

Report to:



**Preliminary Economic Assessment and Technical Report  
of the Tami-Mosi Magnesium Project, Nevada**

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Report to:



**MOLYCOR**  
GOLD CORP.

# PRELIMINARY ECONOMIC ASSESSMENT AND TECHNICAL REPORT OF THE TAMI-MOSI PROJECT, NEVADA

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## GLOSSARY

### UNITS OF MEASURE

Above mean sea level.....	amsl
Acre .....	ac
Ampere .....	A
Annum (year) .....	a
Billion .....	B
Billion tonnes.....	Bt
Billion years ago.....	Ga
British thermal unit .....	BTU
Centimetre .....	cm

Cubic centimetre .....	cm <sup>3</sup>
Cubic feet per minute .....	cfm
Cubic feet per second .....	ft <sup>3</sup> /s
Cubic foot .....	ft <sup>3</sup>
Cubic inch .....	in <sup>3</sup>
Cubic metre .....	m <sup>3</sup>
Cubic yard .....	yd <sup>3</sup>
Coefficients of Variation .....	CVs
Day .....	d
Days per week .....	d/wk
Days per year (annum) .....	d/a
Dead weight tonnes .....	DWT
Degree .....	°
Degrees Celsius .....	°C
Diameter .....	∅
Dollar (American) .....	US\$
Dollar (Canadian) .....	Cdn\$
Foot .....	ft
Gallon .....	gal
Gallons per minute (US) .....	gpm
Gigajoule .....	GJ
Gigapascal .....	GPa
Gigawatt .....	GW
Gram .....	g
Grams per litre .....	g/L
Grams per tonne .....	g/t
Greater than .....	>
Hectare (10,000 m <sup>2</sup> ) .....	ha
Hertz .....	Hz
Horsepower .....	hp
Hour .....	h
Hours per day .....	h/d
Hours per week .....	h/wk
Hours per year .....	h/a
Inch .....	"
Kilo (thousand) .....	k
Kilogram .....	kg
Kilograms per cubic metre .....	kg/m <sup>3</sup>
Kilograms per hour .....	kg/h
Kilograms per square metre .....	kg/m <sup>2</sup>
Kilometre .....	km
Kilometres per hour .....	km/h
Kilopascal .....	kPa
Kilotonne .....	kt
Kilovolt .....	kV
Kilovolt-ampere .....	kVA

Kilovolts.....	kV
Kilowatt .....	kW
Kilowatt hour .....	kWh
Kilowatt hours per tonne (metric ton) .....	kWh/t
Kilowatt hours per year .....	kWh/a
Less than .....	<
Litre.....	L
Litres per minute .....	L/m
Megabytes per second.....	Mb/s
Megapascal.....	MPa
Megavolt-ampere .....	MVA
Megawatt .....	MW
Metre.....	m
Metres above sea level .....	masl
Metres Baltic sea level .....	mbsl
Metres per minute .....	m/min
Metres per second .....	m/s
Metric ton (tonne).....	t
Microns .....	µm
Milligram.....	mg
Milligrams per litre.....	mg/L
Millilitre .....	mL
Millimetre.....	mm
Million.....	M
Million tonnes .....	Mt
Minute (plane angle) .....	'
Minute (time).....	min
Month .....	mo
Ounce .....	oz
ounces per ton .....	opt
Pascal .....	Pa
Centipoise .....	mPa·s
Parts per million .....	ppm
Parts per billion .....	ppb
Percent.....	%
Pound(s) .....	lb
Pounds per square inch .....	psi
Revolutions per minute .....	rpm
Second (plane angle).....	"
Second (time).....	s
Specific gravity.....	SG
Square centimetre.....	cm <sup>2</sup>
Square foot .....	ft <sup>2</sup>
Square inch.....	in <sup>2</sup>
Square kilometre.....	km <sup>2</sup>
Square metre .....	m <sup>2</sup>

Thousand tonnes .....	kt
Three Dimensional.....	3D
Three Dimensional Model .....	3DM
Tonne (1,000 kg).....	t
Tonnes per day .....	t/d
Tonnes per hour.....	t/h
Tonnes per year.....	t/a
Volt.....	V
Week.....	wk
Weight/weight .....	w/w
Wet metric ton.....	wmt
Year (annum).....	a

## ABBREVIATIONS AND ACRONYMS

ALS Chemex.....	ALS
alternating current.....	AC
aluminum oxide.....	Al <sub>2</sub> O <sub>3</sub>
aluminum .....	Al
ammonium nitrate/fuel oil.....	ANFO
Association for the Advancement of Cost Engineering.....	AACE
Bureau of Alcohol, Tobacco and Firearms.....	BATF
Bureau of Land Management .....	BLM
Bureau of Mining Regulation and Reclamation.....	BMRR
Burlington Northern Santa Fe Railroad.....	BNSFR
calcium carbonate.....	CaCO <sub>3</sub>
calcium chloride.....	CaCl <sub>2</sub>
calcium oxide .....	CaO
carbon dioxide .....	CO <sub>2</sub>
carbon dioxide .....	CO <sub>2</sub>
copper.....	Cu
differential thermal analysis .....	DTA
direct current.....	DC
Distributed Control System .....	DCS
engineering, procurement and construction management.....	EPCM
environmental assessment .....	EA
environmental impact statement.....	EIS
Environmental Information Document.....	EID
EPIC Clean Technologies Corporation .....	EPIC
ferrosilicon .....	FeSi
Finding of No Significant Impact .....	FONSI
fluorspar.....	CaF <sub>2</sub>
free board marine .....	FOB
free carrier .....	FCA
general and administrative.....	G&A
Ghalsasi Engineering Systems Pvt. Ltd. ....	GESPL

gold.....	Au
Hazen Research Inc. ....	Hazen
heat recovery steam generator .....	HRSG
heating, ventilation and air conditioning .....	HVAC
induced draft.....	ID
inductively coupled plasma .....	ICP
internal rate of return.....	IRR
International Organization for Standardization/International Electrotechnical Commission .....	ISO/IEC
life-of-mine .....	LOM
magnesium carbonate .....	MgCO <sub>3</sub>
magnesium carbonate .....	MgCO <sub>3</sub>
magnesium chloride.....	MgCl <sub>2</sub>
magnesium oxide.....	MgO
magnesium .....	Mg
Memorandum of Understanding .....	MOU
mercury.....	Hg
Minerals, Metals and Materials Survey .....	TMS
Mintek Thermal Magnesium Process.....	MTMP
Molycor Gold Corp. ....	Molycor
Multi-element Inductive Couple Plasma Mass Spectrometry .....	ME-ICP41
National Environmental Policy Act.....	NEPA
National Environmental Policy Act.....	NEPA
net present value .....	NPV
Nevada Administrative Code .....	NAC
Nevada Department of Wildlife .....	NDOW
Nevada Division of Environmental Protection .....	NDEP
Norm Tribe and Associates.....	NTA
Operator Interface Station.....	OIS
Powder River Basin .....	PRB
preliminary economic assessment.....	PEA
qualified person .....	QP
Quality Management System.....	QMS
reasonably foreseeable future actions .....	RFFA
record of decision .....	ROD
silicon dioxide .....	SiO <sub>2</sub>
silicon.....	Si
silver .....	Ag
sodium chloride.....	NaCl
Standards Council of Canada .....	SCC
State Historic Preservation Office .....	SHPO
sulfur dioxide.....	SO <sub>2</sub>
sulfur hexafluoride .....	SF <sub>6</sub>
Tami-Mosi property.....	the Property
Tenova Group, South Africa .....	Tenova
thermogravimetric analysis .....	TGA
Title 43, Code of Federal Regulations, Part 3809 .....	43 CFR 3809

ultraviolet .....	UV
United States Geological Survey .....	USGS
US Army Corps of Engineers .....	USCOE
US Fish and Wildlife Service.....	USFWS
Wardrop, a Tetra Tech Company .....	Wardrop
Water Pollution Control Permit.....	WPCP
work breakdown structure.....	WBS
X-ray diffraction.....	XRD

## 1.0 SUMMARY

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### 1.1 INTRODUCTION

Molycor Gold Corp. (Molycor) retained Wardrop, a Tetra Tech Company (Wardrop), together with a number of specialists with expertise in the magnesium, ferrosilicon and power generation industries to complete this preliminary economic assessment (PEA) for a proposed 30,000 t/a magnesium (Mg) project. The project consists of a proposed 300,000 t/a dolomite quarry located in the Tami-Mosi area, 10 km south of the City of Ely, Nevada, USA and a proposed vertically integrated 30,000 t/a magnesium processing facility located in Elko County, east of Wells, Nevada, USA.

This study has been prepared to an Association for the Advancement of Cost Engineering (AACE) Class 5 estimate level providing an accuracy of +50% / -25%. This study builds upon the following reports:

- Initial Resource Estimate by Norm Tribe & Associates Ltd. (NTA) (May 1, 2009)
- Phase 1 Process Development Study for Exploitation of the Tami-Mosi Project, Hazen Research, Inc. (June 11, 2010)
- Updated resource estimate by Wardrop (August 3, 2011).

This study is intended to assist Molycor in determining potential future plans for the Tami-Mosi property (the Property) and the approach to magnesium production. Opportunities and possibilities for further investigation in the next study stage are provided in Section 26 Recommendations. These **opportunities and possibilities have not been included in the base case** presented in this report. Further investigation of these opportunities and possibilities in subsequent studies is recommended to determine their potential for lowering the overall operating cost and increasing revenues.

The primary purpose of this study is to prepare a PEA for the base case of 294,000 t/a of dolomite from the dolomite quarry at an average grade of 12.6% Mg to produce 30,000 t/a of 99.9% Mg ingot. The dolomite quarry is capable of generating a production rate of 1500 t/d of dolomite. The quarry design allows for a total production of 8.8 Mt over the 30-year life-of-mine (LOM).

This study, completed by Wardrop, also includes significant contribution from the following sources:

- Mr. James Sever, B.S., M.S., M.B.A. – providing concept of the overall facility and the technical process for magnesium production, the costs and opportunities
- Mr. Robert E. Brown, P.E. – providing input on process operations and responsible for markets and contracts
- Mr. Ralph Carter, B.S. – providing input on ferrosilicon production and the production costs
- Dr. Fred P. Buckingham, Ph.D., P.E. – responsible for coal gasification technology, operations and costs
- Dr. Neale Neelameggham, Ph.D. – providing input for technical review, research and patent development.
- Mr. Norm L. Tribe, P.Eng. – responsible for the initial resource estimate and associated geological information.

## 1.2 GEOLOGY

The Tami-Mosi dolomite property is located in east-central Nevada, near the municipality of Ely, 402 km north of Las Vegas. A property location map is provided in Figure 1.1.

The Property consists of 153 claims for a total of 667.5 ha (1,637 acres). Vegetation and wildlife are typical of the high basin and range with elevations around 2,100 m (7,000 ft).

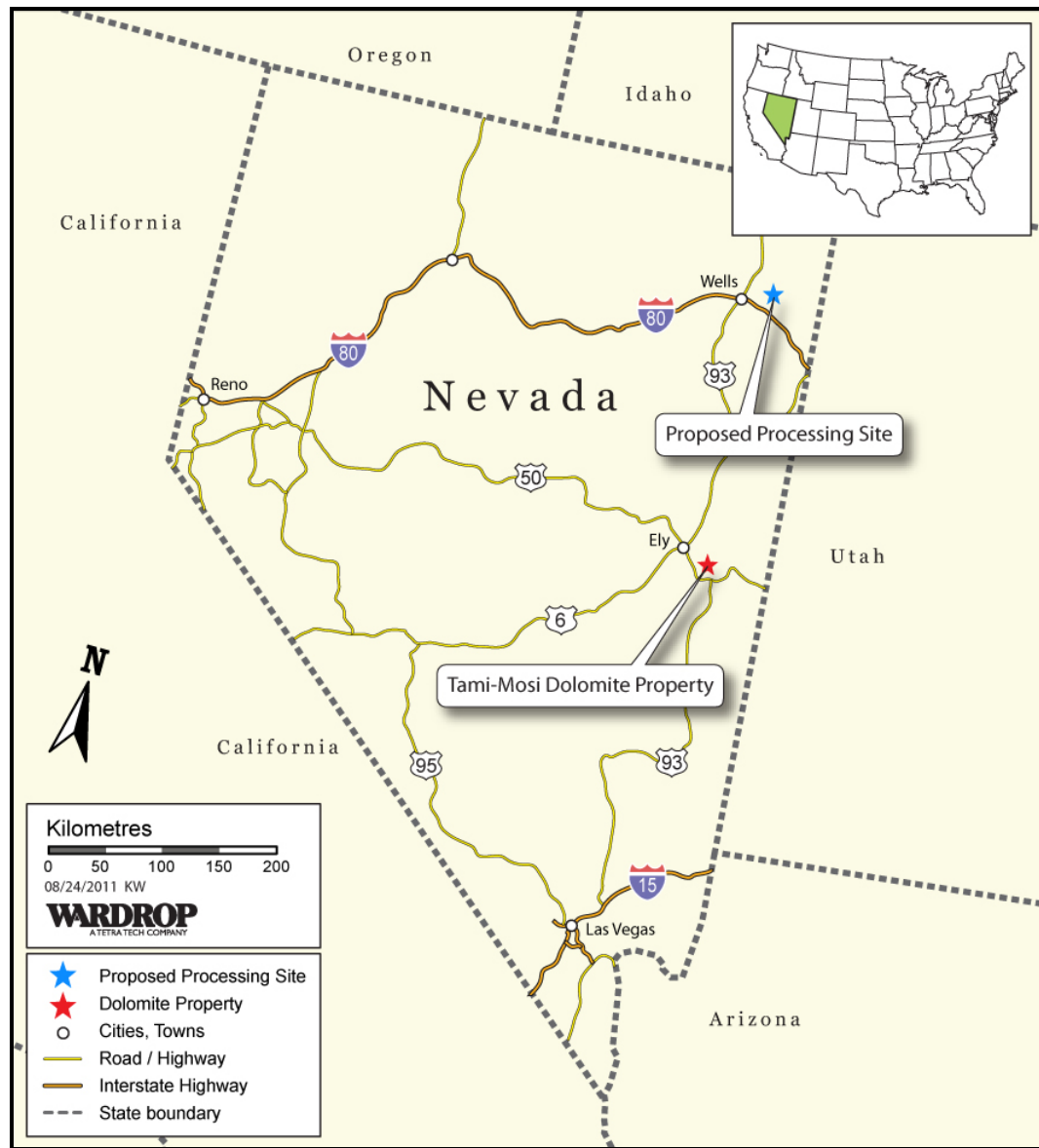
The Duer Mine, an abandoned gold mine, is located adjacent to the Property to the south. There are no other dolomite projects currently active in the area.

The rock types of the Tami-Mosi area are composed of Devonian, Guilmette Limestone. Bands within the Guilmette Limestone (Simonson unit) are altered to a premium quality dolomite. This dolomite is believed to have potential for an industrial source of magnesium.

A total of 16 rotary percussion drillholes were drilled to test the dolomite. A sample was split out of the drill cuttings and sent for analysis. The samples were prepared by ALS Chemex (ALS) in Sparks, Nevada; the assays were performed by ALS Chemex Laboratories in North Vancouver, BC, using a 34-element inductively coupled plasma (ICP) method. In-house data verification was performed at the labs, and no irregularities were found.



**Figure 1.1 Tami-Mosi Dolomite Property Location Map**



### 1.3 MINERAL RESOURCE ESTIMATE

The mineral resource estimate analysis generated by Klaus Triebel of Wardrop (2011), shows an Inferred Resource of 412 Mt with an average grade of 12.3% Mg for a contained metal content of 111 billion pounds of magnesium using a 12% cut-off grade. No dilution was incorporated in the estimate. The increase over the initial estimate by NTA in May of 2009 is a result of the inclusion of 13 additional contiguous claims and the application of block modeling and surface sampling in the analysis. At this time, all resources are in the Inferred category, and therefore are too speculative in nature to be considered as a mineral reserve.

## 1.4 METALLURGICAL TESTING AND MINERAL PROCESSING

### 1.4.1 *METALLURGICAL TESTING*

In 2010, Hazen Research Inc. (Hazen) conducted preliminary test work to determine mineralogy and study process technology for the Tami-Mosi mineralization. The chemical analysis and X-ray diffraction (XRD) analysis on the drill core samples showed that the main component of the samples is dolomite with magnesium oxide (MgO) content ranging from 19.8% to 21.6%. The preliminary thermogravimetric analysis (TGA), differential thermal analysis (DTA) and differential calcination tests were conducted to determine whether there is a distinct transition between the decompositions of magnesium carbonate ( $\text{MgCO}_3$ ) and calcium carbonate ( $\text{CaCO}_3$ ). The test results showed that the  $\text{MgCO}_3$  of the dolomite could be differentially decomposed at approximately 800°C. The results appear to indicate that the chemical composition of the Tami-Mosi dolomite is favourable to magnesium recovery by conventional processes.

### 1.4.2 *MINERAL PROCESSING*

In selection of recovery method technology, consideration was given to the known industrially established reduction methods. The thermo reduction process using resistance heating (modified Bolzano Process) was selected based upon the following:

- The Bolzano Process is proven and a modified version is currently in operation.
- This process is suited to the characteristics of the mineralization.
- This over all process would have the lowest environmental impact of those considered.

## 1.5 MINING METHOD

An open pit was designed containing 8.8 Mt of Inferred Resource. A large amount of resource at or near the surface led to a 3-sided pit design. The pit design was located in the side of a hill containing an average grade of 12.59% Mg and an average strip ratio is 0.04:1. There can be no certainty that the resources listed here will be realized.

## 1.6 ANCILLARY INFRASTRUCTURE

The proposed dolomite quarry includes one mobile crushing plant, two front end loaders, one truck shop, 1.5 km of gravel access roads and gravel site roads, bottled fresh water supply, sewerage holding tank, power supply and distribution and site

services and utilities. Highway trucks will transport primary crushed dolomite 225 km from the dolomite quarry to the proposed processing site.

The proposed processing site will include magnesium plant, ferrosilicon plant, power plant and related infrastructures, including paved access road, paved parking, gravel site roads, water supply, communication system, administration building, 1.5 km rail spur loop complete with coal off-loading and process materials off-loading facilities, and site services and utilities. The various facilities have been incorporated into a vertically integrated processing site conceptual design.

## 1.7 MARKETS, STUDIES, AND CONTRACTS

Magnesium is a metal with many important and vital uses, either by itself or as an alloying element. Its production and consumption has been growing steadily for over 10 years. Magnesium is the lightest structural metal and interest is growing in its use in many areas. In particular, the automotive industry that is struggling to achieve higher miles per gallon performance has been very interested in making cars lighter weight. To that end magnesium is an answer provided a stable producer is capable of delivering product at a consistent price.

The main impetus behind the development of a primary magnesium plant in Nevada is that the domestically produced magnesium metal is not subject to the US antidumping or import duties. US Magnesium LLC is the only primary magnesium producer in the United States. The North American Die Casting Association indicates that the sustained use of magnesium in automotive production may depend on its availability from multiple sources.

## 1.8 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

Considerable up front attention has been paid to the environmental study, permitting, and potential social or community impacts of the project. A multi-agency regulatory process will need to be completed to obtain all required federal, state and local agency permits and approvals necessary to construct, operate and ultimately close the Tami-Mosi dolomite quarry and magnesium processing operations. The quarry site is located on federal public lands managed by the US Department of the Interior, Bureau of Land Management (BLM). The process site is located on a combination of federal public lands managed by the BLM which are adjacent to private lands owned by the Burlington Northern Santa Fe Railroad (BNSFR). BLM will be the lead agency for the overall project permitting and approval process, and would ensure all required federal, state and local permits and approvals are obtained for quarry and magnesium processing operations. BLM would issue federal approval for the Plan of Operations and Reclamation Plan in accordance with their Surface Management Regulations contained in Title 43 of the Code of Federal Regulations, Part 3809 (43 CFR 3809). The Nevada Division of Environmental Protection (NDEP), Bureau of

Mining Regulation and Reclamation (BMRR) will be the primary cooperating agency for the overall quarry and magnesium processing permitting and approval process. The Regulation Branch of the BMRR will issue the State of Nevada Water Pollution Control Permit (WPCP) for the mine and magnesium processing operations in accordance with Nevada Administrative Code (NAC) 445A.350 through NAC 445A.447. The Reclamation Branch of the BMRR will issue the State of Nevada reclamation permit for the project in accordance with NAC 519A, inclusive.

The BLM and the BMRR will also require the placement of a jointly approved financial guarantee (reclamation bond) to ensure quarry and process site reclamation and closure is completed in accordance with the approved Plan of Operations. As lead regulatory agency, the BLM will hold the reclamation bond.

Other Federal, State and County agencies will issue appropriate permits, approvals or concurrences for various mine operations and activities in accordance with applicable Federal, State and County ordinances, guidelines, regulations and laws. The timing of these permits will be aligned with the progressing of the Project.

The proposed Project constitutes a federal action that will be assessed for potential environmental impacts as required by the National Environmental Policy Act of 1969 (NEPA). The NEPA analysis will be managed by the BLM. A multi-resource baseline study program would be implemented to collect the data required to support the completion of the NEPA analysis. The results of the analysis are used by the BLM as part of their 43 CFR 3809 decision making process. The timing of the NEPA analysis will be aligned with the progression of the Project.

## 1.9 CAPITAL COST ESTIMATE

The capital cost estimate was developed for the Tami-Mosi Magnesium Project with an accuracy of +50% / -25% and prepared in Q2 2011 US dollars. A total capital cost of \$424.06 M is estimated for the initial development of the facilities as described in this report including dolomite quarry, processing, and infrastructure. Reclamation has been provided for in the capital cost as an allowance to be held for the LOM for the project.

## 1.10 OPERATING COST ESTIMATE

The operating cost estimate was developed for the Tami-Mosi Magnesium Project with an accuracy of +50% / -25% and prepared in Q2 2011 US dollars. Total operating cost is estimated at \$1.281/lb 99.9% Mg ingot based on a vertically integrated processing site including onsite power generation.

