PRELIMINARY ANALYSIS

OF A

NORTHERN DELIVERY ROUTE

TO THE

ALBERTA OIL SANDS

AND

NWT ECONOMIC DEVELOPMENT

OPPORTUNITIES

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This report has been prepared specifically for Government of the Northwest Territories Department of Transportation in April 2007. Whilst all due care and diligence has been exercised in the collection of data for and the preparation of this report, The Mariport Group Ltd. provides an advisory service only, based on the opinion and experience of the individual consultant responsible for its compilation. The Mariport Group Ltd. issues such advice in good faith and without prejudice or guarantee. Anyone wishing to reply on such opinions should first satisfy themselves as to the feasibility of the recommendations and accuracy of the data upon which the opinions are based.

1. BACKGROUND

The Alberta Oil Sands represent a hydrocarbon resource second only to that in Saudi Arabia. However, recoverable oil is quite a low percentage of in situ resources, and producing and converting the bitumen into transportation fuels is both costly and plant intensive. Equipment needed is massive, from dump trucks capable of handling 4-500 tonnes, to process equipment 50m in length and weighing several hundred tonnes. Much of this heavy equipment is not readily available in Canada or in locations that can easily ship into the oil sands area. Some large items have been sourced offshore, but the available routes have severe limitations in terms of both weight and physical dimensions.

A typical route from offshore has been by ship to Duluth(MN) at the head of the Great Lakes, and then by rail to Linton (AB) followed by a road haul of up to 200km. For oil sands operations south of Fort McMurray, weight limits are about 600 tonnes. However the bridge over the Athabasca River[1] into Fort McMurray limits loads to about 450 tonnes for all locations north of the city. All rail moves have significant gauge limits of 14'2" width and 20' 2" above the rail. However, the top corners of the load must be rounded at maximum height, if the full gauge is used[2].

Rail guages limit what can be ordered offshore and delivered to site. The northern route, via the Beaufort Sea, Mackenzie River, Great Slave Lake and Slave/Peace and Athabasca Rivers has the potential to offer much higher weights and a loading gauge that is unlikely to be limiting. See map on the following page.

We understand that oil companies have looked, and are looking, at the route, but have been reluctant to commit because of uncertainties with regard access and reliability. One company, Synenco, has indicated a firm interest in the route, and GNWT as stewards of 90% of the inland portion wish to understand whether the route represents a real opportunity and if so, whether it could impact annual re-supply to water transport to dependent communities; potentially imperil deliveries for the Mackenzie Pipeline; affect the safety of the Mackenzie River system, and if the activity could represent economic opportunities in communities on the route.

[1] As far as we are aware, the Alberta government does not have any intent of rebuilding the bridge in the short term.

[2] Double stacked containers on well cars do not need to be rounded because the width of 8' is well within the maximum gauge.

Marine Route through the Beaufort Sea to Fort MacKay

2. EXECUTIVE SUMMARY[3] and NEXT STEPS

Executive Summary

2.1 Offshore sourced, large process equipment for the oil sands is limited to about 450 tonnes by the bridge over the Athabasca at Fort McMurray, and rail gauge limits of 20’2” (6.147m) above the rail and a width of 14’2” (4.318m). The northern route effectively removes these limits.

2.2 Our analysis suggests that there is a cost benefit to moving overweight and over size items via the Arctic. This opportunity has been created partly by the railroads materially escalating transit fees over the last few years.

2.3 We are unsure of the maximum load that could be moved. Based on information available, we are confident that units of up to 1,000 tonnes could be readily moved; up to 1,500 tonnes could probably be moved, but we are unsure that 2,000 tonnes is physically achievable.

2.4 Seasonal limitations are for arrival by mid to late August in the Beaufort, which would put arrival at Fort Smith by mid-September. At this point, depths in the Athabasca may be insufficient to support navigation.

2.5 A potential downside to the northern route is that only smaller items could feasibly be moved to Fort McKay in the same season. We believe it more likely that goods would need to over-winter at Fort Smith. Additionally, part cargoes from heavy lift ships may need to be stored in Tuktoyaktuk following discharge and moved upstream early in the following season. These cargoes could then proceed direct to Fort McKay.

2.6 Because of seasonal limitations it is highly likely that service centres would be needed in both Tuktoyaktuk and Fort Smith to facilitate these moves.

2.7 NTCL have indicated that Synenco intended to move up to sixty heavy items via the arctic. If Synenco’s demand was scalable based on bitumen throughput, then up to 1,200 units could be needed over the period to 2015.

2.8 Demand has been based on those companies with operations/plans north of Fort McMurray as these activities have the most severe limits. Oil sands operations south of Forth McMurray, and in other districts, are able to ship heavier items, although gauge is still an issue. They would be limited by the Fort McMurray Bridge for weight, but may elect to ship over gauge items via the northern route.

[3] Because of commercial confidentiality issues, the study has not been able to draw on the knowledge of NTCL about the route, or discuss it with Synenco.

2.9 We have had limited discussions with oil companies and logistics providers regarding the opportunity presented by the Northern Route. Those companies with which we have been able to speak were very interested in the potential and wished to be kept fully informed. Oil companies were not at the stage of project development where advice on size, number of units and time frame could be provided.

2.10 In some instances, there was a lack of understanding of the route. This suggests that some form of information package created by GNWT as to the opportunities of the route would be appropriate

2.11 Longer term, there are water resource issues related to oil sands development that may impact water flows, and depths in the Athabasca. Water demand and changing climate could have material impacts on Mackenzie flows, as well as the Slave/Peace/Athabasca route. The Bennett Dam in British Columbia has had some impact on peak flows into Lake Athabasca.

2.12 Capacity of the Mackenzie system will be increased this year with the delivery of six new deck/fuel barges by Horizon North Logistics. NTCL have indicated that they would build new equipment to manage heavy cargoes through to Fort McKay. If all cargo moves upstream at end season, following arrival in the arctic, then there will be little impact on fleet capacity to serve river and arctic communities. As it is likely that some items would over-winter at Tuktoyaktuk for upstream movement early the next season, then there could be an impact on capability of the river companies to service all clients. We do not have enough data on potential movements to determine what the impact might be.

2.13 Current best case expectations for the Mackenzie gas Pipeline are a commitment to proceed by 2010, with construction over the 2012 to 2014 period. Should the oil sands companies make use of the northern route, their peak movements to serve planned projects could be over the 2008 to 2013 period. However, these projects could slip, and it is likely that there will be an overlap in terms of demand. The Wolfden High Lake/Ulu project is currently going through permitting, and may be in a position to commence operation by 2009/10. Shipment needs will be prior to the MGP.

2.14 As shipping into the oil sands via the northern route would be all deck cargo, and all upstream, there should be no increased environmental risk to the Mackenzie system.

Next Steps

The preliminary study was designed as a short desk analysis of the feasibility of a northern route for moving process equipment that exceeded the capability of the current rail/road system into the Alberta oil sands. The analysis strongly suggests that the route is viable, even though there are a number of questions that need to be answered. The fact that Synenco, the operator of the Northern Lights oil sands project, has entered into agreements with Mammoet, and NTCL supports the basic conclusions of the study. The participants were unwilling – for commercial reasons – to discuss the route in detail, although some limited information was provided.

There are a number of steps that could be taken to assist in furthering the concept and ensuring that companies are able to include a realistic assessment of the route in their planning.

1. Although only four out of eleven companies entered into detailed discussions with Mariport, they were enthusiastic about possible benefits of the route and requested face-to-face discussions on the topic. Such meetings would be beneficial in determining the kind of information that companies would find useful as well as getting feedback on equipment that might be moved; size; weight and time frame. Announcing an opportunity for a meeting may also encourage other companies and logistics providers to discuss their projects and contribute their perception of the route.

2. An information package is essential, and while a Power Point presentation derived from the preliminary study would start the process, more detail will be needed, including a section on what GNWT sees as their contribution to helping make the route work.

3. There are gaps in the pro-forma transportation costs and efforts are needed to obtain better input relative to marine and rail costs that are key to the comparison between routes. This will need a better understanding of items that might be moved so that specific rates can be obtained.

4. There is very little information available about the rivers; no formal charts have been produced although private ones may exist. Thus it is difficult to provide an independent assessment of the route and its ability to handle large tows.

   An independent bathymetric survey could be undertaken, but this is estimated to cost in the range of $200-750,000[4]. This would have be cost-shared by the commercial sector, NWT, Alberta and Canadian Hydrographic Service and the information made publicly available as part of the package.

[4] Price indication by McQuest Marine who have some experience of the river downstream of Fort McMurray. The range depends on whether the charting is of a reconnaissance type or to chart status. Lower costs are achievable using Lidar air borne technology, but this does depend on the water being clear. Turbid water cannot be surveyed in this way.

5. The impact on the Mackenzie system and the potential for economic development in Tuktoyaktuk and Fort Smith cannot be properly assessed at present as we do not have an idea of size of the units, numbers and time frame. Meetings with the companies could help, but it is likely that an iterative process with the companies will be needed over, possibly, a six-month period to acquire enough data to be able to confidently provide a preliminary assessment of capacity issues and potential employment and investment.

6. As noted in the study, there are a number of other developments in the Arctic that may, taken together with shipping to the oil sands, create an environment where dredging at Tuktoyaktuk could be justified and investment in an enhanced logistics operation considered. The amount of traffic that could be generated into the Beaufort, together with transits of the North West passage and sovereignty concerns may justify the federal government considering stationing an ice breaker at Tuktoyaktuk. Thus it may be appropriate to prepare a planning document that would identify the opportunities and give the NWT the appropriate update procedures to permit demand to be tracked.

Probable Costs

Step 1 Prepare a Power Point presentation based on the report for use in meetings. ***Probable cost $1,500***.

Step 2 Meetings in Calgary, Edmonton, and Fort McMurray with oil companies and logistics providers.
Probable cost $7,500[5]

Step 3 Using information from the meetings, seek specific price indication from heavy lift companies and the railroads regarding a representative move. Presuming valid information is provided, update the Preliminary Report and the Power Point presentation. Circulate the revised Power Point presentation to oil company and logistics contacts.
Probable cost $4,500[6]**.**

Step 4 Assuming the oil companies are still supporting the overall concept, firm up bathymetric survey pricing and seek commitments from stakeholders in a cost sharing agreement.
Probable cost, as indicated.

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5 Includes five days professional fees, airfare Halifax to Yellowknife with stopover. Budget per diems at $200. Trip may take less time and thus cost would be reduced.

6 Includes five days professional fees. May be achievable in less time.

Step 5 Commission bathymetric surveys and use results to upgrade the preliminary assessment to a full feasibility study. This could, again, be a cost shared approach.
Probable cost $30-40,000.

Step 6 Update Power Point presentation and arrange second round of meetings with oil companies to discuss the route and present the finds of the feasibility study.
Probable cost $7,500 (same assumptions as step 2).

Step 7 Economic benefit and planning study, Tuktoyaktuk and Fort Smith, using information from discussion with the oil companies about oil sands movements and other information regarding the Arctic. Prepare a preliminary assessment of activities and employment opportunities that could be developed in the communities. For Tuktoyaktuk this would include an assessment of traffic into the Beaufort and through the NWP. Include full update procedures.
Probable cost $15,000.

Step 8 Mackenzie River impact assessment, using most current data available modify the Mariport capacity model of the Mackenzie to accommodate upstream movements and re-evaluate river capacity and demand over the 2010-2020 period taking into account best information on the MGP, oil and gas exploration, mining, oil sands etc. Re-evaluate potential environmental risk associated with the traffic.
Probable cost $15,000.

3. SHIPPING AND TRANSPORTATION

We have looked at origins in Europe and the Far East for offshore sourced process plant, with shipment into the Arctic, or via the Great Lakes as the two competing routes. The estimates given below presume a single shipment of goods bound for the oil sands area. The section on sensitivity indicates the likely comparative costs for multiple loads on the same ship and discusses some of the issues associated with the cost estimates.

