Stassinu Stantec Limited Partnership
19-21 Burnwood Drive
Happy Valley-Goose Bay, NL A0P 1C0

Analysis of Infrastructure Constraints on the Future Development of Iron Resources in Labrador, Canada
FINAL REPORT

January 25, 2011

Analysis of Infrastructure Constraints on the Future Development of Iron Resources in Labrador, Canada

Final Report

Stassinu Stantec Limited Partnership
19-21 Burnwood Drive
Happy Valley-Goose Bay, NL A0P 1C0
Tel: (709) 896-5860
Fax: (709) 896-5863

Prepared for:

Government of Newfoundland and Labrador
Department of Natural Resources
50 Elizabeth Avenue
St. John's NL A1A 1W5

File No. 113536124

Date: January 25, 2011

EXECUTIVE SUMMARY

Introduction

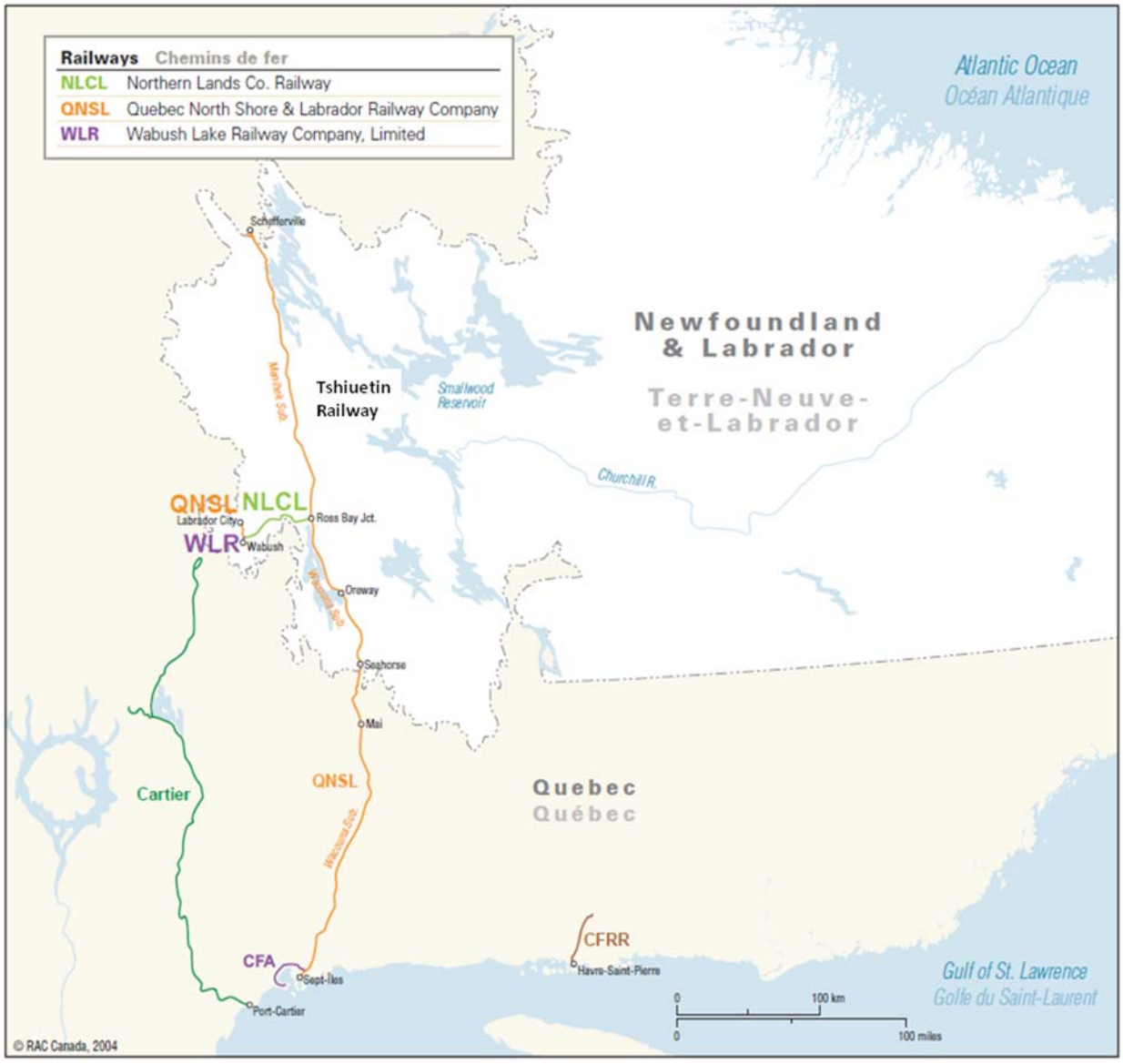
The Government of Newfoundland and Labrador, Department of Natural Resources (DNR), retained Stassinu Stantec Limited Partnership (Stantec) to conduct an analysis of infrastructure constraints on the future development of iron resources in Labrador. The purpose of the analysis is to review the existing railway and ports infrastructure, determine its capability to handle a planned future iron ore production level as detailed by DNR, examine the feasibility of upgrading the existing transportation facilities and review the possibility of new rail, pipeline and ports infrastructure to link the iron mining district to the east coast of Labrador.