## 1.11 ECONOMIC ANALYSIS

An economic evaluation of the Tami-Mosi Magnesium Project was carried out by Wardrop incorporating all the relevant capital, operating, working and sustaining capital costs per year for the LOM. The evaluation was based on a pre-tax financial model. The US spot price has averaged \$2.50 over the past 4 years. For the 30-year LOM and 8.8 Mt dolomite inventory, the following pre-tax financial parameters were calculated using the lower limit of the July 2011 magnesium US spot price contracts range, \$2.45/lb, as the base case:

- 16.1% internal rate of return (IRR)
- 5.9-year payback on \$424 M capital
- \$547 M net present value (NPV) at 6% discount value.

It should be noted that the data used in the financial analysis incorporates Inferred Mineral Resources which are considered too geologically speculative to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. Therefore, there can be no certainty that the estimates contained in the PEA will be realized.

## 2.0 INTRODUCTION

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Molycor retained Wardrop, together with a number of specialists, with expertise in magnesium, ferrosilicon and power generation industries to complete this PEA for a proposed 300,000 t/a dolomite quarry located in the Tami-Mosi area of Nevada, USA. The project also includes a proposed 30,000 t/a magnesium processing facility located east of Wells, Nevada, USA.

This study has been prepared to an AACE Class 5 Estimate level providing an accuracy of +50% / -25%.

The primary purpose of this study is to prepare an economic evaluation for the base case of producing 30,000 t/a 99.9% Mg from 300,000 t/a of dolomite. This study is intended to assist Molycor in determining potential future plans for the Tami-Mosi property and the approach to magnesium production.

A list of Qualified Persons (QPs) and responsibility is provided here:

- Mr. Norm L. Tribe, P.Eng. – responsible for Sections 1.2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 23 (N. Tribe & Associates Ltd.)
- Mr. Klaus Triebel, CPG – responsible for Sections 1.3, 14, 25.2, and 26.1.2 (Wardrop)
- Dr. Jianhui (John) Huang, Ph.D., P.Eng. – responsible for Sections 1.4, 1.10, 13, 17, 21.1.7 (magnesium plant costs only), 21.2.1, 25.4, 26.1.4 (Wardrop)
- Mr. Tysen Hantelmann, P.Eng., M.Eng. – responsible for Sections 1.5, 1.11, 15, 16, 21.2 (dolomite quarry costs only), 22, 25.1, 25.3, 26.1.1, 26.1.3 (Wardrop)
- Mr. Barrie D. Fraser, P.Eng. – responsible for Sections 1.1, 1.6, 1.9, 2, 3, 18.1, 18.2, 18.3, 18.5, 18.7, 18.8, 18.9, 21.1 (except 21.1.7), 24, 25 (introduction), 26.1.5, 26.1.7, 26.2, 27 (Wardrop)
- Dr. Fred P. Buckingham, Ph.D., P.E. – responsible for Sections 18.4, 21.1.7 (power plant only), and 21.2.2 (MPR Associates, Inc.)
- Mr. Hassan Ghaffari, P. Eng. – responsible for Sections 18.6, 21.1.7 (ferrosilicon plant only), 21.2.3 (Wardrop)
- Mr. Robert E. Brown, P.E. – responsible for Sections 1.7, 19, 25.5 (formerly of Dow Chemical and Fluor Daniel)
- Mr. Doug Ramsey, M.Sc., R.P. Bio. (BC) – responsible for Sections 1.8, 20, 25.6, and 26.1.6 (Wardrop).

## 3.0 RELIANCE ON OTHER EXPERTS

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Wardrop followed standard professional procedures in the preparation of this study. Data used in this report has been verified where possible; Wardrop has no reason to believe that the data was not collected in a professional manner.

No experts were relied on by the QPs in the preparation of this study. Various independent reports were prepared throughout the duration of this project. This study compiles all of the data received and used in the financial analysis.

## 4.0 PROPERTY DESCRIPTION AND LOCATION

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The Tami-Mosi property is located 10 km southeast of the town of Ely, in White Pine County, in east-central Nevada.

The Property consists of 78 claims and three fractions covering a total of 667.5 ha (1,637 acres).

The claims are staked in the name of Nevada Moray, Inc. The claims were purchased by Molycor Gold Corp. from James Marin and Tim Neal, principals of Nevada Moray, Inc., for \$12,525 in costs plus a 2% net smelter return (NSR). Half the NSR, or 1%, can be purchased by Molycor for \$1,000,000.

Table 4.1 lists the claims and county document serial numbers for 22 unpatented lode mining claims known as the Tami Nos. 1-4, 7-12, 70, 71, 80-89. These claims are located and situated in White Pine County, Nevada. The claims are cadastrally described as being positioned within Sections 2, 3, 4, 10, 11, Township 15 North, Range 64 East and Sections 32, 33, 34, 35, Township 16 North, Range 64 East, Mount Diablo Baseline and Meridian.

**Table 4.1 Tami-Mosi Property – Tami Claims**

Claim Name	Country Document #	NMC Serial #
Tami # 1	335925	944011
Tami # 2	335926	944012
Tami # 3	335927	944013
Tami # 4	335928	944014
Tami # 7	335931	944017
Tami # 8	335932	944018
Tami # 9	335933	944019
Tami # 10	335934	9440120
Tami # 11	335935	9440121
Tami # 12	335936	9440122
Tami # 71	335972	944058
Tami # 80	335981	944067
Tami # 81	335982	944068
Tami # 82	335983	944069
Tami # 83	335984	944070
Tami # 84	335985	944071
Tami # 85	335986	944072

*table continues...*



Claim Name	Country Document #	NMC Serial #
Tami # 86	335987	944073
Tami # 87	335988	944074
Tami # 88	335989	944075
Tami # 89	335990	944076
Tami # 70	336001	944087

Table 4.2 lists the claims and county document serial numbers for 59 unpatented lode mining claims known as the Mosi Nos. 2-30, 32-34, 36-39, 45-54, 71, 72, 75, 76, 94, 95, 300-303, Frac 1, 3, 4. These claims are located and situated in White Pine County, Nevada. The claims are cadastrally described as being positioned within Sections 22, 28, 33, 34, Township 16 North, Range 64 East and Section 3, 4, Township 15 North, Range 64 East, Mount Diablo Baseline and Meridian.

**Table 4.2 Tami-Mosi Property – Mosi Claims**

Claim Name	Country Document #	NMC Serial
Mosi # 3	333928	932963
Mosi # 4	333929	932964
Mosi # 5	333930	932965
Mosi # 6	333931	932966
Mosi # 7	333932	932967
Mosi # 8	333933	932968
Mosi # 9	333934	932969
Mosi # 10	333935	932970
Mosi # 12	333936	932971
Mosi # 13	333937	932972
Mosi # 15	333938	932973
Mosi # 16	333939	932974
Mosi # 17	333940	932975
Mosi # 18	333941	932976
Mosi # 19	333942	932977
Mosi # 20	333943	932978
Mosi # 51	333944	932979
Mosi # 52	333945	932980
Mosi # 53	333946	932981
Mosi # 54	333947	932982
Mosi Frac1	337750	956527
Mosi # 11	337752	956529
Mosi # 34	337753	956530
Mosi # 71	337754	956531
Mosi # 72	337755	956532

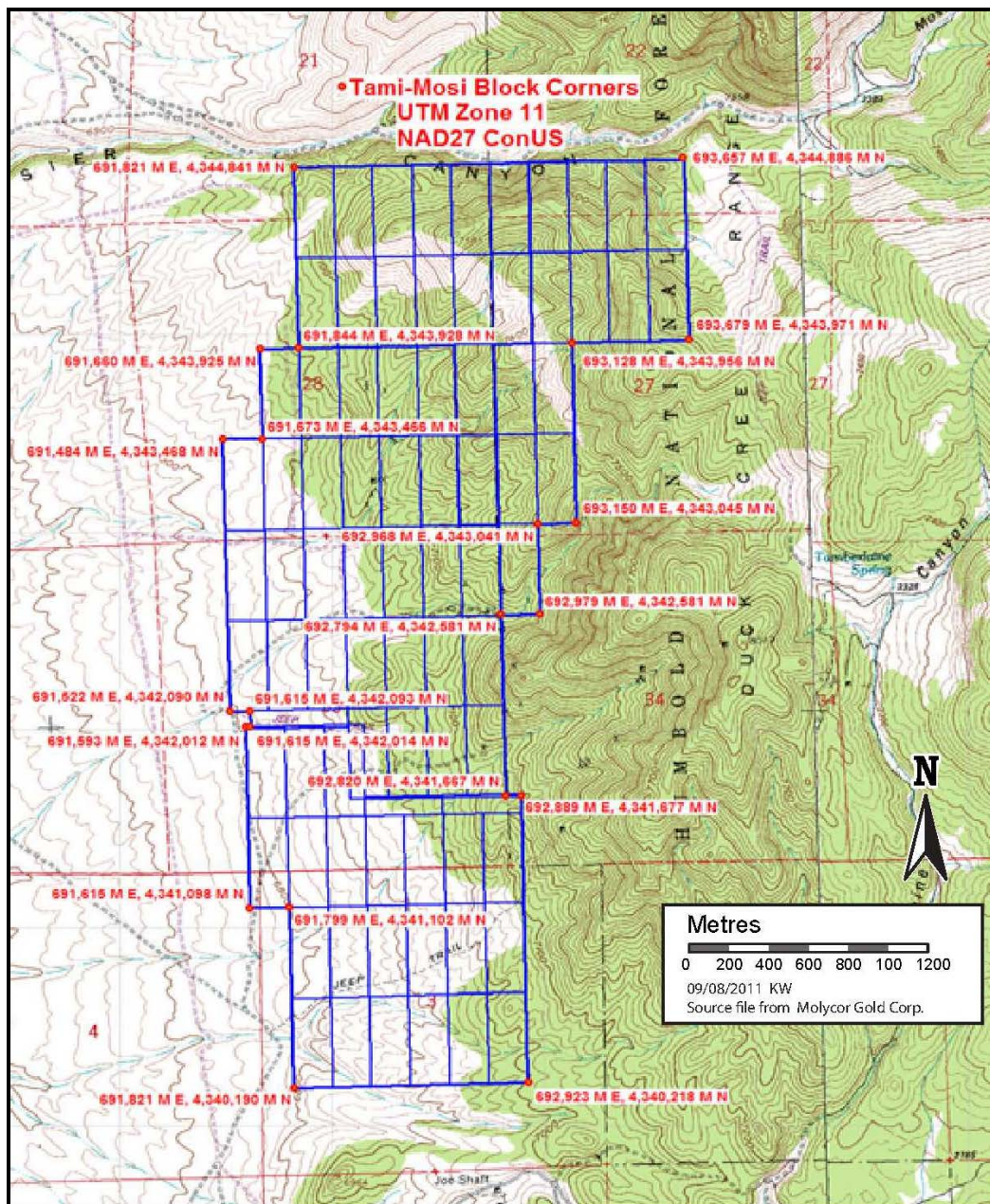
*table continues...*

Claim Name	Country Document #	NMC Serial
Mosi # 75	337758	956535
Mosi # 14	338336	961758
Mosi # 32	338337	961759
Mosi # 33	338338	961760
Mosi # 76	338339	961762
Mosi Frac 3	338348	961768
Mosi Frac 4	338349	961769
Mosi # 21	350182	1034469
Mosi # 22	350183	1034470
Mosi # 25	350184	1034471
Mosi # 26	350185	1034472
Mosi # 27	350186	1034473
Mosi # 28	350187	1034474
Mosi # 29	350188	1034475
Mosi # 30	350189	1034476
Mosi # 36	350190	1034477
Mosi # 37	350191	1034478
Mosi # 38	350192	1034479
Mosi # 39	350193	1034480
Mosi # 45	350194	1034481
Mosi # 46	350195	1034482
Mosi # 2	pending	1048844
Mosi # 23	pending	1048845
Mosi # 24	pending	1048846
Mosi # 47	pending	1048847
Mosi # 48	pending	1048848
Mosi # 49	pending	1048849
Mosi # 50	pending	1048850
Mosi # 94	pending	1048851
Mosi # 95	pending	1048852
Mosi # 300	pending	1048853
Mosi # 301	pending	1048854
Mosi # 302	pending	1048855
Mosi # 303	pending	1048856

The coordinates of the claim area are presented in Figure 4.1. Figure 4.2 shows the relative location of the various claims by number making up the Property.

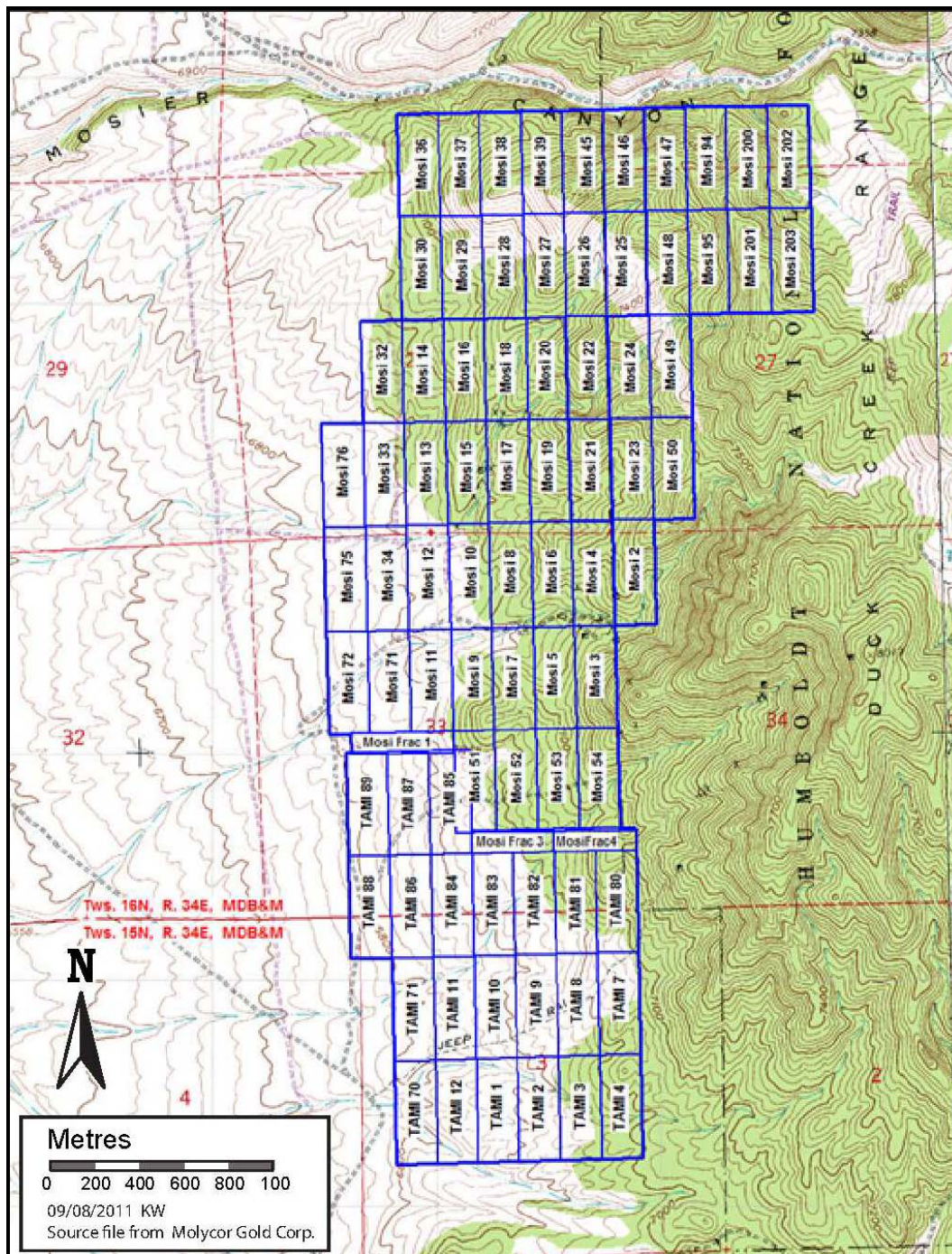
For information regarding environmental liabilities and permitting requirements, refer to Section 20.0 Environmental Studies, Permitting, and Social or Community Impact.

**Figure 4.1 Tami-Mosi Claim Map (Corner Coordinates)**





**Figure 4.2 Tami-Mosi Claim Map (Claim Numbers)**



## 5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

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### 5.1 ACCESSIBILITY

The community closest to the dolomite quarry property is Ely, Nevada, which can be accessed from Reno via Interstate I-80 to Fernley (50 km), and then Highway 50A to Fallon (27 km), and then via Highway 50 to Ely (400 km).

Several dirt roads, located 10 km from Ely, lead off Highway 6/50 to the Property. The western boundary and certain other portions of the Property can be accessed by two-wheel-drive vehicle; some areas require a four-wheel-drive vehicle.

### 5.2 CLIMATE

The regional climate is typical of central Nevada. Basins receive less than 10" of rain per year; ranges receive up to 20" of rain per year, and less than 24" per annum of snow.

### 5.3 VEGETATION AND LAND USE

The terrain is typical of central Nevada's basin and range topography. The Steptoe Basin is located between the Schell Creek Range on the east, and the Egan Range on the west. The elevation in the valley bottom is 2,072 masl and the top of the Schell Creek Range is 2,865 masl at the top of Taylor Peak.

The basin is vegetated with sagebrush and grasses, while the ranges are sparsely forested with pine, juniper and mountain mahogany. Large fauna consist of elk, mule deer, pronghorn antelope, coyote, mountain lion, and a small number of wild-horses and black bears. There are also a number of small animals in the area, including squirrels, jack rabbits, grouse, partridges, crows, raptors and numerous birds.

There are a number of hay meadows in the basin, near the center of the Steptoe Valley, and Comins Lake, where irrigation is available.

## 5.4 LOCAL RESOURCES

Ely has a full range of industrial and business supplies. The area infrastructure surrounding Ely features high-quality roads, major power lines that cross the Property, and cell phone service that reaches most areas of the Property. An industrial process water supply is not required for dolomite quarry operations.

## 5.5 ENVIRONMENTAL PROTECTION MEASURES USED DURING THE EXPLORATION

There was minimal impact on air quality during the initial drilling program. In keeping with best management practices, contractors and employees were encouraged to minimize the use of the roads in order to keep the dust to a minimum.

Drilling water, estimated at 5,700 L/d, was obtained from a local rancher. Best management practices were used in the construction, operation and reclamation of the drill sites in order to minimize sedimentation from disturbed areas. Sediment traps were constructed adjacent to the drill sites to catch the drill cuttings and prevent their release. Weed-free straw bales were used in the drainages to control erosion from the disturbed areas and prevent the release of drill cuttings. Water bars were constructed in roadways where deemed necessary.

No chemicals, equipment or drill cuttings were left on site. All drillholes were plugged.

Reclamation, including re-contouring, ground preparation, and reseeding was completed to the satisfaction of BLM, which initiated the return of the bond monies to Molycor.

## 6.0 HISTORY

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The previous owners of claims now making up the Tami-Mosi dolomite quarry property were James Marin and Tim Neal.

The following text is taken from the initial NI 43-101 resource report dated May 1, 2009, Tami-Mosi Property Evaluation Report by N. Tribe & Associates Ltd.

*The first activity in the area is believed to be in the 1870s when the first miners arrived in the Steptoe Valley, and shortly thereafter, a stage coach route was established and the station at Ely became the center of activity. By 1880, the Town of Ely had a population of 200 residents, and in 1887, Ely was declared the County seat. Most of the activity in the region was at the surrounding mining camps of Ward, Cherry Creek, Osceola and Taylor.*

*After the turn of the century, immense copper deposits near Ely began to attract attention away from the failing gold mines, and by 1906, a boom had developed in copper. The Nevada Northern Railway was completed in the fall of that year to connect the mines with the Southern Pacific Railroad at Cobre. In 1908, when the smelter at McGill went on the line, mineral production leapt from barely more than \$2,000 the year before to more than \$2 million. By 1917, annual production climbed to nearly \$26.5 million. The Kennecott Copper Company began acquiring Ely copper mining companies in 1915. By 1958, these acquisitions resulted in control of the region's copper mines and dominated the local economy.*

*The mines at Ruth, 9.66 km west via US 50, were originally underground mines, but came to be worked from the surface. Five great open pits in a line measuring 9.66 km east and west were developed and mined 80,000 t of waste and 22,000 t of copper ore per day. The ore was processed at the smelter in McGill, where it was processed into "blister copper".*

*In 1978, the copper mines, smelter and the railroad, and most of Kennecott's 1,500 local employees were laid off.*

*In the 1990s, Magna Copper Co. reopened the Ruth mine. The company spent \$314 million to establish a state of the art mill capable of processing 46,000 t of ore per day. Mineable reserves of 252 Mt were blocked out, and in 1996, 425 employees produced 146,000 lbs of copper (Cu), 366,000 oz of silver (Ag) and 16,000 oz of gold (Au). In 1997, the Ruth Mine was closed.*

*The Taylor District and the Taylor Silver Mine were discovered and first mined in the 1860s. Production since then has been intermittent and has consisted of mining of high-grade zones (+10 oz/ton) of silver and some gold. The Taylor Silver*



*Mine, produced approximately 23.2 Moz of Ag at an average grade of 3.24 opt. This figure represents an aggregate total of silver mined through the years that includes high-grade zones of +20 opt mined in the late 1800s to the three opt ores mined in the 1970s and early 1980s. Twenty one million ounces of the 23.2 oz district production was produced in this latest period of mining. About 95% of the gold was produced from an antimony-rich jasperoid at the Enterprise mine (Ilchik, 1981). Most of the silver ore came from the silty limestones that occur at the transition zone between the Guilmette Limestone and Pilot Shale – essentially the same stratigraphic horizon as Alligator Ridge.*

*More recently, the district has been explored for disseminated gold deposits by both Amselco at their Ridgetop claims and nearby Gonzo claims in the early 1980s, (located near Molycor's Tami-Mosi claims) and by Nerco and Alta Gold at the Taylor Chipps zone in the 1980s and 90s. Alta drilled out a small gold resource at the Taylor Chipps zone (on claims now controlled by Fury Exploration), adjacent to Molycor's RT and Jo claims. They reported drill intercepts of 95' at 0.038 opt Au and 95' at 0.033 opt Au in two reverse circulation drillholes, 93-7 and 93-8.*

*The Taylor Mine is 13 m south of Ely, just south of the Property, on Highway 50. At this time, it is believed to be temporarily shut down.*

*Other small operations include the Duer Mine, adjacent to the Tami-Mosi claims on the south, worked a small underground gold mine. Gangue at the Duer Mine is intensely rich in manganese. The Duer Mine is abandoned although the patented claims remain.*



## 7.0 GEOLOGICAL SETTING AND MINERALIZATION

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### 7.1 REGIONAL GEOLOGY

The Tami-Mosi area is located in the Duck Creek Range of central Nevada. The area is underlain by more than 3,350 m of miogeoclinal clastic and carbonate rocks, including the Devonian Guilmette Formation, upward through the Mississippian Pilot Shale, the Joanna Limestone, Chainman Shales and into the Tertiary rhyolites. At approximately 111 Ma (McDowell and Kulp, 1967), a number of quartz monzonite porphyries intruded the sedimentary rocks. Evidently, faulting was active either prior to, or concurrently with, porphyry emplacement. Hydrothermal alteration and mineralization associated with the intrusive event, in the wall rocks resulted in the gold/silver deposits at the Taylor Mine and the Duer Mine immediately to the north.