3.1 SHIPPING AND TRANSPORTATION TO SITE FROM EUROPE

i) Shipment via the Canadian Eastern Arctic

This scenario presumes that the origin of the units would be Germany (Bremen as typical port) and would be shipped by an ice-strengthened vessel (Lloyd's Type 1, Canadian Type B). While a better ice class vessel may be available, Type A vessels are much less common and may carry a relatively high premium in charter rates. There could also be difficulty finding heavy lift ships having such ice capability. See notes elsewhere regarding heavy lift capability within the world fleet.

Entry to the Canadian Arctic is controlled by the Arctic Shipping Pollution Prevention Regulations, which have established certain zones and dates for entry by vessels having particular ice capabilities. The zones and dates are in the following figures. There are provisions for modifying the dates using the Arctic Ice Regime Shipping System (AIRSS), however this is usually a matter of days, not weeks or months[7]. While there have been a number of years with exceptionally light ice conditions, climate change does not guarantee a continuation of such conditions and there will be years when ice conditions are not favourable to navigation without ice breaker assistance. Under the zone date system, the least capable vessel that could sail from the east is a Canada Type C. Vessels with lesser strengthening are not permitted into zone 6 (unless it could be demonstrated under AIRSS, that access was feasible), this zone controls access to Peel Sound and Franklin Strait.

A voyage is presumed to proceed via Nuuk to pick up an ice advisor, (in Greenland on the east side of Davis Strait) and then via Lancaster Sound, Peel Sound, Victoria Strait and Coronation Gulf to Tuktoyaktuk. Zones and dates for a Type B vessel are as follows:

TYPE B VESSEL

Zone	Entry	Exit	Distance nm
Zone 13	July 15	Oct 15	337
6	Aug 25	Sep 30	370
7	Aug 10	Oct 15	)
11	July 15	Oct 20	) 863
12	July 1	Oct 25	)

[7] It should be noted that AIRSS has been used to permit entry into Kugaaruk in Nunavut by a Type A vessel, where the zone date system would not permit entry. This activity has been achieved over the last three shipping seasons.

TYPE C VESSEL

	Entry	Exit	Distance nm
Zone 13	July 15	Oct 10	337
6	Aug 25	Sep 25	370
7	Aug 10	Oct 10	)
11	July 15	Oct 15	) 863
12	July 1	Oct 25	)

Thus the critical dates are for zone 6, giving plus/minus one month for turnaround.

Sailing legs and time, presuming reasonable conditions are as follows:

NORTHWEST PASSAGE ROUTE

Leg	Distance Nm	Average Speed	Time/days	Delays
Bremen-Nuuk	2,210	14	6.6	1[8]
Nuuk-Lancaster Sound	890	13	2.9	
Lancaster Sound-Peel Sound	377	12	1.1	
Peel Sound-Victoria Strait	270	8	1.4	
Victoria Strait-Tuktoyaktuk	863	12	3.0	
Total transit days			15.0	
zone days			5.5	
BIWL[9] days			9.2	

Assuming one week at anchor off Tuktoyaktuk for cargo transfer, the vessel should be able to do a round trip Lancaster Sound-Lancaster Sound in 20 days. This is well within the time limits for zone 6. For insurance purposes, the vessel will be above 60°N for a total of 25.4 days including cargo transfer.

In terms of timing, and assuming entry to zone 6 on or about August 25th, delivery in Tuktoyaktuk should be completed by September 6th, which would enable materials to be into Hay River/entry to the Slave River prior to season close on the Mackenzie. Freeze up for the Slave/Peace/Athabasca rivers is not known[10], although freeze up for Great Slave Lake is, typically, not until end November. However, a key factor is seasonality with regard to river depths. On the Mackenzie, end season depths can

8 Pickup ice advisor.

9 BIWL= Breaking Institute Warranty Limits. This is the term used by the marine insurance community when vessels trade outside the limits that have been agreed for normal Hull and Machinery coverage. The Great Lakes are also outside warranty limits, but the “AP’s”, or additional premiums are much lower than for trading north of 60°.

10 Critical dates for the Slave/Peace/Athabasca do not relate to freeze up, but to water flows. See later sections of the report.

create problems, and Athabasca flow rates have declined to less than half peak flows by October. See section 5.3.

For pro-forma purposes, the vessel is presumed on/off hire in Bremen, i.e. no ballast in/ballast out assumptions, but the voyage has to support a complete round trip. Also, no icebreaker assistance for the trip is assumed. Charter rate is presumed at U$50,000[11]/day, plus fuel at U$10,000/day at sea, and U$2,000/day in port or at anchor.

PRO FORMA VOYAGE COST VIA N.W. PASSAGE

Voyage sailing days	30.2
Port days, inc ice advisor pick up/drop off.	16.0[12]
On-hire days	46.2
5% margin	4.6
Total on-hire days	50.8
Charter cost	$2,540,000
Fuel cost at sea	348,000
in port	32,000
Ice advisor @U$500/day, 15 days	12,000
Ice advisor travel expenses	5,000
Port dues & charges	30,000
Insurance, additional premium for BIWL @$10,000/day	254,000
Pro forma cost	U$3,221,000
NTCL freight to Fort McKay [13]	C$1,500,000
Portage between Fort Smith and Fort Fitzgerald	100,000
Total cost into Fort McKay @ 85¢ exchange	C$4,821,000

Technically a tug and barge may be able to offer at a lower time charter rate but the much lower speed, typically 6kts for a tow, would put such a unit much closer to not being able to achieve a turnaround through the Arctic within the appropriate window. A conventional vessel would have a 10-day grace period between voyage time and window; the tug/barge would only have three days. There is a European based company that offers heavy lift services using a fleet of eight semi submersible barges. Thus equipment could be available.

[11] We have used the *Anna Desgagnes* as a prototype vessel for the ocean moves. Advice by Desgagnes in 2003 was that a budget time charter rate would be C$35,000/day, equivalent to about U$30,000/day at current exchange rates. The market has moved up considerably since 2003, and a current rate would be about $50,000/day. See the Sensitivity discussion for more information on comparative time charter rates.

[12] Assumes one week load, one week discharge.

[13] Based on a price indication in 2003 from NTCL for a move from Tuktoyaktuk to Hay River, and proportionately increased for cost of living, distance, and additional fuel costs

ii) Shipment via the Great Lakes

This scenario assumes the same port of origin for the units, but would not require an ice-strengthened vessel, although heavy lift and/or Ro-Ro capability would still be essential. The Seaway is open from end March through to end December, which gives a much more flexible window for cargo delivery into Duluth. Evaluation of options for delivery of units to Linton (AB), within current axle limits shows that a total load could not exceed 450tonnes[14] within a gauge of 20'2" height above the rail, 14'2" width and 130' length. Heavier items (750 tonnes) have been shipped through Duluth, but these went to Lloydminster in Saskatchewan.

GREAT LAKES ROUTE

Leg	Distance (Nm)	Average Speed	Time (days)
Bremen-Montreal	3,146	14.0	9.4
Montreal-Tibbets Point	160	-	1
Tibbets Point-Port Weller	139	14.0	.4
Port Weller-Port Colborne	23	-	.5
Pt. Colborne-Detroit River Light	190	14.0	.6
Detroit River Light-Port Huron	75	-	.5
Port Huron-Sault Ste. Marie	234	14.0	.7
Sault Ste. Marie-Duluth	343	14.0	1.0
Total time			14.1

Vessel is presumed on/off hire in Bremen at a charter rate of U$50,000[15]/day, plus $10,000/day for fuel at sea and $2,000/day fuel in port.

[14] This is not the rail limit, but the road bridge into Fort McMurray. See later report sections.

[15] We have assumed a market vessel with heavy lift capability.

Map showing route from the Atlantic via the Great Lakes to Linton AB

PRO FORMA VOYAGE COST VIA GREAT LAKES

Voyage sailing days	28.2
Port days, inc. pilot delays	16.0[16]
On-hire days	44.2
5% margin	2.2
Total on-hire days	46.4
Charter cost	$2,320,000
Fuel cost at sea	282,000
in port	32,000
Lake & Seaway pilots - 12.4 days @ $3,000/day	37,200
Port dues & charges	80,000
Additional BIWL insurance costs, unit	20,000
Seaway tolls, up and down	10,000
Pro forma ocean cost	2,781,200
Rail transfer	50,000
Rail freight[17]	2,000,000
Load master	55,000
Total cost to Linton AB	U$4,886,200
@ 85¢ exchange	C$5,748,471
Road transfer to Oil Sands area, 220km	C$250,000
Total transportation cost	C$5,998,471

The barges noted the arctic delivery option, are too wide for seaway access.

3.2 SHIPPING AND TRANSPORTATION TO SITE FROM FAR EAST

i) Shipment via the Bering Strait and Point Barrow

This scenario assumes that the origin of the units would be China (Shanghai as a typical port) and would be shipped on a non ice-strengthened vessel via the Bering Sea and around Point Barrow. Comments made regarding ice-strengthened vessels under 5.1 apply equally to this routing except that such ships may be less available in the Far East than in Europe. Heavy lift vessels should be equally accessible.

There are no specific US regulations regarding access to the US arctic waters and Canada's Zone Date system would apply from entry into zone 12, which has an earliest entry date of July 1, and an exit date of October 20[18]. This applies to a near-shore corridor, generally about the 50m depth contour; further north zone 4 is only

[16] Assumes one week load, one week discharge.

[17] Advice in 2003 indicated U$750,000 for rail freight to Linton AB. However, Mammoet advised, in connection with this study, that the railroads have materially increased pricing for heavy oversize units, and that a price as high as U$3m could be expected.

[18] It should be noted that ore concentrates are shipped annually from Kotzebue Sound by non ice-strengthened vessels (the Red Dog mine).

accessible to Type B and higher classed vessels from August 20-September 15. However, the Beaufort tends to break up earlier than Prudhoe Bay, although access from Point Barrow generally could not be expected before early August.

The voyage, once north of 60º, is presumed to proceed via Gambell (AK)[19] to pick up an ice pilot and then via Port Barrow to off Tuktoyaktuk. Distances are given below.

TYPE B VESSEL

Zone	Entry	Exit	Distance nm
US Waters			912
Zone 12	July 1	Oct 25	189

NON-ICE CLASSED VESSEL

Zone	Entry	Exit	Distance nm
US Waters			912
Zone 12	July 1	Oct 20	189

Thus there is a wide window of opportunity, even for a non ice-strengthened vessel.

Sailing legs and time presuming reasonable conditions are given below.

BERING STRAIT ROUTE

Leg	Distance Nm	Average Speed	Time/days	Delays
Shanghai-Gambell	3,209[20]	14	9.6	1
Gambell-Can/US border	912	12	3.2	
Zone 12 to Tuktoyaktuk	189	12	.7	
Total transit days			14.5	
BIWL days			5.0	

Assuming one week at anchor off Tuktoyaktuk for cargo transfer, the vessel would be well able to accomplish the round trip within an ice-free window. For insurance purposes the vessel would only be outside warranty limits for 17 days including cargo transfer, and mainly in waters that have an excellent history relative to ice-free access.

For pro-forma purposes the vessel is presumed to be on/off hire in Shanghai, i.e. no ballast in/out assumptions, but the voyage has to support a complete round trip.

[19] On St Lawrence Island at the entry to the Bering Strait. There is air service from Nome and deep sheltered water of the Northwest Cape where a pilot could embark.

[20] Part of this distance estimated from chart work

Also, no icebreaker assistance for the trip is assumed. Charter rate, as for the eastern delivery route is assumed to be U$50,000/day, plus fuel at U$10,000/day at sea and $2,000/day in port or at anchor.