For the purposes of evaluating rail and ports infrastructure constraints, DNR established the following iron ore production levels. All simulation and analysis work is based on the tonnage levels indicated in this table:

Mine/Development	Current annual shipments (millions of metric tonnes)	Short term study level annual shipments (millions of metric tonnes)	Future study level annual shipments (millions of metric tonnes)
Iron Ore Company of Canada (IOC)	17	17	26
Wabush Mines (Cliffs) (WAB)	4	4	6
Consolidated Thompson (CLM)	8	8	16
Labrador Iron Mines (LIM)	0	4	6
New Millennium (NML)	0	4	8
Subtotal	**29**	**37**	**62**
Julienne Lake (JLK)	0	0	4
LabMag (LMG)	0	0	22
TOTAL	**29**	**37**	**88**
Production Level Reference:	**"CURRENT"**	**"SHORT TERM"**	**"FUTURE"**

Movement of 88 million tonnes of iron ore product will require the railway to accommodate at least 160 million gross ton-miles, a figure that includes the weight of the equipment necessary to move the traffic (both loaded and empty). Such an operating metric is unprecedented in Canadian railroading and is seen in a limited number of heavy haul operations in the United States. Traffic volume of this magnitude requires careful examination to establish an effective infrastructure to handle the business efficiently.

The study area and existing rail network and port locations are illustrated in the map below.



Key Findings:

<u>Review of Tshiuetin Railway</u>

Tshiuetin Rail Transport (TRT) operates the former Quebec, North Shore and Labrador Railway (QNSL) line between Ross Bay Junction, Labrador, and Schefferville, Quebec. Heavy haul iron ore operations ceased on this line in 1982 following closure of the Schefferville mines. New mining developments, specifically Labrador Iron Mines (LIM) and New Millennium Capital Corporation (NML), are in the process of restarting and planning, respectively, iron mining operations in the Schefferville area. While the TRT line has been in operation despite the lack

of heavy haul traffic it has been maintained to standard sufficient for passenger and light freight traffic since 1982. The Centralized Traffic Control (CTC) signal system was removed and six of eight passing sidings were removed from service since 1982 as well.

TRT track conditions remain good for light duty services despite the lack of considerable maintenance work over the past 28 years. The railway has identified trackwork needs in order to restore daily heavy haul service on the line and developed a plan to carry out the necessary work. The value of this work has been recently updated to be worth $90 million over a 10 year period. Rail, ties and surfacing work are all necessary to restore regular heavy haul operations on the line.

A rail capacity simulation analysis was completed that encompassed the entire Labrador rail network, including TRT. During the course of the simulation it was determined that restoration of the closed sidings will be necessary in order to accommodate the future iron production level. This will require reconstruction of three former long sidings (capable of handling more than 240 car trains) and three former short sidings. Reconstruction of these sidings will require reinstallation of track on the grade where the siding infrastructure was previously located, simplifying some of the construction process.

Analysis of Labrador City Freight Transload and Alternatives

QNSL facilities at Labrador City include a freight transload facility that handles supplies and goods arriving from or destined to Sept Iles, Quebec, in QNSL general freight train service. Previously, when QNSL operated the line to Schefferville, both passenger and general freight services were offered between Labrador City and Schefferville. With the TRT takeover of the route to Schefferville, both passenger and freight services were reorganized and as a result regular service between Labrador City and Schefferville was eliminated.