During the early Tertiary Period, the district was overlain by conglomerate and lacustrine limestone of the Eocene Sheep Pass Formation, and by a series of rhyolitic volcanic rocks. Rhyolitic dikes and diatremes, also of Tertiary age, cut the strata.

Sets of tilted normal fault blocks are cut by several later series of normal faults, resulting in structural superposition. Faulting also caused mineralization that formed at varying elevations to be exposed at the surface, further complicating geologic interpretation.

### 7.2 LOCAL GEOLOGY

The local geology consists of beds of Guilmette Limestone, Pilot Shale, Joanna Limestone and Chainman Shales dipping moderately to the west with block faulting disrupting the beds so that dips may steepen or even dip to the east in some localities.

Within the Guilmette are beds of dolomite altered from the limestone, which are referred to as the Simonson Dolomite unit.

### 7.3 MAGNESIUM

Within the Guilmette Formation limestones is a unit referred to as the Simonson Dolomite. This dolomite is a hydrothermal alteration product of the Guilmette

Limestone and is believed to be relatively consistent throughout the Guilmette. During the drilling program for the gold and manganese occurrences, several holes intersected strong magnesium dolomite.

The mineralization consists of hydrothermally-altered limestone. This alteration is poorly understood, and there are no documented locations where this alteration is occurring today, only the previously altered limestone is present. The alteration appears to be regional in extent, and varies only a few percentage points from place to place. At any place on the property where the dolomite has been mapped and sampled, the grade is generally above 10% and increasing up to 13% toward the northern end of the Property.

#### 7.4 GOLD

The Property sits in an area considered to be part of the Carlin Trend, long recognized as a prospective gold silver district. Some of the jasperoid alteration is believed to be Carlin Type mineralization.

Rock chip sampling done early in 2007 returned anomalous values near 692000E, 434200N. Two drillholes were drilled in this area in 2007. Both returned samples with anomalous values.

#### 7.5 MANGANESE

The Tami-Mosi claims surround five claims owned by the Duer Family near the south end of the Property. The Duer Mine is located in a strong northwest trending mineralized fault rich in manganese and carrying some gold. This deposit was worked for gold and manganese in the past, but is now abandoned. The rocks dip steeply to the west and are cut by strong strike faults which carry manganese/gold mineralization. This structure was believed to continue onto the Property where high manganese values were intercepted in the drilling (Hole TM-07-003). The mineralization at TM-07-003 appears to be fault controlled, narrow and discontinuous. Holes TM-08-015 to TM-08-022 were drilled on what was thought to be the northern extension of the Duer manganese/gold bearing structure. Further search for the manganese bearing Duer extension was considered unlikely to produce positive results.

## 8.0 DEPOSIT TYPES

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The mineral of interest in this study is dolomite. The dolomite forms a bed, known as the Simonson Dolomite Unit within the Guilmette Formation. The bed is consistent in composition with the dolomite assaying between 9% and 13% Mg. There appears to be very little deformation of the Guilmette Formation rocks; they dip 25° to the west.

There is little local faulting; any regional faulting associated with the development of the basin and range geographic environment has had little effect on the Simonson Dolomite within the claims.

## 9.0 EXPLORATION

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A total of 24 holes have been drilled on the Property concentrating mainly on exploring for gold and manganese.

A total of eight holes have been drilled on the dolomite. Due to the fact that the deposit is bedded, and that the grades within the deposit are relatively consistent from place to place within the dolomites, the eight holes are considered adequate for a regional appraisal. A small gradation in magnesium grade is apparent in this drilling; material that ranged up to 13% Mg was found in the northern part of the property.

A surface mapping program with associated channel sampling was conducted early in 2011 to further explore the region to the north and east of the earlier drilling. In all 55 samples were collected and sent to ALS for analysis. This sampling indicates a zone of mineralization in excess of 12% Mg.

As described in Section 26 of this report, further testing and development work that concentrates on the northern portion of the property is planned.

## 10.0 DRILLING

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In all, a total of 24 drillholes were drilled on the Property. Of these, eight were directed toward gold exploration in the south and eastern part of the Property; eight holes were directed toward the manganese showing just north of the Duer Mine patented Claims. The remaining eight holes were directed toward the magnesium bearing dolomite through the center to northern part of the Property. In all, 3,840 m of rotary percussion reverse circulation drill was completed in two phases of exploration.

The first phase in 2007 consisted of 14 drillholes for a total of 2,567 m of drilling using a truck mounted rig. Eight of these holes were in the magnesium rich dolomite.

A sample was split out of the drill cuttings and sent for analysis. The samples were prepared by ALS in Sparks Nevada and the assays were performed by ALS Chemex Laboratories, located in North Vancouver, BC using a 34 element ICP method. For the most part cuttings from the entire hole were analyzed with the exception of alluvials. Table 10.1 presents the results.

The second phase drilling, completed in 2008, consisting of 10 holes, was focused on the magnesium rich dolomite. A total of 4060 ft (1,237.5 m) was drilled in this second phase, using the same equipment and techniques as was used in Phase I. Only two of the holes in Phase II are suitably located for use in the block model.

**Table 10.1 Drilling Results - Drillholes with Intercepts**

Drillhole	Interval (m)	% Mg
TM-08-024	96.01	10.62
TM-08-023	108.23	12.22
TM-07-006	67.06	12.08
TM-07-005	30.48	10.50
TM-07-004	60.98	9.45
TM-07-007	60.98	10.16
TN-07-007	79.27	11.02
TM-07-013	145.0	12.12
TM-07-010	16.77	11.38
TM-07-010	60.98	9.74

## 11.0 SAMPLE PREPARATION, ANALYSES, AND SECURITY

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Sample preparation was completed by the ALS sample preparation laboratory in Sparks, Nevada, using the standard preparation methods. The following is a summary of the sample preparation.

Samples were:

- crushed to 70% minus 2 mm
- pulverized to 85% minus 75  $\mu$ m in a ring pulverizer
- compared with one quality-control sample was introduced for every ten samples
- rolled, and approximately 25 g of the sample pulp was cut out for analysis
- processed and the pulps were sent to ALS in North Vancouver for analysis by ME-ICP41 (Multi-element Inductive Coupled Plasma mass spectrometry) methods, the accuracy of which is considered to be  $\pm 10\%$  for magnesium
- handled by Molycor personnel and those of the ALS Laboratory.

Mr. Norm Tribe visited ALS in Sparks, Nevada on August 23, 2008, and again on May 20, 2009 and found the facility to be in excellent condition, clean and well-organized on both occasions. Mr Tribe has made numerous visits to the ALS laboratories in North Vancouver and found the facility to be in excellent condition, clean and well organized on each occasion. ALS uses standard control samples to ensure quality control. These control samples are inserted regularly into the sample stream for comparison. ALS is recognized by the industry as the leader in assay work quality. The ALS Quality Management System (QMS) complies with the requirements of the International Standard ISO 9001:2008. Specifically, the North Vancouver laboratory is accredited to International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) 17025:2005 from the Standards Council of Canada (SCC) for various methods including ME-ICP.

## 12.0 DATA VERIFICATION

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Quality assurance was handled by ALS; routine in-house checks using the acceptable lab standards performed by the lab on approximately every tenth sample. These checks did not indicate irregularities in the analyses.

Unlike gold and other precious metals, dolomite samples do not lend themselves to contamination. The chance of contamination is practically non-existent.

## 13.0 MINERAL PROCESSING AND METALLURGICAL TESTING

### 13.1 HEAD CHARACTERISTICS

In 2010, Hazen conducted preliminary test work to determine mineralogy and study process technology. The tested drill core samples and the bulk densities of the samples are shown in Table 13.1.

**Table 13.1 Drill Core Samples**

Sample ID	Weight (kg)	Loose Bulk Density (lb/ft <sup>3</sup> )	Packed Bulk Density (lb/ft <sup>3</sup> )
TM-08-024 340'-345'	6813	96	113
TM-08-024 345'-350'	7096	109	135
TM-08-024 350'-355'	6762	108	131
TM-08-024 355'-360'	6028	107	126
TM-08-024 360'-365'	6644	107	126
TM-08-024 370'-375'	5755	96	118

Hazen performed chemical analysis and XRD analysis on the drill core samples to verify the mineralogy. The test results are shown in Table 13.2 and Figure 13.1.

**Table 13.2 Head Chemical Compositions**

Compound/ Content (%)	Sample						
	SRM 88b <sup>*</sup>	340'-345'	345'-350'	350'-355'	355'-360'	360'-365'	370'-375'
MgO	21.03	20.3	21.1	20.9	19.8	21.0	21.6
CaO	29.95	28.3	30.4	29.0	28.5	28.9	30.0
CO <sub>2</sub>	46.37	47.5	46.4	46.6	45.8	46.5	46.3
SiO <sub>2</sub>	1.13	1.51	0.968	0.93	2.15	1.09	0.558
Fe <sub>2</sub> O <sub>3</sub>	0.277	0.154	0.066	0.092	0.29	0.152	0.097
Al <sub>2</sub> O <sub>3</sub>	0.336	0.329	0.098	0.132	0.548	0.227	0.232
MnO	0.016	0.015	0.018	0.015	0.01	0.014	0.018
P <sub>2</sub> O <sub>5</sub>	0.0044	<0.001	,0.001	<0.001	,0.001	<0.001	<0.001
K <sub>2</sub> O	0.103	0.088	0.03	0.036	0.154	0.06	0.054
Pb	-	0.001	<0.001	<0.001	0.001	0.002	0.003
<b>Total</b>	<b>99.2</b>	<b>98.2</b>	<b>99.1</b>	<b>97.7</b>	<b>97.3</b>	<b>97.9</b>	<b>98.9</b>

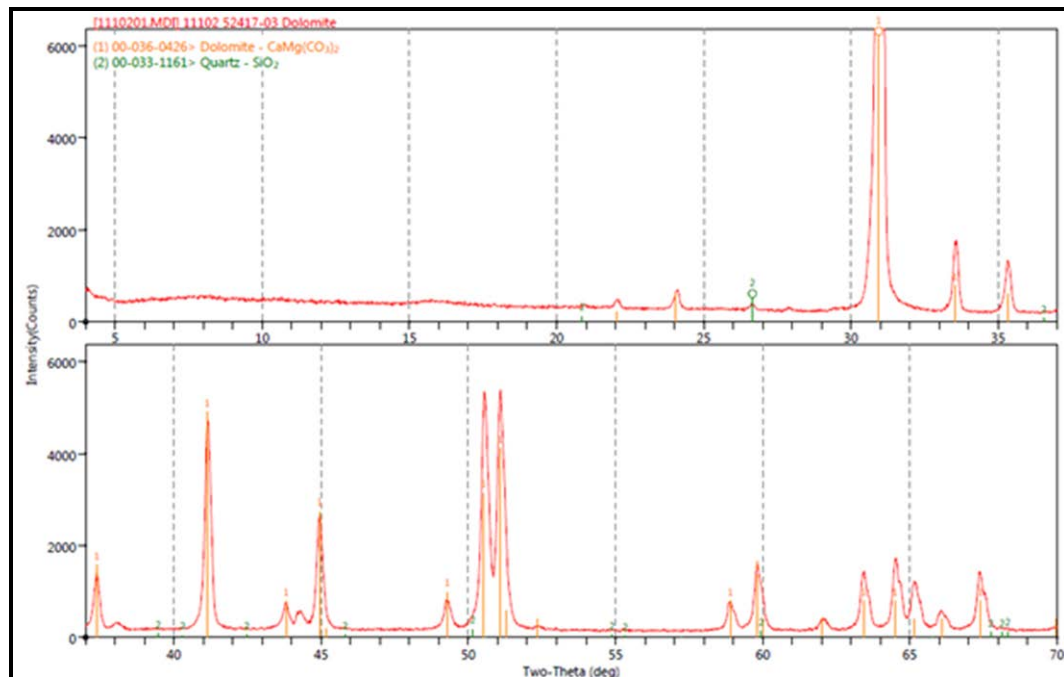
<sup>\*</sup>Standard reference material 88b for dolomite (National Institute of Standards & Technology)



The assay data show that magnesium oxide content of the samples ranged from 19.8% to 21.6%. The report titled “Tami-Mosi Property Evaluation Report 2009”, by N. Tribe & Associates Ltd., indicated that the average magnesium oxide content for the samples from the Drillhole TM-07-13 (over an interval of 164.4 m) was 18.6% MgO. The results appear to indicate that the chemical composition of the Tami-Mosi dolomite is favourable to magnesium recovery by conventional processes.

As shown in Figure 13.1, the XRD analysis verified that Sample TM-08-024 350'-355' is primarily dolomite, with a very small amount of impurities consisting mainly of quartz.

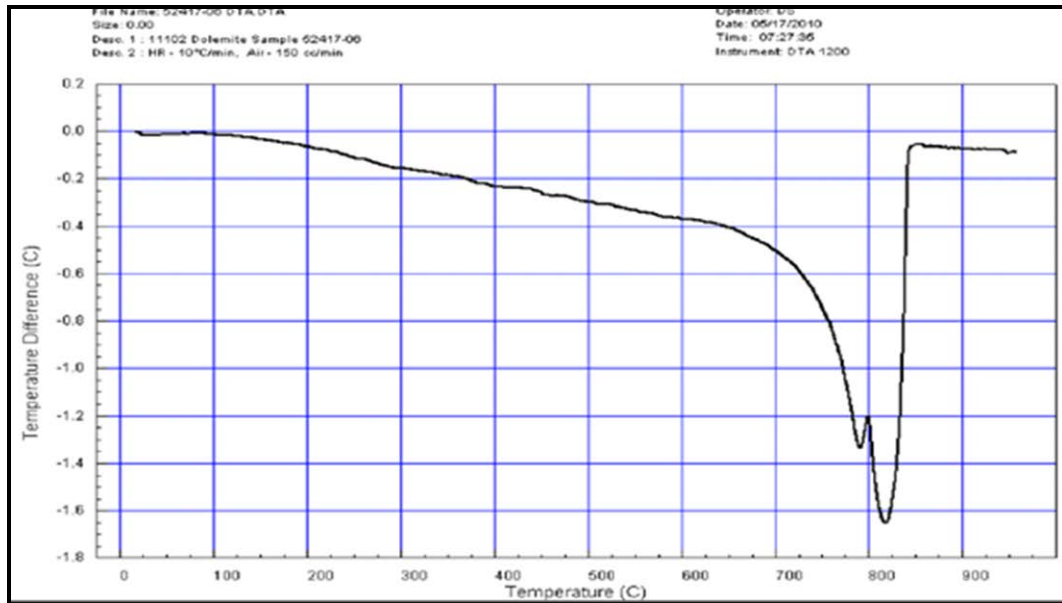
**Figure 13.1 XRD Pattern – TM-08-024 350'-355'**



## 13.2 DECOMPOSITION TESTS

Hazen conducted preliminary testing in an effort to determine whether there is a distinct transition between the calcinations of  $\text{MgCO}_3$  and  $\text{CaCO}_3$ . The tests included TGA, DTA and differential calcinations. The TGA tests did not show a distinct carbon dioxide ( $\text{CO}_2$ ) release difference. However, DTA tests showed a distinct difference in the endothermic release of  $\text{CO}_2$  between  $\text{MgCO}_3$  and  $\text{CaCO}_3$  in the dolomite. The  $\text{MgCO}_3$  decomposed at approximately  $790^\circ\text{C}$ , while the  $\text{CaCO}_3$  decomposed at approximately  $820^\circ\text{C}$ . The DTA thermogram is displayed in Figure 13.2.

**Figure 13.2 DTA Analysis Result – TM-08-024 370'-375'**



Hazen conducted a series of calcination tests to determine the differential decomposition as determined by the DTA analysis. The test results are shown in Table 13.3. It appeared that the  $\text{MgCO}_3$  was selectively calcinated to magnesium oxide, while the  $\text{CaCO}_3$  was kept unreacted or partially reacted by controlling the temperature and the partial  $\text{CO}_2$  pressure of the calcination reactor.

**Table 13.3 Batch Calcination Test Results**

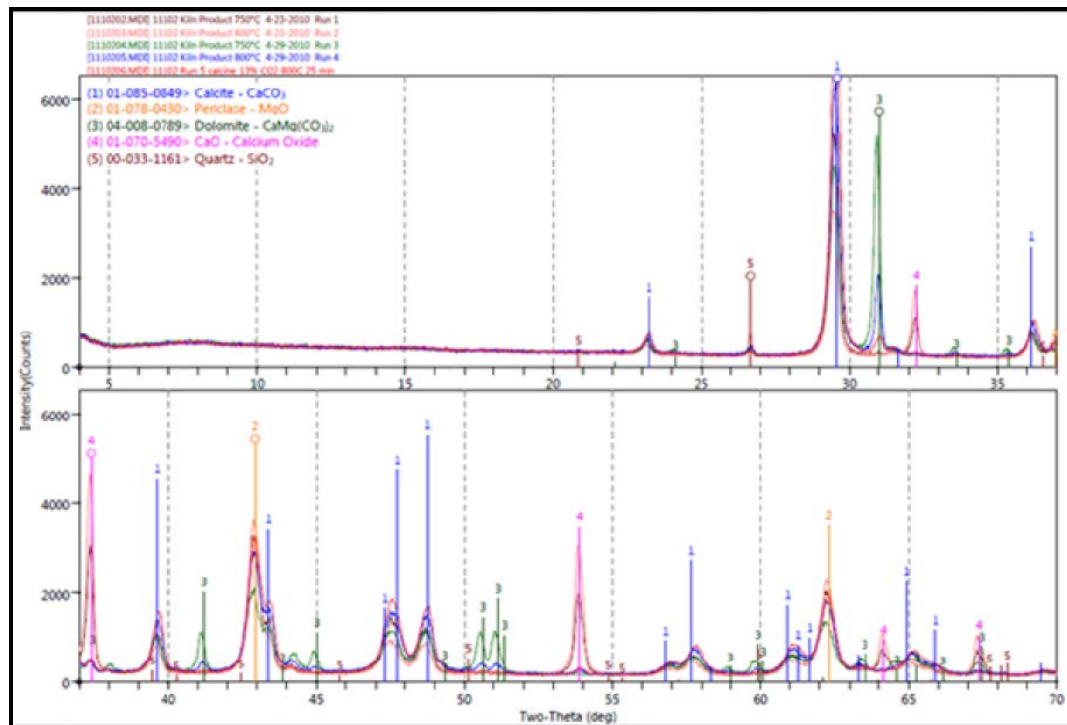
Sample ID	Test	Temperature (°C)	Atmosphere	Peak $\text{CO}_2$ (%)	Weight Loss (%)
TM-08-024 350'-355'	1	750	Air	25.6	39.8
	2	800	Air	48.0	35.4
	3	750	Air	26.0	19.6
	4	800	Air	43.5	23.6
TM-08-024 370'-375'	5	800	Air with 13% $\text{CO}_2$	46.7	24.0

XRD analysis showed that the calcination products contained mainly  $\text{MgO}$  and  $\text{CaCO}_3$ , in particular, the calcination products produced at 800°C. This confirmed that the differential calcination was achieved. The XRD results are shown in Table 13.4 and illustrated in Figure 13.3.

**Table 13.4 XRD Analysis Results**

Product	Area @ 30.9° Dolomite CaMg (CO <sub>3</sub> ) <sub>2</sub>	Area @ 41.1° Dolomite CaMg (CO <sub>3</sub> ) <sub>2</sub>	Area @ 37.3° Calcium Oxide CaO	Area @ 29.3° Calcite CaCO <sub>3</sub>	Area @ 42.9° Periclase MgO
Dolomite	Major, 100%	Major, 100%	Not detected	Not detected	Not detected
Test 1	Not detected	Not detected	Subordinate	Subordinate	Major
Test 2	Not detected	Not detected	Major	Minor	Major
Test 3	Subordinate, ~13%	Subordinate, ~20%	Major	Minor	Subordinate
Test 4	Trace, ~4%	Trace, ~5%	Trace	Subordinate	Major
Test 5	Trace, ~1%	Trace, ~2%	Trace	Major	Major

**Figure 13.3 XRD Pattern – Differential Calcination Test Products**



Although the Hazen test work verified that the samples tested were primarily dolomite, and the  $\text{MgCO}_3$  of the dolomite could be differentially decomposed at approximately  $800^\circ\text{C}$ , further test work is recommended to investigate the optimum process technology, effect of partial decomposition on subsequent processes, effect of impurities on recovery of magnesium, process related parameters, and determination of the optimum mill feed grade using representative samples. The flash calcination should be investigated, including the effect of the calcination on the magnesium thermal reduction.