PRO-FORMA VOYAGE COST VIA BERING STRAIT

Voyage sailing days	29.0
Port days, inc ice advisor pick up/drop off.	16.0[21]
On-hire days	45.0
10% margin	4.5
Total on-hire days	49.5
Charter cost	$2,475,000
Fuel cost at sea	335,000
in port	32,000
Ice advisor @U$500/day, 15 days	7,500
Pilot travel expenses	10,000
Port dues & charges	30,000
Insurance, additional premium for BIWL @$10,000/day	170,000
Pro forma cost	U$3,595,500
NTCL freight to Fort McKay	C$1,500,000
Portage between Fort Smith and Fort Fitzgerald	100,000
Total cost into Fort McKay @ 85¢ exchange	C$5,830,000

As with comments in section 5.1, a tug and barge may be able to offer a somewhat lower rate, but with a towed speed of 6kts, round trip time would be much longer. However, there would not, necessarily, be the same concerns as with the eastern Arctic route in terms of being able to get in and out within the zone dates. Suitable equipment could be available on the US west coast, as large ice-capable barges were built for moving cargo into the North Slope in the 1970's, thus unlike a European origin cargo, equipment might be available.

ii) Shipment via the Great Lakes

This scenario assumes that the units originate in the same location, and like the example of shipment from Europe meet a March through December window. Limits would be the same as discussed in section 5.1.

[21] Assumes one week load, one week discharge.

GREAT LAKES ROUTE

Leg	Distance (Nm)	Average Speed	Time (days)
Shanghai-Montreal	11,633	14.0	34.6
Montreal-Tibbets Point	160	-	1
Tibbets Point-Port Weller	139	14.0	.4
Port Weller-Port Colborne	23	-	.5
Pt. Colborne-Detroit River Light	190	14.0	.6
Detroit River Light-Port Huron	75	-	.5
Port Huron-Sault Ste. Marie	234	14.0	.7
Sault Ste. Marie-Duluth	343	14.0	1.0
Total time			39.3

Vessel is presumed on/off hire in Shanghai at a charter rate of U$50,000[22]/day, plus $10,000/day for fuel at sea and $2,000/day fuel in port.

PRO FORMA VOYAGE COST VIA GREAT LAKES

Voyage sailing days	78.6
Port days, inc. pilot delays	16.0[23]
On-hire days	94.6
5% margin	4.7
Total on-hire days	99.3
Charter cost	$4,965,000
Fuel cost at sea	833,000
in port	32,000
Lake & Seaway pilots - 12.4 days @ $3,000/day	37,200
Port dues & charges	80,000
Additional BIWL insurance costs, unit	20,000
Seaway tolls, up and down	10,000
Pro forma cost	5,972,200
Rail transfer	50,000
Rail freight	2,000,000
Load master	55,000
Total cost to Edmonton	U$8,082,200
@ 85¢ exchange	C$9,508,471
Road transfer to Oil Sands area, 220km	C$250,000
Total transportation cost	C$9,758,471

22 We have assumed a vessel with heavy lift capability at Mariport's perception of market rates.

23 Assumes one week load, one week discharge.

A tug/barge unit would not be feasible for delivery via the Great Lakes as the US units noted for the arctic delivery option exceed the maximum permitted beam for the Seaway.

3.3 COST SENSITIVITY

The primary area of cost sensitivity relates to charter hire assumptions in creating the ocean freight cost. There is not an open market for heavy lift ships and – typically – the fleet is booked at least 12-18 months ahead with project cargo. This is because the ships move both heavy and bulky items that cannot be handled easily by conventional ships.

Within the total transportation cost estimates, ocean freight ranges from 40-50% of the total transportation costs and although a relatively high rate has been used to generate the pro forma costs, a representative rate may be higher. As the shipping market is relatively strong at present it is unlikely that the effective rate would be any lower[24]. A complication in estimating ocean rates for the heavy lift fleet is that different consignments will often he combined on a single voyage. For example, a heavy lift voyage from Europe may involve a delivery of one item to Philadelphia[25], another to Montreal and then complete the voyage with the discharge in Duluth. This combination of different consignments could reduce the freight rate billed, although at the risk of a lengthy delivery voyage. While company practices may lower rates into the Great Lakes, it is unlikely that an Arctic delivery would combine different consignees on the same ship, unless all for the oil sands. Thus it would be appropriate for users to maximize shipments, even with the downside of over wintering parts of the shipment.

Advice regarding the cost of movements from Duluth to the oil sands area has been mixed, which suggests that current pricing is not available. One logistics representative believed that the estimate Mariport obtained in 2003 of around U$750,000 from Duluth (MN) to Linton (AB) was not unreasonable. However, Mammoet[26] felt that a price of US$3m could be expected today, because the railroads had materially increased pricing on the basis that they had a monopoly and such moves created major disruptions to their regular freight activities. We have assumed US$2m in the estimates.

The estimates have assumed a single consignment, but within the ocean freight more than one unit could be shipped. For example, a trip into Duluth could move 3 or 4 heavy units. The following example assumes all pieces are for discharge in Duluth, and under these circumstances the cost per unit may vary as follows:

[24] Recent comments by the Chairman of the DVB (a leading ship finance bank) strongly suggest that shipping is shortly to enter an oversupply position, which should bring rates down. Rate declines are already widespread in the container ship market, in which heavy lift ships occasionally trade as alternate employment. A possible contrary statement was reported in Lloyds List that African project cargo is about to boom, with a large number of power and infrastructure projects all scheduled over the next decade.

[25] The US Eastern Seaboard port that handles most project cargo.

[26] Telecon with a Senior Estimator for Mammoet on 5th March 2007

Estimated cost per unit shipped via Duluth as a part of a multiple order, in $millions

Europe origin	1 unit	2 units	3 units	4 units
Ocean freight	C$3,272	3,272	3,272	3,272
Inland freight	C$2,726	5,452	8,178	10,904
Total	C$5,998	8,724	11,450	14,176
Cost/unit	**C$5,998**	**4,362**	**3,817**	**3,544**

If the carrier moved multiple units for different consignees in different locations on the North American Atlantic seaboard, the savings would not be as great. Reductions in unit cost might be expected for moves via the Arctic, if there were Pacific coast consignees in addition to those in the Arctic, or multiple items for delivery into Tuktoyaktuk.

3.4 TRANSIT ISSUES

For maximum weight items, the route via Duluth typically has to be timed for end season delivery so that units will arrive for winter transfer to site due to track bed and road conditions in northern Alberta. Less heavy items will have a wider window for transfer. However, for movement via the Arctic and up the Mackenzie, there are two shipping windows, one for safe ship entry and departure to the Beaufort Sea, and the other relative to water depths in the rivers, particularly the Athabasca.

The section of the report on Arctic access, notes that the earliest likely date that a non ice-strengthened vessel could proceed inbound from the Bering Sea would be August 1st. This would put it into the Beaufort Sea approximately five days later, for cargo transfer[27]. Mackenzie flow rates, and thus depths, reportedly peak in June, and 70% of annual discharge occurs in the May to October period[28], therefore with a mid-August potential arrival for cargo transfer, available depths will be declining and care will be needed regarding tows and drafts used to support heavier items heading upbound. At this stage of the season, the Athabasca is already in decline and while it may be possible to move cargo as far as Fort Smith[29], it may be necessary to winter items there, moving them in May or June of the following season when better water depths should be available.

Late season drafts on the Mackenzie have not generally been an issue for NTCL as the system is in return mode, with light barges being brought back up stream. A cautious assumption would be 4’0” available draft, although there have been low water years in the past that have given problems for upbound navigation.

[27] Advice by the VP Operations for Horizon North Logistics indicated that the date for open water has shifted later in the season, and may be as late as August 15th, but exit dates have also moved later by 15 days to the end of November.

[28] It is reported that the flow rates do not vary significantly over this period

[29] We are unsure of water depths in the channels that form the delta of the Slave River in Great Slave Lake. Access into the river could be problematic late season.

In terms of capability, a movement from the Beaufort to Hay River, and possibly into the Slave River as far as Fort Smith, may be achievable by early September. Utilizing a 4-barge tow of different series NTCL barges would give the following lifts:

ESTIMATED TONNES, DECK CAPACITY[30], FOUR UNITS

Barge series	600	800	1000	1500
5'0" draft	2,200	3,600	4,000	5,200
4'6"	1,800	2,700	3,700	4,500
4'0"	1,600	2,300	2,800	3,600
3'6"	1,300	1,900	2,200	2,800

Our records indicate, and this was confirmed by NTCL, that the standard tow that used to operate the Slave/Peace/Athabasca route was 6 x 600 series barges. At 3'6" draft, which is what NTCL have indicated is a target draft. Such a tow could possibly lift 1,950 tonnes[31], based on our estimates of individual barge capacity. However, we are not sure that a six-barge tow could realistically be assumed for a straddled load, and would expect four to be a more realistic configuration. The problem then becomes one of manoeuvring the tow in shallow channels. The envelope for 6 x 600 series barges is 378' x 58'. A tow of 4 x 1000 series would be 346 'x 88'. We do not know whether the additional tow width could be accommodated on bends.

30 This is not standard deck capacity with re-supply items. Assumes a single heavy load straddled over the four barges. Mariport estimates from various sources.

31 Advice by the VP Operations for Horizon North Logistics indicated that previous studies suggested that the maximum lift achievable was about 1,400 tonnes.

4. HEAVY LIFT MARKET

The Heavy Lift Market is relatively small for capabilities over about 500tonnes. Companies that have been identified deploy ships that fit into three market areas:

Heavy Lift (Big Lift[32], Jumbo, SAL[33], Beluga and BBC)
Semi-submersible platform (Dockwise[34] and Anchor Marine Transport)
Semi-submersible dock type (mainly Dockwise).

Another company, although not generally considered as heavy lift, is Zenhua[35], a subsidiary of Shanghai crane maker ZPMC. Fleet information is provided on the following page and examples given in Annex 10.3. BBC and Beluga Shipping have generally been active in vessels with lift capabilities under 500 tonnes. Beluga have an aggressive construction schedule, and will have 6 x 1,400 tonne capable 20,000dwt ships coming on line starting in 2008. SAL will deliver ships with capabilities of up to 2,000tonnes in 2008/9 and BBC are expanding their project cargo fleet with lift capabilities of up to 800 tonnes from the current 500 tonnes. Summary information is given in the table on the following page and in Annex 10.3.

The crane capability of the heavy lift fleet currently tops out at 1,800 tonnes. Heavier items have to be either rolled out over the stern of suitable ships or side-skidded onto a dock. In Mariport's opinion, a transfer at such a weight may not be able to take place at anchor, as most crane type heavy lifts are understood to use the dock for load stabilization on transfer. Lighter items could be transferred at anchor. Mariport is not sure if any of the companies have stern or side-discharged a very heavy item onto a floating platform, such as a four- or six-barge tow at anchor.

Barges being transferred from a heavy Lift ship in the Arctic in 2001
Image from Cooper Services web site

[32] Big Lift used to be the shipping arm of Mammoet. Mammoet is now, through various corporate manoeuvres, exclusively land based.

[33] SAL has recently sold 50% of equity in the firm to K Line of Japan

[34] Dockwise has just been purchased by Sealift, a new Norwegian heavy lift company with six semi-submersible ships on order.

[35] Equipment photographs are available, but not technical specifications.

Lighter units can be discharged while the ship is at anchor, and Big Lift unloaded three barges for Cooper Services off Tuktoayktuk in 2001. See image on previous page. Barge light weight is estimated by Mariport at under 200 tonnes.

Heavy items, although not usually of the size being considered, can be handled as deck cargo on conventional dry cargo vessels, providing suitable shore handling equipment is available. For Arctic transhipment this equipment is not available unless a floating crane were to be separately chartered and manoeuvred into position for handling the unloading operation. High capacity floating cranes are an even more specialized market than heavy lift shipping.

It would seem that the dock at Tuktoyaktuk would need to be actively used for transfer and that this activity, together with wintering of modules, could support a marine service centre.

