice in the Antarctic.

TABLE 14 - CHARACTERISTICS OF RECENT ARCTIC CRUISE SHIPS

Name	Year Built	Draft	Grt	Passengers
Akademik Ioffe	1989	5.90m	6,450	110
Bremen	1990	4.55m	6,752	164
Clelia II	1990	3.7m	4,077	100
Clipper Adventurer	1977	4.65m	4,376	116
Hanseatic	1991	4.80m	8,378	188
Hanse Explorer ³⁵	2006	nd	nd	12
Kapitan Khlebnikov	1981	8.50m	12,288	112
Le Levant ³⁶	1998	3.00m	3,504	95
Le Diamant ³⁷	1974	4.8m	8,282	226
Lyublov Orlova	1976	5.3m	4,251	188
Polar Star	1969	6.55m	4,998	105
Silver Explorer ³⁸	1989	4.4m	6,072	132
The World ³⁹	2002	6.7m	43,188	699 (386)

Outlook to 2020 & 2030

As will be seen from the table of cruise ships, the existing fleet that is accessed for Arctic cruising is small and relatively old. While the ships meet IMO requirements, they cannot continue in service indefinitely. Few ships of a size that is generally considered suitable for Arctic (and by extension Antarctic cruising) are being built.

Cie des Iles du Ponant, which specializes in small ships, has one passenger ship under construction. *Le Boreal* was delivered in 2010, its sister vessel *Le Soleal* will be completed in 2013. Whether the company will continue in its current niche market may depend on its new owners, having recently been sold by CMA/CGM to European private equity investor Bridgepoint.

With the concentration of the cruise industry into three major groups that focus on very large passenger ships, it is unknown where fleet replenishment for specialist destinations will come from.

Certainly, the existing fleet can maintain activity to 2020, but beyond that point most of the ships will have passed their economic life and likely will be scrapped. Thus the pattern of voyage indicated for 2010, with 18 voyages, can be expected to continue in the near term, but unless new ships are brought into the fleet, Arctic cruise tourism is likely to decline.

³⁵ Expedition Yacht

³⁶ Recently sold by Ponant to Paul Gaugin Cruises and renamed *Tere Moana*

³⁷ Recently sold by Ponant to International Shipping Partners and renamed *Ocean Diamond*

³⁸ Previously *Prince Albert II*

³⁹ Capacity as given by Cruise and Ferry International. 386 believed to be lower berths only.

TABLE 15 - 2010 VOYAGES BY CRUISE SHIPS IN THE CANADIAN ARCTIC

Akademic Ioffe	Single Greenland – Canada cruise
Bremen	Greenland – Canada cruise and reverse Greenland – Canada cruise
Clelia II	2 internal cruises from southern ports
Clipper Adventurer	Partial NWP transit – grounded off Kugluktuk
Hanse Explorer	NWP transit
Hanseatic	Greenland – Churchill cruise and reverse NWP transit
Kaptan Khlebnikov	Greenland – Canada cruise
Le Diamant	Greenland – Canada cruise
Lyubov Orlova	2 internal cruises. Vessel arrested in Saint John on return from Arctic ⁴⁰
Octopus ⁴¹	NWP transit
Polar Star	Single Greenland – Canada cruise
Prince Albert II	Single Greenland – Canada cruise

3.6 NORTHWEST PASSAGE (NWP)

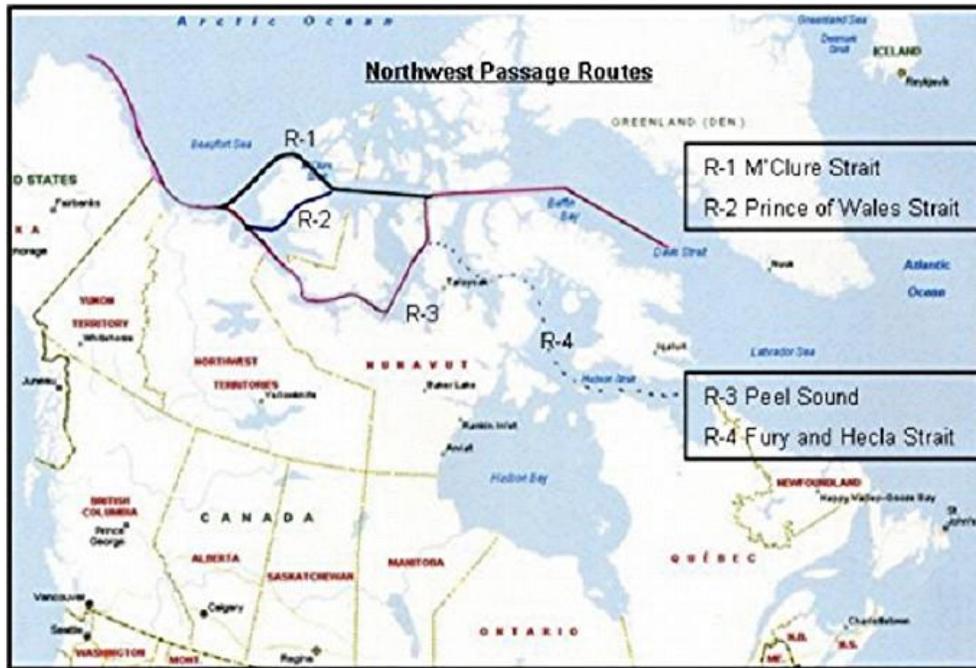
There has been a continuing perception – mainly by the media – that global climate change will result in a flood of shipping via the NWP, which is shown in the following map. The map demonstrates that there are at least four primary routes that constitute the NWP. The primary shipping route at present is R3, which is relatively shallow. Routes R1 and R2 are deeper draft.

There are many reasons why increased shipping will not occur through the NWP.

⁴⁰ Vessel has now been scrapped.

⁴¹ Mega yacht, repositioning Atlantic to Pacific, not on a cruise.

