

Annexe VI

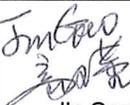
Étude de comparaison pour l'emplacement d'une usine de production de carbonate de lithium (Hatch, 2018)

**Comparison Study for the Location of a Lithium Carbonate Production Plant:
Chibougamau (Canada) and Taixing (China)**

Guo AO Lithium Ltd/Neotec Lithium (Quebec)

December 2018

Final Report

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Executive Summary

Shenzhen intend to construct an open pit lithium mine (the **Moblan mine**) and concentrator in Quebec (implemented and operated by its Canadian subsidiary Guo AO Lithium Ltd ('GuoAO Li')) and a processing plant in China to produce high-grade lithium carbonate for the international battery market.

The mine and concentrator will be located around 165 km from Chibougamau in Northern Quebec. Mining from Moblan will be via conventional truck and shovel both for overburden and hard rock mining. The deposit outcrops at surface and is suited to conventional open pit mining. The concentrator will be located close to the mine and be used to generate a spodumene-rich concentrate.

In addition to the concentrator, Guoao Li sister company, **Neotech Lithium** intend to construct a processing plant in Taixing, Jangsu Province, close to Shanghai China, to convert the spodumene-rich concentrate into a commercial lithium carbonate product.

Construction of the plant in China, rather than Canada, has led to community concerns in relation to the loss of potential employment opportunities and other socio-economic benefits for the wider James Bay region. The purpose of this study is to provide a comparative evaluation of the two options, namely Taixing China versus a domestic option under which the plant would be located close to Chibougamau.

Both options have been evaluated against a series of environmental and social parameters. Where there is no material difference between the two sites, the analysis is limited to the table below and the appraisal score recorded as **Neutral**.

Both options have advantages and disadvantages.

The main advantages of the Canada option are in relation to the availability of renewable energy through hydropower, proximity to the concentrator and therefore reduced emissions associated with the long-haul transportation of the spodumene concentrate and available land. Potential disadvantages are the lack of availability of ready natural gas supply (in the absence of a pipeline), no rail connection, potential lack of availability of sufficient labour and complications associated with the relinquishment of land rights. Total CO₂ emissions for the Canada option are around 16% of emissions vs the China option with the largest contribution being from the marine transportation of spodumene concentrate.

The main advantages of the China option are proximity to marine and land transport routes, availability of natural gas, wastewater treatment facilities and facilities for the disposal of potentially-hazardous waste. In addition, the bi-product of lithium carbonate production (sodium sulfate) may be used in the domestic chemical industry. Labour is likely to be available (and skilled) given the cluster of complimentary chemical industries. The main disadvantages of the China site are twofold: the existing chronic state of air quality with air conditions being particularly bad in winter months (December and January); government initiatives to improve ambient air include timed business closures and restrictions on ground transport. Under the China option, spodumene concentrate would be exported from Canada by truck (final modes to be determined) followed by marine transport to Taixing.

The summary table below provides a comparison of the two options based on key environmental and social aspects.

Keys:

- ✓✓ strongly favours Canada option
- ✓ favours Canada option - neutral for both options
- ✗✗ strongly favours China option
- ✗ favours China option

Comparison of China and Canada options				
Parameter	Canada	China	Appraisal (Score)	Commentary
Location	Chibougamau, N. Quebec	City of Taixing, Jangsu, China		
Production Capacity	Lithium Carbonate (Li ₂ CO ₃) capacity of 20,000 tpa	Lithium Carbonate (Li ₂ CO ₃) capacity of 20,000 tpa	-	Same for both options
Feed Spodumene Quality	5.5 – 6.0% Li ₂ O concentrate	5.5 – 6.0% Li ₂ O concentrate	-	Same for both options
Bi-Products	63,400 tpa of industrial sodium sulfate (>92% purity) shipped to China as secondary product	63,400 tpa of industrial sodium sulfate (>92% purity) reused in China as secondary product	-	Same for both options
Transport Routes and Transport Options	25 trucks/day of spodumene from mine to Chibougamau plant 83,400 t/y shipment between Chibougamau and China: 1 x 80 car trains per month and 2 marine shipments per year. 50,000 t storage at port.	25 trucks/day of spodumene from mine to Chibougamau or Matagami train loading station. 250,000 t/y shipment between Chibougamau and China: 2 x 120 cars train per month and 1 marine shipment every 2 months. 50,000 t storage at port. Plant located in an industrial zone; construction would require the removal/realignment of number of roads	✓	Additional emissions associated with transport of spodumene concentrate to China; significant road network impacts for Taixing; increased GHG footprint through bulk materials transport
Construction Program	18 months	18 months	-	Same for both options
Power Supply	73.5 MW hydropower (renewable source)	73.5 MW coal-fired power available but fossil fuel contribution vs renewable source	✓	Renewable supply available in Quebec vs coal-fired power in China
Water Demand	From new water supply infrastructure as this is not currently available in Quebec; associated construction costs and timeframe would be higher.	From local water supply	✗	Readily available water supply in China not in Quebec