HEAVY LIFT FLEET

CATEGORY	No.	LIFT	SPECIAL FEATURES
Big Lift			
Happy Buccaneer	1	2 x 700	Stern ramp 2,500t capacity
Happy R Types	4	2 x 100	
TRA Types	4	2 x 275	
DA Types	4	2 x 250	
Jumbo Shipping			
J 1800 class[36]	4	2 x 900	Stern ramp
D 1000 class	2	2 x 500	
H 800 class	2	2 x 400	Stern ramp
E 650	2	2 x 325	Stern ramp
E 500	1	2 x 250	Stern ramp
G 500	3	2 x 250	Stern ramp
Dockwise			
Open deck	5	40-70,000	
Open deck/dual cargo[37]	4	30,000	
Dock Type	2	10,000	Stern ramp to 2,000 tonnes
Yacht carriers[38]	4	10,000	Stern ramp

[36] One vessel this class under construction.

[37] Able to carry petroleum products below deck.

[38] Dock type vessels that have been converted for use as yacht carriers. May no longer be in the Heavy Lift/Project Cargo market. Dockwise have just delivered another yacht carrier- ***Yacht Express***

CATEGORY	No.	LIFT	SPECIAL FEATURES
Beluga			
Existing fleet	34	120-500	Mainly for project cargo
Newbuildings F,G&N	25	120-240	
Newbuildings P1 series	8	800	
Newbuildings P2 series	6	1,400	
SAL			
132 series	4	2 x 250	
161 series	4	2x275+1x150	
161A series	4	2x320+1x200	
161B series	2	3x350+1x250	
176 series	4	2x750+1x350	Delivery 2008/09
179 series	2	2x1,000	Delivery 2009
Anchor Marine			
Semi-submersible barges	8	No data	91-144m loa,24-36m beam, 6-9m draft
Zenhua			
Open deck	10	?	Details not available.

5. ARCTIC ACCESS

5.1 Into the Beaufort Sea

As noted in the transportation section, regulation of access from the Pacific versus the Atlantic is quite different, and potential windows of opportunity are also different. Based on historic ice data it was estimated in 1998[39] that reliable access to the Beaufort could only be achieved two years in ten from the east, but seven years in ten from the west. However, the impacts of global climate change will have increased the probability of reliable access. As an indication, the North West Passage has actually been ice-free for at least a part of each of the last five seasons. There could, however, continue to be concerns regarding the eastern route, given that the warming climate has released multi-year ice from the high arctic and this is now a hazard in lower latitudes. Such ice, being much harder than first year ice, is much more likely to create hull damage in an impact at normal operating speeds.

Non-ice strengthened ships from the Pacific regularly trade as far as Kotzebue Sound[40] to service Cominco's Red Dog zinc/lead concentrates mine. The shipping season is, typically, about 100 days between July and October.

Material available in Mariport's files, which analysed transit time for the ten years between 1985 and 1994 inclusive, showed that a vessel could make good without icebreaker support between about 6th August and 5th November entering the Beaufort from the west. Conditions prior to August could be difficult due to ice cover, even in good years[41]. Conditions in a poor ice year would deteriorate from late September onwards, but sailing conditions were reasonable to end October/early November with a transit achievable within five days from Point Barrow to Tuktoyaktuk.

5.2 Mackenzie River and Great Slave Lake

The Mackenzie River season is essentially 1st June to mid October, or 132 days; a statistical range of navigation days was not identified by Mariport. There are also seasonal variations in water depth that vary with winter conditions. For example, a good snow year in the river's tributaries will lead to better depths compared with a below average year. Water depths tail off in late season and NTCL have had difficulties in returning light barges over Rampart Rapids in some years. Great Slave Lake[42] has a median break-up by 18th June with freeze up by 7th December. The range in June is between first and third weeks while the freeze up range is third week in November to end December. Thus the lake should not impose any increased restrictions on seasonal operations for a northern delivery option into the oil sands.

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[39] D F Dickens *A study of technical aspects of deep draft shipping to the Western Arctic.*

[40] Kotzebue Sound is about 67º N in the Chukchi Sea.

[41] As indicated in footnote 27 access dates may have moved about 15 days later into the season. The season also closes about 15 days later, towards the end of November.

[42] Walker A 1998 *Great Slave Lake and Great Bear Lake Ice Freeze Up and Break Up.*

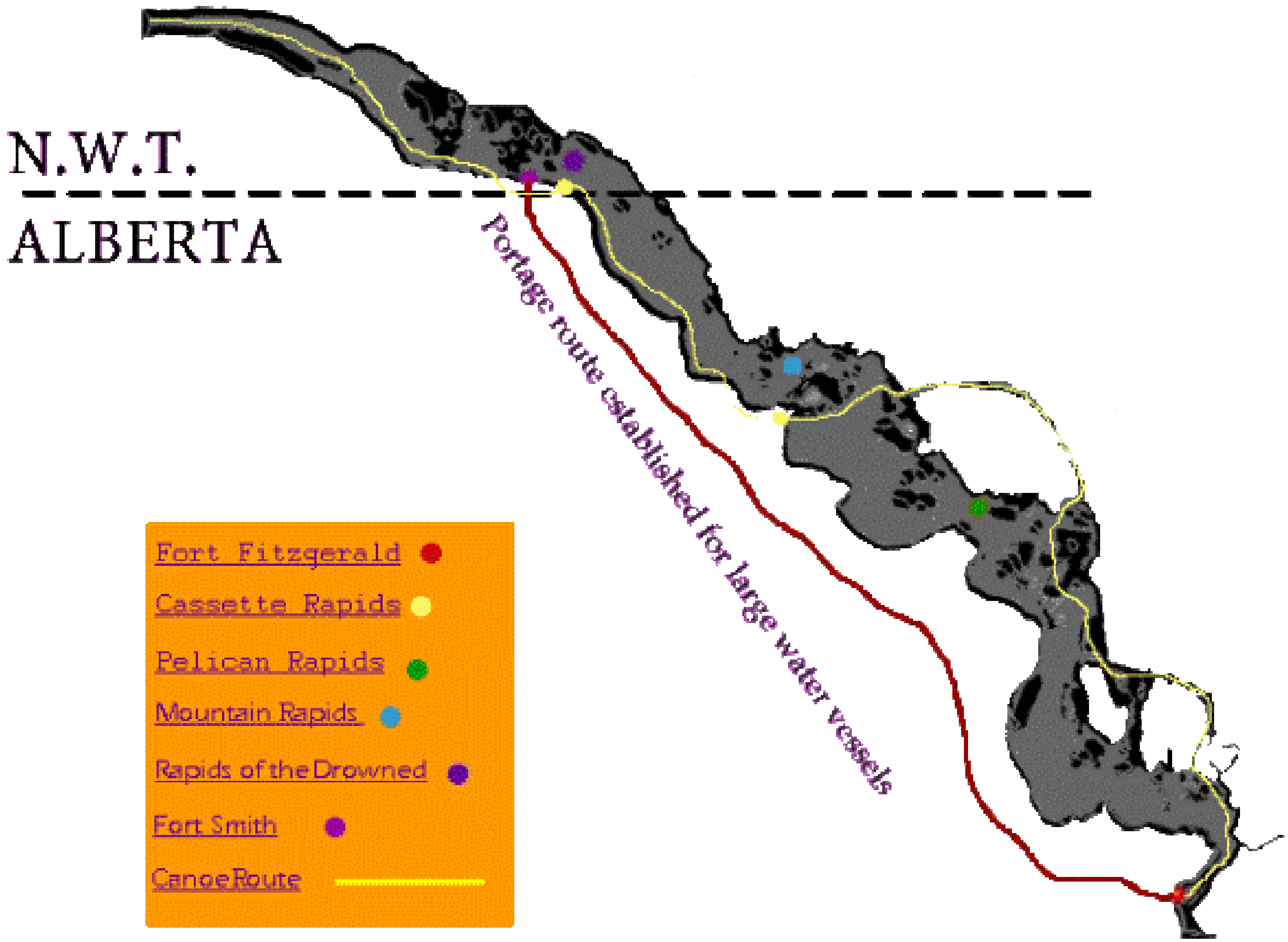
5.3 Slave/Peace/Athabasca Rivers

We have not been able to identify any data that independently provides conditions for the river system that might be used for access from Great Slave Lake into the oil sands area. However, it is heading south from Great Slave Lake, and winter conditions should be less limiting than on the Mackenzie. Difficulties may come in water supply and depth, given the watershed of the Athabasca River, and controls in BC[43] on the headwaters of the Peace River and the amount of water withdrawn from the Athabasca for oil sands activities. The chart on page 22 gives monthly flows on the Athabasca. This suggests that moves may have to be accomplished in the May through August period. This would require units being shipped via the northern route to winter over at Fort Smith as a tow could not start up the Mackenzie until mid/late August and could be 20 days in transit.

A transit of the system for any goods involves a portage around the rapids between Fort Smith and Fort Fitzgerald. See map on the following page The portage was first used in fur trading days, but was upgraded in 1942 by the US Army as part of the logistics system for moving materials to Norman Wells. At that time, equipment and materials were brought by rail to Waterways AB, then the rail head, barged to Fort Fitzgerald, portaged using a 40 wheel trailer, and re-launched below the rapids.

[43] The Bennet Dam at Lake Williston.

Sketch map of the Portage Route (courtesy of GNWT)



mv Tembah on the portage, about 1964
Image from Society of Naval Architects and Marine Engineers paper

Following completion of the rail link to Hay River, the portage was used sporadically by NTCL and A Frame Construction in servicing communities on Lake Athabasca and on the river. As shown in the photograph above, it was used to transfer marine equipment for the federal government into the 1960's, despite the availability of a rail line to Hay River. There appears to have been some service providers on Lake Athabasca, and the rivers, at least until the mid 1990's, thus the portage may have continued in use.

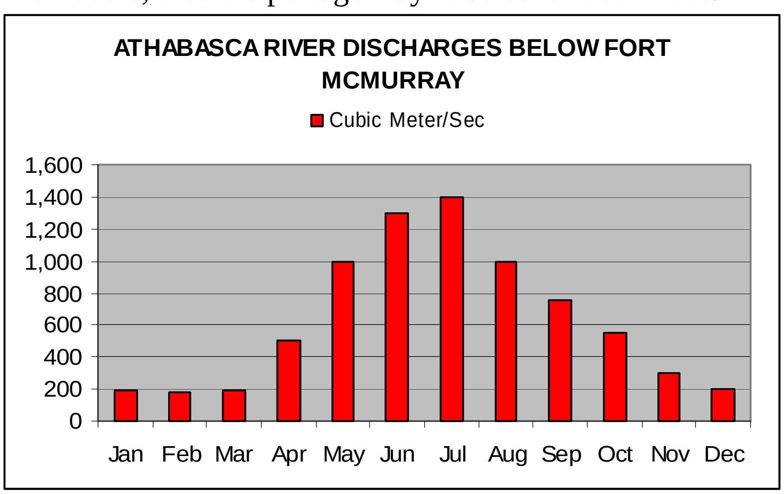


Chart derived from data in *Troubled Waters, Troubling Trends.*

6. WATER RESOURCES

Much of the information for this section has been drawn from a major study by the Pembina Institute in May 2006 *Troubled Waters, Troubling Trends.* Also referenced has been a paper published by the National Academy of Sciences in February 2006 by D.W. Schindler and W.F. Donahue *the Impending Water Crisis in Canada's Western Prairies Provinces.*

The critical water basins that relate to navigation in the Slave/Peace/Athabasca route are the Peace/Slave with a flow of 18,900m m^3/year and the Athabasca 2,240m m^3/year[44]. Other basins trend east and/or south. The Great Slave Lake is served by other rivers, most notably the Hay River. The upstream portion of the Mackenzie also benefits from the Liard River.