Figure 15 Map of NWP Routes



1. The NWP is not economic for most transit traffic between East and West. It is the Northeast Passage or Northern Sea Route through Russian arctic waters that offers the most opportunity and has been used for a number of commercial transits.
2. Charting of Canada's Arctic is poor, and for many parts of the NWP there is insufficient confidence in the hydrography to permit deep draft transits.
3. The most common route is the southern one (R3 above), via Dolphin and Union, Coronation Gulf, Simpson Strait and James Ross Strait. It is shallow draft, and while a deeper draft alternative exists via Victoria Strait there can be ice issues with Victoria Strait and the maximum safe draft is only 12m. The barrier is Dolphin and Union, and while a deeper draft route may be feasible it is not defined.
4. The deep draft route (R2) via Prince of Wales and Viscount Melville can accommodate up to 15m, but there are ill-defined areas and the route does not open reliably each season.
5. The seasonal window for transits, although improving, is only 46 days via Peel Sound. This may continue to grow, but the commercial transits would need a significantly better availability.
6. Climate change does not mean that there is no ice, and the maximum number of days between break up and when cold, winter darkness and growth of new ice commences is unlikely to exceed 150 days within the foreseeable future.
7. There may be a growth in transits of opportunity, such as the megayacht *Octopus* mentioned in Section 3.5, but it is most unlikely that there will be regularly scheduled transits.

4.0 VESSEL TRAFFIC SUMMARY

This section provides Mariport's best estimates for traffic level by service and vessel type for 2010 base year, 2020 and 2030. Where possible in the forward estimates, an indication of possible range of activity is also provided.

The tables provide Inbound and Outbound cargo and shipping information organised by Eastern and Western Arctic. For Inbound Cargo, cubic metres m³ of dry and POL is given; the number of sailings, i.e. voyages needed to deliver the cargo on a seasonal basis, and the size of ships (dwt) likely to be used. Note that ship size may be project specific, or scenario specific. If tugs and barges are indicated, then this is identified as by the term TBU. Outbound cargo is described in a similar manner.

Where low and high values are given, the suffixes L (low) and H (high) are used after the values.

4.1 TRAFFIC IN 2010

Arctic Community Service – Dry Cargo

- The four NEAS vessels undertook 11 community related trips in 2010. These combined Nunavut and Nunavik communities on the same voyage and one vessel (mv *Umiavut*) operated an extended service into the Western Arctic, returning via Bellot Strait, Fury and Hecla and the Foxe Basin.

The company integrated some mining re-supply activity with its community calls. Five northbound trips called at Deception Bay, which would indicate business for Xstrata or Nunavik Nickel, and one called Milne Inlet, which would have been logistics for the Mary River iron ore project.

- NSSI's five vessels undertook 16 community related trips. Most trips combined Nunavut and Nunavik communities. They served Kitikmeot communities with the *Sedna Desgagnes*, which also called Robert's Bay for Newmont. The company chartered in additional tonnage as follows:

Federal Patroller one trip to Nunavik

Kent Sunrise one trip to Nunavut with transshipment of Western Arctic cargo to *Sedna Desgagnes* at Pond Inlet

*Dutch Runner*⁴² one trip dedicated to Iqaluit.

The company had two ship calls at Deception Bay combined with community calls that would have been mine re-supply. Also, the *Anna Desgagnes* called Thule with USAF supplies; this trip was integrated with community calls on Baffin Island.

- NTCL ran a tug and barge service out of Churchill into Kivalliq communities and made 10 trips during 2010, using Moosonee Transport's tug *Hudson Bay Explorer* and their own tug *Pat Lyall*. It was not known how many barges were involved.

⁴² Canadian flag.

- NTCL ran a barge from Richmond (BC) to Cambridge Bay, redistributing cargo from there to Western Arctic communities. They also had a number of tug/barge trips from Tuktoyaktuk (where they consolidate dry and POL) into NWT and Nunavut communities.

Some of the Richmond barge cargo was for Newmont at Robert's Bay and six trips were noted. There were probably six community trips in addition to Robert's Bay. Because NTCL's modus operandi is to combine deck cargo with POL in the barge hull, it is not possible to determine whether calls were solely dry cargo (probably none), solely POL or combined. NTCL's tugs *Edgar Kotokak*, *Nunakput* and *Pisurayak Kootook* were involved in the Community calls, each with two trips from Tuktoyaktuk. It is not known which tug hauled the barge from Richmond. The *Pisurayak Kootook* trips included service to NWS sites in the Western Arctic as well as community calls.

Arctic Mine Dry Re-Supply

See comments above regarding voyages that combined community and mine re-supply. Dedicated voyages were as follows:

<i>Rosaire A. Desgagnes</i>	one trip to Robert's Bay for Newmont from Becancour.
<i>Zelada Desgagnes</i>	four trips to Helicopter Island anchorage from Becancour for transfer to Baker Lake on behalf of Agnico Eagle.
<i>Dutch Runner</i>	one trip as above.
<i>Atlantic Beech & Atlantic Elm</i>	believed ⁴³ to be one trip each from Becancour with <i>Atlantic Marlin</i> and <i>Atlantic Swordfish</i> ice class heavy deck barges. The barges are 5,000 dwt. On charter to Desgagnes Transarctik for Agnico Eagle.
<i>Flevoborg</i> ⁴⁴	called Deception Bay, probably with offshore project cargo for either Xstrata or Nunavik Nickel.

Arctic Community Service POL

- Woodward tankers undertook 14 trips to the Nunavut Eastern Arctic communities
- Petronav tankers undertook six trips to Nunavik
- NTCL barges as above, also foreign flag tanker *Marilee* anchored off Tuktoyaktuk and POL lightered into tankage there. Some of this fuel may have been to Newmont's account.
- The *STX Ace 10*, a 46,159dwt tanker, visited Iqaluit⁴⁵, probably on charter to Woodward. Quantity not known.

Arctic Mine Re-Supply POL

- As far as we can ascertain, Baffinland did not take any fuel in 2010.

⁴³ VTS records only provide the vessel with motive power, i.e. the tug. Barges are not identified in the records.

⁴⁴ Following the call in Deception Bay, the vessel proceeded to Churchill and loaded grain.

⁴⁵ In port 23rd August-3rd September.

- Woodward chartered the *CPO Germany*, believed to have 40,000m³ ULSD, which was then lightered from the Helicopter Island anchorage to Baker Lake on behalf of Agnico Eagle.
- As noted in the discussion about Xtrata Nickel, the mv *Arctic* is reported to bring 5,000m³ of POL into Deception Bay on each visit. The ship undertook six voyages. In addition, the *Jana Desgagnes* called twice as part of a Nunavik port rotation and the *Maria Desgagnes* once. These calls may have been for grades other than ULSD, possibly Jet A1 and gasoline. Also, these calls might have been for Nunavik Nickel
- The mt *Primrose* was frozen in at Robert's Bay with 20,000m³ ULSD for Newmont. The ship stayed over the 2010/11 winter, sailing eastbound late 2011.