## 14.0 MINERAL RESOURCE ESTIMATES

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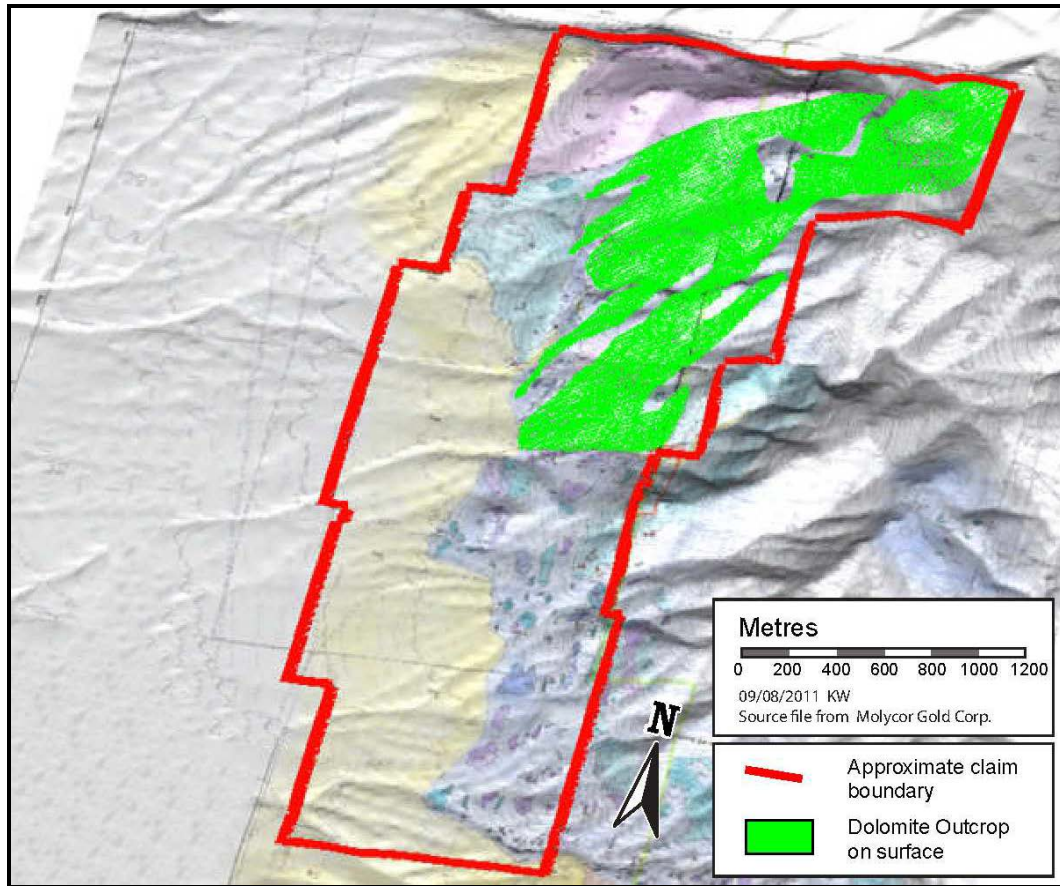
To produce an Inferred Mineral Resource estimate for the magnesium mineralization on the Property, Wardrop completed a block model and resource analysis of the Simonson dolomite unit. The resource estimate was completed by building upon data from the initial NI 43-101 resource estimate (Tribe, 2009), and by including additional surface sample data generated in 2010.

### 14.1 ASSUMPTIONS AND METHODS

Wardrop used Mintec's MineSight<sup>®</sup> version 6 to generate a block model for pit creation and mine planning. The dolomite of interest is exposed as outcrop over a strike length of approximately 7 km. There are 24 drillholes (including one hole that was re-drilled) over that distance. The area of immediate interest, selected because dolomite is present in higher proportions than in nearby carbonate rocks, is approximately 2 km long. The 3D topography used to limit the upper surface of the model was provided to Wardrop by Great Basin GIS of Spring Creek, Nevada.

The area included in the resource model is shown as a green region in Figure 14.1; the claim outline is shown in red. Draped onto the topography is the geological map (Muto, 2010) as a reference. Within the green area, four drillholes have been drilled. No valid grade interpolation could be carried out based on such limited drilling. To facilitate some viability for modeling, surface grab samples were also used to construct the geology wireframe and to interpolate the block model.

**Figure 14.1 Geological Map**



#### 14.1.1 GEOLOGICAL MODEL

Bedrock mapping and geological interpretations of surface and drillhole samples were utilized to model the distribution of the Simonson dolomite unit. Mapping was conducted by geologist Paul Muto, Exploration Geologist, C&M Consultants (Nevada) in 2006 and 2010. The updated geological map produced in 2010 was used to create the geology wireframe and resource model. The presence of dolomite outcropping at surface was verified during the Wardrop site visit (the distinction between dolomite and limestone was confirmed using hydrochloric acid). Bedrock mapping established surface continuity of the dolomite over most of the area included in the resource model. Locally, limestone or interbedded limestone/dolomite was mapped; these intervals were excluded from the dolomite solid.

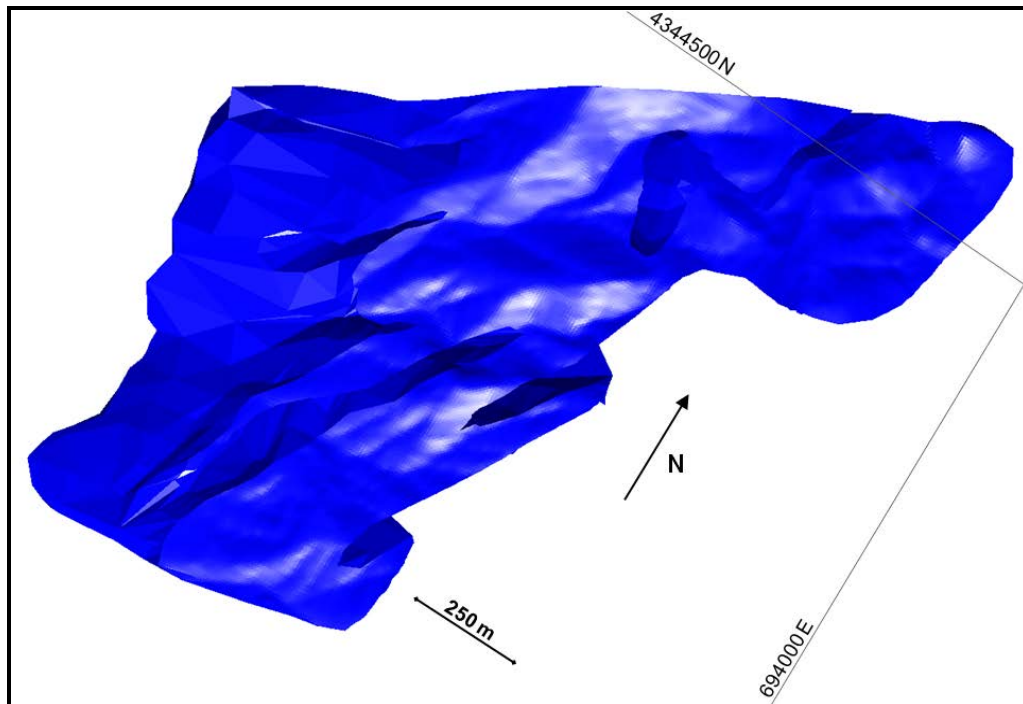
The 3D geology model of the dolomite was created by draping the geology map (Muto, 2010) on the 3D topography, which was then used as a base surface for geological interpretation. All relevant information from the geology map was digitized directly onto the topography (strike and dips, faults, and lithology boundaries). Surface grab-sample information was imported into MineSight® and the lithology interpretation of each sample was included during modeling. The wireframe was



then built by honouring bedding attitudes, mapped rock units, and surface samples as well as relevant drillholes. All limestone or mixed limestone/dolomite surface samples within the modeled area are excluded from the wireframe by interpretation as dolomite-barren regions. The solid was then clipped at 200 m depth using a surface parallel to the topography, assuming only the uppermost 200 m of the deposit will be mined.

A screen capture of the 3D dolomite geology wireframe is presented in Figure 14.2. The volume of this solid is 335 Mm<sup>3</sup>. Because the geology is not confirmed through core drilling, the solid is considered an approximation of the dolomite distribution. The model is constrained on the west side by overburden (Quaternary alluvium and gravel) and on the south and north sides by faults.

**Figure 14.2 3D Geology Wireframe of the Simonson Dolomite Unit**



#### 14.1.2 PREVIOUSLY COMPLETED RESOURCE REPORT

The following text and *Table 14.1* are copied from the initial NI 43-101 resource report dated May 1, 2009, Tami-Mosi Property Evaluation Report by N. Tribe & Associates Ltd.

*In order to arrive at an Inferred Mineral Resource estimate for the dolomite mineralization, the drill holes were plotted on 100 m spaced cross section drawings. The following parameters were used in this calculation:*

- *Drillholes plotted and projected onto vertical cross sections oriented east west (N90°E, looking north).*

- The Inferred Mineral Resource blocks were outlined on section, on grades exceeding 8% Mg and projected 100 m along strike and down dip or half way to the next intersection whichever was smaller.
- Although the dolomite bands are continuous along strike, no resource estimate was applied to those sections where the drillholes were more than 100 m apart.
- The resource blocks were projected to a depth of 200 m below the existing surface. This depth is considered to be a practical depth for open pit mining.
- Due to the large size of the dolomite zone and the small size of the sample intervals down to 1.52 m, the assays were plotted at a scale too small to read. Insets of appropriate mineralization were enlarged four times and set into the section drawings.
- Areas of mineralization were outlined by taking data directly from the drillholes, the surface sampling and adding any areas that project from adjacent sections. These mineral zones were subsequently projected along strike and dip. These mineral zones outline the Simonson dolomite unit and are only partially included in the resource.
- A figure of 2.84 t/m<sup>3</sup> was used to calculate the tonnage. This figure is listed as a standard specific gravity (SG) for dolomite.
- An External dilution factor of 10% was taken into account. The grade of this dilution was given a value of 4.89% Mg. This being the average grade of material adjacent to the resource blocks. Some minor internal dilution was taken into the calculation where practical. These were isolated instances where samples were missing or grades were just slightly below the cut-off.
- The cut-off grade was arbitrarily set at 8% Mg.
- **The total Inferred Resource is calculated to be 236,184,000 t of resource at a grade of 10.00% Mg.**

**Table 14.1 Resource Tabulation by Block and Section\***

<b>Resource Calculations for the Tami-Mosi</b>							
	<b>Section</b>	<b>Area (m<sup>2</sup>)</b>	<b>Horiz. (m)</b>	<b>Volume (m<sup>3</sup>)</b>	<b>Tonnage (t)</b>	<b>Grade (% Mg)</b>	<b>Pounds (Mg)</b>
1	43500N	72450	100	7245,000	20575800	12.12	5486331312
2	43200N	78378	100	7837,800	22259352	10.62	5200675001
3	43100N	58873	100	5887,300	16719932	10.16	3737239201
4	43000N	62513	100	6251,300	17753692	12.22	4772902557
5	42700N	46354	100	4635,400	13164536	10.09	2922263701
6	42600N	64290	100	6429,000	18258360	9.19	3691475225

table continues...

<b>Resource Calculations for the Tami-Mosi</b>							
	<b>Section</b>	<b>Area (m<sup>2</sup>)</b>	<b>Horiz. (m)</b>	<b>Volume (m<sup>3</sup>)</b>	<b>Tonnage (t)</b>	<b>Grade (% Mg)</b>	<b>Pounds (Mg)</b>
7	42500N	99316	100	9931,600	28205744	10.5	6515526864
8	42000N	29483	100	2948300	8373172	10.16	1871571405
9	42000N	65001	100	6500100	18460284	11.02	4475511253
10	41800N	26558	100	2655800	7542472	9.74	1616200900
11	41800N	16897	100	1689700	4798748	11.38	1201414549
12	41300N	26491	100	2649100	7523444	9.45	1564124008
13	41000N	37326	100	3732600	10600584	9.33	2175875872
14	40900N	17436	100	1743600	4951824	10.21	1112278707
15	40900N	19400	100	1940000	5509600	9.1	1103021920
16	40800N	35264	100	3526400	10014976	9.95	2192278246
<b>Total Pounds Mg</b>							<b>49,638,690,722</b>
<b>Total Tonnes and Grade Undiluted</b>					<b>214,712,520</b>		<b>10.51</b>
<b>With 10% Dilution at the Listed Grade</b>					<b>21,471,252</b>	<b>4.89</b>	<b>2,309,877,290</b>
<b>Diluted Tonnage and Grade</b>					<b>236,183,772</b>		<b>10.00</b>

\*Table 14.1 "Resource Tabulation by Block and Section" has been reformatted for clarity. The data and calculation presented in the table has been copied from the original table as provided in "Tami-Mosi Property Evaluation Report" by N. Tribe & Associates Ltd.

### 14.1.3 WARDROP ESTIMATION

The resource estimation was conducted using the dolomite geology wireframe presented in Section 14.1.1. All blocks are classified as "Inferred".

Surface grab samples were imported into MineSight<sup>®</sup>, and for the purposes of block modeling; the samples were assumed to represent short 1.5 m vertical drillholes collared on the sample location. Rock type and grade information from each sample was used. These pseudo-drillholes were then raised by 0.75 m to intercept the topography (to allow for contouring of the topography by sample assay grade), but had no influence on the model interpolation.

All drillhole assay samples were composited to 5 m interval lengths, respecting geology boundaries. Most assay samples were approximately 1.5 m (5 ft) in length; remnants were added to the composite if they were greater than 2.5 m, while remnants less than 2.5 m were disregarded. The 1.5 m pseudo-drillholes (surface grab-samples) were also included in the composite database.

The mineral resource was estimated as follows:

- A block model was created with parameters as outlined in Table 14.2.
- The block model covers approximately 96% of the dolomite rock solid.
- Interpolation applied Inverse Distance to the power of 2 (ID2) and nearest neighbour (NN) techniques.



- The search ellipsoid represents a “squished” sphere and was derived by visually orienting it along the overall strike and dip direction of the dolomite. It was chosen big enough to populate approximately 95% of all blocks within the rock solid. The search ellipsoid parameters are outlined in Table 14.3.
- No geostatistical investigation or variography analysis was conducted.
- An average dolomite density of 2.80 t/m<sup>3</sup> was used for resource calculations.

**Table 14.2      Block Model Parameters**

	<b>Min</b>	<b>Max</b>	<b>Block Size</b>	<b>Number of Blocks</b>
X	691,800	693,600	20	90
Y	4,342,300	4,344,800	20	125
Z	1,500	2,300	5	160

**Table 14.3 Interpolation and Search Ellipsoid Parameters**

Interpolation Method	Minimum Number of Composites	Maximum Number of Composites	Maximum Number of Composites/ Hole	Main Axis Length	Secondary Axis Length	Tertiary Axis Length	Anisotropy	Azimuth of Main Axis	Dip of Main Axis
ID2	1	10	3	150	600	600	Applied	120	-53

## 14.2 BLOCK MODEL

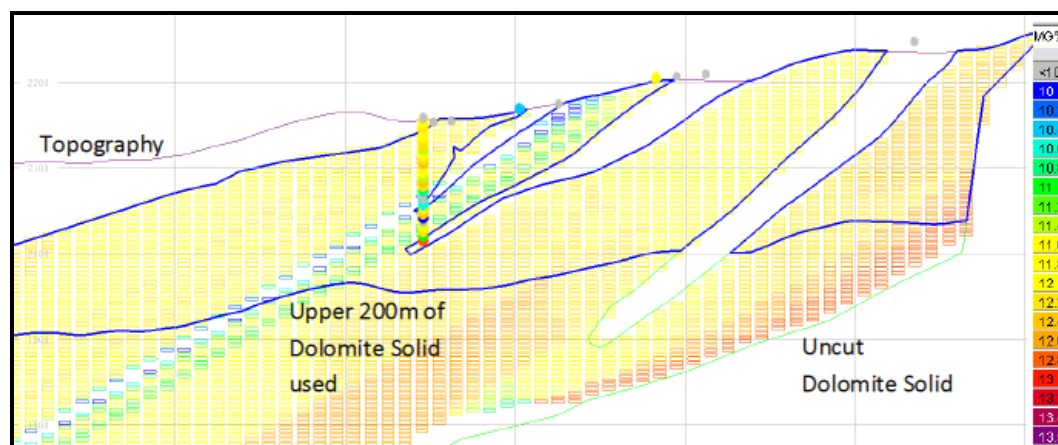
The resource estimate was generated by applying the interpolation as described in Section 14.1.3. Results from this estimation are summarized in Table 14.4. At a cut-off of 12% Mg, there is a resource of 412 Mt at an average grade of 12.3% Mg.

**Table 14.4 Resource Estimate of Volume, Mass, and Average Grade at Various Cut-off Grades**

Cut-off Grade (% Mg)	Volume (Mm <sup>3</sup> )	Mass (Mt)	Average Grade Above Cut-off (% Mg)
>= 9	301.2	843.5	11.67
>= 10	299.8	839.6	11.68
>= 10.5	287.2	804.3	11.74
>= 11	218.3	611.3	12.04
>= 11.5	190.9	534.5	12.16
>= 12	<b>147.4</b>	<b>412.6</b>	<b>12.29</b>
>= 12.5	32.0	89.7	12.57

Block model validation was conducted by visually comparing drillhole assay values and block grades (Figure 14.3).

**Figure 14.3 Block Model Validation Showing Comparison of Drillhole and Block Grades on Section N4343500.**



### 14.3 RESOURCE CLASSIFICATION

Wardrop's block model and resource analysis classifies the Tami-Mosi magnesium property at an Inferred Resource level as containing 412 Mt of dolomite at an average grade of 12.3% Mg using a 12% cut-off grade.

## 15.0 MINERAL RESERVE ESTIMATES

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According to the definition set out by the Canadian Institute of Mining, Metallurgy and Petroleum, a Mineral Reserve “is the economically mineable part of a Measured or Indicated Mineral Resource demonstrated by at least a Preliminary Feasibility Study.”

Currently, the entire resource is within the Inferred category; therefore a mineral reserve cannot be estimated at this time.

Despite not being able to quantify a Mineral Reserve, a pit was designed in a high-grade out-crop constrained by a 30-year LOM at a production rate of 30,000 t of magnesium produced per year. Details of the pit design parameters can be found in Section 16 of this report. Resources contained within the designed pit are shown in Table 15.1.

**Table 15.1 Mineral Resources within Pit**

Resource Category	Kilotonnes	Grade (% Mg)
Measured + Indicated	0	0
Inferred	8,828	12.59

## 16.0 MINING METHODS

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Wardrop selected an open pit mining method for the Tami-Mosi deposit, on the basis that the resource lays at or near the surface, with little surrounding waste material. Due to the at-surface nature of the deposit, pit optimization software was not used in the design of the mine; rather the pit was designed around a drill hole and high-grade out-cropping.

### 16.1 MINE PLANNING 3D BLOCK MODEL

The provided block model contained 674 Mt of resource above a cut-off grade of 12% Mg, with an average grade of 12.49%. For the magnesium-containing rock, Wardrop assumed a density of 2.8 t/m<sup>3</sup>. A portion of this resource is at the surface, and will require minimal waste stripping.

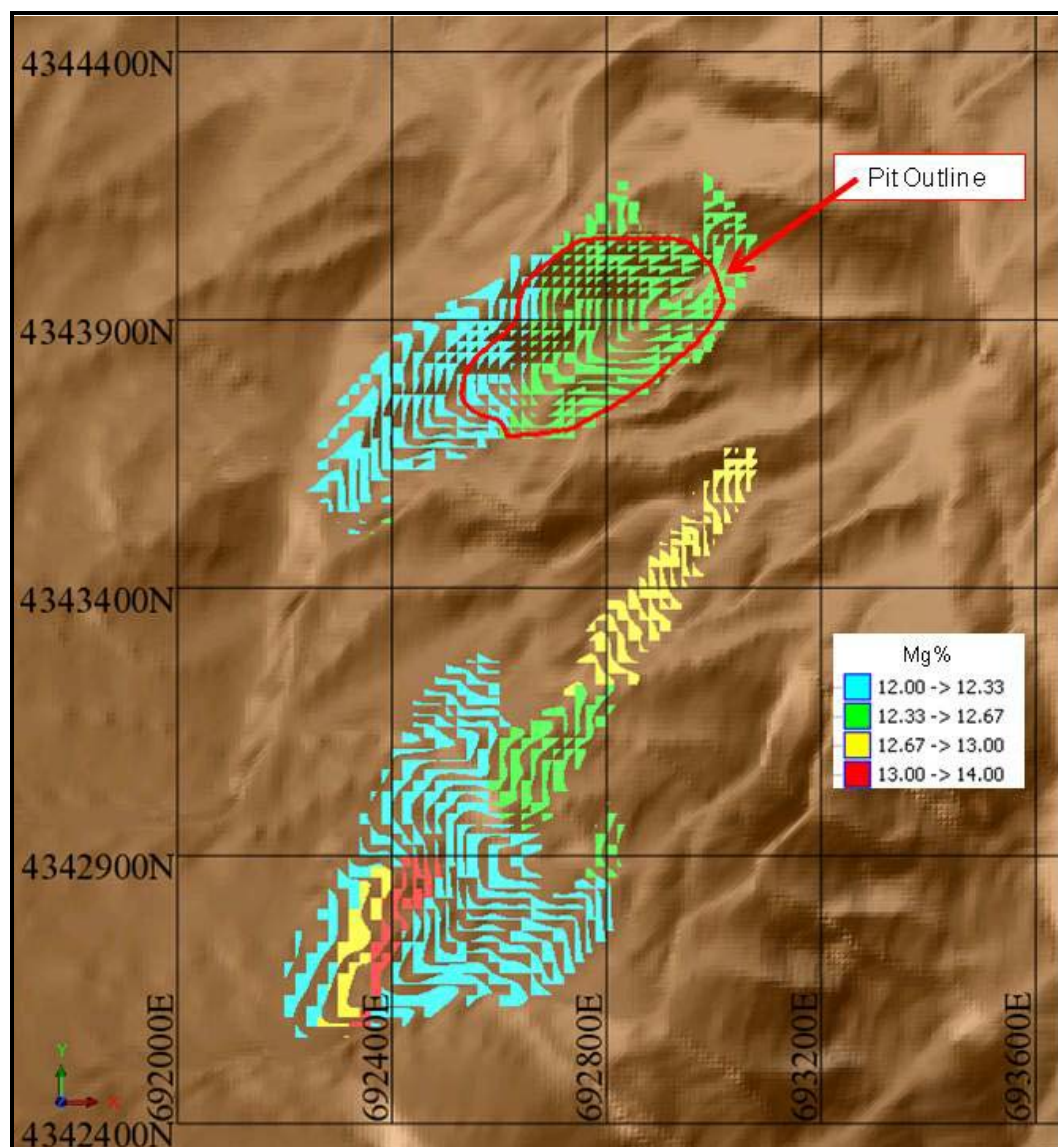
### 16.2 PRODUCTION RATE

The production rate was set at 30,000 t/Mg. The mining rate is expected to fluctuate yearly, depending on the grade mined. The mine was assumed to operate 10 hours per day, four days per week.