The major water flow into the Athabasca system is the Peace River, which was dammed in its headwaters in 1968 by the Bennett Dam. The dam has influenced flows in the river, as shown in the chart below, creating a much flatter flow profile. River flows are now 40-60% below historic values, although the impact has been primarily on the delta area where reduced river flows into Lake Athabasca have created a drier environment, as flow rates are now not high enough to fill hanging wetlands. Reduced flows, given the overall importance of the Peace River will have had an impact on available water depths on the Slave and the Mackenzie, but not on the Athabasca River.

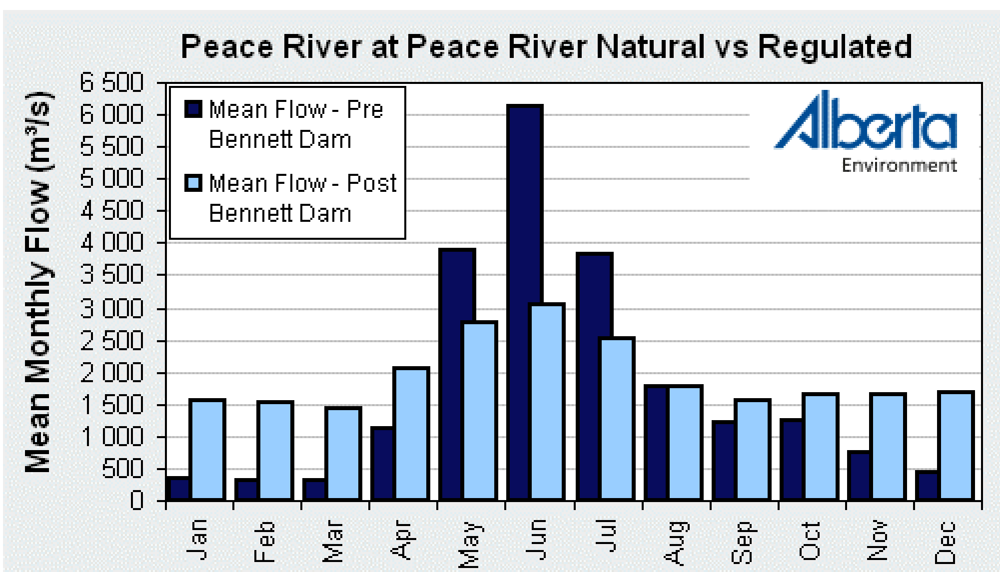


Chart from and Albert Environment web site

While river flows are of importance, there are broad climate change issues that are of concern relative to the long-term reliability of water flows. Studies strongly suggest that the twentieth century – not withstanding the droughts of the 1930's and between 1998 and 2004 – has been unusually stable and moist. In earlier centuries, severe droughts that

[44] The Taltson River also feeds the Slave River below Fort Smith

lasted for decades were common. Captain John Palliser warned that water was scarce in the prairie provinces and both the North West Company and the Hudson's Bay Company reported water flow problems on principal rivers.

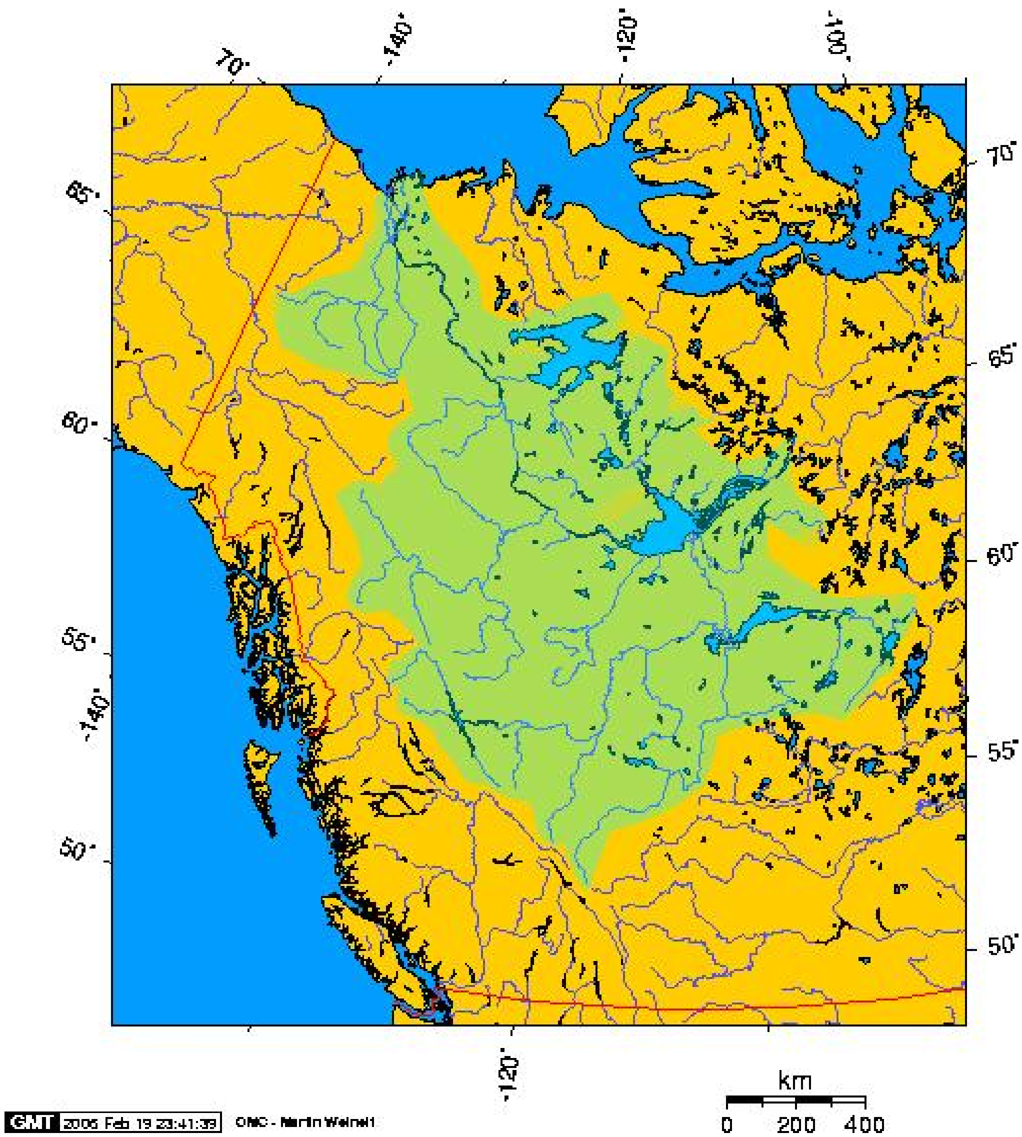
Records show that rainfall has been declining for much of the last century and that water flows have been maintained by glacial melt caused by elevated temperatures. Glacial retreat has been so severe that it is not expected to remain a viable source of water much beyond 2030. Average temperatures in Alberta and British Columbia have risen[45], and snow pack has diminished (although snowfall in the winter of 2006 has been heavier than average). Average depths of snow cover have declined, both in river headwaters and in the prairie provinces, and stream flows are significantly below historic levels. The Athabasca is the only major river in the region that has not been dammed or subject to large water withdrawals (except for the oil sands) but summer flows in its lower reaches have declined 20% over the last fifty years Climate forecasts indicate increasing temperatures, will increase evapotranspiration, further reducing regional re-charge resources for the rivers and therefore leading to significant reductions in flows.

Water resource issues cover not only withdrawals from the river and climate change, but also changes to water resources in each region through muskeg and over burden drainage, stripping of peat bogs and aquifer depressurization, all of which could ultimately affect river flows and thus water levels. The amount of water used by oil sands is high during the start up periods and then reduces somewhat into operations. Although overall use is high it does depend on the type of bitumen recovery employed; quantities can range from 2 – 4.5m^3 for each m^3 of upgraded bitumen recovered. In situ activities tend to use less water, because recycling is higher needing about 15% makeup water. Recycling rates for mining are reported to be as less than 10%, although water for in situ mining appears to mainly come from ground water and thus may not have as great an impact on river flows.

Current (at 2005) licences for water for oil sands mining operation total 518m m^3 of water from all sources, of which 359m m^3 are from the Athabasca River. The expected peak year for withdrawals is forecast to be 2041 at just over 300m m^3, or about 13% of average annual flows.

[45] Lodge pole beetle infestations are directly attributable to milder winters.

Mackenzie River Watershed
(Image from a Wikpedia article about the Mackenzie)



7. OIL SANDS DEVELOPMENT

7.1 History and Growth Expectations

The Alberta oil sands[46] represent one of the largest hydrocarbon deposits in the world, with 1.6 trillion barrels of bitumen in place. However, only some 178 billion bbls are actually recoverable with current technology. Discovered by Europeans over a century ago[47], they have only been worked within the last 40 years. This lack of development has been mainly due to both extraction and upgrading of the bitumen as it cannot be used as feedstock for most North American refineries, even when diluted. Early uses depended on the bitumen as a product for roofing and road surfacing in the 1920's. Experimental and small demonstration plants were researched and run by the Alberta Government until the early 1960's. The first operation was by Sun Oil Company (now Suncor Energy). The Syncrude consortium was formed in 1964, construction of their plant at Mildred Lake commenced in 1973 and the first oil was shipped in 1978. In the twenty years to 1998, the plant produced 1 billion barrels.

There are four methods of extraction used at present:

i) Strip mining of shallow deposits with hot water extraction of the bitumen from the accompanying sands

ii) In situ using steam to heat the bitumen to the point where it can be pumped out

iii) In situ burning of a part of the deposit. This heats up the remaining bitumen and also partially refines it

iv) Some deposits in the Athabasca and Southern Cold Lake are less viscous and can be pumped without external energy input.

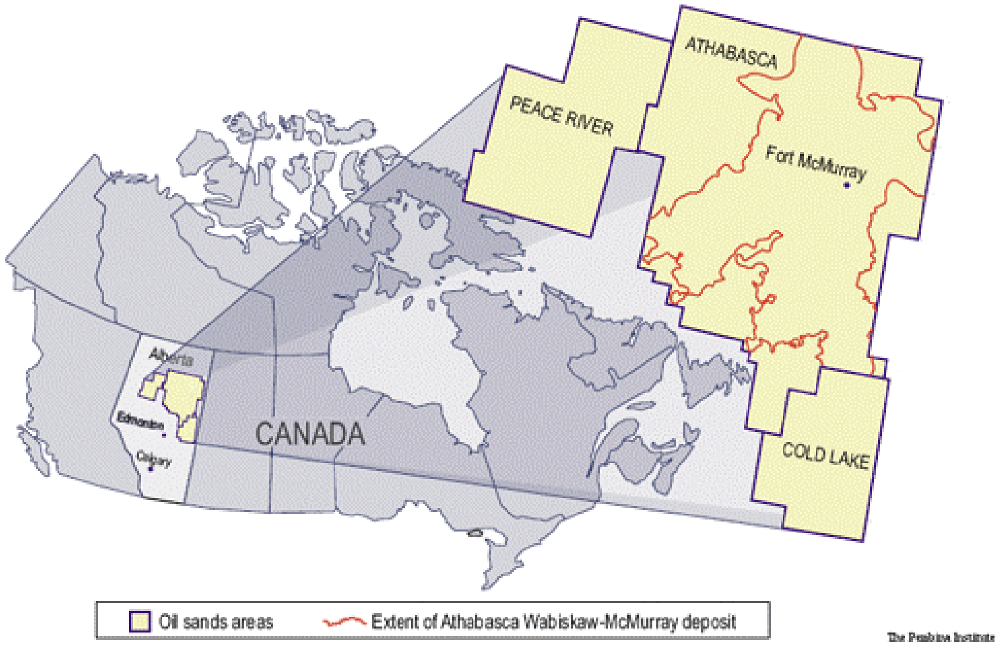
Methods i) and ii) are the primary ones used at present.

The location of the primary oil sands zones is shown in the following map.