Marine Tourism

As noted in the section on Marine Tourism, there were 18 revenue voyages by 11 cruise ships during 2010.

Churchill

As noted in the section on Churchill, there were 22 ships that called for grain during 2010. These ranged in cargo size from a high of 46,000 tonnes to a low of 12,000 tonnes (mv *Flevoborg*).

As far as we are aware, there was no other traffic apart from some community re-supply business by NTCL with the tug *Pat Lyall* and the *Anna Desgagnes* of NSSI.

Oil and Gas Activity

We do not believe there was any exploration activity under way by 2010, and this is reflected in the summary table.

Labrador

In order to avoid confusion, traffic for Nain and VBN have not been included in the Arctic tables following, or in the summaries above.

Nain would have received approximately 20 calls by the *Northern Ranger* on its seasonal weekly service out of Happy Valley/Goose Bay. There would have been about 10 freight trips from Lewisporte on the *Astron*. In 2011 VBN received 12 calls by the *Umiak 1* and 6 calls by foreign flag ships. See discussion about VBN as to why 2011 has been used as a base year, rather than 2010.

TABLE 16 - 2010 ARCTIC TRAFFIC SUMMARY

Activity	Inbound Cargo						Outbound Cargo		
	Dry m ³	# Sailings	Size dwt	POL m ³	# Sailings	Size dwt	Tonnes	# Sailings	Size dwt
Eastern Arctic									
Community Support	265,000	27	12,000	250,000	21	3,000 45,000	- nd -	- na --	- nd -
Marine Tourism	- na -	18	- na -	- na -	- na -	- na -	- na -	- na -	- na -
Churchill Grain	0	0	0	0	0	0	658,948	22	12,000 46,000
Mines	75,000	2 TBU 4	5,000 12,000	40,000	1	36,000	0	0	0
Subtotal	340,000	2 TBU 49	5,000 12,000	290,000	22	3,000 46,000	658,948	22	12,000 46,000
Western Arctic									
Community Support ⁴⁶	25,000	1 TBU 2 TBU	5,000 2,000	7,000	2 TBU 3 ⁴⁷	2,000 75,000 ⁴⁸	- nd -	- na -	- na -
Marine Tourism	- na -	3 ⁴⁹		- na -	- na -	- na -	- na -	- na -	- na -
Mines	20,000	1	12,000	20,000	1	25,000	0	- na -	- na -
Oil & Gas	0	0					0	0	0
Sub total	45,000	3 TBU 4	2,000 12,000	27,000	2 TBU 4	2,000 25,000	0	0	0
Total All	385,000	5 TBU 53	2,000 12,000	317,000	2 TBU 26	2,000 75,000	658,948	22	12,000 46,000

⁴⁶ This is an estimate for cargo delivered from Vancouver and Tuktoyaktuk in the Western Arctic. Ship deliveries from the East are counted under Eastern Arctic

⁴⁷ The *Nanny* grounded off Gjoa Haven, and the *Tuvaq* was sent to lighter fuel and help complete deliveries

⁴⁸ This is an unusually large vessel and would not have carried other than a part cargo.

⁴⁹ NWP Transits, included in voyage numbers for Eastern Arctic

4.2 SHIPPING TRAFFIC TO 2020

Arctic Community Dry Cargo

Based on the average loads of 14,000m³/sailing during 2010 by the current nine-ship fleet, Eastern Arctic (Nunavut and Nunavik) estimated demand plus Kitikmeot estimated demand, there would need to be 33 sailings from the Montreal area. This compares with 27 sailings during 2010. In addition, there may be one or two sailings from Churchill to meet Kivalliq demand from Prairie suppliers, as well as some sailings from Hay River by NTCL's (or other) tug and barge fleet. See Annex 5.3 regarding Hay River and Churchill cargo.

The number of sailings from the Montreal area may be affected by changes in fleet make up as the NEAS fleet will have an average age of 32 years, requiring some⁵⁰ (if not complete) renewal. The NSSI fleet has four newer vessels⁵¹ that will continue in service, and two older ships that may require replacement⁵², given their age.

Also, with demand growing, operators may be able to improve productivity by minimising the number of port calls.

At 2010 activity levels, the existing fleet can achieve 36 sailing a season, thus with a combination of productivity gains and fleet renewals, we believe community demand could be met by a ten ship fleet and 32 sailings from the Montreal area.

Arctic Community Petroleum Products

We have suggested that POL demand in Nunavut and Nunavik could rise to a low of 285,000m³ to a possible high of 300,000m³. Assuming that the current fleet is still operational, this suggests that 25-30 northbound trips may be needed.

This projection presumes that POL will continue to be sourced from Canadian refineries. POL for NWT communities may be sourced from offshore as there is a history of bringing requirements into the Western Arctic in a single large tanker and then transshipping to tug and barge.

NTCL's single hull barges will not be permitted to haul POL in ASPPR zones after 1st January 2105. There is no indication of NTCL renewing it's fleet, but other operators may move into the region with double hull equipment as there is a need for extreme shallow draft operation that cannot be readily served by conventional tankers.

⁵⁰ The *Aivik*, although the oldest ship in the fleet at forty by 2020, may continue operating because it is only used seasonally and has been laid up between end November and late June all but one year since coming into the Canadian fleet in 1990.

⁵¹ As noted earlier, Desgagnes have added another heavy lift ship to their fleet. The *Claude A Desgagnes ex Elseborg* was built in 2011.

⁵² The *Camilla Desgagnes* may continue in service although 38 years old in 2020. Desgagnes did considerable work on the ship after buying it as a constructive total loss in 2003 and re-engined it over the 2009/10 winter.

Arctic Mining Company Activity

Activity is only included where there is either an operating mine, or a high probability that a mine will be operational by 2020. See section 3.2 of the report for a discussion on possible timing and quantities.

Marine Tourism

Much of the existing fleet of small cruise ships deployed seasonally in the Canadian Arctic will probably have been scrapped by 2020, however, there is time for new small ships to be introduced even though the cruise industry is controlled by three companies that only build very large cruise ships that are unsuitable for Arctic cruises. We expect a pattern of activity similar to 2010, with 18 revenue cruises and three NWP transits.