Comparison of China and Canada options				
Parameter	Canada	China	Appraisal (Score)	Commentary
Natural Gas	Supply not available (8 Mm ³ required) in the Chibougamau region: would need to be shipped from Montreal or Quebec city as no natural gas feed is available in the region. Stornoway (another mine in the region) is supplied by trucks that run near Chibougamau with high hazards risks.	Readily available	xx	No direct connection with Canada option; gas would need to be shipped to site with associated hazardous material shipment risk.
Climate	Cold, sub-arctic	Temperate, heavy rainfall	-	Not a limiting factor for either site
Air emissions (CO₂)	CO ₂ : reduced emissions with the location of the plant in Canada (total of c.6,810 tpa CO ₂ eq.)	CO ₂ : includes emissions from additional ore shipment to China for processing (total of c.41,389 tpa CO ₂ eq.)	✓✓	GHG emissions due to shipment between Canada and China are minimized with the plant in Canada
Air emissions (Acid mist)	Sulphuric acid mist: 4.38 tpa	Sulphuric acid mist: 4.38 tpa	✓	Taixing already affected by significant air quality issues; Canada project area includes dense forest and already acidic surface waters; forestry industry important to the area; any impacts to vegetation and surface water likely to be significant
Air Emissions (SO₂)	SO ₂ : 1.01 tpa	SO ₂ : 1.01 tpa	✓	Emissions profile is the same; Taixing is already affected by significant air quality issues
Air emissions (dust)	21.1 tpa	21.1 tpa	-	Same for both options
Noise & vibration	<70dB at the boundary	<70dB at the boundary	-	Same for both options
Wastewater	513,735 m ³ wastewater will be produced p.a. A new wastewater treatment plant (WWTP) will be required.	513,735 m ³ wastewater will be produced p.a. WWTP reported to be available.	x	No WWTP facility available at Canada site; wastewater treatment facilities available in Taixing
Solid Waste (Hazardous)	237,840 (extraction residues); disposed at mine site as mining residue.	Recycled as backfill material in construction industry	xx	Quebec waste recycling regulation will not allow for reuse in the construction industry whereas this can be used in China.

Comparison of China and Canada options				
Parameter	Canada	China	Appraisal (Score)	Commentary
Biodiversity Value (setting)	Chibougamau industrial zone (low sensitivity); regional forest and natural park areas sensitive	Taixing industrial zone (low sensitivity)	*	Industrial setting in China beneficial ☐ lower biodiversity value.
Population	6,862 (2016 census)	1,235,000 (Dec 2016)	-	Neutral
Land Take	9.8 hectares	9.8 hectares	-	Same footprint
Land Classification	Needs agreement with Cree Nation for Category III land use; industrial park legislated by municipal and provincial regulations. Clarification needed as to whether an IBA would be required for the facility.	In existing industrial zone/potentially easier to obtain permits	*	Land negotiation may be easier in China as the site is located within an existing industrial zone.
Direct Employment	230 personnel	230 personnel	-	Assumed to be the same for both.
Labour Availability	Lack of available labour supply in the region and in the Province which is characterized by high employment levels	All labour (at different skill levels) can be sourced locally	**	Significantly better availability in China
Skilled Labour Availability	Low due to existing high employment levels; existing roles not filled in local area. Present lack of industrial labour in Quebec and in Chibougamau region.	High (according to data reported by Guo AO)	**	High employment levels in Quebec; lack of skilled labour to fill roles
Multiplier Effect/Regional Economic Effects	Relatively high due to existing supply chain for the metals processing industry	Relatively high due to existing supply chain for the metals processing industry	-	Assumed to be the same for both sites
Cultural Heritage	No significant impacts expected	No significant impacts expected	-	No significant impacts expected at both sites
Cumulative Impacts	Competition for both natural resources and labour from other projects in the region.	Cumulative impacts associated with air quality.	-	Cumulative impacts on air quality in Taixing; cumulative impacts in terms of traffic, transport and competition for labour in Canada.

1. INTRODUCTION

1.1 Background

Shenzhen intend to construct an open pit lithium mine (the "Moblan mine") and concentrator in Quebec (implemented and operated by its Canadian subsidiary Guo AO Lithium Ltd ("GuoAO Li")) and a processing plant in Taixing, China to produce high-grade lithium carbonate for the international battery market.

The mine and concentrator will be located around 165 km from Chibougamau in Northern Quebec. Mining from Moblan will be via conventional truck and shovel both for overburden and hard rock mining. The deposit outcrops at surface and is suited to conventional open pit mining. The concentrator will be located close to the mine and be used to generate a spodumene-rich concentrate.

In addition to the concentrator, Guoao Li sister company, "Neotech Lithium" intend to construct a processing plant in Taixing, Jangsu Province, close to Shanghai China, to convert the spodumene-rich concentrate into a commercial lithium carbonate product.

Construction of the plant in China, rather than Canada, has led to community concerns in relation to the loss of potential employment opportunities and other socio-economic benefits for the wider James Bay region. In addition, Mining Law in Quebec requires that a full Market and Economical opportunity study be presented to justify location of the plant outside of the region. The study will need to address, among other issues, the potential loss of natural resources and associated loss of revenue and will be addressed under separate cover.

1.2 Objectives of the Study

The purpose of this study is to provide a comparative evaluation of the two options (China and Canada) for the lithium carbonate plant in relation to environmental and social impacts.