A large portion of the Athabasca zone is sufficiently shallow to permit mining. Other regions, and elsewhere in the Athabasca region, need various in situ procedures to extract the bitumen.

[46] Technically they are tar sands. It has been suggested that the term oil sands was adopted for PR purposes.

[47] Peter Pond was the first European to report them in 1778. It was Alexander Mackenzie who explored a deposit at the fork of the Athabasca and Clearwater in 1788.



Mining uses trucks and shovels with the biggest process equipment being the feeder/crushers and cyclo-feeders. Large process equipment is also needed for the in-situ and the burning recovery methods, and this relates primarily to steam generators and water treatment[48] plant. It is in the upgraders that very large refining equipment is needed, and while some have been located at the oil sands extraction point, much of the activity has been in the Edmonton area and in Sturgeon and Strathcona Counties. There are trade-offs in building in the south; labour is more available and construction costs can be reduced. However, in order to move the bitumen to the upgrader, a pipeline must be built and a diluent supply sourced to reduce the viscosity of the bitumen to a pumpable level. One oil company representative to whom we spoke, having extolled the virtues of a southern location for the upgrader, did say that an economic way of moving process plant into the oil sands area might change the upgrader location.

Current production is about 1m b/d [49] and will grow to between 3.6 – 5.7m b/d by 2020 depending on project time lines, delays etc. Of current production, about 65% is upgraded to a synthetic crude oil, the balance being shipped as bitumen to market refineries with the processing capabilities. The disparity between upgraded and non-upgraded bitumen is expected to grow slightly to 60%, as investment in upgraders lags extraction investment.

48 Discussions with one oil company representative indicated that the preferred manufacturers were North American, and that they had designed equipment around rail guage limitations.

49 1, 064,000 b/d in 2005.

7.2 Growth in North Athabasca[50]

While overall developments cover all three oil sand areas, the area of primary interest for the northern route via the Mackenzie River are those projects north of Fort McMurray that have the more severe weight limits. Information over location and timing is given elsewhere, but scheduled completion dates indicate development in the target region as follows:

NORTH ATHABASCA OIL SANDS EXTRACTION - BBLS/DAY BY YEAR

Completion Year	Mining	In Situ	Total
Operating	863	113	976
2007	0	25	25
2008	158	35	193
2009	0	90	90
2010	372.25	20	392.25
2011	181.5	35	216.5
2012	157.25	120	177.25
2013	50	100	150
2014	90	120	210
2015	284.5	193	477.5
Later	412	100	512
No dates	500	120	620
	3,068.5	1,071	4,039.5

7.3 Demand for Large Units

Connected with the projects, noted in 7.2 above, several upgraders are planned, most of which are in the Edmonton area, however location is not clear as source documentation assigns the upgrader to the oil sands operation, not the location. While no independent data is available, NTCL stated that up to sixty large modules could be shipped to service Northern Lights. As press reports indicate that the Synenco upgraders will be in Sturgeon County, this means that the heavy items have to be a part of the plant needs for the mining operation. Upgrader projects in the target area are given in the following table:

50 Mainly from information provided on line by Strategy West, www.strategywest.com.

NORTH ATHABASCA UPGRADERS B/D CAPACITY

Completion Year	Bitumen Capacity	Syncrude Output
Operating	731	610
2007	0	0
2008	116	97
2009	0	0
2010	156.0	127
2011	46.5	40.0
2012	78.0	63
2013	50	42.5
2014	0	0
2015	139.5	120.0
Later	50	42.5
Not known	0	0
Total	1,480.2	1,243.2

Thus if the NTCL comment is correct and the demand is scalable in line with mining activity, there should be the potential for twenty times this number of units to service the market.

7.4 Oil Company Discussions

We had expected to be able to discuss the opportunity for the northern route with the oil companies, if it appeared that there were potential benefits. While we have called all the target entities with operations north of Fort McMurray (see Annex 10.2), we have had great difficulty both in finding a person with whom to discuss the concept, and getting a call back. To date we have been able to discuss the project with two logistics companies and four oil companies. The oil companies expressed considerable interest in learning more about the capabilities of the route, and incorporating it into their evaluation of specific projects. None were far enough advanced in the planning stage to be able to indicate size or numbers of units that might use the northern route. There was some uncertainty about the concept and an information package would be welcomed.

Thus it would seem necessary for GNWT to ensure that good information is available to stakeholders and that the benefits of the route, as well as its limitations, are understood.

8. IMPACT ON DEMAND ON MACKENZIE CAPABILITY

The Mackenzie River is a major re-supply route serving communities on the river, in the delta region and in the western Arctic. In excess of 100,000 tonnes of dry cargo and fuel are delivered down the river from Hay River and Fort Simpson each season. This cargo is delivered to communities, exploration camps and mining and oil and gas development projects. When the MGP is built, the river will assume even greater importance, in ensuring timely and economic delivery of logistics material to the many construction sites.

8.1 Overall System

The following commentary is based on work Mariport undertook for Transport Canada Marine Safety in 2006. For this study, a capacity model of the Mackenzie fleets was prepared. The model included NTCL, Cooper Barging and Horizon North Logistics[51]. Fleet characteristics were as follows (NTCL barge series or equivalents):

	Tugs	400	800	1000	1500
NTCL	6	0	8	24	18
Cooper	1	0	1	3	0
HNL	1	6	0	0	0

Operations were based on advice from the operators as to typical barge tows. The model excluded NTCL's 600 series barges; noted that Cooper had recently introduced three new barges and that BOSS were planning to expand their fleets in the future. As noted, Horizon North Logistics (HNL) will bring in six new "1200" series barges this year. At 200' x 50' x 10', they will lift 860 tonnes on 5' draft. These are double hull, deck/fuel barges and thus have a higher lightweight than NTCL or Cooper barges, which are single skin, hence the reduced load capability relative to other barges. HNL have not introduced any new towboats, but do have existing units that could be assigned, although they are not of great power. Consequently productivity, except in the lower reaches of the Mackenzie, will be reduced. HNL plan to introduce a 7000 bhp towboat in the future, but this have been deferred with the delay in the MGP.

The methodology adopted for the demand model was to assign the capability of the Cooper and HNL fleets first within their understood market areas, with NTCL being the default carrier. Both Cooper Barging and HNL have strong independent contacts with river communities and the oil companies, thus it is expected that their equipment will be fully employed. The new HNL equipment, despite lack of higher power towboats, will enable them to cut into NTCL's market share, effectively freeing up capacity. However, if Mariport's estimates of barge tow configurations to maximize lift are correct, then NTCL would need to take a number of 1000 series barges out of Mackenzie service and put them into Athabasca service for heavy loads. If four 1000 series barges were permanently stationed above Fort Fitzgerald to service oil sand project cargo then there

51 Originally equipment was under Beaufort Offshore Support Services. It is now a part of Horizon North Logistics (HNL).

could be an impact, as these barges and the 1500's are core to the re-supply operation. However, it could be argued that HNL's six "1200" series barges would more than compensate in terms of capacity on the Mackenzie.

While there would be some impact on NTCL fleet capacity, they can assign smaller barges from lay up, and as noted earlier they intend to build an unspecified number of new barges for the Synenco project. The problem will be motive power. Mariport assigned six of NTCL's tow boats to active tows, but noted that NTCL had three smaller boats available, the ***NT Marjory***[52], ***Arctic Kugaluk*** and ***Sans Sault***, although they were all of lower power. There are also other boats available that could feasibly be re-activated. It would seem that NTCL could well assign two towboats with tows to the Mackenzie/Fort Smith leg, with the ***NT Marjory*** and another tow above Fort Fitzgerald. This system would be limited as round trip days/tow could be in the order of 20 days including cargo time. Thus the number of units that could be handled during a season will be limited and it would seem appropriate to stage part of the deep sea cargo at Tuktoyaktuk, for upstream transfer by tows early the following season.

8.2 Impact on Community Re-Supply on the river and Western Arctic

In preparing the capacity analysis noted above, Mariport excluded three deep draft tugs from river service during the "arctic season", together with the equivalent of ten x 1500 series barges during the same period. This "fleet" served NWT communities as well as those in Nunavut and demand by mining exploration/development at Gray's Bay.

As noted above, the potential for impact on NTCL's re-supply capacity depends on which barges are used for load transfer to Fort McKay. Use of 600 series would not have an impact on either the river or the western arctic. However, use of other barges could affect fleet capacity, although the six new HNL barges will likely be assigned to oil and deck carriage that was handled by NTCL in previous seasons. As these barges are roughly equivalent to NTCL's 1000 series, then their deployment would release equivalent capacity in the NTCL fleet.

The Cooper Barging fleet is, at present, underutilised with a reported annual operation of 15,000 tonnes of deck cargo. Their primary operation is between Fort Simpson and Norman Wells and Tulita, but could well offer service on extended river routes, if the demand was present.

8.3 Mackenzie Gas Pipeline

The model developed by Mariport incorporated known information about the MGP, and the planned approach to moving equipment and fuel into the field during an expected construction period of 2008 and 2009. The model, as noted, took into account the requirements of community re-supply as well as mine development in the western Arctic.

[52] The *Marjory* undertook the trial tow with a single light 600 series barge up the Slave/Peace/Athabasca system to Fort McKay.

The analysis indicated that at 5' draft between 1st June and mid October, current fleet capacity could handle demand. As river draft, or season was reduced, then meeting demand with the existing fleet became more problematic.

Potential fleet capacity has been enhanced since that analysis was undertaken, and the MGP has been slipped to a probable 2012 to 2014 construction period. At this later date, the Wolfden project at Gray's Bay is likely to be completed and operational. If it is operational, then most of their logistics materials will be shipped in by the vessels that take out concentrates, thus reducing demand on the river system.

8.4 Risk Issues

The tows will be upstream and all will be with deck cargo, thus the environmental risk for the Mackenzie is limited. Likelihood of incidents may increase slightly, as these related to tonne miles carried. Actual transit frequency in key areas is not likely to increase, as up bound tows carrying project cargo for transfer at Fort Smith will have carried down bound cargo to river communities or to the Delta for cargo consolidation to barges handling western Arctic traffic.

9. NWT ECONOMIC DEVELOPMENT OPPORTUNITIES

If the movement via the arctic is to go ahead then it is likely that the dock at Tuktoyaktuk will be needed for cargo transfer and winter storage. There is a limit to the weight that heavy lift ships can transfer at anchor without the risk of severe rolling endangering ship, cargo and the vessel or tow to which the item(s) are being transferred. We understand that heavy lift ships use the dock edge to help support the ship and the load as it is transferred. The load would then have to be rolled onto a platform on the selected tow. Some heavy lift ships have a stern ramp and this may enable loads to be transferred directly to the tow at anchor.

If deck ships are used, e.g. the Zenhua fleet, then these are organized to side-transfer from ship to dock. Again, we would feel that such a side off-loading may not be safely accomplished to another floating platform – the designated tow.

If cargo is moved via this route then it would make sense to maximize the number of units that are carried on the same vessel. If this is the case, then not all units could be moved upstream on the Mackenzie and Slave to Fort Smith in the same season. Therefore a part of the load would need to winter over, moving early in the following season. This would create opportunities in the community for added value work on the items over the winter.

For cargo transfer to occur, we believe some dredging may be needed at Tuktoyaktuk. As far as Mariport is aware, the harbour was last dredged in the early 1980's and it will have undoubtedly silted in, as regular maintenance dredging was needed.