Restoration of a supply freight service between Labrador City and Schefferville would be complicated. TRT has no right to serve Labrador City directly and must interchange all traffic with QNSL at Ross Bay Junction. Loading at Labrador City would require QNSL to provide a short haul service (approximately 45 km) to the interchange at Ross Bay Junction. Traffic would likely experience delay between arrival and departure at Ross Bay Junction as there is no guarantee that QNSL and TRT services will connect directly as they each have their own particular operating procedures and schedules suited to conditions on their respective properties. Other options, including granting rights for TRT to serve Labrador City and through QNSL/TRT train service, would be complex to implement and may not be deemed attractive to QNSL.

TRT constructed a loading ramp facility at Emeril, just north of Ross Bay Junction on the Trans Labrador Highway (TLH), on TRT property, during 2010. The facility was developed initially for the purpose of loading supplies for the Labrador Iron Mines (LIM) Schefferville project. TRT can accommodate other users at the facility besides LIM. The facility is conveniently located adjacent to the existing passenger train stop that serves the TLH market and Labrador City area.

A considerable constraint to the productivity of a transload facility at either Labrador City or Emeril is the state of the highway system linking this region to the rest of North America. The Quebec portion of the highway, linking Baie Comeau to the Labrador border, is a 580 km two-lane road with 50% of the distance consisting of a narrow gravel route. This must compete with the 230 km, paved, two-lane highway linking Baie Comeau to Sept Iles, where QNSL transload facilities exist today that are in position to load supply traffic heading to Labrador City or Schefferville. Additionally, short sea shipping, with transload to rail, is available at Sept Iles for supply traffic and a rail car ferry allows direct movement of loaded rail cars from the North American rail network to the dock at Pointe Noire without any need for transload. The rail car ferry, however, is constrained by the two calls per week it can make at Pointe Noire and its maximum capacity of 25 freight cars; capacity that must be shared with other users (particularly the aluminum smelter at Pointe Noire). Also, any goods shipped by rail from Sept Iles must fit within the clearance profile of the tunnels on the QNSL main line. However, only extremely oversized components are barred from this routing.

Overall, the transload facilities of Sept Iles are generally more attractive for goods arriving by road and the only option for supplies arriving by water or directly by rail car.

Analysis of Quebec, North Shore and Labrador Railway Capacity

The primary concern surrounding the future development of iron ore reserves in Labrador is the effectiveness of the railway transportation available to move the product to an ocean port. Currently all iron ore production must be shipped via the QNSL between Labrador and the ports in the vicinity of Sept Iles, Quebec. The effectiveness of the railway to handle the current, short term, and future iron ore production levels, as provided by DNR, was tested through a series of rail capacity simulations. The simulation process included the properties of QNSL, TRT and Chemin de Fer Arnaud (CFA) plus the interchange and terminal interactions between these carriers and their interaction with mine sites.

A base case, referred to as current production, was established and a train package developed in accordance with existing operating practices, car types and capacities, and existing railway infrastructure. This process established an understanding of the dynamics of the railway at an unconstrained state operating at less than capacity. Next, the short term production levels were introduced onto the existing rail infrastructure to evaluate any degradation of network performance and to understand if the new traffic will tax the capacity of the network. Following that, the future level production levels were introduced to the network and problem areas identified and remedied through addition of infrastructure. A step-by-step process was followed to add infrastructure to the point where operating metrics reflected an operation similar to that experienced at the short term level and review of the resulting projected train operating plan provided confidence that the plant could handle the future traffic. Effectiveness of the network was gauged through the metrics of average train speed (in miles per hour) and average delay minutes per 100 train miles. The calculated values do not necessarily indicate the absolute expected value of these metrics but instead permit a basis for comparison of the network at different production levels and infrastructure.

Results of the simulation process indicate that sufficient rail capacity exists on the network for the current and short term iron ore production levels. However, investment in infrastructure will be necessary to accommodate the future iron ore production level.

Simulation Case	Average Train Speed	Delay Minutes per 100 Train Miles
"CURRENT" Production Level	14.7	36
"SHORT TERM" Production Level	14.2	48
"FUTURE" Level Production all Mining Companies	Failed	Failed
New Infrastructure Package with interchange management	13.7	76

The following infrastructure upgrades have been identified to accommodate 88 million tonnes of iron ore production based on railway operations simulations and analysis.