1.3 Study Structure

The study includes the *following* sections:

- Plant design and basic environmental design criteria (where these are common to both options)
- Description of the Canada option ☐ key environmental and social parameters
- Description of the China option ☐ key environmental and social parameters
- Summary of stakeholder views

1.4 Environmental and Social Parameters

The comparative study *addresses* the following environmental and social parameters for each plant:

- General setting (with location map)
- Climate
- Gaseous emissions (including Greenhouse Gases (GHGs))
- Use of natural resources: sources of natural gas
- Sources of water and wastewater treatment
- Solid and liquid waste (residual) disposal options

- Labour
- Traffic and transport

1.5 Limitations

The report has been prepared based on secondary information provided by GuoAO Li and publicly-available information including socio-economic information provided by the Quebec Bureau of Statistics and other available sources. In addition, Hatch and the engineering partner, DRA-MetChem have conducted a series of technical studies including: GHG emissions inventory, review of transport mode options and stakeholder engagement study. The results of these studies have been integrated into the report.

The report does not consider the *no project* scenario which would normally be covered under an alternatives assessment to align with IFC Performance *Standards* on Environmental and Social Sustainability.

No field work has been taken in the preparation of the report.

2. PLANT DESIGN CONCEPT

The following section describes the conceptual plant design including production capacity, plant layout and associated infrastructure. In addition, environmental and social issues are described where these are the same for both plants e.g. noise and vibration, dust emissions etc.

2.1 Production Capacity

For both the Chinese and Canadian *options*, the plant will produce battery-grade Lithium Carbonate (Li_2CO_3).

The operating capacity is expected to be 20,000 tonnes per annum (tpa) for both cases. Secondary products will include 63,4000 tpa of industrial sodium sulfate (>92% purity) ¹. Under the Canada plant option, sodium sulfate would be shipped to China for processing. For Taixing, the bi-product would be consumed directly in the local market.

2.2 Construction Program

The construction program is expected to be *the same* for both options and take approximately 18 months.

2.3 Associated Infrastructure

In addition to the main plant, associated *infrastructure* for both sites will include:

- Power infrastructure (main substation, site power distribution, emergency generator)
- Communications tower
- Gate house
- Office complex including First Aid
- Cold storage building

¹ Assuming that sodium sulfate residue can be shipped to China for industrial use.

- Fuel storage area
- Dry processing area
- Natural gas storage and distribution system
- Na₂SO₄ storage area
- Water effluent treatment plant (as required)
- Tailings facility (operated by a third party or by the mine site)

2.4 Emissions to Air

2.4.1 Noise Emissions

The noise emissions profile for both plants is expected to be similar. The primary sources of noise during the construction phase will be from compressors, concrete batching, earth-moving equipment, bulldozers, diesel engines, and vehicular traffic. The movement of heavy vehicles could result in frequent-to-continuous noise. Noise will be restricted to the *immediate* vicinity of the work in progress. If noise-producing activities occur near a settlement, then this may affect local communities. Exposure to prolonged noise may result in a disruption to sleep and heightened levels of stress.

There is general agreement that exposure to sound levels less than 70 dB will not produce hearing damage, regardless of the duration of exposure and this *would* be expected as a boundary limit in both scenarios. Quebec industrial site construction and operation sound levels, prescribed in the Note d'Instruction 98-01 will apply to the Chibougamau plant. The Taixing plant is located in an established industrial zone, with (an expected) high level of ambient noise, therefore additional noise impacts are not expected to be significant.

The Taixing plant is located in a heavily-urbanised setting therefore the impacts to residents/local communities may be slightly lower than with the Canada plant. Neither plant is expected to have a significant impact in relation to noise.

2.4.2 Dust Emissions

Dust emissions are also expected to be similar for both plants. Fugitive emissions of particulate matter (dust) will be generated during the construction process. Dust will be created from a number of sources including localised land clearing, the movement of vehicles and equipment over unpaved road surfaces, soil removal and wind erosion of exposed areas. The *impact* of dust on local communities will be experienced during the course of the project, mostly during the construction phase. At a production level of 20,000 tpa Li₂CO₃, dust emissions are expected to be around 21.1 tpa for both plants with the main sources being raw material and product handling and shipping.

Dust emissions are expected to be similar for both plants assuming the same production capacity. Dust sources will be similar. Emissions can be controlled for both plants through the implementation of best practice mitigation measures.

2.5 Emissions to Land: Process Residues

The residues of the hydrometallurgy plant will comprise three main constituents:

- Approximately 35% silica
- 21% of $Al_2Si_4O_{12}H_2$ (not present in the ore, but obtained from the reaction with H_2SO_4)
- 24% of $Al_2Si_2O_7$ (not present in the ore, but obtained from the reaction with H_2SO_4)

It is anticipated that the waste residue will be classified as potentially-hazardous. Waste products will be the same for both plants. It is more likely that *waste* infrastructure will be available in China for disposal of the residue. It is unlikely that suitable waste disposal infrastructure will be available in Quebec Province.

3. CHIBOUGAMAU: CANADA

3.1 Location

The Quebec plant would be located close to the town of Chibougamau, approximately 135km from the Moblan mine site and concentrator, northern Quebec. Concentrate will be shipped between the mine and Chibougamau via truck, although the final transport details are yet to be decided and are the subject of a separate evaluation.

The products (lithium carbonate and sodium sulfate) will, in turn, be shipped to Montreal² by diesel fuel train then on to Taixing Port, Juangsu Province, China via marine vessels.