Churchill

Our best estimate, given the demise of the Canadian Wheat Board is 15-20 ship calls and no more than 500,000 tonnes of grain.

Oil and Gas Activity

We would expect some exploration activity to be under way by 2020, and this is reflected in the summary table.

POL needs will probably be piggy backed on mine and community support, with some being landed at Tuktoyaktuk and then redistributed by modern tug and barge equipment and/or AHTS vessels associated with the drilling operations. Additional seismic work could also be ongoing by this period.

Labrador

In order to avoid confusion, traffic for Nain and VBN have not been included in the Arctic tables following, or in the summaries above.

Nain is expected to receive approximately 20 calls by a passenger/freight ferry on seasonal weekly service out of Happy Valley/Goose Bay. There would be about 10 freight trips from Lewisporte. VBN is expected to received 12 calls by the *Umiak 1* and 6 calls by foreign flag ships

TABLE 17 – ARCTIC MINE ACTIVITY SUMMARY TABLE AT 2020

Mine	Status	Product Shipping			POL Demand			Dry Cargo Demand		
		Quantity tpa	Ships pa	Size dwt	Quantity m ³	Ships pa	Size dwt	Quantity m ³	Ships pa	Size dwt
Meadowbank	Closed	- na -	- na -	- na -	- na -	- na -	- na -	- na -	- na -	- na -
Meliadine	Operational	None by sea	- na -	- na -	40,000	1	45,000	75,000	2 TBU 4	5,000 12,000
Xstrata Nickel	Operational	180,000	6	30,000	40,000	8	30,000 10,000	85,000	5	12,000
Chidliak	In developm't	- na -	- na -	- na -	- na -	- na -	- na -	- na -	- na -	- na -
Kiggavik	Pre-product'n	None by sea	- na -	- na -	20,000	1	25,000	20,000	2	12,000
Mary River	Pre-product'n	2,000,000	30-35	60,000	40,000	1	45,000	50,000	4	15,000
Roche Bay	In developm't	- na -	- na -	- na -	- na -	- na -	- na -	- na -	- na -	- na -
Hackett River	In developm't	- na -	- na -	- na -	- na -	- na -	- na -	- na -	- na -	- na -
Hope Bay	Operational	None by sea	- na -	- na -	16,500	1	20,000	25,000	2	12,000
Sabina	In developm't	- na -	- na -	- na -	- na -	- na -	- na -	- na -	- na -	- na -
Izok Lake	In developm't	- na -	na	- na -	- na -	na	- na -	- na -	na	- na -
Nunavik Nickel	Operational	120,000	4	30,000	30,000	2	15,000	75,000	4	12,000
Ungava Bay Iron Ore	In developm't	- na -	na	- na -	- na -	na	- na -	- na -	na	- na -
Total		2,300,000	40-45	30,000 60,000	186,500	14	10,000 45,000	330,000	2TBU 21	5,000 12-15,000

TABLE 18 - 2020 ARCTIC TRAFFIC SUMMARY

Activity	Inbound Cargo						Outbound Cargo		
	Dry m ³	# Sailings	Size dwt	POL m ³	# Sailings	Size dwt	Tonnes	# Sailings	Size dwt
Eastern Arctic									
Community Support	473,000 ⁵³	32	12,000	285,000 L 300,000 H	20L 25H	10,000 15,000	- nd -	- na --	- nd -
Marine Tourism	- na -	18	- na -	- na -	- na -	- na -	- na -	- na -	- na -
Churchill Grain	0	0	0	0	0	0	500,000	15L 20H	25,000 55,000
Mines	305,000	2 TBU 19	5,000 12-17,500	170,000	13	10,000 45,000	2,300,000	40L 45H	30,000 60,000
Subtotal	778,000	2 TBU 69	12,000 17,500	510,000 L 620,000 H	33L 38H	10,000 45,000	2,800,000	55L 65H	25,000 60,000
Western Arctic									
Community Support	7,000	1	12,000	7,000	1	45,000	- nd -	- na -	- nd -
Marine Tourism	- na -	3 ⁵⁴	- na -	- na -	- na -	- na -	- na -	- na -	- na -
Mines	25,000	2	12,000	16,500	1	20,000	0	0	0
Oil & Gas	20,000	- int -	4,000	20,000	- int -	4,000	0	0	0
Sub total	52,000	6	4,000 12,000	43,500	2	20,000 45,000	0	0	0
Total All	830,000	2 TBU 73	5,000 4-17,500	553,500L 663,500H	37L 42H	4,000 45,000	2,800,000	55L 65H	25,000 60,000

Int = Internal voyages from base. nd = no data L =Low, H= High

⁵³ Includes Kitikmeot, supported from East.

⁵⁴ NWP transits, included in Eastern Arctic numbers.

4.3 SHIPPING TRAFFIC TO 2030

Arctic Community Dry Cargo

By 2030, only the newer Desgagnes vessels are likely to be operational and new ships will have had to be brought into service. With increased cargo quantities to communities we would expect ship size to increase somewhat, and the ship type and size shown in Annex 5.4 might be the model for this time frame. Dry cargo demand is forecast as follows:

Nunavut	428,000m ³
Nunavik	150,000m ³
NWT Coastal	7,000m ³

Thus 578,000m³ dry cargo would need to be handled by the fleet from the Montreal area. We would expect 32 sailings with larger ships to be needed. Thus traffic will not change from 2020 levels.

Arctic Community Petroleum Products

Projected demand to 2030 could range from 375-400,000m³ and all the existing fleet would need to be replaced. Limitation in southern terminals effectively caps Canadian flag tanker size at 20,000m³, thus we see little change in the probable fleet size and make up available for Arctic service. Shipments would range from a low of 25 voyages from southern origin to a possible high of 35 voyages.

Another factor that needs to be considered is the make up of the Canadian refining industry as most refineries are too small to be competitive in the current climate, let alone that which might exist by 2030. Also, POL origins depend on the approach of Nunavut or others on sourcing. In the mid-1990's, NWT opened up bidding worldwide and for many years Nunavut's POL needs were shipped on international flag tankers from offshore refineries.

Arctic Mining Company Activity

As with 2020, activity is only included where we expect a mine to be operational, or to have closed between 2020 and 2030. See section 3.2 for a discussion of quantities and probabilities for each of the mines.