Infrastructure Item	New Track Miles
Terminals:	
Additional track at QNSL facility Sept Iles Jct.	2
Additional track at Wabush interchange Sept Iles Jct.	2
Additional track at Con T interchange Sept Iles Jct.	2
Yard track Sept Iles Jct.-Sept Iles	2
Additional track at Mai	4
Track capacity for four trains at Emeril Jct. interchange	4
Double Track:	
Double track Arnaud Railway	21
Double track Nicman-Tika on QNSL	21
Double track Waco-Chico on QNSL	10
Double track Seahorse-Pitaga on QNSL	22
Double track Dry Lake-Ashuanipi on QNSL	11
Double track Opocopa-Wabush Lake Jct. on QNSL	13
Sidings:	
Restore 3 long sidings on TRT (Esker, Faden, Astray)	8
Restore 3 short sidings on TRT (Shabo, Sawbill, Cavanagh)	4
Restore 2 short sidings on QNSL (Tonkas, Dufresne Lake)	3
Restore & Extend Saumon siding on QNSL	2.5
Restore & Extend Ross Bay siding on QNSL	2.5
Total New Track Miles	134

In addition, effective management of the interchange process between QNSL and CFA at Sept Iles Junction is vital to the success of the rail operation at the future tonnage level. Current procedures of changing and switching out locomotives and dwell (stop time) at the interchange must be virtually eliminated as part of any infrastructure improvement program. Terminal, interchange and yard dwell are all problematic to effective utilization of rail assets and result in over-construction of terminal facilities in order to accommodate unproductive rail equipment.

The cost of the infrastructure improvements tabled above has been estimated at $332.5 million. Factoring in the cost of the $90 million TRT maintenance project to permit daily heavy haul rail services the overall cost of upgrades increases to $422.5 million.

A common practice to reduce infrastructure requirements is to eliminate train starts by increasing the size of trains on the network. This practice could be feasible thanks to the existing use of distributed power locomotives on trains, however, the loading and unloading loops and facilities of the existing producers are constrained by surrounding land uses or owners and the process to increase train size in a practical manner would be complex. Alternative methods of unloading trains, such as triple-car dumpers or two-track unloading do not yield enough saved time to have a significant impact on main line rail capacity. The existing railway already employs the highest performance locomotives for slow speed, heavy haul service. The existing locomotives provide service performance better than any prior electric freight locomotive built in North America, and matching the only possible freight electric locomotive elsewhere in the world, thereby eliminating any possible capacity improvement offered by electrification. An upgrade of speeds in sidings, from the current 15 MPH standard to 30 MPH, at those siding locations remaining after the upgrades listed above, was simulated and resulted in a measurable improvement in average train speed, implying that upgraded siding speeds could help to improve the capacity of the network.

Analysis of Existing Ports Facilities

Currently iron ore is loaded into ships at two separate facilities within the Port of Sept Iles. Iron Ore Company of Canada (IOC) loads iron ore at a facility adjacent to their rail yard and car dumper just east of the Town of Sept Iles. Wabush (Cliffs) and Consolidated Thompson utilize a facility located at Pointe Noire. Existing loadout capacity exceeds the current throughput of both facilities. The Port of Sept Iles is in the process of planning a new super port capable of exporting 30 to 40 million tonnes of iron ore annually. The new port facility will be able to load the Chinamax class of vessel of 400,000 tonnes capacity directly at the dock as opposed to the current practice of transshipment in the bay using smaller vessels to load at the dock. Land area for new rail yards and port facilities at Pointe Noire is a major concern as property ownership is currently dominated by Wabush (Cliffs), the Crown and the Port of Sept Iles. Topography is challenging as the landscape closest to deep water is predominately rocky hills unsuitable for rail yard construction.

The Port of Sept Iles is considered a Canada Port Authority (CPA) under the National Marine Policy of 1995. The CPA operates the port on behalf of the Government of Canada. They are required to be self-sufficient and must fund their operations through the revenues they generate. The Port is not eligible for federal funding other than through general application for grants or in case of emergency. If the port seeks to borrow funds, it is not considered to be an agent of the Government of Canada. They may acquire and own land in their own name. They may also be given Crown land to manage but not to own.

Analysis of a Closed Loop Railway Operation

A possible option to handle future iron ore production is to connect the QNSL network with the Arcelor-Mittal (Cartier) Railway (CFC) at the north and south ends in order to provide a continuous loop operation. In this arrangement northbound empty trains would flow on one railway while the southbound loaded trains would run on the other railway. This would eliminate the majority of the delays attributable to train meets and maintain a consistent flow of trains moving in the same direction at approximately the same speeds.