Tuktoyaktuk could see significant demand for services as there are a number of arctic shipping opportunities developing in the period to 2020. These are:-

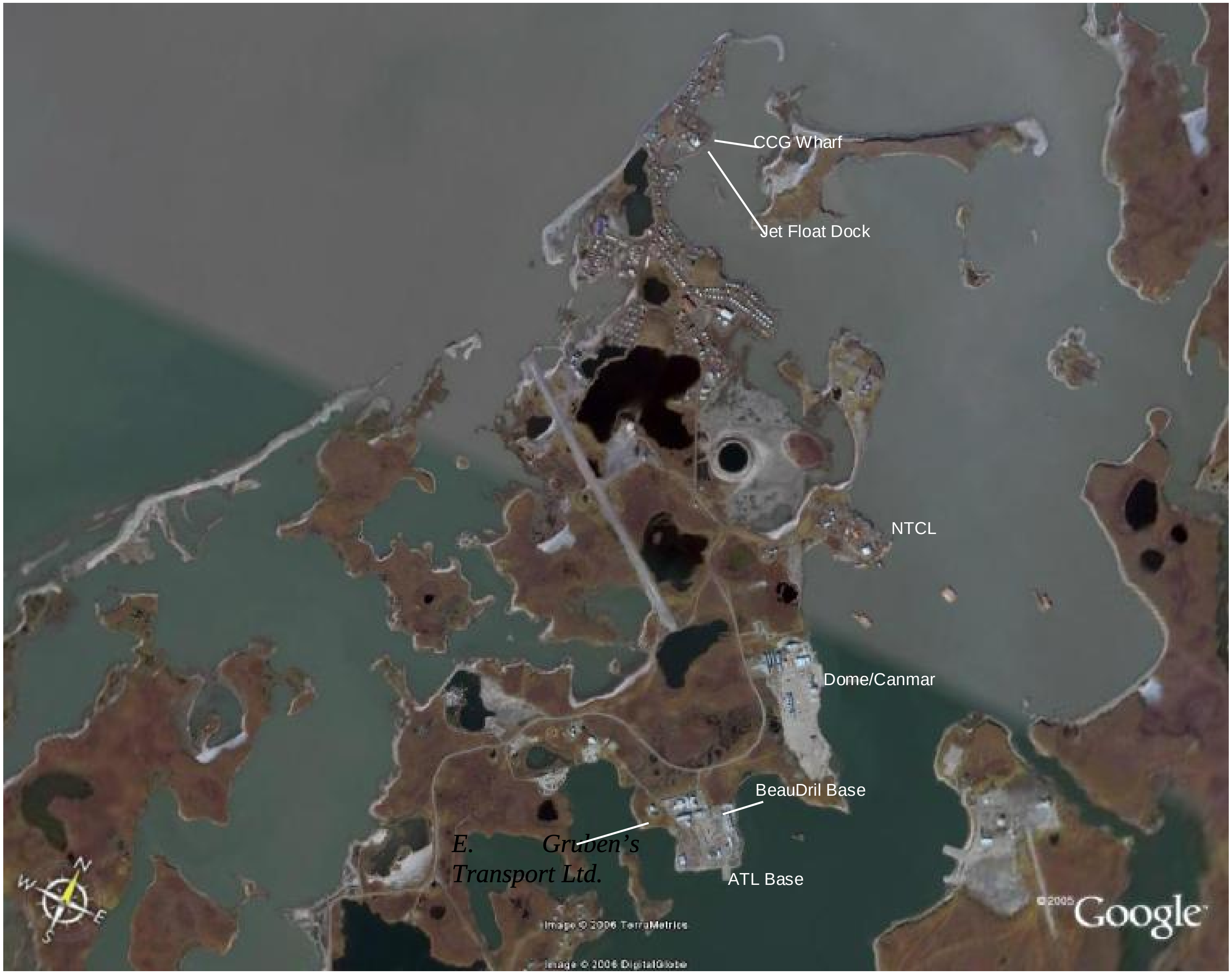
- Service to the oil sands via the Mackenzie, as discussed in this report
- Service to the Mackenzie Gas Pipeline for Arctic routed modules and logistics
- Completion of the dock at Gray's Bay to service the High Lake and Ulu mines. This would create significant inbound and outbound traffic.
- Continued problems with the ice roads serving mining operations south of Lupin, and the probable development of a northern logistics operation using more reliable ice roads.
- Expanded exploration and development in the Slave Geologic Province that could piggy back on Gray's Bay.
- Increased traffic through the North West Passage as a result of global climate change.

These developments could, when coupled with the intent of the current federal government to assert Canadian Sovereignty in the Arctic, lead to the stationing of an ice breaker at Tuktoyaktuk to facilitate shipping in the Beaufort Sea/Coronation Gulf area[53].

As discussed in the report, there could also be a need for a service centre/storage yard at Fort Smith, as units moved up during the season in which they arrived at Tuktoyaktuk would likely have to winter at Fort Smith because of lack of water in the Athabasca in late season. Again, value added activity may be called for in checking the units and preparing them for installation as soon as they have been move to Fort McKay.

Aerial photographs of both locations are provided in the following pages.

[53] It was announced at CMAC Northern 25th and 26th April 2007 that an ice breaker will over winter in the Western Arctic 2007/08


CCG Wharf
Jet Float Dock
NTCL
Dome/Canmar
BeauDril Base
E. Gruben's Transport Ltd.
ATL Base
Image © 2006 TerraMetrics
Image © 2006 DigitalGlobe
© 2005 Google
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N
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Image © 2007 DigitalGlobe
Image © 2007 TerraMetrics
© 2007 Navteq
© 2005 Google
Pointer 60°00'49.78" N 111°54'07.21" W elev 709 ft
Streaming |||||||||| 100%
Eye alt 22196 ft

10. ANNEXES

10.1 Reference Material

10.1 REFERENCE MATERIAL

1. STRATEGY WEST INC.

- Existing and proposed Commercial Canadian Oil Sands Projects *February 2007*
- Canadian Oil Sands Industry – Production Supply Outlooks *January 2007*
- Canada's Oil Sands – A World-Scale Hydrocarbon Resource *September 2006*

2. UNIVERSITY OF ALBERTA SCHOOL OF BUSINESS

- An Introduction to Development in Alberta's Oil Sands *February 2005*

3. THE PEMBINA INSTITUTE

- Troubled Waters, Troubling Trends *May 2006*

4. An Impending Water Crisis in Canada's Western Prairie Provinces – Schindler, D.W. *February 2006, National Academy of Sciences*

5. MARIPORT REPORTS

- Mackenzie River, Preliminary Risk Analysis *July 2006*
- Taltson to Snap Lake Power Transmission via Great Slave Lake *October 2003*

6. A Study of Technical Aspects of Deep Draft Shipping to the Western Arctic – D.F. Dickens Associates Ltd *September 1998*

7. Two proprietary studies in Mariport's library relating to navigation into the western arctic from the Pacific *October & December 1995*

8. SNAME and reference material in Mariport's library regarding vessel navigation between Waterways (AB) and Great Slave Lake

9. Web material regarding the oil sands and company activity

10. Reports from the Globe and Mail on the oil sands and corporate activity

10.2 Contacts

10.2 CONTACTS

DIRECTORY OF COMPANIES INVOLVED IN OIL SANDS ACTIVITIES NORTH OF FORT MCMURRAY

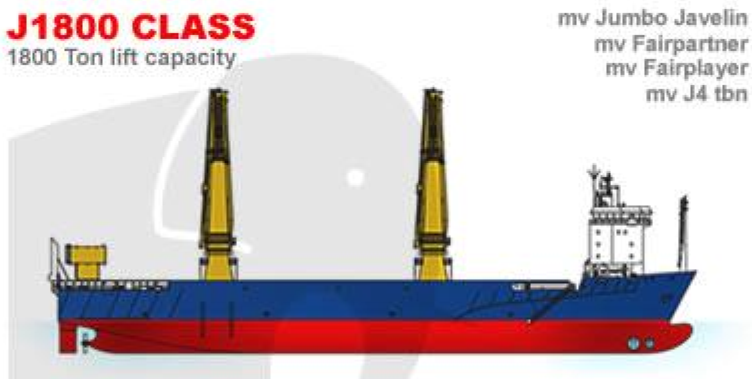
Albian Sands Energy	www.albiansands.com	PO Box 5670 Fort McMurray AB T9H 4W1	780 713 4400
Canadian Natural Resources	www.cnrl.com	2500, 855-2nd Street SW Calgary AB T2P 4J8	403 517 6700
Chevron Canada *Chevron Canada Resources*[54]	www.chevron.ca	500-5th Ave. SW Calgary, AB T2P 0L7	604 668 5300 403 234 5200
Encana	www.encana.com	1800, 855-2nd Street SW PO Box 2850 Calgary AB T2P 2S5	403 645 2000
Husky Energy Inc	www.huskyenergy.ca	707 8th Ave SW Box 6525 Stn D Calgary AB T2P 3G7	403 298 6111
Imperial Oil	www.imperialoil.ca	16045-237 4th Ave SW Calgary AB T2P 0H6	403 237 3371
PetroCanada	www.petro-canada.ca	PO Box 2844 Calgary AB T2P 3E3 150-6th Ave SW	403 296 8000
Syncrude Canada	www.syncrude.ca	PO Bag 4023 Fort McMurray AB T9H 3H5	780 790 5911
Synenco	www.synenco.com	Ste 1020 715-5th Ave SW Calgary AB	403 261 1990
Suncor Energy Inc	www.suncor.com	PO Box 38 112-4th Ave SW Calgary AB T2P 2V5	403 269 8100
Total E&P Canada	www.total-ep-canada.com	Dome Tower Ste 1900 333-7th Ave SW Calgary AB T2P 2Z1	403 571 7599
Western Oil Sands[55]	www.westernoilsands.com	Ste 2400 Ernst & Young Twr 440 2nd Ave SW Calgary AB T2P 5E9	403 233 1700

54 Upstream exploration business.

55 Have 20% of Chevron's Ells River field.

10.3 Exemplary Lift Ships

10.3 EXEMPLARY LIFT SHIPS



Specifications - Jumbo Javelin / Fairpartner - Heavy-Lift Transport Vessels

Key Data

Name	Jumbo Javelin and Fairpartner
Type	Heavy-lift/transport vessels
Class	J-1600
Builder	Damen Shipyards, Galatz
Agents	Kahn Scheepvaart
P and I	Gard Arendal
Overall length	143.1m
Breadth	26.5m
Air draft	46.40m (derricks down)
Width	26.5m
Gross tonnage	15,069t
Net tonnage	3,768t
Deadweight	7,750t, 10,975t including derricks
Hold capacity	19,500m³
Lowerhold	82.7m x 17m
Tweendeck	101.9m x 17m
Tank-top strength	12t/m²
Tweendeck strength	7t/m²
Hatch-covers strength	Three x 12t/m², five x 8t/m²
Cranes	2
Combined crane lift capacity	1,600t
Crane outreach	28m
Auxilliary hoist	35t

Whiphoist	10t
Engines	2
Type	MAN 9L 32/40
Speed	Up to 17.5 knots
Output	4.320kW
Fuel	37t of fuel per day at 90% MCR
Bow thrusters	Lips
Bunker capacity	1,200t heavy fuel oil, 100t gasoil, 150t fresh water
Classification	Lloyds
Notation	100 A1, LI, CG, +LMC, UMS, with descriptive note SCM regarding loading and unloading

The 20,871 tons Mad Dog truss spar was the heaviest complete Rauma spar transported by Dockwise.

The spar was skidded longitudinally onto 1300 tons of grillage. Because of the diameter of the spar, 49 m incl. strakes, there was insufficient space to load barges that normally provide additional stability during discharging. A solution was found by positioning a barge under the soft tank, which overhung the stern of the Mighty Servant 1.