We have only included mines discussed in section 3.2; other mines may be developed in the time frame, but we have no way of knowing what, or where, these might be. Another factor, that could affect traffic, is the successful development of BIPAR. If constructed, the port and storage opportunities available could open up the Slave Geologic Province and also feed fuel and logistics south to the Diamond mining area, north and east of Yellowknife. The southern route serving this area has suffered considerably from the effects of climate change with reduced loads and a shorter winter road season.

Marine Tourism

Much of the existing fleet of small cruise ships deployed seasonally in the Canadian Arctic will have been scrapped by 2030, however, there is time for new small ships to be introduced even though the cruise industry is controlled by three companies that

only build very large cruise ships that are unsuitable for Arctic cruises. We expect a pattern of activity similar to 2020, with 18 revenue cruises, but with five NWP transits.

Churchill

Our best estimate, given the demise of the Canadian Wheat Board is for traffic to be the same as for 2020 at 15-20 ship calls and no more than 500,000 tonnes of grain. However, it is entirely possible that the port may have closed by 2030.

Oil and Gas Activity

As with mining, BIPAR could be a significant influence on both dry and POL support for oil and gas. We have assumed enhanced activity, with some oil production.

Labrador

In order to avoid confusion, traffic for Nain and VBN have not been included in the Arctic tables following, or in the summaries above.

Nain is expected to receive approximately 20 calls by a passenger/freight ferry on seasonal weekly service out of Happy Valley/Goose Bay. There would be about 10 freight trips from Lewisporte. If the mine is still operational in 2030, VBN is expected to received 12 calls by the *Umiak 1* and 6 calls by foreign flag ships. Current indications are that the mine may close by 2025.

TABLE 19 - ARCTIC MINE ACTIVITY SUMMARY TABLE AT 2030

Mine	Status	Product Shipping			POL Demand			Dry Cargo Demand		
		Quantity tpa	Ships pa	Size dwt	Quantity m ³	Ships pa	Size dwt	Quantity m ³	Ships pa	Size dwt
Meliadine	Closed									
Xstrata Nickel	Closed									
Chidliak	Operational	Non by sea	- na -	- na -	50,000	3	20,000	35,000	3	17,500
Kiggavik	Operational	None by sea	- na -	- na -	40,000	1	45,000	35,000	3	17,500
Mary River	Operational	18,000,000	100	185,000	50,000	2	30,000	100,000	5	15,000
Roche Bay	Operational	10,000,000 ⁵⁵	60	185,000	40,000	1	45,000	20,000	2	17,500
		7,500,000 ⁵⁶	125	60,000	50,000	2	30,000	35,000	3	17,500
Hackett River	Operational	150,000	3	50,000	40,000	1	45,000	75,000	4	17,500
Hope Bay	Operational	None by sea	- na -	- na -	30,000	1	35,000	35,000	2	17,500
Sabina	Operational	None by sea	- na -	- na -	16,500	1	20,000	25,000	2	17,500
Izok Lake	Operational	300,000 L	6	50,000	30,000	1	35,000	75,000	4	17,500
		600,000 H	12		50,000	2	30,000	100,000	5	17,500
Nunavik Nickel	Operational	150,000	5	30,000	40,000	2	25,000	75,000	4	17,500
Ungava Bay Iron Ore	Operational	10,000,000	60	185,000	50,000	1	55,000	100,000	5	17,500
Total		31,400,000	234 L	30,000	386,500 L	14L	20,000	575,000 L	34L	15,000
		38,600,000	305 H	185,000	416,500 H	16H	55,000	615,000 H	36H	17,500

L = Low H = High

⁵⁵ Concentrates.

⁵⁶ Briquettes

TABLE 20 - 2030 ARCTIC TRAFFIC SUMMARY

Activity	Inbound Cargo						Outbound Cargo		
Eastern Arctic									
	Dry m³	# Sailings	Size dwt	POL m³	# Sailings	Size dwt	Tonnes	#Slgs	Size dwt
Community Support	578,000 ⁵⁷	32	17,500	375,000L 400,000H	25L 35H	10,000 20,000	0	0	na
Marine Tourism		18							
Churchill Grain	0	0	0	0	0	0	500,000	15 20	25,000 55,000
Mines	365,000L 380,000H	22L 23H	17,500	270,000L 280,000H	10L 11H	20,000 55,000	30,950,000L 38,150,000H	225L 290H	30,000 185,000
Subtotal	943,000L 958,000H	72L 73H		720,000L 910,000H	35L 46H		31,450,000L 38,650,000H	240L 310H	
Western Arctic									
Community Support	7,000	1TBU	2,000	7,000	1	45,000			
Marine Tourism		5 ⁵⁸							
Mines	210,000L 235,000H	12L 13H	17,500	116,500L 136,500H	4L 6H	20,000 45,000	450,000L 750,000H	9L 15H	50,000
Oil & Gas ⁵⁹	60,000	-int- 2	4,000 17,500	60,000	-int- 2	4,000 40,000	100,000	2	50,000
Sub total	277,000L 302,000H	1TBU 17L/18H		183,500L 203,500H	7L 9H		550,000L 850,000H		
Total All	1,220,000L 1,260,000H	89L 91H	2,000 17,500	903,500L 1,113,500H	42L 55H	4,000 55,000	32,000,000H 39,500,000H	251L 325H	25,000 185,000

⁵⁷ Includes Kitikmeot, supported from East.

⁵⁸ NWP transits, included in Eastern Arctic numbers.

⁵⁹ See discussion for actual number of units on station.

5. ANNEXES

5.1 Community Population

5.1 COMMUNITY POPULATION

The following information is drawn from Mariport in-house resources, supplemented as noted. Population is given for 2010 or 2011 with projection to 2020 and 2030. These projections are based on growth continuing at current rates.