Directional running, as this concept is referred to by the Class I North American railways, is not a new procedure for railways intending to streamline operations and reduce operating costs in order to effectively compete with other forms of transport such as trucking. Such a concept in the Labrador mining region would be unique as the railway companies involved are all owned by competing mining firms. The multiple ownership issue may create serious challenges to the development of a loop operation as there is no particular incentive for the mining companies to streamline their competitor's operating costs.

Establishment of a railway to build the connecting links would be necessary under the Canada Transportation Act. Federal regulation would apply to the new operation and all parties to it. A new railway incorporated to build the trackage could be arranged as either:

- A private company partially owned by all the existing railway operators with ownership in proportion to their useage (either by quantity of movements or annual tonnage)
- A private company owned by a third party that would charge each user on a basis related to movements or tonnage

In both cases significant negotiation would be necessary. In the first option disagreement over the shares of ownership and who would manage the property would be key points. In the second option the onus would be on the third party to convince all railways and owners to use the linked network.

Corporately the loop concept may have a better chance of realization if all the railways forming the loop were amalgamated into a third party rail operator independent of the mining concerns.

Assuming a rail loop is plausible, identification of the direction of operation is a key technical challenge. A Train Performance Calculation (TPC) modeling exercise was undertaken to determine the direction of travel that would result in the lowest expected running time given both the CFC and QNSL alignments are virtually identical in terms of motive power requirement to move a given amount of tonnage southward. The run time calculation yielded that the minimum expected running time is achieved by routing loaded southbound trains on the QNSL and empty northbound trains on the CFC.

Railway	Hours	Route Miles	*QNSL Route Time Savings*
Southbound - Loaded Direction			*(Hours)*
QNSL Wabush Lake Jct - Sept Iles Jct	10.7	251	*1.2*
CFC Mont Wright - Port Cartier	11.9	259	
Northbound - Empty Direction			
QNSL Sept Iles Jct - Wabush Lake Jct	8.4	251	*-0.4*
CFC Port Cartier - Mont Wright	8.0	259	

The issue of crewing is a technical challenge that would need to be addressed for proper operation of the loop network. Two options exist for crewing:

1. QNSL crews handle QNSL contracted train services around the loop while CFC crews handle Arcelor Mittal traffic only around the loop
2. QNSL crews handle all trains on QNSL property while CFC crews handle all trains on CFC property

The first option requires considerable management to function effectively, but, maintains an expected work schedule for train crews similar to that already in place. The second option simplifies crew management but introduces the need to position crews via airplane between Labrador City and Sept Iles/Port Cartier since crews will only work in one direction.

Another technical challenge surrounds the increased distance rail equipment must travel on the loop railway. For all producers, except Consolidated Thompson, the distance their rail equipment will travel to complete a load/empty cycle will increase.

Ore Producer Flow	Loop Operation One-Way Trip Distance (km)	Loop Operation Round Trip Distance (km)	Existing Round Trip Distance (km)	Increased Round Trip Distance (km)
IOC Loads	416			
IOC Empties	566	982	832	150
Wabush Loads	436			
Wabush Empties	519	956	873	83
Consolidated Thompson Loads	476			
Consolidated Thompson Empties	479	956	953	3
Arcelor-Mittal Loads	540			
Arcelor-Mittal Empties	415	956	830	125
Schefferville Loads	595			
Schefferville Empties	793	1388	1190	198

The issue of shared cost for maintenance of the loop network must also be addressed. Each shipper would be required to pay some portion of the maintenance costs, possibly on a gross ton-mile basis.

A conceptual railway route planning exercise was carried out to evaluate the technical practicality of building the linking rail lines at the north and south ends of the loop. Each rail line was laid out using 1:50,000 topographic maps issued by Natural Resources Canada with the

main design criteria of a ruling ascending grade for loaded movements of less that 0.5% and curves no sharper than six degrees. At this high level of conceptual planning it was determined that rail links could be built within these parameters. The main points of interest for each link are:

- South link – 33.5 km in length, estimated cost $100.5 million
- North link – 16 km in length, estimated cost $48 million

Thus a high level cost estimate to construct these link railways totals $148.5 million.

Analysis of New Port Sites in Labrador and Associated Railway and/or Pipeline Requirements

To accommodate increased iron ore production growth an alternative to upgrading or expanding the Sept Iles facilities is the development of a new port on the east coast of Labrador along with a new rail and/or pipeline link.