### 16.3 ECONOMIC PIT LIMITS AND PIT DESIGNS

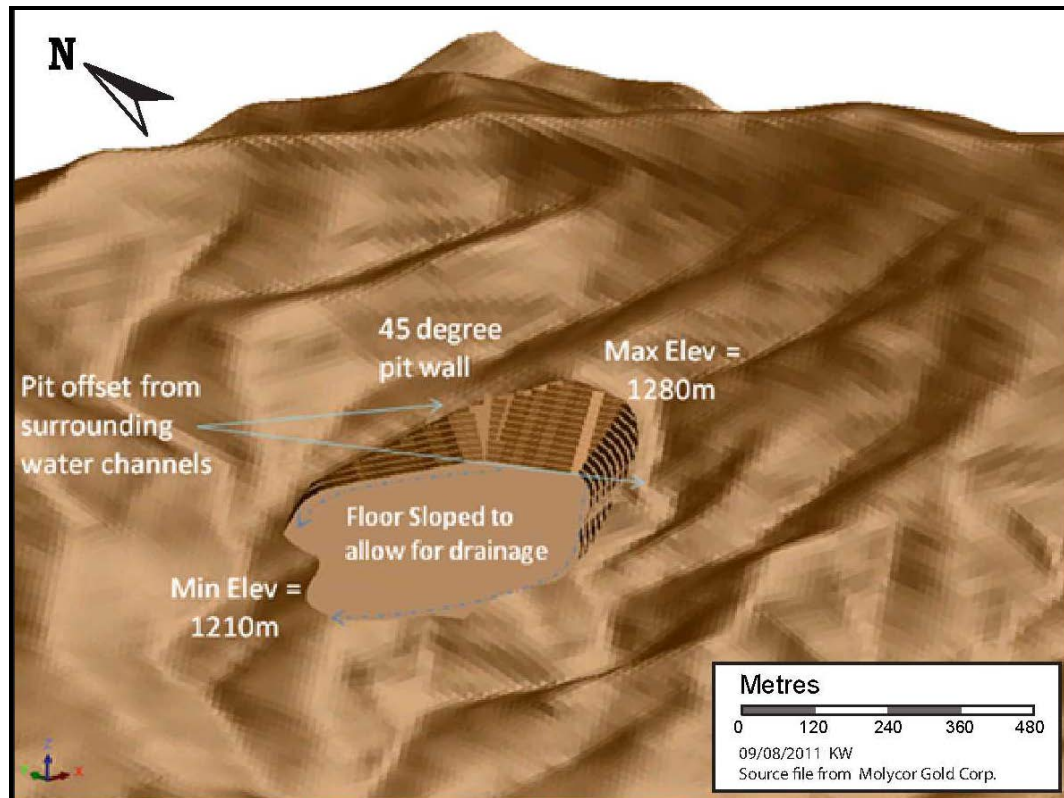
Considering the amount of available resource and the specified production rate, Wardrop selected a LOM of 30 years for the purposes of this study. Since a portion of the resource is lying at the surface, and no waste other than a thin layer at the surface is expected, a pit was manually designed without optimization software. A high-grade (greater than 12% Mg) resource outcropping at the surface was located (Figure 16.1) and an open-sided pit was designed using an average wall slope of 45° (Figure 16.2).

**Figure 16.1 Pit Location Relative to Resource Outcropping**





**Figure 16.2 Pit Design for a 30-year Mine Life**

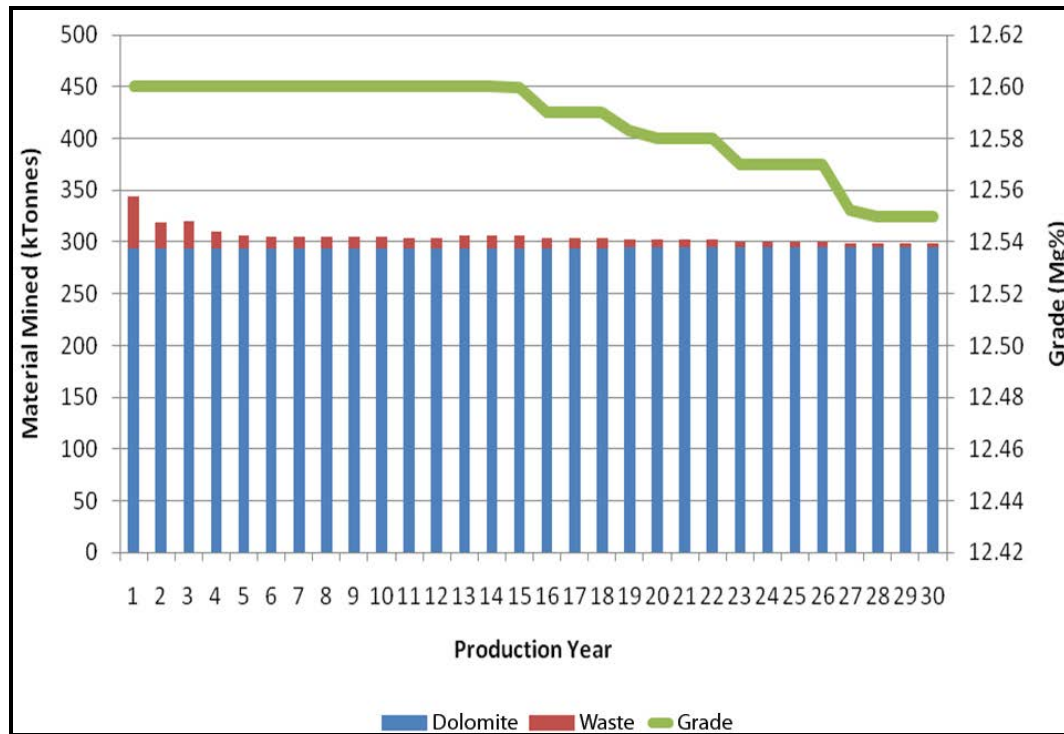


Should the project wish to go longer than the specified 30-year LOM, the current pit can be mined further down, while maintaining an open face and the integrity of nearby natural drainage channels.

## 16.4 MINE PLAN

The resource within the pit contains an average grade of 12.59% Mg. With the plant capacity set at 30,000 t/a of magnesium, the mine production rate was calculated to be approximately 294 kt/a. Over the 30-year production period, a total of 8.8 Mt of resource will be mined at an average strip ratio of 0.04. A graphical representation of the production schedule is shown in Figure 16.3.

**Figure 16.3 Mine Production Schedule to Produce 30,000 t of Mg per Year**



## 16.5 MINE OPERATIONS

Mining operations will include the use of two front-end loaders, a mobile crusher, a drill, and blast contract. One loader will move blasted material to the crusher, which will be located a short distance from the active mining face; the other loader will load the stockpiled, crusher material into highway trucks to be transported to the process plant.

There is minimal waste material covering the outcropping resource. This material will be bulldozed into piles and loaded off to the edge of the pit for future reclamation. The mine roads will be maintained and dust-controlled as required.

Over the 30-year LOM, the pit floor exits the side of a hill, so there is no need for dewatering activities. The pit is designed so that water will flow to a collection area and evaporate.

Waste from the process plant will be transported back to the mine and stored within the mined-out areas. The mining sequence must be designed to ensure that adequate mined-out area is available for this material without covering future resource.

## 16.6 MINE EQUIPMENT

The following equipment will be required to operate the mine:

- a 9-yd<sup>3</sup> front-end loader (owner)
- a 6-yd<sup>3</sup> front-end loader (owner)
- a mobile crusher (owner)
- a 4" drill (contractor)
- an ammonium nitrate/fuel oil (ANFO) loader (contractor)
- a stemming loader (contractor)
- a water truck (contractor)
- a grader (contractor)
- a bulldozer (contractor).

## 16.7 MINE CLOSURE AND RECLAMATION

No significant reclamation activities are expected at this time. The waste from the process plant will fill most of the mined-out pit, in a manner similar to concrete. The small amount of mine waste material that will be moved to the edge of the pit will be spread back over the mined area. Water will continue to drain to a collection area and evaporate.

## 16.8 CONCLUSIONS AND RECOMMENDATIONS

An open pit, containing 8.8 Mt of resource, was designed to produce 30 kt/a of magnesium over 30 years of production. The design will mine only a small portion of the overall resource available; future expansion is easily achievable. A production rate increase would likely benefit the projects economics and should be assessed in future studies.

## 17.0 RECOVERY METHODS

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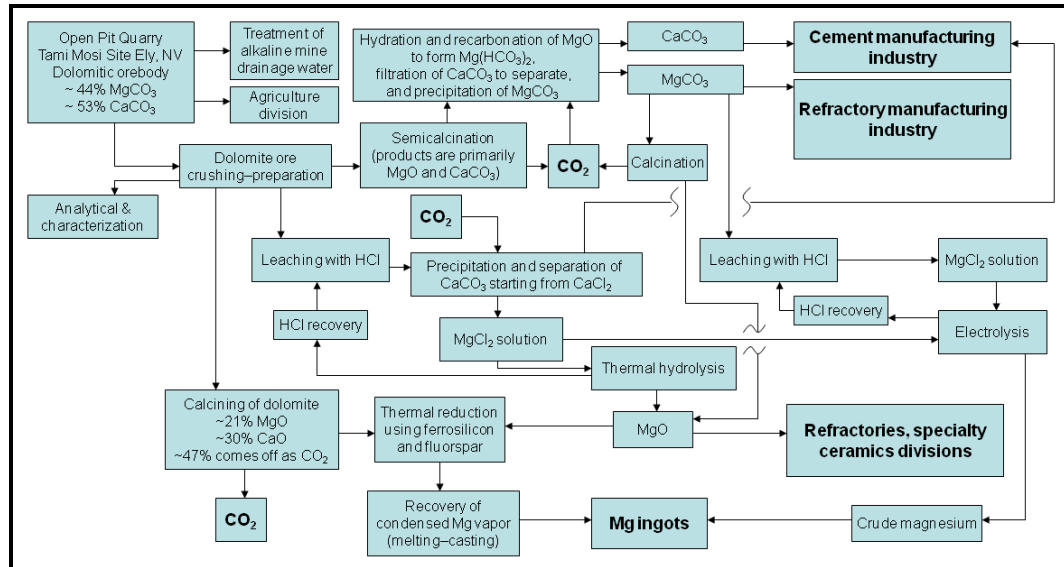
Magnesium is a reactive metal (among the alkaline earth, or “Group II” metals on the periodic table of elements). Its extraction requires special conditions, compared to that of conventional metals (copper, iron, zinc etc.). A full understanding of benefits and their shortcomings of available processes was required in order to select the most suitable process.

### 17.1 PROCESS TYPES

Two basic types of production processes are used to produce magnesium: the electrolytic process and the thermal reduction process. The electrolytic process, or hydrometallurgical process, is mainly used to produce magnesium from carnallite, salt brines or seawater. In this process, magnesium chloride ( $\text{MgCl}_2$ ) is extracted, dried, melted and reduced in a direct current electrolytic cell to produce magnesium. The thermal reduction method utilizes a reductant such as silicon (Si) or aluminum (Al) at an elevated temperature and a low pressure to extract magnesium from calcined dolomite. Currently, the majority of magnesium is produced using the Pidgeon Process which is one of the thermal reduction methods. Both the hydrometallurgical process and the pyrometallurgical process are energy intensive.

Hazen conducted a literature review to investigate the potential magnesium-magnesium production from the dolomite of the Tami Mosi deposit. The potential production methods that are used in the industry or could be potentially used for the dolomite are summarized in Figure 17.1.

**Figure 17.1 Potential Processing Paths for the Dolomite from the Tami-Mosi Deposit**



The proposed processing paths by Hazen included:

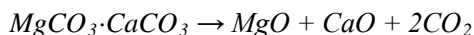
- **Thermal Reduction Processes:** dolomite calcination, thermal reduction, recovery of condensed magnesium vapor
- **Hydrometallurgical Process:** hydrochloride acid leaching to produce magnesium chloride solution followed by thermal hydrolysis or electrolysis to produce magnesium
- **Pyrometallurgy + Hydrometallurgy:** differential calcination of dolomite, hydration/re-carbonation/precipitation to produce magnesium carbonate ( $\text{MgCO}_3$ ), followed by calcination, thermal reduction and recovery of condensed magnesium vapor.

Hazen did not recommend an optimum process routine for the recovery of magnesium from the dolomite.

Based upon the mineralization type and current operating technologies, it appears that a thermal reduction approach would offer the best opportunity to extract magnesium economically from the Tami-Mosi dolomite. The thermal reduction process proceeds as follows:

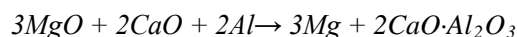
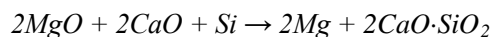
1. calcination of dolomite to dolime
2. blending of the dolime with a reductant, such as ferrosilicon (FeSi)
3. heating of the dolime-reductant mixture in a vessel under vacuum
4. condensation of the liberated magnesium vapor
5. melting, alloying and casting of the condensed magnesium.

Chemical reactions for the thermal process are relatively simple, including dolomite decomposition and magnesium oxide reduction. The dolomite decomposition, or calcination, involves an endothermal chemical reaction at an elevated temperature:



Depending on the physical characteristics required for the dolime, the calcination temperature can vary from 780 to 1,450°C. Calcination conditions will influence the reduction reaction.

The calcined dolomite is then mixed with a reductant, typically silicon or aluminum, and heated at approximately 1,150 to 1,400°C at a low pressure of approximately 10-100 Pa to reduce the magnesium oxide in the dolime to metallic magnesium which escapes in the form of gas from the reaction zone and is captured at a reduced temperature.



There are a number of thermal processes, including:

- **Pidgeon Process:** This is the predominant process in use at this time. Calcined dolomite is ground and blended with ferrosilicon containing 75% silicon. The mixture is briquetted and charged into a steel retort. A vacuum is drawn on the retort which is externally heated to approximately 1,200°C. As the magnesium oxide reacts with the silicon, magnesium vaporizes and migrates to a water-cooled condenser attached to the retort. The condensed magnesium and spent briquettes are removed from the retort on a batch basis. Cycle time for the batch process varies between eight and 12 hours.
- **Bolzano Process:** This process is essentially the same as the Pidgeon Process, but the briquette charge is heated by electric resistance. Instead of using an externally heated retort, the charge is constructed of alternating layers of steel plate and briquettes. The charge is placed in a vertical furnace and electric current is applied to the electric resistance plates. The resistance heating brings the charge to the desired temperature allowing the magnesium to be reduced and vaporize. As in the Pidgeon Process, an external condenser attached to the furnace captures the reduced magnesium. The quantity of magnesium produced per furnace is eight to 10 times more than that extracted from a retort.
- **Magnetherm Process:** Dolime and reductants are together fed at a controlled rate to the furnace. Briquetting is not required. The furnace contains a quantity of slag that is heated by passing an alternating current (AC) current through the slag. The magnesium oxide is reduced by ferrosilicon, but aluminum is also used as a reductant and a slag conditioner.

The furnace operates at a higher temperature (1,300°C to 1,700°C), but the vacuum required is not as low as the Pidgeon Process or Bolzano Process. The Magnetherm Process is semi-continuous, however, the furnace must be shut down periodically to tap slag and to change out the condenser.

- **Mintek Thermal Magnesium Process (MTMP):** The MTMP furnace arrangement is similar to the Magnetherm unit. Rather than resistance heating of the slag, a direct current (DC) arc heats the charge to a higher temperature (1,650°C to 1,750°C) at which the system can operate at atmospheric pressure. A condenser is used that keeps the magnesium in the liquid phase rather than condensing it as a solid as in the other thermal processes described.

MTMP Process can be operated on a continuous basis; however, the system must be periodically shut down to allow for tapping of the slag and the metal.

## 17.2 PROCESS SELECTION

Based upon the mineralization type and current operating technologies, it was determined that a thermal reduction approach would be one of the best opportunities to extract magnesium economically from the Tami-Mosi dolomite.

Although the Pidgeon Process is more widely used in producing magnesium from dolomite, it was not selected for use for this project, primarily because:

- The process is labour intensive.
- The process is more energy intensive compared to the other thermal reduction processes.
- Retorts are expensive, and fail due to high temperature operation with an internal vacuum.

Although the Magnetherm Process and the MTMP Process can be operated at a semi-continuous or continuous basis, and the vacuum required is not as low as the Pidgeon Process or Bolzano Process, both the processes were excluded because:

- The MTMP Process has only operated on a pilot basis and additional work is necessary to advance the technology.
- The Magnetherm Process utilizes a complicated furnace, raw material feeding system and condenser all of which must be maintained under vacuum. In addition, there are issues with electrode failure and limited life of the condenser components.

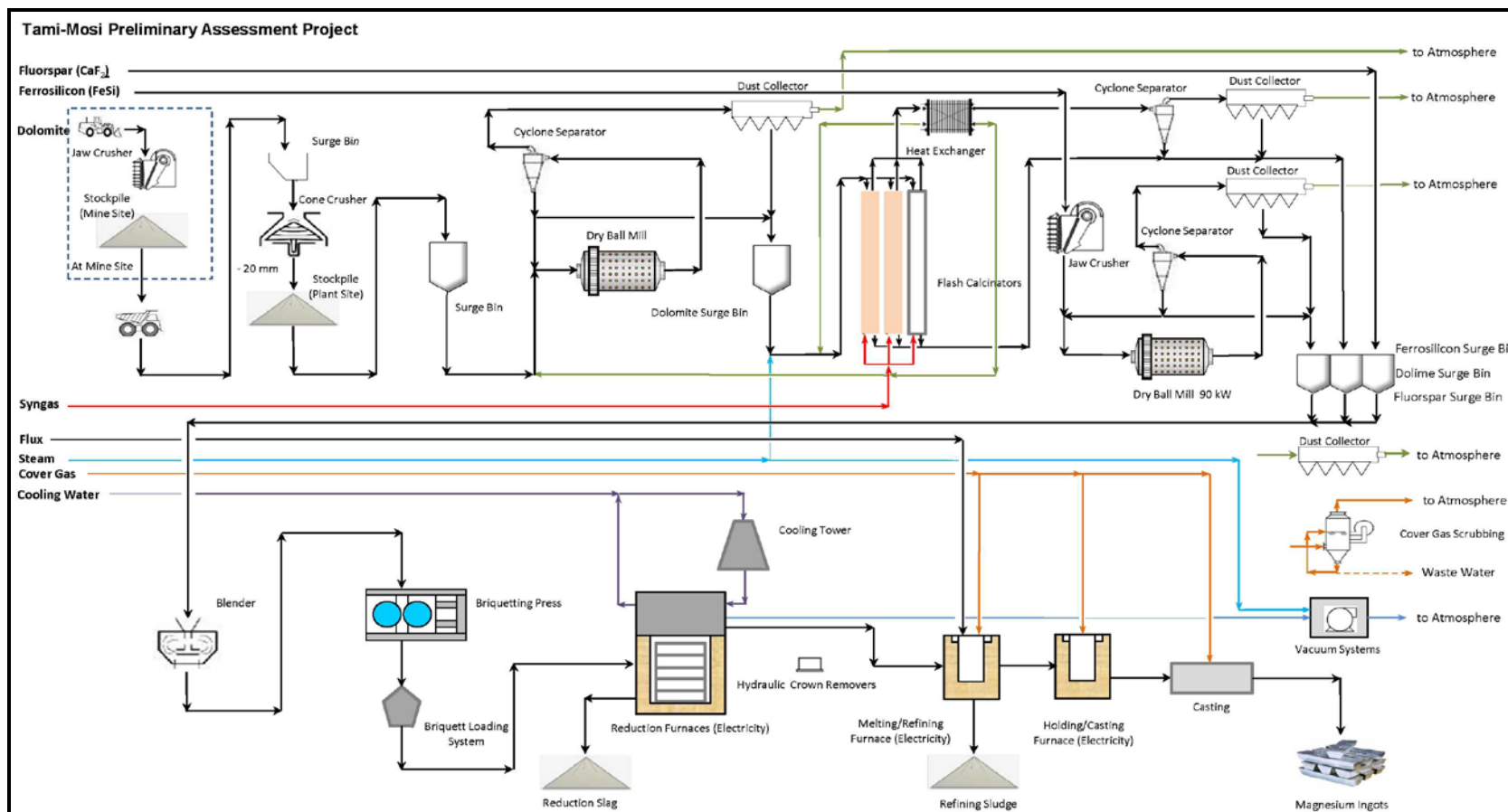
A modified Bolzano Process was selected as the reduction process for this PEA study. A version of this process (known as the RIMA Process) is currently in use in Brazil. The resistance heating and simple furnace design result in efficient energy

utilization and good vacuum integrity. The proposed flow sheet is shown in Figure 17.2.

Further investigations, including various test work and trade-off studies, are recommended for future studies to optimize the process technology for magnesium production from the dolomite.



**Figure 17.2 Magnesium Process Flow Sheet**



### 17.3 DESIGN CRITERIA

The proposed magnesium production plant is designed to produce 30,000 t/a of magnesium ingots. The major design criteria are shown in Table 17.1.