Figure 3-1: Location Map: Moblan Mine and Chiboumagau



² Other port locations are also being evaluated: the port of Montreal is used as a basis in the present study.

3.2 Environmental Aspects

3.2.1 Climate

The climate of the region is sub-arctic, with long, cold winters and short cool summers. Daily average temperatures vary from -20°C in January to +17°C in July. Ice break-up in James Bay usually occurs in June with freeze-up around November. Ice is not expected to affect marine shipments however there may be some short-term interruptions to trucking; the construction schedule will need to take into account seasonal variations in weather together with weather extremes. Annual precipitation is around 640mm with rain falling from March to November and c.350 cm snow from September to May.

3.2.2 Air Emissions

Air pollution in Quebec is regulated by *standards* set by the Ministry of Environment and Fight Against Climate Change (MELCC3), the provincial authority responsible for environmental protection.

Gaseous emissions are expected to include:

- Green House Gases (GHGs): 6,810 tpa of CO₂ eq. of which the main constituents are marine transportation (2,264 tpa), road transportation (4,453 tpa) and rail (93 tpa) (emissions for the plant are anticipated to be the same for both)
- Sulphuric acid mist: 4.38 tonnes per annum (tpa)
- SO₂: 1.01 tonnes per annum (tpa)

The RAA (Règlement sur l'amélioration de l'atmosphère) sets the standards applicable in Quebec. These are:

- CWS for PM2.5 = 30 µg/m³ (24-hour averaging time, by year 2010, based on 98th percentile ambient measurement annually, averaged over 3 consecutive years)
- CWS for ozone = 65 ppb (8-hour averaging time, by year 2010, achievement is based on the 4th highest measurement annually, averaged over 3 consecutive years)

Impacts from gaseous emissions are certain, expected to be localized and mostly during operations. Limited emissions are expected during construction and limited to the operation of generators and vehicular traffic etc. With the application of standard best practice measures, the residual impact is expected to be minor. Nearest residents are expected to be inhabitants of the town of Chibougamau c.2km from the plant. Greenhouse Gases will be generated by the plant and through land-based and marine transport. Under the Canadian option, lithium carbonate will be transported to China rather than spodumene concentrate which will have a significantly lower emissions profile.

3.2.3 Power and Utilities

Electricity *within* the Province is provided by Hydro-Quebec (HQ), owned solely by the Province of Quebec.

Power consumption will be 73.5 MW to be supplied via the existing, public grid network with the need for a new sub-station. The power source will be 100% hydropower (i.e. renewable energy) which is readily available through HQ.

18 Mm³ of natural gas will also be required which is not currently available. Natural gas used by Stornoway mine is shipped as liquified natural gas by trucks.

³ Until recently called the Ministère du développement durable, de l'environnement et de la lutte contre les changements climatiques (MDDELCC), the name was modified to MELCC by the new government in place since early October 2018.

Operation of the Quebec plant would require a natural gas supply and, hence, construction of a new pipeline which would have significant cost implications and possibly not be viable for a single low volume consumer.

3.2.4 Transport Links/Transport Options

Chibougamau is located on the south border of the James Bay region. Chibougamau is located:

- 365 km from Chicoutimi
- 408 km from Val d'Or
- 515 km from Rouyn-Noranda
- 525 km from Québec City
- 690 km from Montreal
- 135km from Moblan mine

One main road (highway 167) connects Chibougamau with the surrounding regions. Several forestry roads are also maintained and largely used in the region. In addition to land transport, Chibougamau-Chapais Airport (YMT) is located 20 km away from Chibougamau and the *Chibougamau/Lac Caché Water Aerodrome (CSZ7)* provides airway services for float-planes within the region. The nearest railway infrastructure is the CN Rail Line approximately 88 km to the southwest. This line is used for merchandise transport and is not a passenger train (Railway Association of Canada, 2012).

Spodumene concentrate will be trucked between the mine and the processing plant (25 trucks per day, or 175 trucks per week over the 135 km per journey); a diesel *fuel* train will then be used to transport lithium carbonate product and the sodium sulfate by-product to the port of Montreal (one * 80 car trains per month over 500 km per journey, based on the spodumene shipping study data⁴). Shipment will be via marine vessel from Montreal to Tiaxing Port, Jangsu Province (two 42,000 t shipments per year over more than 20,000 km). Both land-based and marine transport will generate emissions of particulates and gases, consume fuel, and emit GHGs.

3.2.5 Waste (Residues)

The Quebec plant will produce c.237,840 tpa of extraction residues which will be classified as mining wastes. Waste disposal will need to follow the regulatory requirements of Quebec Directive 0-19. Waste residues will need to be transferred off-site to a suitable disposal facility which will require transportation by licensed operator due to the waste constituents. This is likely to be expensive and *will* require full permitting. A disposal procedure, an environmental monitoring plan and a restoration plan will need to be authorized by the regulator.

Vehicles delivering concentrate to the *plant* may be suitable for use for waste disposal and this would be the subject of additional valuation.

There is one landfill located within Chibougamau referred to as the *Le Lieu d'Enfouissement technique (LET)* available for various household wastes that are *not* accepted during regular collections (Chibougamau, 2018). The site is only accessible to residents of Chibougamau and they are required to provide proof of residence. The landfill is not suitable for industrial waste disposal.