1. NUNAVUT

NUNAVUT POPULATION & PROJECTIONS

REGION AND COMMUNITY	ESTIMATED POPULATION IN 2010	ESTIMATED POPULATION IN 2020	ESTIMATED POPULATION IN 2030
AREA A – HIGH ARCTIC			
1. Arctic Bay	757	850	
2. Qikiqtarjuaq (Broughton Island)	548	550	
3. Clyde River	912	1,013	
4. Grise Fjord	157	145	
5. Kugaaruk (Pelly Bay)	736	852	
6. Pond Inlet	1,484	1,716	
7. Resolute Bay	257	294	
TOTAL	4,851	5,420	6,000
AREA B – FOXE BASIN			
1. Igloodik	1,700	2,138	
2. Hall Beach	721	815	
3. Repulse Bay	855	1,142	
TOTAL	3,276	4,095	5,000
AREA C – IQALUIT	7,054	8,977	12,000
TOTAL			
AREA D – SOUTH BAFFIN			
1. Cape Dorset	1,411	1,648	
2. Kimmirut (Lake Harbour)	459	464	
3. Pangnirtung	1,489	1,656	
TOTAL	3,359	3,768	4,200
AREA E – KIVALLIQ			
1. Baker Lake	1,950	2,389	
2. Chesterfield Inlet	386	412	
3. Rankin Inlet	2,704	3,193	
4. Whale Cove	392	480	
5. Arviat	2,331	2,721	
6. Coral Harbour	861	998	
7. Sanikiluaq (Belcher Islands)	812	918	
TOTAL - ALL KIVALLIQ	9,436	11,111	13,500
AREA G – KITIKMEOT			
Cambridge Bay	1,676	2,035	
Kugluktuk (Coppermine)	1,458	1,670	
Gjoa Haven	1,184	1,391	
Taloyoak (Spence Bay)	895	1,064	
Umingmaktok	nd	nd	
Bathurst Inlet	nd	nd	
TOTAL ALL KITIKMEOT	5,213	6,160	7,200
TOTAL ALL COMMUNITIES	33,189	39,522	47,900

Notes to Nunavut population tables

- i) Layout has been maintained relative to dry cargo re-supply areas.
- ii) Bathurst Inlet and Umingmahtok have been excluded, as population is uncertain because they are more summer camps than year-round communities. Seasonal population, other than Inuit who may travel from other communities, probably no more than twenty in each location.
- iii) Population forecasts to 2020 and 2030 have been based on growth in the last decade, except as noted below.
- iv) Base data from Nunavut Bureau of Statistics.

Comments on Growth propensities by Region

High Arctic There are no developments, of which we are aware, that will lead to significant changes. Grise Fjord, being one of the most isolated communities, is likely to continue a slow decline in size. This was one of the “fabricated communities” from the 1960’s, moved into the location because of sovereignty concerns. There were no natural attributes of the region. Resolute Bay is sustained by a heavy military presence and a strong local service economy structured around its airport. It is the jumping off point for most polar expeditions. There could be continued growth in terms of vessel monitoring in Lancaster Sound, driven by sovereignty and defence prerogatives.

Foxe Basin Repulse Bay is really part of the Kivalliq region and has only been included in the Foxe Basin for convenience in re-supply management. Hall Beach is a major North Warning System site and will maintain its presence. Both Hall Beach and Igloodik could benefit from development of Roche Bay (although this is likely long- rather than short-term). Whether there is a significant benefit from Mary River depends on how the operator structures its logistics. If Steensby Inlet is solely the export point for iron ore and possibly import point for petroleum products, then opportunities are limited. If all logistics are focused through Steensby, then there is probably more employment opportunity.

Iqaluit As this is the capital city, growth will continue to be robust. It is expected that the airport will be renewed under a P3 arrangement over the next two seasons and this will lead to significant activity and economic spin off.

South Baffin Cape Dorset continues to be the centre of artistic activity in Nunavut and as a traditional community is likely to maintain steady growth. Kimmirut tends to be in the shadow of Iqaluit being relatively close, and without employment prospects, growth will be limited. Pangnirtung is a fisheries centre and a dock is currently under construction to enhance opportunities. Growth should continue to be strong.

Kivalliq is probably the most robust region in Nunavut with an operating gold mine – Meadowbank – outside Baker Lake, and another being developed by the same company — Meliadine outside Rankin Inlet. Because of this mine’s proximity to Rankin Inlet – only 24km – it is likely that a high proportion of service activities and personnel will be based in the community rather than at the mine. This will probably lead to significant population growth. Rankin Inlet has also benefitted over the last 2-

3 years from the construction of a correctional facility⁶⁰ and a trades school. These two operations could well increase population by 200-250 persons. Baker Lake will also benefit if AREVA decide to go ahead with the development of Kiggavik uranium deposit. Other communities are less likely to see development impacts.

Kitikmeot The region has had a roller coaster ride relative to economic growth potential, with mines and projects showing every likelihood of proceeding, only to be stalled by corporate manoeuvring. The most recent disappointment is Newmont's Hope Bay gold mine that was on track for major shipping of equipment during the 2012 season only to have the company decide to mothball the operation. There are other mining projects, but none are as far along.

Cambridge Bay should benefit from the High Arctic Research Station, but information as to size and time line has not been available in order to assess its impact on the community.

2. NORTHWEST TERRITORIES

	POPULATION 2010	ESTIMATED POPULATION 2020	ESTIMATED POPULATION 2030
Coastal			
Sachs Harbour	134	127	
Ulukhaktok	472	471	
Paulatuk	311	314	
	917	912	900
Delta			
Tuktoyaktuk	916	862	
Aklavik	658	654	
Inuvik	3,552	3,616	
Fort McPherson	795	754	
Tsilgehtchic	123	126	
Total	6,044	6,012	6,000

The economy in the Delta and Coastal regions has depended on oil and gas exploration and the Mackenzie Gas Pipeline. Although there is new hope for the former, gas pricing in North America does not give expectation that the latter project will proceed. There may be some local impact if Darnley Bay Resources has a successful exploration programme, but the best expectation is for a stable population, as some communities decline slightly and others, like Inuvik, grow.

The Inuvik to Tuktoyaktuk road should have an impact on Tuktoyaktuk but the purported economic benefits are likely to be muted because of major reductions in NTCL's carriage rates from Hay River.

⁶⁰ 48 bed capacity, 45 staff, 15 casual staff.