**Table 17.1 Major Design Criteria**

Items	Unit	Criteria
Annual Magnesium Production Rate	t/a	30,000
Operating Day	d	350
Magnesium Content in Mill Feed	% MgO	>20
Magnesium Recovery (to Ingots)	%	81
Crushing		
Operating Day	d/w	4
Operating Hour	h/d	10
Grinding/Calcination/Reduction/Refining		
Operating Day	d/a	7
Operating Hour	h/d	24
Process Rate (Dolomite)	t/h	39
Process Rate (Magnesium Ingots)	t/h	3.8
Calcination Process		Flash Calcination/Syngas
Calcination Temperature	°C	850-1,100
Briquetting Pressure	MPa	150
Briquette Size	mm	~10
Reduction Method		Ferrosilicon Thermal Reduction
Reduction Furnace Type		Vertical
Reduction Furnace Capacity	kg	1,000 kg of Mg Crown
Pressure (Inside of Furnace)	Pa	~20
Reduction Temperature	°C	1,200-1,250
Heating Method		Electricity
Crown Production	kg/batch	1,000
Reduction Retention Time	h	22
Crown Melting Temperature	°C	670-700
Casting Temperature	°C	710-720
Reagent Consumption		
FeSi	kg/t Mg	1,008
Fluorspar	kg/t Mg	166
Flux (MgCl <sub>2</sub> /KCl/NaCl/CaCl <sub>2</sub> /MgO)*	kg/t Mg	135
Ingot Weight	kg/piece	8±1
Magnesium Content (Ingots)	% Mg	>99.9

\*NaCl – sodium chloride, CaCl<sub>2</sub> – calcium chloride

## 17.4 PROCESS DESCRIPTION

### 17.4.1 *DOLOMITE HANDLING AND CRUSHING*

The deposit is located 225 km south of the proposed processing site. The dolomite will be crushed at the dolomite quarry, using a mobile jaw crusher system equipped with dumping pocket, feed conveyor, jaw crusher and stacking conveyor. The dolomite will be crushed to 80% passing approximately 50 mm to 60 mm. The crushed dolomite will then be stockpiled prior to being delivered to the processing site by 20 t highway trucks. The proposed transport schedule will be identical to the mining schedule.

### 17.4.2 *SECONDARY CRUSHING AND GRINDING*

As the crushed dolomite from the dolomite quarry is discharged from the transport truck at the processing site, its size will be further reduced by an HP500 or equivalent cone crusher to 80% passing approximately 12 mm. The secondary crushing and material handling will be operated continuously to match the trucking schedule.

The cone crusher discharge will be conveyed to the dolomite stockpile, which will have a live capacity of 9,000 t. The stockpile will be capable of supplying feed to the plant for a minimum of 10 days.

The crushed dolomite will then be reclaimed by belt conveyor to the grinding mill feed surge bin, where the dolomite will be dried by the recovered heat from the downstream calcination process. The dried dolomite will be fed to a dry ball mill with an installed power of 700 kW. The ball mill will be in closed circuit with cyclone separators. The mill discharge will be sent to the cyclone separator where the fine dolomite (approximately 80% passing 150  $\mu$ m) will leave the grinding circuit, while the coarse fraction will return to the mill for further grinding. The cyclone overflow (ultra fine fraction) will be sent to the baghouse where the fine dolomite will be captured.

### 17.4.3 *CALCINATION*

The ground dolomite, including the grinding area baghouse discharge, will gravity feed to the calcination feed surge bin. The heat recovered from the calcination discharge will preheat the calcination feed.

The calcination reactions of the dolomite will take place in 10 flash calciners (nine operating and one standby) at a temperature of approximately 850°C to 1,100°C. The fuel used for the calcination will be the synthesis gas (syngas) that will be generated from the coal gasification power plant at the processing site. The coal gasification power plant will provide electric power for the magnesium and ferrosilicon production plants. Heat will be recovered from the calciner discharges utilizing a fluidized bed heat exchange system. The recovered heat will be used for

preheating the calciner combustion air and the calcination feed and drying the mill feed.

After cooling, the calcination product, or dolime will be pneumatically conveyed to the dust collecting system. The collected calcined material will gravity feed to the dolime surge bin.

#### 17.4.4 *BRIQUETTING/REDUCTION FURNACE CHARGE LOADING*

Ferrosilicon containing 75% Si will be produced on site in the dedicated ferrosilicon production facility. Consequently, the properties and silicon content of the ferrosilicon produced can be closely controlled and matched to the magnesium reduction requirements. The ferrosilicon will be ground to 80% passing 150  $\mu\text{m}$  or finer prior to being used in the downstream operation.

The dolime will be blended with the reducing reagent, ferrosilicon, and the reduction catalytic reagent, fluorspar ( $\text{CaF}_2$ ). The mixture will be pressed at 150 MPa into spherical briquettes with a nominal diameter of 10 mm.

The briquettes from the briquetting press will discharge to the briquette storage bins and subsequently charged to the briquette holding stacks. Each briquette holding stack consists of multiple steel resistance plates and will hold 6,000 kg of the briquettes.

#### 17.4.5 *REDUCTION*

The reduction reactions will be conducted at a temperature of approximately 1,200°C to 1,250°C to generate magnesium vapour under a vacuum of approximately 20 Pa (0.15 mm mercury (Hg)). The vacuum will be generated by 6-stage stream vacuum jets utilizing available steam generated by the coal gasification power plant.

The estimated reduction retention time is approximately 22 hours. A total of 96 furnaces, each with a 6,000 kg briquette load capacity, will be used for the thermal reduction process. The furnaces will be electrically heated at a controlled rate. The electrically conductive steel plates in the charge stack will behave as resistors heating the entire charge when electric current is applied.

One loaded briquette stack will be placed in each of the magnesium reduction furnaces. The furnaces will be airtight and consist of two sections, the lower section for stack heating and the upper section for condensing magnesium vapour. The removable condensing section will be cooled by a water cooling jacket. The temperature of the water will be maintained via a closed circuit incorporating a cooling tower. The evaporated magnesium metal generated in the heating section of the reduction furnace will be condensed in the cooled chamber inside of the condensing section to form a solid magnesium crown.

The vacuum will be broken after the thermal reaction is complete. The upper section of the furnace will be removed to an area where the solid magnesium crown will be extracted by hydraulics.

The crown will be refined in the casting area where it will be melted, alloyed and cast into magnesium ingots.

The residue remaining in the resistor stack after the thermal reaction consists of dicalcium silicate and residual ferrosilicon. Upon removal from the reduction furnace, the residue will be separated from the resistor plates and transported to the residue storage load out bin from which it is transported to the quarry for backfilling. Owing to its cementitious properties, it may be used as construction materials.

#### 17.4.6 *REFINING*

The magnesium crown will be melted in one of four melting furnaces, each having a melting capacity of approximately 1.5 t/h. The crown will be melted by placing it in a cascade of molten flux at over 700°C. During this process, the raw magnesium will be refined by removal of entrained oxides and nitrides. In addition, any calcium that is reduced will convert the magnesium in magnesium chloride in the flux into metallic magnesium by reduction.

The molten refined magnesium metal will be transferred by pump to the alloying/holding furnaces where the molten magnesium will be prepared for casting.

After the metal quality is certified, the molten magnesium will be cast into magnesium ingots using a conventional ingot casting machine. The magnesium ingots will be stacked, packaged, placed in the warehouse and staged for shipping.

Covering gas consisting of a combination of sulfur dioxide (SO<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) will be injected into the furnaces to shield the reactive molten magnesium and avoid oxidation during melting and cleaning. The off-gas of the protecting cover gas system will be cleaned and neutralized by scrubbing prior to discharging to atmosphere. A non-sulfur hexafluoride (SF<sub>6</sub>) cover gas, such as Novec™ 612 or HFC-134a, will be used for protecting the magnesium metal during casting.

#### 17.4.7 *PROCESS CONTROL AND INSTRUMENTATION*

The plant control system will consist of a Distributed Control System (DCS) with PC-based Operator Interface Stations (OIS) located in the central control room. The control room will be staffed by trained personnel 24 h/d.

An on-site assay system will be provided to control final and intermediate product quality.

## 18.0 PROJECT INFRASTRUCTURE

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### 18.1 INTRODUCTION

The project infrastructure is divided into two main areas: the dolomite quarry infrastructure and the processing site infrastructure.

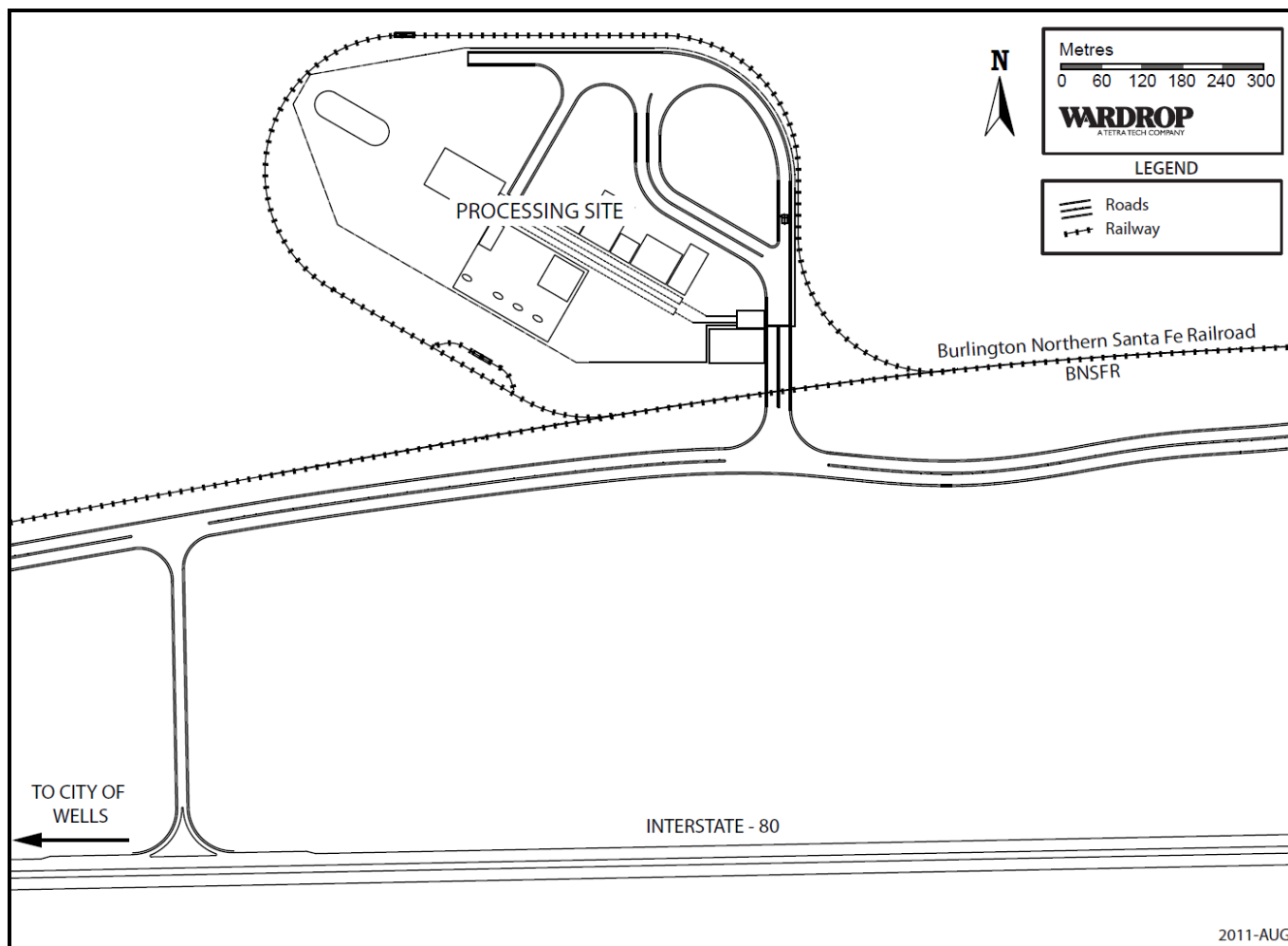
The proposed dolomite quarry will include:

- one mobile crushing plant and stacker
- one 9-yd<sup>3</sup> front-end loader at blast face
- one 6-yd<sup>3</sup> front-end loader at truck loading
- one two-bay truck shop
- site services and utilities.

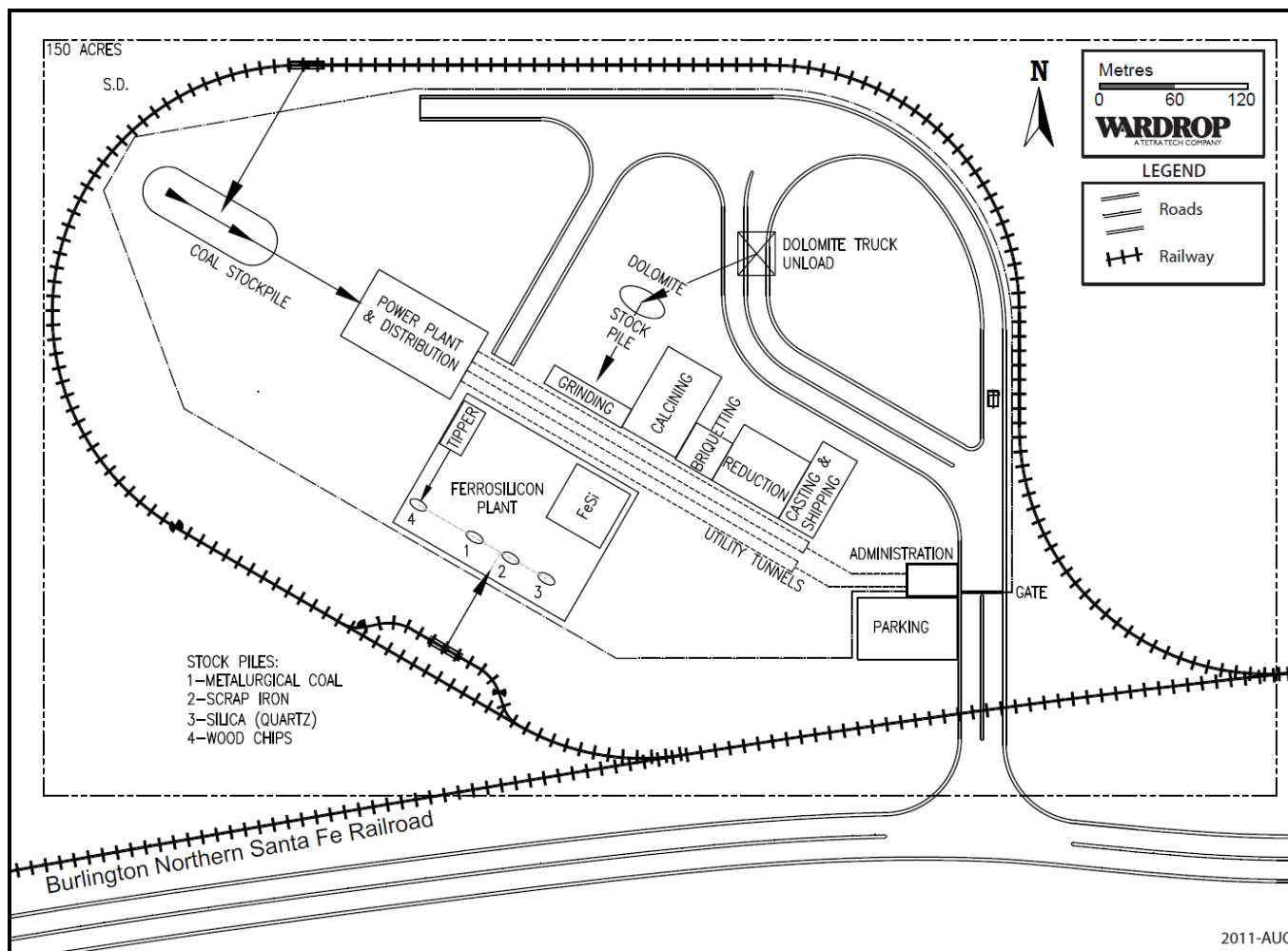
In addition, the dolomite quarry infrastructure will include site and access roads, a sewerage holding tank, and power supply and distribution facilities.

The proposed processing site is presented in Figure 18.1 and Figure 18.2. Figure 18.1 illustrates the existing and future road and rail access, and Figure 18.2 shows the layout of the vertically integrated processing site, respectively.

**Figure 18.1 Processing Site Access**



**Figure 18.2 Processing Site Layout**





The processing site layout was designed to provide optimal material flow, efficient utility distribution, and effective road and rail access to and from the site. The processing site will be capable of processing 85.7 t/d Mg. The site will include:

- a dolomite off-loading, crushing and grinding facility
- a magnesium plant, including:
  - calcining
  - briquetting
  - reduction
  - casting
- ferosilicon production
- power generation and distribution infrastructure
- other site services and utilities
- site and access roads, including rail spur
- fresh and process water supply systems.

## 18.2 ROADS

### 18.2.1 ACCESS ROADS

The dolomite quarry access road branches off of the existing Highway 93 southeast of Ely, and runs 1.5 km to the dolomite quarry. The existing access road will be upgraded to gravel road suitable for tandem highway dump trucks.

The processing site access road will branch off of the existing highway access road north of Interstate 80, east of Wells, and run north approximately 400 m to the processing site entrance. The access road will be paved and divided, and will provide commercial and employee access to the site.

### 18.2.2 SITE ROADS

Planned quarry site roads include a gravel truck loop for the tandem highway dump trucks, and an explosives store access road.

Planned processing site roads include gravel haul roads from the paved site access road to the dolomite off-loading loop, a main process buildings pavement area, and a truck turn-out. A paved employee and visitor parking lot will be accessed from the paved processing site access road.

## 18.3 RAIL

Planned rail access to and from the processing site includes a rail spur line loop complete with one coal off-loading facility, and one process input materials off-loading facility. The approximately 1.5 km spur line loop will access the existing BNSFR.

## 18.4 POWER

### 18.4.1 QUARRY SITE POWER SUPPLY

Power will be supplied to the quarry site via the local gridline that runs parallel to Highway 93, approximately 1 km west of the site, in a 200-amp service panel. Power will be distributed to truck shop for interior and exterior lighting, service outlets, and sentinel lighting in the immediate area. All other equipment will be powered by mobile diesel units.

### 18.4.2 PROCESSING SITE POWER PLANT

The processing site will require a significant amount of electrical power. There is basic existing electric power distribution infrastructure adjacent to the plant site; however, electric power costs were determined to be prohibitively high. Accordingly, a clean coal gasification and a gas turbine was selected as the plant's power supply.

Three forms of energy will be used in the production of magnesium processing facility: electricity, syngas (coal gas) and high pressure steam. All three energy sources will be produced in a single facility using Powder River Basin coal (PRB) or its equivalent. In addition to energy production, a plant-wide water treatment and cooling system will be incorporated within the power plant.

PRB coal is used worldwide because of its low cost, and its low-ash and low-sulfur properties. With the plant sited relatively close to these coal deposits and residing adjacent to the main transcontinental rail line, delivery cost via unit train will be low.

The power plant, with a gross generation of 75 MW, will be capable of delivering a minimum of 71 MW of AC electric power continuously, 52.8 million BTU/h of syngas and process steam as required. The power plant, fed by a high-speed coal train offloading and stockpile reclaim system, will consists of:

- coal gasifiers
- a combustion turbine-generator
- a heat recovery steam generator (HRSG)
- a steam turbine

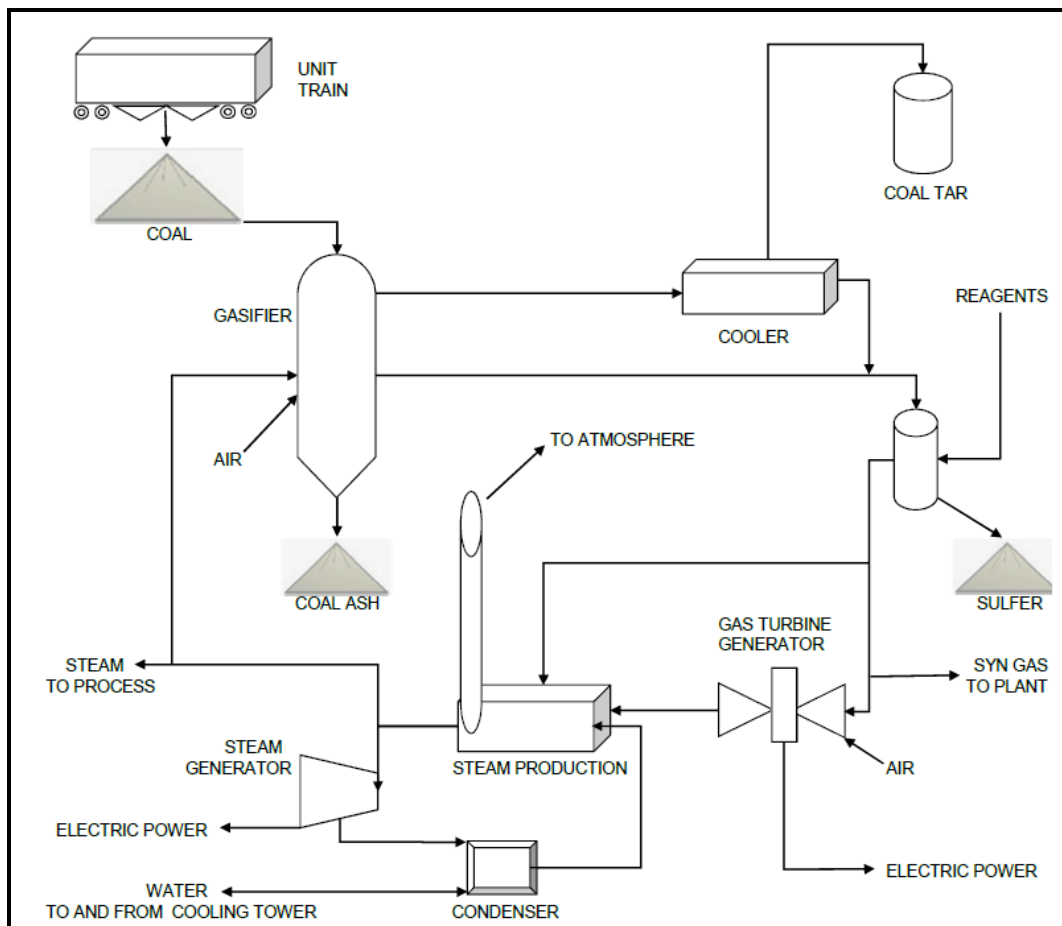
- a boiler
- power regulating and distribution equipment (for all three energy sources)
- water treatment and cooling equipment.

An electric power substation will also serve as the entrance point for power from the local electric power grid. Imported electric power will be utilized to initiate a “cold start” of the power plant, and to safely shutting down the Tami-Mosi Facility in the event of a power plant failure.

### POWER PLANT OPERATION DESCRIPTION

A power plant flow diagram is provided in Figure 18.3 to accompany the Operation Description presented here.