The existing municipal landfill is not suitable for mining waste handling- effectively residues will be treated as potentially hazardous and will require transfer and disposal to a licensed facility which is most likely to be outside the Province of Quebec.

⁴ DRA, « Concentrate Shipping Alternatives », Results presentation, Rev B, October 18, 2018.

3.2.6 Raw Water and Wastewater

Raw water will be sourced from a new water supply main from the existing natural surface water network abundant in the region. Water demand is expected to be around 600,000 m³ per annum.

The plant is expected to produce c. 513,735 t/a of waste water for which will require a dedicated wastewater treatment plant (WWTP) as there is no suitable existing facility.

The WWTP in Chibougamau processes biological treatment for domestic effluent and would not be suitable for industrial effluent.

Raw water is considered readily available for the Project. The project is not expected to contaminate surface or groundwater supplies through the implementation of best practice measures and compliance with Canadian environmental standards. The project will require a new WWTP with associated significant capital investment however this will also be a source of revenue and employment.

3.3 Socio-Economic Aspects

3.3.1 Socio-Economic Setting

Quebec is the largest province in Canada accounting for around 24% of Canada's total population. The Province is bordered by Ontario, James Bay and Hudson Bay to the west, Hudson Strait and Ungava Bay to the north, the Gulf of Saint Lawrence and the provinces of New Brunswick and Newfoundland and Labrador to the east. It also shares a border with the U.S. states New York, Vermont, New Hampshire and Maine and maritime borders with Nova Scotia, Prince Edward Island and Nunavut.

Quebec has an estimated population of **8.18 million** with a population density of 8/km². Montreal is the most populous city in Quebec. Quebec City is the capital of Quebec and its second most populous city.

The Canadian plant would be located a few km from the town of **Chibougamau** in an existing industrial area, effectively brownfield which limits land take impacts. Chibougamau is located approximately 130 km from Moblan mine site, making it the closest and most accessible established community to the Project Location via Route du Nord and Highway 167.

The following table provides the 2016 Census Data for Chibougamau (Statistics Canada, 2017).

Table 3-1: Demographics and Key Population Characteristics Chibougamau

Statistic	Figure
Population, 2011	6,948
Population, 2016	6,862
Population percentage change, 2011 to 2016	-1.2
Total private dwellings	3,215
Land area in square kilometres	6.03
Economically-productive age group (18-64)	2,440 (male) 2,220 female
Languages	95% French primary language

3.3.2 Land Use/Land Tenure

The footprint is expected to be c. 9.8 hectares (ha) (0.098km²) within the city of Chibougamau which falls under the jurisdiction of the Quebec provincial government. Chibougamau also falls within the James Bay wider region which is subject to the James Bay and Northern Quebec Agreement of 1975 which is a land claim settlement area reached

with the Cree and Inuit people of *northern* Quebec (the Naskapi Indians of Quebec joined later in 1978). The rights under this agreement have the status of constitutional rights in accordance with the Constitution Act of 1982.

The plant will be located in the industrial park area of Chibougamau within Terres de Catégorie III defined as *Public lands on which Native people can, subject to conservation principle, pursue their traditional activities all year long in addition to enjoying exclusive rights on the harvest of certain animal species*

The park is located approximately 2 km from the downtown region of Chibougamau and is accessible via Highway QQC-167 (Développement Chibougamau, 2015).

Land acquisition will need to be agreed with the local planning authority to cover the plant and any associated facilities such as access roads, wastewater treatment facilities, power supply, gas pipeline etc. A land asset and inventory will be required with economic evaluation for compensation and entitlements payment. Negotiations may be complex in relation to land agreements under the JBNQA and this will be subject to further review.

3.3.3 Employment

The Chibougamau plant is expected to provide direct labour positions for 230 personnel. Skilled labour is required. There may be a need for labour to be provided from outside the Province to fill certain roles due to the emergence of new mining projects within the region and increasing demand for labour (e.g. the Nemaska Lithium Plant in Shawinigan). The existing unemployment rate in Quebec Province is low at around 5.3%. Direct revenues from employment will be dependent on the minimum and average CAD salary/hr for workers.

Expectations for employment and vocational (specialist) training are likely to be high and have been raised as a material concern through the public consultation process. The expectation for employment could reasonably be assumed to increase as the level of negative impacts felt by a *community* increases, for example due to increased construction traffic movements.

The provision of direct, skilled labour opportunities for workers at the plant will be of significant economic benefit to Chibougamau and the remainder of the Province. However, these benefits will be offset to an extent by the need to bring in skilled workers from outside. In addition to direct employment, there will be opportunities for the provision of goods and services which will provide added economic and social benefits.

3.3.4 In-Migration

The total working population of Chapais-Chibougamou-Mistissini-Ouje Bougoumous is likely to be insufficient to support project labour needs therefore some in-migration of labour will be *required* to support the shortfall.

As per above, some skilled labour will be required to meet the employment shortfall. This is likely to produce both positive and negative benefits. Assuming workers will live locally (Montreal is too far to commute), there may be a need to increase housing stock and a modest increase in housing price (although this may be a bounce during construction). In-migration may lead to community competition for goods and services including healthcare. An influx mitigation plan will be required.