3. NUNAVIK

	POPULATION 2011	ESTIMATED POPULATION 2020	ESTIMATED POPULATION 2030
Kangiqsualiujuag	875	1,183	
Kuujuuaq	2,375	2,840	
Tasiujaq	303	429	
Aupaluk	195	237	
Kangirsuk	550	731	
Qaqtaq	376	510	
Kangiqsujuaq	695	880	
Salluit	1,347	1,535	
Ivujivik	370	406	
Akulivik	615	860	
Puvirnitug	1,692	2,200	
Inukjuaq ⁶¹	1,595	2,822	
Umiujaq	444	557	
Kuujuarapik	657	842	
Total	12,089	16,032	19,500

Population growth in Nunavik between the 2006 & 2011 census data has been quite remarkable. In some instances population by 2011 met or exceeded earlier forecasts for 2020. We do not expect population growth beyond 2020 to be as vigorous.

A contributory factor may be the improved economy and outlook for the communities as a result of the major community harbour development project that commenced in 1999 and was completed in 2010. This \$88m project was partially funded by the federal government and partially by Quebec. Makivik Corporation undertook the construction project in-house, completing the work on time and within budget. The project, which dates back to the mid-1990's, gives every community a safe location for local boats to be moored and extended, or 24 hour access to the water in a region where tidal change is dramatic. The work also provided for new cargo laydown areas and barge landing ramps that have materially improved dry cargo access to each community. A typical project is shown in the illustration on the following page.

The major mining activity in Nunavik is Xstrata's nickel mine at Deception Bay. Whether the Nunavik Nickel project will proceed is moot, given the controlling interest by Chinese principals, however, indications are that it will proceed by 2020.

Quebec's Plan Nord is as yet an unknown quantity in terms of influence on the economy of the region. One possible factor is the development of a major deep-water port at Kuujuarapik. It is not known what projects such a port would serve.

⁶¹ Census data appears to be in error. Based on growth between 2001 & 2006, population should be about 1,971 persons.

New community Harbour at Puvirnituk



Photograph courtesy of Makivik Corporation

4. LABRADOR

Nain is the most northerly community in Newfoundland and Labrador and was originally established by Moravian missionaries in 1771. Residents of more northerly communities were consolidated into Nain in the early 1900's. Unlike Arctic communities, Nain has a dock for passenger and cargo vessel calls.

Population has fluctuated over the last decade.

Nain Population⁶²

2001	1,160
2006	1,020
2011	1,190

Although the community is only 25 miles from the Voisey's Bay Nickel mine, available information does not suggest that the mine is a major employer⁶³. There is a local fish plant that offers seasonal employment May-October, and small scale quarrying for labradorite June-November. Reportedly, 1,000m³ dimensioned stone is produced annually for shipment to Italy for finishing and sale in Europe.

The community receives weekly ferry service via the *Northern Ranger* between mid/late June and early November from Happy Valley/Goose Bay (connecting with the highway to Labrador City and then to Baie Comeau – 1,107km, mainly gravel). A fortnightly freight service is also available from Lewisport using the mv *Astron*. This service is also from approximately mid/end June through early November, depending on ice conditions.

No information is available on freight levels, but if quantities were in line with Mariport's Arctic planning volumes, this would imply about 7,500m³ dry goods per

⁶² nl.communityaccounts.ca. Numbers are slightly different from Statistics Canada census figures.

⁶³ The Nunatsiaq News reported in October 2009 that Innu employment at the mine is 200 persons out of a 469 person workforce.

year, of which 5,000m³ would need to be shipped end season to provide support over the winter.

Fuel requirements are also not available from published sources, but in 2010, the mt *Mokami* made three calls at the community – July 11th; July 19th; Sept 22nd.

Based on demand from Arctic communities with similar population levels, consumption of 3,000m³ of mainly diesel would be indicated. Because of the communities' proximity to Happy Valley/Goose Bay, which is the regional hub, flight refuelling is probably not needed so no Jet A1 would be involved.

2020

There are no population projections available, and although population has recovered somewhat since Voisey's Bay came into operation, there does not appear to be any significant growth expectation. We would not expect population to exceed 1,400 persons by 2020. Dry goods demand might increase to 8,000m³.

2030

Voisey's Bay may be winding down by 2030, thus we would expect no increase in population from 2020; possibly a small decline.

5.2 Nutrition North

Items from INAC website that are to be excluded from food mail as of 11th April 2011

Canned vegetables and fruit
Unsweetened juice in bottles or cans
Croissants and garlic bread
Cake and pastry flour
*Dry rice, dry pasta (macaroni, spaghetti, noodles), other grains, popping corn (unpopped)**
Prepared mixes for cakes, pancakes, muffins, bread and rolls, bannock
Canned sweetened condensed milk
Canned meat, fish and poultry
Canned or dried legumes
Canned soup, pasta, stew, corned beef hash, dried soup mixes
Pasta, macaroni and cheese dinners, noodle mixes, pizza mixes
Spreads and sauces
Plain water
Spices, salt, sugar, baking powder, cornstarch
Jam, honey, syrups, toppings (excluding artificial cream products)
Jelly powders, pudding mixes, puddings (canned or ready-to-eat)
Condiments, ketchup, vinegar, relish, pickles
Coffee, tea
Fruit drink crystals with vitamin C added
Diapers, wipes
Feminine hygiene products, disposable undergarments, toilet paper, nursing pads
Toothpaste, dental floss, denture adhesive and cleaner, toothbrushes
Hand and body lotions, soap, shampoo, deodorant
Laundry detergent, dishwashing liquid and powder
Vitamins, minerals (except meal replacements, power bars, energy bars)
Medical devices

There is a “Phase in” period, and full exclusions will not take place until October 2012. Thus the full effect on annual sealift will not be apparent until the 2013 season.

Some items in the list excluded from Food Mail, such as prescription drugs will likely continue to be shipped by air. Reefer containers may be used to ship other excluded products, such as ice cream and certain frozen products.

Because of relative costs by air, which operates on weight based freight rates versus marine, which tends to operate on cubic based freight rates, some high volume, low weight products may continue to move by air into communities that have relatively good air service.

5.3 Shipping via the Hay River/Mackenzie Route and via Churchill

5.3 SHIPPING VIA THE HAY RIVER/MACKENZIE ROUTE AND VIA CHURCHILL

1. Hay River/Mackenzie Route

NTCL, as the primary operator on this route, and the successor company to the Hudson Bay Company, had a monopoly position until 2008. In this year NSSI made an exploratory sailing (on a private basis) into the Kitikmeot region from the Montreal area. This was successful and materially reduced overall shipping costs. Since then, both NEAS and NSSI have undertaken private sailings from the Montreal area to the major communities of Cambridge Bay, Gjoa Haven, Taloyoak and Kugluktuk. NSSI also had a contract from 2010 with Newmont to service the Hope Bay mine.