Port location evaluation was based on the following requirements:

- Adequate water depth for shipping and related vessel size
- Available water space for turning vessels
- Available and suitable land for storage and reclaim facilities plus rail yard
- Suitable rail or pipeline access from mine to port
- Nearby infrastructure including roads, power and access to labour

The coastal area considered for port review included the shoreline from Voisey's Bay in the north to the Strait of Belle Isle in the south. Ideally an ice-free port location with the shortest possible rail or pipeline link would present the most attractive solution; however, such a combination does not readily exist along the coast of Labrador. A total of 22 bays and inlets were identified as being suitable for harbor locations with two of those locations immediately rejected as inadequate to support vessels employed in the iron ore trade.

Of the locations surveyed, all but one (Goose Bay), are located along the so-called "Iceberg Alley" or the Strait of Belle Isle where pack ice is known to form. These ice regimes restrict the unhindered shipping season and reduce it by a minimum of 4 to 5 months. Ice breaking availability is subject to scheduling by the Canadian Coast Guard Ice Operation Centres. The entrance to Goose Bay incurs ice damming at the narrowest part of the inlet channel although it may be possible to utilize ice breaking vessels to enable transit. The ice is also used as travel route by the Innu community and this would require serious consideration if Goose Bay were to be further studied as a port location.

With the problems surrounding ice another option considered was transshipment. In this case, the possibility of shipping iron ore from the east coast of Labrador on a seasonal basis to a transshipment terminal on the island of Newfoundland suitable for year round shipping was examined. The main problem with transshipment is the introduction of additional handling and transport costs. It is estimated that such a procedure could add $6 to $12 per tonne to the cost

of iron ore shipping. Given the competition of shipping costs for the same product from Brazil and Australia such an increase in transportation cost likely destroys the economics of a transshipment terminal.

A high level conceptual railway corridor planning exercise was conducted to determine if a feasible route for a railway exists between the existing rail network and the east coast. The rail corridor was examined for its suitability in terms of railway construction and the possibility of maintaining the ruling ascending grade for loaded trains to be comparable to that of the current QNSL mainline in order to maintain operating efficiency. Three line segments were examined to connect with the most appropriate potential port locations:

- Segment 1 – Ross Bay Junction (Emeril) to Goose Bay
    - 590 km in length, ruling ascending grade 0.5% or less
    - Estimated cost $2,350 million
- Segment 2 – Goose Bay to Cartwright
    - 375 km in length, ruling ascending grades exceed 1%
    - Estimated cost $1,610 million
- Segment 3 – Off Segment 2 to Pinware/L'Anse au Loup Area
    - 375 km in length, ruling ascending grades exceed 1%
    - Estimated cost $1,620 million

On a railway operating efficiency basis, the analysis shows that only Goose Bay provides a port facility that would be competitive with the QNSL main line.

A rail corridor to Voisey's Bay was examined at a much higher level and rejected on account of the impracticality of constructing this line across the lines of natural drainage and the excessive additional rail transport distance for movement of iron ore from the Labrador City producers to port.

The concept of slurry pipeline was reviewed as an alternative to rail transport to the coast. The independent opinion of a slurry pipeline design consultant, Paterson & Cooke, was commissioned. Subject to a detailed pre-feasibility study and design, a pipeline could be competitively engineered to accommodate at least the output of 22 million tonnes per year. A central Labrador pipeline corridor may also use less power to operate than a pipeline routed to Sept Iles thanks to a preferable descending grade and lower pumping demands. The pipeline would ideally be buried below grade by at least one (1) metre thereby reducing visual impacts and impact on wildlife such as caribou. The cost of constructing this type of pipeline over the 550 km corridor to Goose Bay is estimated at between $970 million and $1,400 million. Extension of the pipeline to locations along the Strait of Belle Isle would incur additional cost for pumping stations to move the product over the highlands between Goose Bay and Pinware.

With the port, rail and pipeline considerations in mind, the following port locations are considered possible candidates for future consideration:

- Goose Bay (rail or pipeline link)
- L'Anse au Loup (pipeline link)
- Pinware (pipeline link)
- L'Anse au Clair (pipeline link)
- Voisey's Bay (pipeline link)

A typical port facility design must consider the significant capital costs of land, material storage, material handling, rail facilities and the water berth. Given a facility loadout rate of 16,000 tonnes per hour, which permits loading of a Chinamax vessel in 25 to 30 hours, the opinion of probable cost of a port using typical layout costs is estimated at $470 million.