3.3.5 Community Health, Safety & Security (CHSS)

There is one police station, Post Chapais-Chibougamau, in Chibougamau and one fire station. In addition to fires, the Fire Department is also responsible for assisting residents where *they* have encountered issues relating to extreme weather events etc. (Chibougamau, 2018).

Heavy vehicle traffic in and out of the plant and along the local highway network may represent a minor risk to pedestrians and other highways users and has been raised as a concern through consultation; it is expected that risks will be mitigated through the employment of vehicle *maintenance* and controls and driver restrictions in compliance with Canadian laws.

No significant community health and safety impacts are expected due to the good condition of the existing road network. Depending on labour influx, there may be some induced pressure on goods and services provision although this is expected to be minor.

3.3.6 Cultural Heritage

The production plant will be located in the industrial zone of the town. Land take will be approximately 9.8 ha. There is sufficient land available therefore no further disturbance is *expected* to occur to sites of cultural heritage interest. The Canadian ESIA process involves an archeological and historical potential. If archeological potential is suspected, inventories are performed to verify the presence of artifacts. If the presence is confirmed, the site must be cleared before the construction work starts or the construction activities must be performed under the supervision of a qualified archeologist. With this standard approach, impacts to cultural heritage resources are not expected to occur.

There are no known cultural heritage sites within and in proximity to the Project. However, chance finds and potential impacts to objects, sites or places of cultural heritage value may be caused during ground disturbing activities conducted during the construction phase for which a watching brief will be needed.

3.3.7 First Nations/Indigenous Rights

In Quebec, the Indigenous population is divided into two separate groups: Inuit and First Nations. In 2016, the population identifying as First Nations represented 2.4% of the total population of Quebec (The First Nations of Quebec and Labrador Health and Social Services Commission, 2018).

There are 41 First Nations communities from 10 nations: Abenaki, Algonquin, Atikamekw, Cree, Innu, Maliseet, Miꞌmaq, Mohawk, Naskapi and Wendat. *Each* nation has its own history, culture, beliefs, way of life and knowledge. The majority (64%) of First Nations live in a community, and 40% of those ages 12 years and up use a First Nations language as their main language Quebec (The First Nations of Quebec and Labrador Health and Social Services Commission, 2018). The nearest Indigenous community to the Project Area is the Mistissini Cree Nation.

*It is becoming a common practice for the native people in the region to negotiate and agree to a form of **Impacts and Benefits Agreement** with developers which sets out various undertakings of the parties to provide for the development of a project in a mutually beneficial manner and provides various types of benefits and opportunities for the native people in this context. Guo Li will need to commit to this type of agreement in order to operate the plant in this area.*

3.3.8 Regional Economic Benefits/Multiplier Effect

Chibougamau provides a number of service offerings to developers and businesses including: business set-up and support initiatives, industrial and *commercial* premise search, local issues, investments and pre-start-up and start-up (Développement Chibougamau, 2018). In Chibougamau, there are more than 425 businesses (Développement Chibougamau, 2018).

The mainstay of the economy depends on five industries which include: lumber, mining, service, energy and tourism. Several key initiatives have been *identified* for the City of Chibougamau and its businesses such as: economic vitality and diversity, tourism development, the impacts of Fly in and Fly out phenomenon, the importance of lost business and the variety and availability of homes. The City of Chibougamau has three main regional development goals: promote and position the City of Chibougamau at the regional, provincial and international level; prioritize the efforts of Développement Chibougamau in promoting investments, attracting and growing business; support to the tourism industry (Développement Chibougamau, 2018). Construction of the plant a Chibougamou is in line with the Provincial regional development goals.

Economic multipliers estimate the total effect of a company or sector's activities as a result of direct, indirect and induced effects. The direct and indirect multiplier effects arise *due* to the inter-relatedness of local industries. The induced multiplier effect arises due to the relationship between wages and employee demands on supporting industries. In a region with a developed mining and metals sector and established suppliers of equipment and services, the total multiplier effect is likely to be around 2.5.

It is not yet known what goods and services are being purchased locally by contractors during civils works or to what extent they are being imported from elsewhere in Canada. Likely areas of spending include fuel and vehicle supplies/services, aggregates and construction consumables, accommodation, food and water, etc.

In addition to the plant, itself, goods and services opportunities are *also* likely to arise through:

- contractors and sub-contractors that have been contracted to fulfil components of the construction programme
- indirect employment generated through the purchase of goods or services from firms supplying the company or its contractors
- induced employment in local communities, generated by the spending of wages on items such as food, transport, public services, etc. by those employed directly and indirectly
- accommodation provision and associated food supply services (restaurants, catering etc.)
- security (manning entrance and exit from the site, 24 hr security provision)
- fuel supply

In addition to the provision of jobs (direct labour), additional regional economic benefits are expected within the wider region through social and business investment associated with the commitments of the Project component. Impacts are expected to be regional in scale and positive.

3.3.9 Cumulative Impacts

The combined impacts on specific resources or *receptors* have been considered in relation to other projects, including oil and gas, construction, government projects and other industries. Considering the numerous ongoing natural resource development projects in the Chibougamau area (Blackrock Metals, Troilus expansion, Stornoway Mine, Nemaska Lithium, and the opening of a new National Park and reserve), some cumulative impacts on road traffic, dust emissions from the trucks and pressure on local labour and services are anticipated.

The full ESIA process will need to include an evaluation of cumulative impacts.