TRANSPORTATION PERIOD:	**VESSEL:**
23 December 2003 - 18 January 2004; 6,500 n.m.	**Mighty Servant 1**
CARGO PARTICULARS:	
Type:	**Truss spar**
Weight:	**20,871 tons**
Length:	**169.16 m**
Diameter:	**39.00 m and 49.14 m incl. strakes**
Height:	**44.83 m**
Overhang:	**22.86 on stern**
LOAD-OUT OPERATION:	
Loading:	**skid-on over the stern**
Discharging:	**float-off**

ZHENHUA 1

ZHENHUA 2

ZHENHUA 3

ZHENHUA 4

ZHENHUA 5

ZHENHUA 6

ZHENHUA 7

ZHENHUA 8

ZHENHUA 9

ZHENHUA 10

Tel:86-21-58396666 Fax:86-21-58399555 86-21-58397000 Mail To:mail@zpmc.com Add: No.3470 South Pudong Road, 200125, Shanghai, PRC

Beluga Shipping

Vessels in operation

R-Series

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Revolution	2005	10.536	MPP/TWN	2x250 combined 500mt	547	18kn
Beluga Resolution	2005	10.536	MPP/TWN	2x250 combined 500mt	547	18kn
Beluga Recommendation	2005	10.536	MPP/TWN	2x250 combined 500mt	547	18kn
Beluga Recognition	2005	10.536	MPP/TWN	2x250 combined 500mt	547	18kn

C-Series

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Constitution	2006	12.477	MPP/TWN	2x240 combined 480mt	675	18kn
Beluga Constellation	2006	12.477	MPP/TWN	2x240 combined 480mt	675	18kn

E-Series

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Elegance	2004	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Efficiency	2004	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Emotion	2004	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Eternity	2004	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Endeavour	2004	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Enterprise	2004	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Endurance	2005	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Energy	2005	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Expectation	2005	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Evaluation	2006	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn

F-Series

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Federation	2006	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Foundation	2006	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Fusion	2006	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Fascination	2006	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Function	2007	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Formation	2007	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn

N-Series

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Nomination	2006	9.775	MPP/TWN	2x40 combined 80mt	474	15,5kn
Beluga Navigation	2006	9.775	MPP/TWN	2x40 combined 80mt	474	15,5kn

I-Series

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Intonation	2000	11.934	MPP/TWN	2x150 combined 300mt	900	17kn
Beluga Indication	2000	11.934	MPP/TWN	2x150 combined 300mt	900	17kn
Beluga Independence	2001	11.934	MPP/TWN	2x150 combined 300mt	900	17kn

Beluga Spirit

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Spirit	1988	7.190	MPP/TWN/RORO	2x100 combined 200mt	546	14kn

Beluga Satisfaction

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Satisfaction	2000	6.194	MPP/TWN	2x120 combined 240mt	660	15,4kn

Beluga Advertising / Beluga Impression

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Advertising	1999	5.170	MPP/TWN	2x80 combined 160mt	512	16kn
Beluga Impression	1999	5.170	MPP/TWN	2x80 combined 160mt	512	16kn

Greenfleet

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Maria Green	1998	17.110	MPP/TWN	3x60 combined 120mt	962	16kn
Marion Green	1999	17.110	MPP/TWN	3x60 combined 120mt	962	16kn
Margaretha Green	1999	17.110	MPP/TWN	3x60 combined 120mt	962	16kn

Vessels under construction

F-Series

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Flirtation	2007 - May	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Fortification	2007 - Jul	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Fiction	2007 - Jul	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Favourisation	2007 - Aug	12.744	MPP/TWN	2x120 combined 240mt	673	15,5kn
Beluga Fighter	2007 - Aug	12.744	MPP/TWN	2x150 combined 300mt	673	15,5kn
Beluga Fanfare	2007 - Sep	12.744	MPP/TWN	2x150 combined 300mt	673	15,5kn
Beluga Fantastic	2007 - Sep	12.744	MPP/TWN	2x150 combined 300mt	673	15,5kn
Beluga Finesse	2007 - Nov	12.744	MPP/TWN	2x150 combined 300mt	673	15,5kn
Beluga Fidelity	2007 - Dec	12.744	MPP/TWN	2x150 combined 300mt	673	15,5kn
Beluga Fraternity	2008 - Jan	12.744	MPP/TWN	2x180 combined 360mt	673	15,5kn
Beluga Foresight	2008 - Feb	12.744	MPP/TWN	2x150 combined 300mt	673	15,5kn
Beluga Fortune	2008 - Feb	12.744	MPP/TWN	2x180 combined 360mt	673	15,5kn
Beluga Felicity	2008 - Mar	12.744	MPP/TWN	2x180 combined 360mt	673	15,5kn
Beluga Fortitude	2008 - Mar	12.744	MPP/TWN	2x180 combined 360mt	673	15,5kn
Beluga Freedom	2008 - Jun	12.744	MPP/TWN	2x180 combined 360mt	673	15,5kn
Beluga Festivity	2008 - Aug	12.744	MPP/TWN	2x180 combined 360mt	673	15,5kn

P1-Series

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Persuasion	2009 - Jan	19.100	MPP/TWN	2x400 + 1x120 combined 800mt	1011	17kn
Beluga Promotion	2009 - Jul	19.100	MPP/TWN	2x400 + 1x120 combined 800mt	1011	17kn
Beluga Participation	2009 - Nov	19.100	MPP/TWN	2x400 + 1x120 combined 800mt	1011	17kn
Beluga Profession	2009 - Dec	19.100	MPP/TWN	2x400 + 1x120 combined 800mt	1011	17kn

P2-Series

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Presentation	2009 - Nov	20.000	MPP/TWN	2x400 + 1x120 combined 800mt	974	17,5kn
Beluga Protection	2011 - May	20.000	MPP/TWN	2x400 + 1x120 combined 800mt	974	17,5kn
Beluga Publication	2011 - Jul	20.000	MPP/TWN	2x400 + 1x120 combined 800mt	974	17,5kn
Beluga Perception	2011 - Sep	20.000	MPP/TWN	2x400 + 1x120 combined 800mt	974	17,5kn
Beluga Perfection	2010 - Jan	20.000	MPP/TWN	2x700 + 1x120 combined 1400mt	974	17,5kn
Beluga Preparation	2010 - Jul	20.000	MPP/TWN	2x700 + 1x120 combined 1400mt	974	17,5kn
Beluga Provocation	2010 - Apr	20.000	MPP/TWN	2x700 + 1x120 combined 1400mt	974	17,5kn
Beluga Passion	2010 - Sep	20.000	MPP/TWN	2x700 + 1x120 combined 1400mt	974	17,5kn
Beluga Procession	2010 - Nov	20.000	MPP/TWN	2x700 + 1x120 combined 1400mt	974	17,5kn
Beluga Progression	2011 - Feb	20.000	MPP/TWN	2x700 + 1x120 combined 1400mt	974	17,5kn

G-Series

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga Generation	2008 - Jun	17.110	MPP/TWN	3x120 combined 240mt	962	16kn
Beluga Gravitation	2008 - Oct	17.110	MPP/TWN	3x120 combined 240mt	962	16kn
Beluga Gratification	2009 - Jan	17.110	MPP/TWN	3x120 combined 240mt	962	16kn
Beluga Graduation	2009 - May	17.110	MPP/TWN	3x120 combined 240mt	962	16kn

N-Series

Name of vessel	Built	TDW	Type	Gear	TEU	Speed
Beluga SkySails	2007 - Apr	9.775	MPP/TWN	2x40 combined 80mt	474	15,5kn
Beluga Nation	2008 - May	9.775	MPP/TWN	2x60 combined 120mt	474	15,5kn

10.4 List of Companies Involved in Oil Sands

10.4 LIST OF COMPANIES INVOLVED IN OIL SANDS

OIL SANDS AND RELATED PROJECTS

NORTH OF FORT MCMURRAY				
Company	**Project**	**Type**	**Location**	**Time Frame**
Albian Sands Energy	Jackpine	M	Fort McKay	After Muskeg River
	Muskeg River	M		Phase 1 Operating Phase 2 2010
	Pierre River	M		Proposed
Canadian Natural Resources	Horizon	M	N Fort McMurray	2005-2008 Phase I under construction 2009-2017 later phases
		U	N Fort McMurray	Phase 1 under costruction Phases 2-5 2011-2017
	Birch Mtn.	S		2013-2015
Chevron	Ells River	S		2015
EnCana	Borealis	S		2010-2014
Husky Energy Inc.	Sunrise	S	N Fort McMurray	2012-2018
Imperial Oil	Kearl Lake	S	N Fort McMurray	2010-2018
Petrocanada	McKay River	S	NW Fort McMurray	Phase 1 Operating Phase 2 2009
	Fort Hills	M	N Fort McMurray	2011-2014
	Lewis	S		Proposed
Syncrude Canada Ltd	Aurora & Mildred Lake	M	N Fort McMurray	Stage 1 Operating Stages 3-4 2011-2014
		U		Stages 1 –3 Operating Stage 4 2015
Synenco	Northern Lights	M	Fort McKay	2010-2012
Suncor	Steepbank & Millennium	M	Fort McKay	Phase 1 Operating Extension 2007-2010
	Voyageur	U	S. Fort McKay	2010-2012
	Firebag	S		Phases1&2 Operating Phases 3-8 2008-2015
	Tar Island	U		Operating, coker 2008
Total Canada	Joslyn Creek	S&M	N. Ft. McKay	2013-2022
		U		2013-2016

SOUTH OF FORT MCMURRAY				
Company	**Project**	**Type**	**Location**	**Time Frame**
Canadian Natural Resources	Primrose	S	N Bonnyville	2007-2009 plus upgrader 2012-2015
	Kirby	S	NE Lac La Biche	2009-2011
	Gregoire Lake			2016-2023
Connacher Oil & Gas	Great Divide	S	SW Fort McMurray	Under construction
Devon Energy	Surmont	S	Nr Anzac	Phase 1 under construction Phases 2-4 2008-2014
	Jackfish	S	SE Conklin	Phase 1 under construction Phase 2 2008-2010
EnCana	Christina Lake	S	S Conklin	Phases 1a-1c operating Phases 1d-1e 2008-2010
	Foster Creek	S	Cold Lake	2008-2009
Husky	Caribou Lake	S		2010
Imperial Oil	Nabiye	S	Cold Lake	Phases 14-16
Japan Canada Oil Sands Ltd	Hangingstone	S	S. Fort McMurray	Pilot operating Phases 1&2 2010-2012
North American Oil Sands	Kai Kos Dehseh	S	Nr. Conklin	Proposed 2008-2015
		U		2011-2014
Opti Canada/Nexen Inc	Long Lake	S	SE Fort McMurray	Phase 1 under construction Phase 2 2014
		U		Phase 1 under construction Phases 2-4 2011-2015
Petrocanada	Meadow Creek	S	S Fort McMurray	Proposed
	Chard	S		Proposed
Petrobank	White Sands	T	Nr. Conklin	In operation
Shell Canada	Orion	S	Bonnyville	Under construction
Value Creation	Halfway Creek	S	SE Fort McMurray	Demo. 2007-2009 plus upgrader

EDMONTON AREA				
Company	**Project**	**Type**	**Location**	**Time Frame**
Albian Sands Energy	Scotford	U	Ft. Saskatchewan	Phase 1 Operating, Expansion1 2010. Other phases tbd
BA Energy	Heartland	U	Bruderheim	Phase 1 under construction Phase 2, 3 2010-2012
Enbridge	Oil terminal & tankerage	n/a	Strathcona	Under construction
Fort Hills Energy	Bitumen uparader	U	Redwater	2008-2011
North American Oil Sands	Bitumen upgrader	U	Strathcona Co	2011-2014
North West Upgrading Inc	Bitumen upgrader	U	Sturgeon Co	Phase 1 2007-2009 Phase 2, 3 2010-2015
Petrocanada	Refinery Conv.	U	Strathcona Co	Under construction
	Sturgeon	U	Sturgeon Co	2011-2015
Synenco	Bitumen upgrader	U	Sturgeon Co	2010-2012
Total Canada	Bitumen upgrader	U	Sturgeon Co	2014

Type: M = Mining S = SAGD T = Underground burning U = Upgrader
Location: N=North, NW=NW, NE=North East S=South, SE=South East,
SW=South West NR=Near