**Figure 18.3 Power Plant Flow Diagram**



A unit coal train will arrive every 9 to 10 days. The unit coal train will transfer onto a discharge rail loop containing a high-speed unloader. As the train progresses through the loop, the cars are automatically dumped. The high-speed unloader

system will be constructed to allow the entire train to be processed within six hours or less. When the last car will be emptied, the train will return to the main line.

The coal will then be transported by conveyer belt to an elevated tripper/stacker. The tripper operation will be controlled such that the coal will be continually discharged on the apex of the coal storage pile minimizing dust generation and breakage of the coal. The storage pad containing the coal storage pile will be sized to contain 1.5 unit trains coal capacity.

The coal will be recovered, as needed, from the coal storage pile via one of three feed chutes located beneath the pile. A belt conveyer will transport the coal to the gasifiers. The gasifiers will produce syngas for use in the power plant and distribution to the facility. A portion of the syngas generated will be directed to a combined cycle power generation system consisting of a combustion turbine-generator, a HRSG, and a steam turbine generator to produce electric power. Another portion of the syngas produced in the gasifiers will be used in a high pressure boiler to generate steam to power the magnesium facility's vacuum pumps and to aid in the flash calcination of the dolomite. The remaining syngas produced will be transmitted across the facility for use in calcination, preheating of equipment, and potentially, in the cast house to heat and melt the magnesium metal.

Electric power for emergency use will be provided by the substation adjacent to the power plant.

## POWER PLANT WASTE STREAMS

The gasifiers will generate an ash and elemental sulfur waste stream. The ash will be collected and then transported to the dolomite mine as a "back haul". This waste stream will be effectively combined with the oxide residue from the magnesium reduction plant to make a cementitious product used for roads and staging pads at the dolomite quarry. Part of the sulfur will be used internally to generate sulfur dioxide for the prevention of oxidation of molten magnesium. Any remaining sulfur will be a by-product marketed to sulfuric acid producers. Economic value of the sulfur by-product was not included in this assessment.

## 18.5 SITE SERVICES

### 18.5.1 WATER SUPPLY

Quarry site potable water will be brought in from local supplier and distributed in bottles. No process water is required.

Planned processing site potable water will be brought in from local supplier and distributed in bottles. Sanitation water and process make-up water for various closed

circuit systems will be provided via a water tower and limited distribution system. The tower will be filled and maintained by contracted truck delivery.

#### 18.5.2 SEWERAGE

Quarry site sewage and processing site sewage will be stored in a collection tank and regularly transported offsite by sewage contractor.

### 18.6 FERROSILICON PRODUCTION

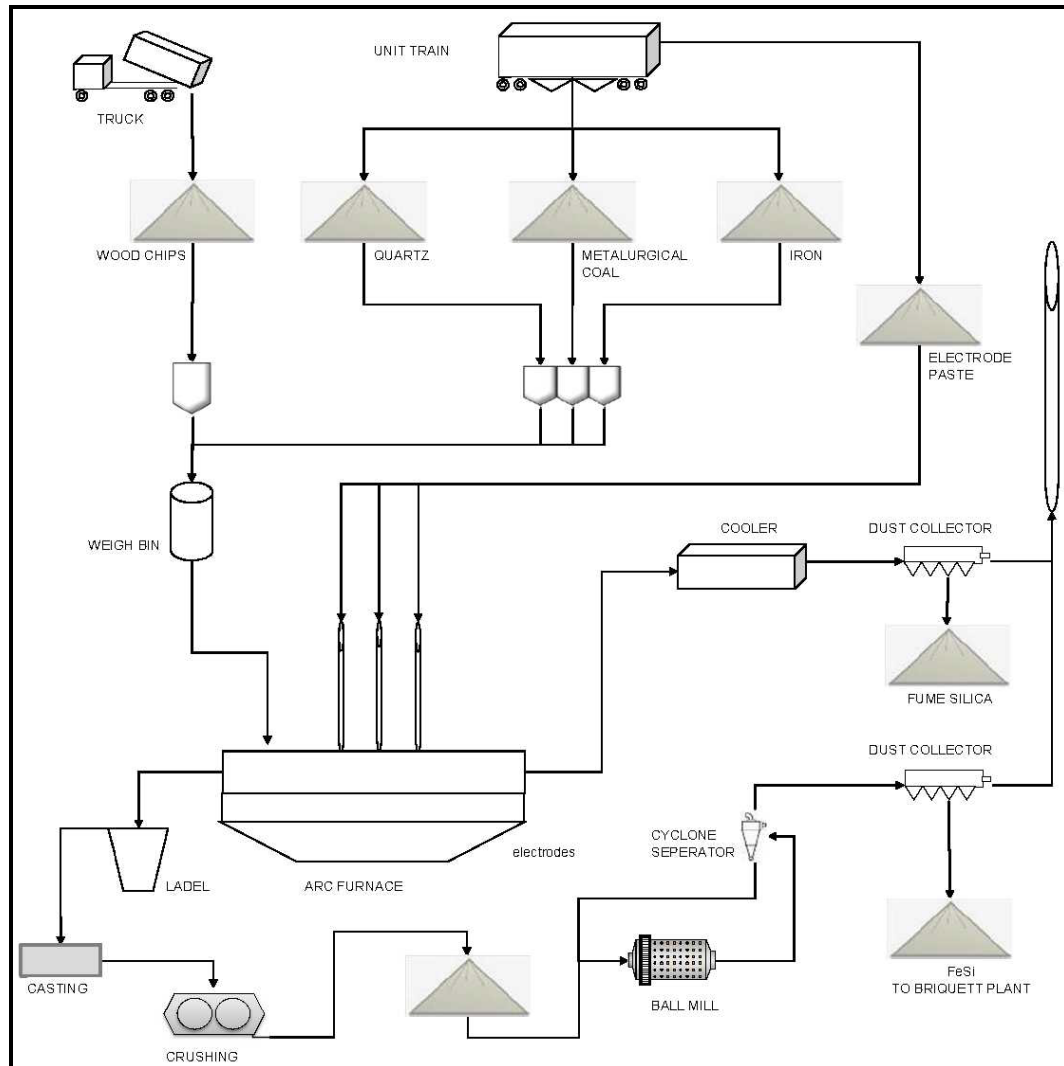
Ferrosilicon reductant constitutes over one-third of the cost to produce magnesium using a silicothermic method. Even though the ferrosilicon is commercially available, the delivered cost is too high for the proposed magnesium project to be viable over the long term. Therefore, a ferrosilicon production operation was incorporated into the overall facility.

#### 18.6.1 FERROSILICON PLANT

The thermal reduction process used to produce magnesium metal from dolomite utilizes 75% ferrosilicon as the reductant. The cost of the ferrosilicon constitutes the largest single cost component in the magnesium cost of metal produced. On Site production rather than purchase of the reductant appears to be an effective method to reducing overall magnesium production costs. A major benefit derived from the local production of ferrosilicon is the ability to directly control the quality of the major process chemical with respect to composition and variability. This will enable efficient control of the magnesium reduction process and lead to maximization of productivity.

Figure 18.4 shows the ferrosilicon plant flow diagram.

**Figure 18.4 Ferrosilicon Plant Flow Diagram**



The ferrosilicon plant will consist of the following major components:

1. **Storage:** A raw material handling and storage area for metallurgical coal, quartz, iron scrap, woodchips and electrode paste.
2. **Process Storage:** Storage tanks for each material as required throughout the process.
3. **Reduction Furnace:** A 36 to 40 MVA Soderberg electrode submerged arc furnace with a rotating hearth.
4. **Casting:** Crucibles, handling equipment, water cooled slab casting machine with 24 molds.
5. **Grinding:** Handling equipment, roll crusher, ball mill, cyclone classifier and storage bin.

6. **Environmental:** Bag houses for the by-product amorphous fumed silica-dust generated as part of the ferrosilicon, insulated duct from furnace to cooler, loop cooler, bag house, and fan.

#### 18.6.2 *FERROSILICON PROCESS CONTROL*

A key to stable process operation is high quality consistent raw materials. This will be defined by contract and maintained using vendor based statistical process control.

Direct control of the furnace and the weigh batch system will be by process control computers located in the plant control room. The charge ratio (i.e. ratio of raw material to quartz feed) is set by the process control manager. The electrode position which eventually results in furnace temperature will be controlled by a power temperature algorithm.

Tapping will be semi continuous. As the furnace rotation moves one tap hole out of position, a new one will be opened and the active one plugged.

Product samples will be taken periodically from the flowing ferrosilicon stream at a point immediately past the tap hole. These samples will be delivered to an automatic analytic cell located on the process floor. The analytic cell will automatically prepare and analyze the sample, communicating the results to the control room via the process control data base. This data will be used by the control computer to make small corrections to the feed charge.

#### 18.6.3 *FERROSILICON PLANT OPERATION*

Raw materials, including: iron scrap, metallurgical coal, quartz, and wood chips, will be brought in via truck in the case of the wood chips, or by rail in bottom dump hopper cars. These will be unloaded and conveyed to the storage area. A minimum of 10 days operation quantity will be available for each raw material.

Twice each day, the raw materials will be reclaimed from the storage area and conveyed to process storage tanks located adjacent to the furnace. Measured amounts of the raw materials are periodically taken from the process tanks. These are delivered by bucket elevator to the charge system located above the furnace. Once a complete charge is accumulated in the bin, it will be positioned above the furnace and fed to the furnace bed via multiple chutes. A furnace operator will then distribute the charge using a powered stoker.

As the charge in the furnace is consumed, the quartz reacts with the carbon components and is converted into silicon. This dissolves into the iron within the charge. The molten ferrosilicon settles to the bottom of the furnace.

The furnace is rotated to prevent a build-up of intermediate product (silicon carbide, etc.) at the cold sides of the furnace and to prevent overheating of the furnace bottom and shell. One rotation is typically completed in 24 to 36 hours.

A series of tap holes will be constructed into the side wall of the furnace at the interior floor level. Once the desired volume of product has accumulated in the bottom of the furnace, a tap hole will be opened by drilling, arcing and/or shooting with a tapping gun. The molten ferrosilicon flows from the tap hole along a refractory lined trough (launder) and cascades into a refractory lined ladle. As one ladle will be filled, the flow will be temporarily shut off by plugging of the tap hole. The full ladle will be removed and a fresh one placed in position for resumption of the tap.

The filled ladle will be transported by overhead crane to a tilt stand. Once secured in the stand, the ladle will be tilted to pour molten ferrosilicon onto water cooled molds. In order to maintain a fine grain size and uniform composition within the product, only 1 cm of the mold will be filled. Once filled, the mold will be rotated out of position to allow the ferrosilicon to solidify and cool. After all the molds in the casting wheel have been filled once, the operation will be repeated. This continues until the ladle is empty, at which point, there will be 6 to 7 cm of solid ferrosilicon in each mold. As the empty ladle is being changed for a fresh one, the molds will be tipped to a vertical position as they index past a dump hopper. The product falls from the mold and breaks into chunks as it enters the hopper.

The hopper will be elevated to the top of the crusher portion of the ferrosilicon building. The ferrosilicon will be dumped into a feed hopper that allows a controlled amount of ferrosilicon to reach a roll crusher. Discharge from the roll crusher falls into a feed bin. From here, the chips are metered into a ball mill. As the ferrosilicon will be pulverized, an air sweep transports the product out of the mill, through a separation system and into a storage bin. At this point, the ferrosilicon will be transported to the briquetting portion of the magnesium reduction plant.

#### 18.6.4 *FERROSILICON PLANT ELECTRODE PRODUCTION*

Carbon furnace electrodes will be consumed during plant operations. The electrodes will be replaced via the Soderberg process, which utilizes the heat transmitted from the furnace to the top of the electrode to bake a mixture of coal tar, coal and coke into an amorphous carbon mass.

At the top of the electrode, a cylinder of heavy gauge steel will be welded on to the existing casing forming an empty cylinder. This cylinder will be filled with blocks consisting of coal tar, coal and coke. As the electrode is consumed, it will move down, and these blocks will enter the temperature zone that causes them to flow and fuse into a plastic mass without voids. As this segment of the electrode progresses down, it will pass through progressively hotter zones. The coal tar will then be converted into amorphous carbon, binding the coal and coke into a continuous mass. Above the furnace bed, the electrodes pass through the pressure ring where electrical power will be applied to the electrode to provide the heat for curing paste into the final baked electrode. Volatiles from the coal tar flow down through the bottom of the electrode and are consumed in the reduction process.



#### 18.6.5 FERROSILICON PLANT WASTE STREAMS

Proper selection of raw materials will result in all of the furnace charge being consumed. Slag is not expected to form.

The top of the furnace will be covered to capture all fumes emanating from the process. Access doors enable service by the operator. An exhaust system conveys the fume to a cooler and bag house. Exhaust from the bag house will be ducted to the plant exhaust stack. Solid particles trapped by the bag house are predominantly very fine amorphous silica and minor amounts of carbon soot. This solid waste stream will be discharged into a silo via pneumatic conveyer. The silo will be periodically emptied into a dolomite truck returning to the dolomite quarry. This fumed silica will be blended with the oxide waste stream coming from the magnesium reduction plant to form a cementitious material suitable for roads and staging areas within the quarry.

#### 18.7 ANCILLARY BUILDINGS

The processing site administration building, change facility, assembly/board room and gate office will provide offices and workstations for all management, supervisory and support staff. This facility will be located adjacent to the main process site entrance gate and employee/visitor parking lot. The administration building will be provided with heating, ventilation, and air-conditioning (HVAC), and other services required.

#### 18.8 SITE PROCESS CONTROL, INSTRUMENTATION, AND DATA SYSTEMS

The quarry site will include communication via two-way radio capable cell phones utilizing a cell phone repeater located in the pit. A single workstation will be included in the truck shop for limited administrative functions.

The various areas of the processing site will be connected through three separate data systems and one phone system. Operation data will be relayed throughout the site via a closed data network (intranet). Similarly, a second closed data network will relay financial data. External data access will be administered through a restricted separate data network. In addition, the processing site will be equipped with a multi-line phone system.

Process control will be managed via a central control room located at the power plant utilizing the operation data network.

## 18.9 CONCLUSION

The dolomite quarry truck-loading and truck shop will be located in close proximity to the open sided pit to limit material handling and within 1 to 2 km of the highway and electrical service line.

The processing site layout was planned to minimize the overall footprint and to utilize the existing grade for site drainage minimizing excavation requirements. The rail loop encircles the processing site to afford unit train unloading clear of main rail line and to limit rail crossings to one, at the main entrance only. Distribution of utilities will be provided via service tunnels running under the central corridor of the plant to minimize overhead wires and pipes and to provide ultraviolet (UV) protection. All process facilities have been located based on process sequence to minimize material handling and footprint.

The vertical integration of the processing site further enhances the economic opportunity present in the Tami-Mosi Magnesium Project.

## 19.0 MARKET STUDIES AND CONTRACTS

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The worldwide production and usage of magnesium grew by 16% in 2010. The price of magnesium in the US and worldwide has been rising and world consumption is anticipated to increase by 5% per year from 2010 to 2015.

### 19.1 MARKETS

The world market for magnesium is small compared to other industrial metals markets. Unlike most commodities, magnesium is not traded on any major exchange. Major magnesium users negotiate contracts for magnesium alloy deliveries in advance of their production requirements, and do not make actual prices publically available. Some major metals magazines indicate general pricing trends.

Magnesium markets are categorized by end uses of the metal, both on a worldwide and local basis. There are three major categories of magnesium usage:

- aluminum alloying
- magnesium die casting
- desulfurization of iron and steel.

Magnesium consumption has been growing slowly in recent years, in response to the slowing world economy. Because total magnesium production is relatively low compared to world aluminum production (800,000 t/a versus 40 million t/a, respectively), magnesium sales contracts are small, but vital to aluminum producers as an alloying element. Both aluminum sheet and extrusions are composed of 3% to 5% magnesium to improve alloy properties.

It has been suggested that “the sustained use of magnesium in automotive production (in the US) may depend on its availability from multiple sources” (NADCA, 2010). Accordingly, several large US die casters have already contacted Molycor representatives to discuss the project and the production schedule. The potential introduction of magnesium from the Molycor project will provide an additional supply of magnesium to the automotive industry.

#### 19.1.1 *WORLD PRODUCTION AND USAGE*

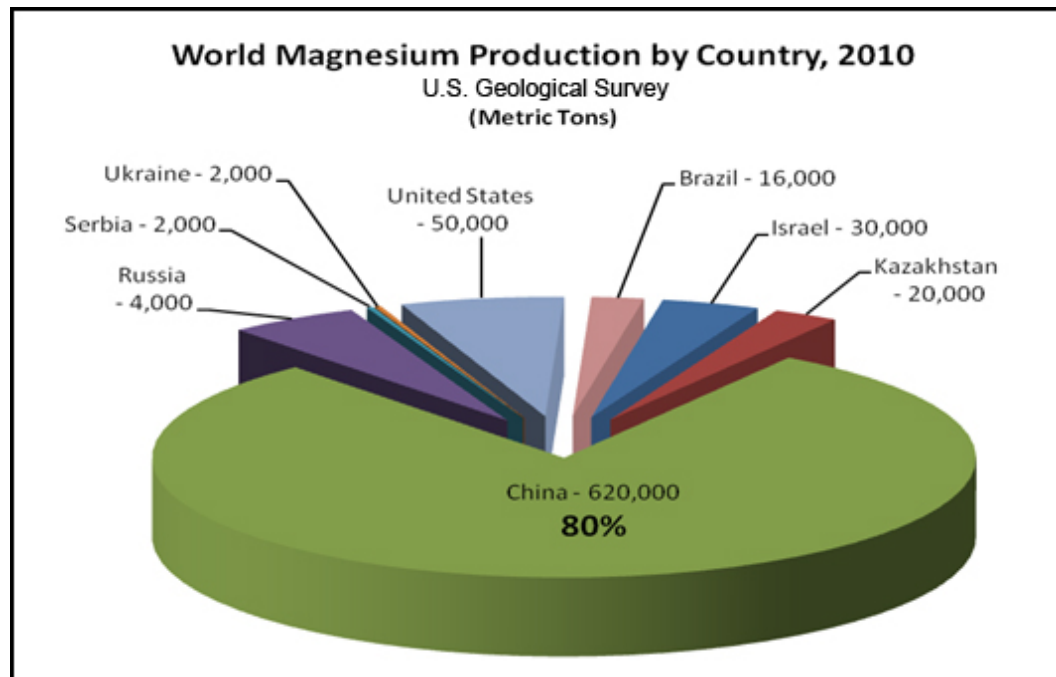
A brief summary review of world production from the US Geological Survey (USGS) is provided in Table 19.1 and illustrated in Figure 19.1 (Kramer, 2011).

**Table 19.1 2009-2010 World Magnesium Production\***

Country of production	Total Magnesium Produced 2009(t)	Total Magnesium Produced 2010(t)
United States	50,000	50,000
Brazil	16,000	16,000
Israel	29,000	30,000
PR of China	501,000	620,000
Serbia	2,000	2,000
Russia	37,000	40,000
Ukraine	2,000	2,000
Kazakhstan	21,000	20,000
<b>Totals</b>	<b>658,000</b>	<b>780,000</b>

\*Table based on USGS estimates adjusted

**Figure 19.1 World Magnesium Production 2010 US Geological Survey**



In 2010, total world magnesium production was an estimated 780,000 t, up from 658,000 t in 2009. China produces over 80% of the magnesium supplied worldwide, which significantly impacts world magnesium prices. The internal consumption of magnesium in China is increasing rapidly.

The worldwide demand for magnesium grew by 16% in 2010. Aluminum alloying continues to be the largest worldwide usage category, while demand for die casting (principally used for automotive production) has decreased. China consumes more magnesium than any other country in the world.

In the context of the current world economic uncertainty, worldwide consumption can only be projected to 2015. Total consumption can be reasonably expected to increase 5% each year between 2010 and 2015. Accordingly, total world consumption of magnesium is expected to reach 995,000 t/a by 2015.

### 19.1.2 US USAGE OF MAGNESIUM AND MAGNESIUM ALLOYS

There is only one US-based producer of magnesium, and supply numbers are withheld to protect the parties involved; accordingly, it is difficult to accurately determine magnesium consumption in the US. However, a recent presentation from the Minerals, Metals and Materials Survey (TMS) (Slade, 2011) suggested an improved market environment in 2011 over 2010.

Table 19.2 presents US Magnesium Consumption by Use on an annual basis.

**Table 19.2 US Magnesium Consumption by Use (Tons)**

Category	2003	2004	2005	2006	2007	2008	2009	2010**
Die Casting	49,100	69,100	33,500	25,600	23,100	16,200	19,100	19,600
Permanent Mold	71	112	112	50	29	19	107(r)	163
Sand Castings	394	391	412	357	2800	428	410	424
Wrought Products	3,190	2,240	2,890	2,410	2,720	2,480	1,090(r)	2,120
Aluminum Alloys	33,800	33,900	30,300	33,700	29,800	35,000	23,000	23,800
Cathodic Protection	3,720	3,520	3,020	3,000	916	824	686	709
Desulfurization	8,130	8,360	7,410	7,570	9,290	7,070	3,970	5,960
Reducing agent Ti,	930	934	812	869	1,280	1,320	1,120	882
Other	3,340	3,580	3,300	3,690	2,010	1,080	1,350	1,630
Nodular Iron	W/other	W/other	240	323	304	61	72	412
<b>Total</b>	<b>103,000</b>	<b>122,000</b>	<b>82,100</b>	<b>77,600</b>	<b>72,300</b>	<b>64,500</b>	<b>50,900</b>	<b>55,680</b>

Source: US Geological Survey Minerals Year Book.

\*\* Unofficial estimated numbers

(r) revised

The majority of magnesium consumed in the US is used as an alloying agent for aluminum, followed by die casting and desulfurization. Other uses are as a reducing agent in the production of titanium, beryllium, and zirconium, a ferroalloy nodulizing additive, a sacrificial anode, an engraving plate, and as a catalyst.

Table 19.3 show the US uses of primary magnesium as a percentage of total US consumption.