4. TAIHING, CHINA

4.1 Location

The lithium carbonate plant will be located *close* to the town of Taixing City, Taixing Economic Development Zone, near Shanghai, Jangsu Province, Eastern China. Concentrate will be shipped from Montreal via marine vessels. Figures 4.1 and 4.2 illustrate the plant location.

Figure 4-1: Location Maps: Taixing, Jangsu Province (Regional Map)

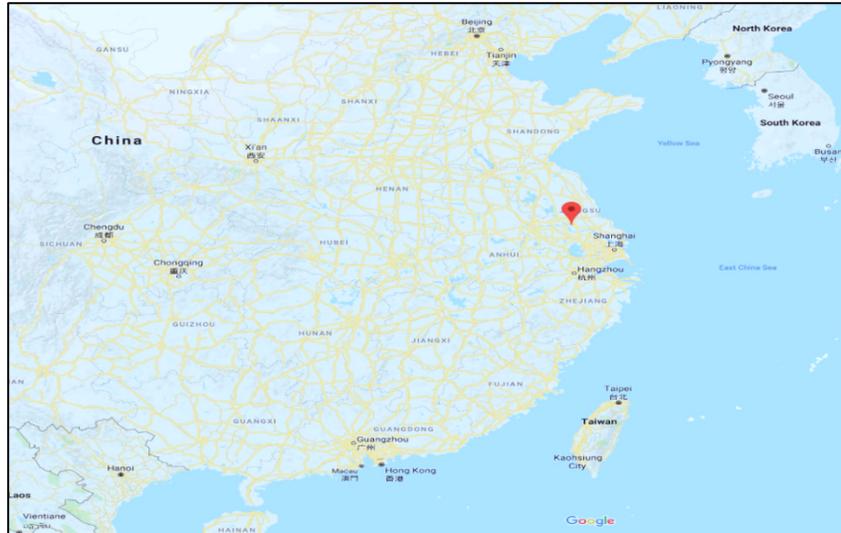
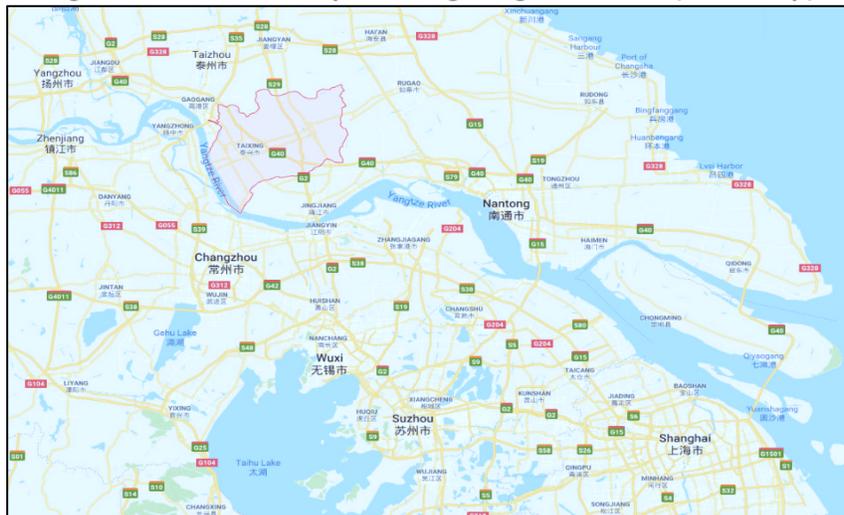


Figure 4-2: Location Maps: Taixing, Jangsu Province (Local Map)



4.2 Environmental Aspects

4.2.1 Climate

Taixing has a subtropical monsoon climate with humid and changeable winds. The rainy season is usually from the middle of June to July. Average temperatures in July (summer) are around 28°C and 2°C in January (winter). Precipitation is high with an annual average of 1,040 mm. Local weather conditions are affected by the influences of the Yangtze River and Grand Canal systems.

4.2.2 Air Emissions

Both dust and gaseous emissions are expected to be the same for both plants, however, the airshed (ambient) setting is different for both. Air emissions are above WHO limits in many Chinese cities including Shanghai. The addition of a new industrial plant will have a cumulative effect on local air quality. The Shanghai municipality has issued a series of directives aimed at reducing air pollution which is at dangerous levels for human health in relation to smog, dust, PM2.5 (respirable fraction), *diesel* emissions etc. The Shanghai government committed to reducing the average annual PM2.5 density to 49.6 ug/m³ (a 20% reduction from 2012 levels) by 2017 as part of the Clean Air Action Plan initiated in 2013. Emissions from vehicles, which cause around 20% of Shanghai's air pollution, are also a key target. About 90,000 heavy polluting vehicles and 30,000 old cars were taken off the roads in 2015. The government has also implemented many preferential policies to encourage the use of electric and other green cars.

Many large construction sites, which contribute about 10% of Shanghai's pollution, have installed dust detectors so that authorities can require them to shut down when they produce too much pollution. Fines of 154 million yuan (US\$ 22million) were levied on over 2,000 pollution-related cases in Shanghai in the first 9 months of 2016, a 40% increase on the previous year. These more stringent fines are based on the stricter air pollution law which came in to effect on October 1st, 2014.