From 2012 onwards, NSSI has the GN contract to move cargo from port of exit Montreal. NTCL has the GN contract to move cargo from port of exit Hay River.

Because of the high cost of shipping goods on the Mackenzie route⁶⁴, it is likely that only very small quantities of dry goods will move this route in the future. NTCL's business model required fuel in the barge hull and dry cargo on deck. The company lost their POL delivery contract in 2010 and their single skin barges will not be permitted to operate in ASPPR Control Zones after 1st January 2015.

Barging from the Vancouver area is a possible option, but distances are greater than from Montreal and costs are not competitive unless the operating company can guarantee large volumes.

The all-weather road between Inuvik and Tuktoyaktuk may not change the preference for shipping into the Kitikmeot region from Montreal due to the high cost of trucking on the Dempster Highway from Edmonton.

Oil and gas activity in the Beaufort would probably benefit from the highway, in that time is more critical than cost. The NWT coastal communities of Sachs Harbour, Paulatuk and Ulukhaktok may be forced to use the route, if further erosion of cargo on the Mackenzie River forces up rates, and makes trucking to Tuktoyaktuk followed by a short barge haul competitive.

2. Churchill Route

The Kivalliq was served out of the Montreal area until 1975, when the federal government designated NTCL and Churchill as the preferred company and port of exit for the region. This route was run with NTCL's Western Arctic business model of fuel in the barge hull and cargo on deck until 2003, when GN's PPD bid the fuel and awarded the contract to Woodward. Because fuel cross-subsidised the deck cargo, deck cargo alone could not support the operation and the company was forced to withdraw service.

There has been some tug and barge activity on the coast since then, both by NTCL and independents. However, NTCL finally withdrew after the 2010 season and

⁶⁴ Cargo has to be trucked or railed from Edmonton, transferred to barge at Hay River, barged down the Mackenzie to Tuktoyaktuk, consolidated there, and then barged to the community.

business is handled by a GN contracted carrier from the Montreal area that calls Churchill after community delivery inbound. Churchill cargo is loaded and then delivered to communities on the outbound voyage from Hudson Bay.

The route suffers, like Hay River, from high internal costs. Delivery to Churchill from Winnipeg is controlled by a monopoly carrier (Omnitrax and the Hudson Bay Railroad) as the only means of transport beyond The Pas.

5.4 Estimating Re-supply Cargo Quantities for Mining

5.4 ESTIMATING RE-SUPPLY CARGO QUANTITIES FOR MINING VENTURES

Some estimates from Mariport's work have been provided in the report text and volume can be inferred from demand by Agnico Eagle at Baker Lake and at Xstrata's operation in Deception Bay. However, there is very little data available in public domain as to the support needs for mining ventures.

A report for GNWT in 1999⁶⁵ provided some indication of quantities:

TABLE 5.4 – 1
Indicative Inputs⁶⁶

Diamond Mine	52,000-80,000 m ³	Fuel
	13,000-17,000 tonnes	Consumables
	1,000-1,200 tonnes m ³	Supplies
Gold Mine	28,000-36,000 m ³	Fuel
	9,000-17,000 tonnes	Consumables
	600-1,000 tonnes	Supplies
Base Metal	15,000-22,000 m ³	Fuel
	6,000-9,000 tonnes	Consumables
	400-600 tonnes	Supplies

The base metal output ranged 240-360,000 tonnes of concentrate per season. No indication of production or milling rates was provided for the diamond and gold mine scenarios.

Given that NSSI are moving two dedicated 5,000 ton barges and four shiploads of dry goods to the Meadowbank mine each season (2010 & 2011), the dry cargo numbers posited for the gold mine may be on the low side. Cargo moved by NSSI for Newmont is not, necessarily, indicative of volumes as the mine is not yet in production.

The Mary River Project, is essentially a transportation project with unprocessed ore from quarry area to port and then to customer. The only intermediate process may be some minor crushing and screening for fines. As a result, fuel for the mine trucks, basic crushing and screening, rail transportation to the port will be the most significant input. A diamond mine is somewhat similar in nature, i.e. primarily rock recovery, transportation and screening could give some indication of potential volumes.

Information gathered from online resources indicates that the Mary River rail line to Steensby Inlet is 149km, operating speeds will average 60km/hr and there will be three consists of 2 x 4,000 bhp engines and 64-130 hopper cars. Each consist will

⁶⁵ *Needs/feasibility study for the Slave Geologic Province Transportation Corridor* by Arthur Anderson LLP and others.

⁶⁶ From Figure 5.2, page 76 of reference 5

make three round trips per day for an operating year of 300 days. Hopper car size was not given, nor the mining rate that this operation supported. The length of each train may indicate a range from low to high mining volumes.

Based on typical specific fuel consumption values, the annual fuel consumption would be in the order of 10,000 tonnes of diesel, or about 12,500m³.

No information has been found about the number of trucks to move the ore, or related information on flight refuelling needs for Jet A1.

Based on the above, it would seem reasonably conservative to use the Diamond mine fuel number range for Mary River.

For POL, and without knowing whether the vessels proposed for ore shipment would be dry ore carriers or ore/bulk/oil (OBO) configuration, it is difficult to state how the fuel would be shipped. We will assume separate delivery, i.e. the ore carriers will be dry cargo vessels based on productivity needs for cargo shipment.

Based on Meadowbank actuals, Baffinland would probably need at least monthly dry cargo shipments during the season. These shipments may originate in Canada, but inputs could come in foreign flag vessels from offshore. Vessel size used could be similar to the *Federal Power*; see following.

FEDERAL POWER⁶⁷

Dwt	17,451
Cube	21,697m ³ (box holds, double hull)
Gear	2 x 45mt cranes
TEU	1,098
Ice	GL E3 up to 8.7m draft.

As Fednav appear to be contracted to arrange ore shipping, ArclorMittal may contract with them to provide dry cargo re-supply needs as well.

Other projects outlined in section 3.2 of the report will draw directly on current knowledge and projected requirements from Table 5.4. – 1.



Federal Patroller from the vesseltracker web site

⁶⁷ Sister ships *Federal Patroller* (used in the 2010 sealift by NSSI, but no longer in the Fednav fleet list), *HAL Patriot*, *Pendant* and *Pride*.