In addition to different ambient conditions, construction of the lithium carbonate plant in China will require the long-distance marine transport of spodumene-rich concentrate which will have significant implications for GHG emissions (2 shipments across a distance of 20,000 km per year). Construction of the plant in Canada will require the long-distance transport of lithium carbonate only rather than concentrate.

Gaseous emissions are expected to *include*:

- Green House Gases (GHGs): 41,389 tpa of CO₂ eq. of which the main constituents are marine transportation (13,585 tpa), road transportation (13,851 tpa) and rail (93 tpa) (emissions for the plant are anticipated to be the same for both)
- Sulphuric acid mist: 4.38 tonnes per annum (tpa)
- SO₂: 1.01 tonnes per annum (tpa)

The Taixing plant is located within an existing industrial zone therefore there is expected to be low sensitivity in relation to gaseous emissions however there is chronic existing air pollution which is being tackled through a number of government initiatives. The CO₂ emissions profile is significantly higher than with the Canada option due to the requirements for bulk marine shipment of the spodumene concentrate.

4.2.3 Power and Utilities

Power consumption will be 73.5 MW to be supplied via the existing grid network with the potential for a new sub-station. 18 Mm³ of natural gas will be required p.a. which is *available* from a local distribution pipeline according to Guo Ao Li. As there is no existing natural gas pipeline connection to the Chibougamau plant, the Taixing plant has a significant advantage.

4.2.4 Transport Links/Transport Options

The site is located within a heavily industrialised area with an *existing* network of tarmacked roads and good/close access to the port.

4.2.5 Waste (Residuals)

The plant will produce c.237,840 tpa of extraction *residues* which, according to Guo Ao, can be recycled in the Chinese construction industry.

Waste residues from the industrial process will be recycled by the construction industry or will need to be transferred off-site to a suitable disposal facility which will require transportation by licensed operator due to the waste classification. It is expected that a suitable facility would be available locally whereas Canadian (Quebec) regulations would most likely prevent the disposal of metallurgical waste.

4.2.6 Raw Water and Waste Water

Raw water will be sourced from the local water distribution network and is readily available. As Taixing is an existing industrial zone, it is likely that wastewater treatment facilities will be available locally.

Raw water is considered easily available for the Project. In contrast to the Canadian plant, there is unlikely to be the need to construct a WWTP.

4.3 Socio-Economic Aspects

4.3.1 Socio-Economic Setting

Taixing is a county-level city under the administration of Taizhou, Jiangsu province, China. It is located in the Yangtze River Delta, bordering the prefecture-level *cities* of Nantong to the east, Changzhou to the southwest, and Zhenjiang to the west (China 2010 Census County-by-county Statistics/中国2010年人口普查分县资料》 (in Chinese) Accessed 9 July 2014). Population density is extremely high at 920/km². **Table 4.1** provides a summary of key demographic statistics for Taixing.

Table 4-1: Demographics and Key Population Characteristics Taixing

Statistic	Figure
Population, 2016	1,073,921
Land area in square kilometres	1,172.2 km ²
Population Density	920/km ²

4.3.2 Land Use/Land Tenure

The processing plant footprint is expected to be c. 9.8 hectares (ha), the same as the Canadian plant. The lithium carbonate plant is expected to be located in the industrial area of Taixing in which a number of chemical industries are already located. China tends to develop industrial areas which promote synergies between plants to maximize opportunities for recycling and re-use. This would not be *the* case in Chibougamau.

Land acquisition will need to be agreed with the municipal authority in Taixing. The process is expected to be straightforward in comparison to the Canada plant i.e. permitting for an industrial plant in an already heavily-industrialised area.

4.3.3 Employment

The plant is expected to provide direct labour positions for c.335 personnel (in operations) with an additional 25 personnel in management and administration. Skilled labour will be required. Given the presence of neighbouring chemical industries it is considered likely that *labour* will be available from the local (city-wide) or Jangsu Province market.

The provision of direct, skilled labour opportunities for workers at the plant will be of significant economic benefit to Jangsu Province. In addition to direct employment, there will be opportunities for the provision of goods and services. Taixing comprises a cluster of chemical industries therefore skilled labour is expected to be available. The municipality is very densely populated which will reduce in-migration risk.

4.3.4 In-migration

In-migration with respect to labour resources is expected to be low. The site is within an existing industrial zone.

4.3.5 Community Health, Safety & Security

Heavy vehicle traffic in and out of the plant and along the local highway network may represent a minor risk to pedestrians and other highways users; it is expected that risks will be mitigated through the employment of vehicle maintenance and controls and driver restrictions in compliance with Chinese legal requirements. *No significant community health and safety impacts are expected.*

4.3.6 Cultural Heritage

The proposed production plant will be located in the *industrial* zone of the town. There is sufficient land available therefore no further disturbance is expected to occur to sites of cultural heritage interest.

4.3.7 Regional Economic Benefits

In addition to the provision of jobs (direct labour), additional *regional* economic benefits are expected within the wider region through social investment associated with the commitments of the Project component. Impacts are expected to be regional in scale and positive.

4.3.8 Cumulative Impacts

The combined impacts on specific resources or receptors have been *considered* in relation to other projects, including metal processing, construction, government projects and other industries. The project is likely to contribute to air emissions which are already reported to be bad (sometimes chronic) in the Shanghai area. The ESIA process will include an assessment of air emissions.

END OF SECTION