**Table 19.3 US Uses of Primary Magnesium (2010)**

US Use of Primary Magnesium	Consumption (%)
Aluminum Alloy (Packaging/Transportation, etc.)	41
Structural (Cast/Wrought)	32
Desulfurization of iron and steel	13
Other	14

The majority of the growth of magnesium demand in the past decade is a result of its increased use in automotive applications. Further increases in automobile applications are expected to boost the demand for magnesium. However, automotive manufacturers may be less likely to choose magnesium over other lightweight materials if the availability of magnesium continues to be limited to a very small number of producers (Kramer, 2009).

#### TARIFF INFLUENCES

Because of anti-dumping duties assessed on magnesium imported from China and until recently Russia, automotive manufacturers and die casters were limited to sourcing primary magnesium from only two companies: one in Israel, and one in the US. The limited number of suppliers and lack of competition is one of the reasons that the US automotive industry has historically been reluctant to use magnesium in its manufacturing process.

#### ALUMINUM SHEET INFLUENCES

In mid-2010, the output of US aluminum rolled product producers was approximately 50% of their capacity. However, aluminum production in the US apparently is rising. Aluminum producers are bringing idled rolling capacity on line to meet the demand for lighter-weight car production. Expansion is expected to continue.

The can sheet market (which uses large quantities of magnesium) is mature; usage remains level (Martens, 2011).

#### DIE CASTING INFLUENCE

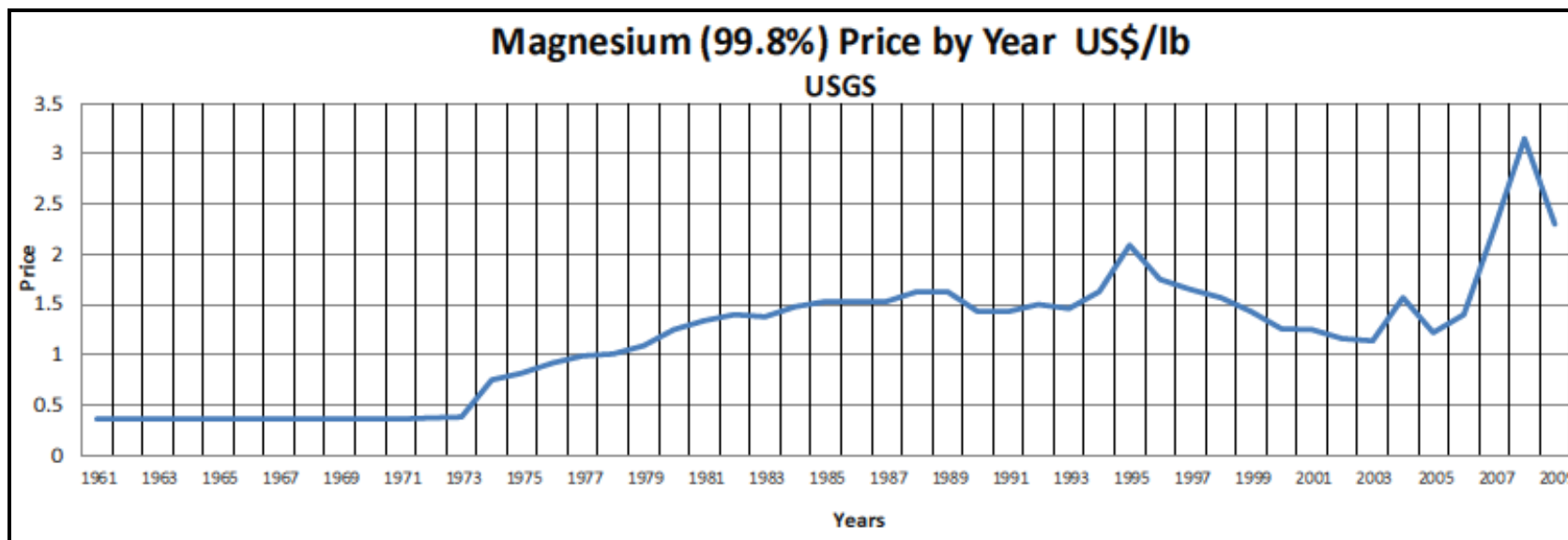
Auto production demand for magnesium die castings is also expected to increase. The demand for magnesium is expected to rise 10% in 2011, partly because auto manufacturers are seeking new magnesium part designs to reduce vehicle weight, incorporate crash energy management, and improve “fit and finish” over steel stamping assemblies. These new design initiatives are in response to changes in Corporate Average Fuel Economy (CAFE) regulations that require vehicle manufacturers to improve their overall vehicle portfolio fuel efficiency.

While the US die casting industry has been weakened by the economic down turn, there have been recent reports of new magnesium die casters opening in 2011 (Slade, 2011).

#### OTHER INFLUENCES

The demand for magnesium as a reducing agent in the production of other metals, such as beryllium and titanium, is growing in the US.

**Figure 19.2 Magnesium Price US\$/lb**





## 19.2 MAGNESIUM PRICING AND CONTRACTS

### 19.2.1 *INFLUENCES ON US SELLING PRICE OF MAGNESIUM*

There are a number of factors that influence the US selling price of magnesium.

- Magnesium is not traded on a metal exchange; hence prices are regional and the product of negotiated contracts and supply and demand.
- Magnesium produced within the US is not subject to anti-dumping or import duties. The internal US domestic selling price of magnesium is higher than that of Europe or Asia.
- There is an internal export tax on magnesium and magnesium alloys that are exported from China. The tax rate is currently 10%.
- There is steady upward pressure on production costs in China due to increases in labour costs, electricity costs, and changes in environmental regulations. This upward pressure is reducing China's current cost advantage.

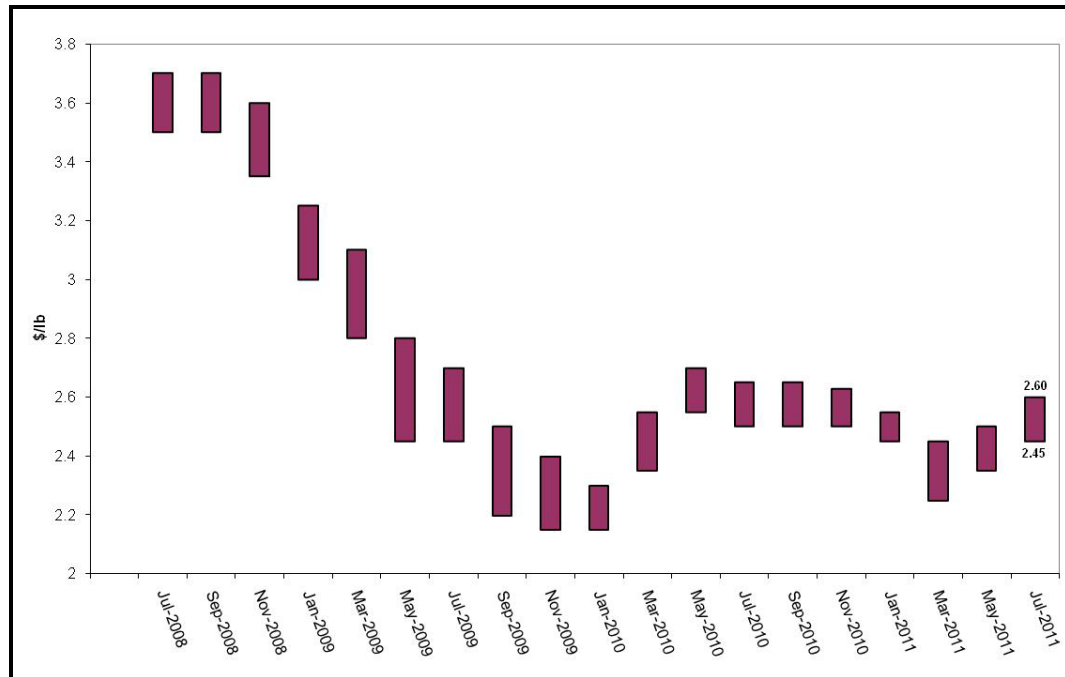
### 19.2.2 *CONTRACTS*

It is normal practice for larger users of magnesium and magnesium alloy to negotiate contracts and place orders for enough magnesium to accommodate the upcoming years' production. Price review periods are routinely included in the contracts.

One of the major industry outlook reports qualifies their numbers by adding a disclaimer which says, "This report quotes figures for volumes, prices and costs in the traded magnesium industry. It is important that readers understand that no single organization produces, collects, collates and publishes accurate and independent statistics for the entire traded magnesium industry. A comprehensive set of industry statistics was published periodically by the International Magnesium Association until 2002. This was ceased as the result of the dwindling number of 'western world' primary producers and the unwillingness of the remaining producers to share sensitive data." (Clark, 2011)

Reference prices are basically those listed in Metals Week magazine. They have listed the selling price of US Spot Western pure magnesium as an average of US\$2.60/lb for 2010. This is estimated by the Metals Week staff which surveys producers, traders, buyers and users. They are based on an estimate since the actual transaction prices are kept confidential. Figure 19.3 presents the contract price ranges bi monthly based on the estimates from Metals Week Magazine.

**Figure 19.3 US Spot Price Range Bi-monthly (99.9% Magnesium)**



The entire magnesium user industry, particularly the die casters, will be watching the development of this project very carefully.

## 20.0 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

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This section describes the overall permitting and approval process that must be completed by Molycor in order to construct, operate and close the Tami-Mosi dolomite quarry and processing site facilities.

This process includes the acquisition of all necessary permits and approvals from various federal, state and local government agencies, and the completion of a baseline study program to collect data for biological and socio-economic resources that will be used to support the overall permitting and approval process.

As part of this process, an environmental documentation program, completed in accordance with NEPA will be completed to assess the potential impacts to the human and natural environment that could result from the implementation of project activities.

### 20.1 ENVIRONMENTAL STUDIES

A multi-resource baseline study program will be implemented to collect the data required to support the completion of the multi-federal and state agency permitting program, and the anticipated environmental documentation process required under NEPA. This baseline program may include, but will not be limited to, studies on the following resources:

- general vegetation
- general wildlife
- special status vegetation and wildlife species including those species managed under the requirements of the Federal Endangered Species Act of 1973, as amended
- invasive, non-native plant species including noxious weeds
- soils
- palaeontology
- water quality and quantity, including surface and groundwater hydrology
- Jurisdictional Wetlands and Waters of the United States as required by Section 404 of the Federal Clean Water Act of 1977, as amended

- air quality as required by the Federal Clean Air Act of 1963, as amended
- cultural resources as managed under the Federal National Historic Preservation Act of 1966, as amended, and the Federal Archaeological Resources Protection Act of 1979
- Native American traditional values as regulated by various federal laws and regulations including the American Indian Religious Freedom Act of 1978, as amended, the Native American Graves Protection and Repatriation Act of 1990, and Executive Order 13175 – Consultation and Coordination with Tribal Governments
- Environmental Justice in accordance with Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Providers
- hazardous materials and solid waste
- range management
- social and economic impacts
- aesthetics, including noise and visual assessments.

This baseline program would be developed in consultation with the appropriate federal and state regulatory agency specialists to ensure the information is collected using approved procedures to meet appropriate data adequacy standards to support the multi-federal and state agency permitting program, and the anticipated NEPA environmental documentation process.

The estimated cost to complete the baseline program could range between \$100,000 and \$200,000, depending on the resources that that will require study, the amount of data that must be collected to assess the particular resource, and the type of environmental documentation program that is required by NEPA which the baseline data will support. The federal and state agency consultation program will assist in determining the detailed cost estimate for completing the baseline program.

## 20.2 WASTE AND TAILING DISPOSAL, SITE MONITORING, AND WATER MANAGEMENT

The management of waste rock, tailings disposal facilities, water management, and site monitoring during operations is a key issue for any mine, quarry, and mineral processing operation in Nevada. The State Mining Regulations contained in NAC 445A.350 through NAC 445A.447, mandate that mine/quarry and mineral processing operations “will not degrade waters of the State”. This is accomplished by constructing and managing quarry and mineral processing operations in accordance with approved engineering design plans, and regulatory agency approved operating plans.

The Regulation Branch of the NDEP, BMRR, will issue the State of Nevada WPCP for the dolomite quarry and processing site operations in accordance with NAC 445A.350 through NAC 445A.447, inclusive. The WPCP will stipulate requirements for the management and monitoring of the dolomite quarry and processing site operations to ensure they do not “degrade waters of the State”. Operating plans that detail the management of waste rock, tailings, quarterly site monitoring, and water quality management and monitoring will be developed and implemented as part of the WPCP process. Staff from the BMRR will conduct routine inspections of the dolomite quarry and processing site to ensure the requirements of the WPCP are being implemented as stipulated.

BLM will serve as lead regulatory agency for the project. BLM normally incorporates the WPCP permit requirements for the management of waste rock, tailings, quarterly site monitoring, and water quality management and monitoring into their stipulations for the approval and operation of the dolomite quarry and processing site operations.

## 20.3 PERMITTING

### 20.3.1 *FEDERAL, STATE AND LOCAL AGENCY PERMITTING*

A multi-agency regulatory process will be completed to obtain all required federal, state and local agency permits and approvals necessary to construct, operate and ultimately close the Tami-Mosi dolomite quarry and processing site operations. The proposed dolomite quarry is located in south central White Pine County, on federal public lands administered by the BLM Ely District Office of the US Department of the Interior. The proposed processing site is located in east central Elko County, east of the town of Wells on a checkerboard of public lands managed by BLM's Elko District Office, and private lands owned by BNSFR. The proposed processing site is located approximately 215 km north of Ely. Dolomite will be transported from the dolomite quarry to the processing site using licensed, over-the-road trucks that travel north along Highway 93.

Either the BLM's Ely District Office or the Elko District Office will be the lead agency for the overall project permitting and approval process. Discussions between the two offices will determine which District serves as the lead agency, and which District would be the co-lead agency. It is possible that separate federal permitting actions will be required for the dolomite quarry and the processing site, given their locations in separate BLM Districts, and the distance separating the two sites. However, it is strongly suggested that Molycor pursue one, comprehensive permitting and approval action with one lead agency.

As lead agency, the BLM will ensure all required federal, state and local permits and approvals are obtained. BLM would issue federal approval for the operations in accordance with their Surface Management Regulations contained in 43 CFR 3809. BLM will require the submittal of a Quarry Plan of Operations and Reclamation Plan, prepared in accordance with 43 CFR 3809 inclusive, that details the proposed

dolomite quarry and processing site operations, along with reclamation and closure activities. The BLM will also require the placement of a financial guarantee (reclamation bond) to ensure dolomite quarry and processing site reclamation is completed in accordance with the approved plan. The Plan of Operations and reclamation bond are coordinated with the Reclamation Branch of the NDEP BMRR as described in the following section.

The NDEP BMRR will be the primary cooperating agency for the overall dolomite quarry and processing site permitting and approval process. The Regulation Branch of the BMRR will issue the State of Nevada WPCP for the mine and ore processing operations in accordance with NAC 445A.350 through NAC 445A.447. The WPCP will stipulate requirements for the management and monitoring of the dolomite quarry and processing site operations to ensure they do not degrade waters of the State. Due to the distance between the dolomite quarry and the processing sites, and the distinct difference between dolomite quarry and processing site operations, the BMRR could issue separate WPCPs for each operation.

The Reclamation Branch of the BMRR will issue the State of Nevada reclamation permit for the project in accordance with NAC 519A, inclusive. The reclamation permit, with the associated Plan of Operations and Reclamation Plan, will stipulate procedures for the reclamation and closure of the dolomite quarry and processing site facilities. As mentioned above, the BLM required Plan of Operations and Reclamation Plan will be a joint plan submitted concurrently to both the BLM and the Reclamation Branch of the BMRR for review and approval under a Memorandum of Understanding (MOU) between these two agencies. The Reclamation Branch of the BMRR will review and approve the joint plan and the associated reclamation bond cost, and will issue the State of Nevada Reclamation Permit. It is expected that only one reclamation permit addressing both the dolomite quarry and processing site operations will be issued.

Other federal, state and White Pine County agencies will issue appropriate permits, approvals or concurrences for various mine operations and activities in accordance with applicable federal, state and county ordinances, guidelines, regulations and laws. County Departments that could issue permits or approvals for the Project include the Public Works Department, and the County Health Department. Other State agencies that could issue permits, approvals or concurrence for the project include, but are not limited to, the NDEP Bureau of Air Quality, the NDEP Bureau of Waste Management, the NDEP Bureau of Water Pollution Control, the Nevada Department of Wildlife (NDOW), the Nevada State Fire Marshal's Office, the Nevada Department of Health for public water system, and the Nevada State Historic Preservation Office (SHPO). Additional federal agencies include, but are not limited to, the US Fish and Wildlife Service (USFWS), the US Army Corps of Engineers (USCOE), and the Bureau of Alcohol, Tobacco and Firearms (BATF).

It is anticipated that the federal, state and local agency permitting and approval program can be completed within a 24-month period. This would allow

coordination with the NEPA process, whether it is an environmental assessment (EA) or an environmental impact statement (EIS).

#### PERMITTING AND APPROVAL COST ESTIMATE

Excluding the NEPA process, the estimated cost to complete the multi-agency permitting and approval process is estimated to range between \$100,000 and \$250,000, or more, depending on the additional permits and approvals that are actually required. Scoping meetings with the appropriate federal, state and local agencies will help determine the detailed cost estimate for this permitting and approval process.

#### 20.3.2 NEPA ENVIRONMENTAL DOCUMENTATION PROCESS

The proposed dolomite quarry and processing project constitutes a federal action. The federal action will be assessed for potential environmental impacts as required by NEPA. NEPA is not a permit or approval action. NEPA is a “law of disclosure” which:

- analyzes and discloses to the public the potential impacts to the environment that could result from the proposed action (and/or alternatives)
- assesses the level of significance for each identified impact
- proposes mitigation measures, if needed, to reduce the potential impact from the selected proposed action to a less than significant level.

The results of the NEPA analysis are used by the BLM to support their 43 CFR 3809 decision-making process.

Potential impacts resulting from the proposed action would also be assessed in terms of cumulative impacts during the NEPA process. Cumulative impacts are inter-related impacts to individual resources that are the result of past, present and reasonably foreseeable future actions (RFFAs), including the proposed action. Cumulative impacts for individual resources are assessed according to defined areas that include, or are adjacent to, the proposed project area. The BLM would determine the size and location of the cumulative study areas for individual resources. The cumulative assessment program would be completed as part of the selected NEPA program. The proposed baseline study program would be developed to collect appropriate resource data to support the cumulative impact assessment studies.

The NEPA analysis program for the dolomite quarry and processing project would take the form of an EA, or an EIS. The EA process is less stringent than the more comprehensive EIS process in terms of public scoping and depth of analysis. As lead agency, BLM will determine the appropriate NEPA program to assess the proposed project upon formal review of the draft Plan of Operations.



In Nevada, an EIS program is normally required to analyze and assess a new quarry or mine project in accordance with NEPA. However, based on the size and scope of the proposed project, BLM could determine that an EA is the proper NEPA analysis.

The formal decisions approving mining projects located on BLM-managed public lands in Nevada are often appealed by special interest groups or individuals. These appeals are often based on pre-determined inadequacies in the NEPA assessments. Under the less-stringent EA process, the burden of proof to show the environmental analysis was scoped and properly completed is placed on BLM. If an appeal to an EA is ultimately upheld, then BLM and the proponent, at minimum, could be required to revise portions of the environmental assessment. Alternatively, if an EA appeal is upheld, the BLM could be required to re-analyze the proposed action under an EIS. This new EIS program could require several years and significant monies to complete, and delay the proposed action. Depending on the scope of an EA appeal, the proponent is often allowed to move forward with construction and operation activities while the appeal, and possibly a resource re-assessment, is worked through.

To avoid the EA appeal action discussed above, the proponent could request that an EIS program be completed for the project environmental analysis. Although an EIS is generally more time consuming, with a greater cost, an ultimate time and cost savings could be realized if the Record of Decision (ROD) and the Finding of No Significant Impact (FONSI) for an EA is appealed. Under an EIS program, the burden of proof is placed on the appellant to show that BLM did not adequately scope and complete the EIS process, which is normally a very challenging technical and legal activity to complete. Also, an appeal to an EIS, should it be actively pursued, could simply require a re-assessment of a specific resource issue. Under an EIS appeal, the proponent is often allowed to move forward with construction and operation activities while the appeal, and possibly a resource re-assessment, is worked through. Again, the burden of proof is on the appellant to prove an EIS program was not completed properly by the BLM. Also, for a project of the proposed size and scope of Tami-Mosi, an EIS program that is properly scoped and planned upfront with the BLM could easily be within the estimated time and cost range of an EA project.

By law, the NEPA process is a federal agency process that technically should be completed by the lead BLM District staff. However, BLM Districts are not adequately staffed to complete NEPA actions personally. In order to complete NEPA programs in a timely manner, BLM allows qualified third-party contractors to complete the process, under their direct supervision; BLM simply manages this third-party process.

If an EA is the selected NEPA action, BLM will normally let the project proponent select their own third party contractor to complete the project, with BLM approval. A Conflict of Interest is generally not considered an issue under an EA process in regards to a project proponent selecting their own third party contractor.



If an EIS is the selected NEPA action, BLM will require a formal solicitation and bid process to select the third party contractor. This solicitation and bid process is closely managed by BLM to ensure there is no conflict of interest by either the project proponent or the consulting firms submitting bids.

When the NEPA action is started, involvement of the project proponent during the process is often a politically sensitive issue, whether it is an EA or an EIS. BLM will make it very clear that the NEPA process is “their process”, and although Molycor will be part of the Interdepartmental Team for the NEPA process, direct involvement and contact by the mine staff has to be “politically correct”.

One method of determining whether an EA or EIS program should be completed for the proposed project is the completion of an Environmental Information Document (EID). EID is a comprehensive assessment of the key resource issues associated with the project. Prepared by Molycor in advance of the Draft Mine Plan of Operations, the EID identifies and assess the key resources and the potential impacts that could result to them from project activities. The EID can be prepared in consultation with the BLM, and would be a valuable tool for both Molycor and the BLM in regards to determining the appropriate NEPA action.

## NEPA AND EID COST ESTIMATE

Depending on the scope of the project, including the resources that could be impacted by the Proposed Action, experience indicates that an EA process for a quarry and mineral processing project in Nevada can be completed for a cost ranging between \$250,000 to \$350,000. An EIS process can cost between \$350,000 to over \$700,000. The NEPA process and the associated cost estimate could be complicated due to the “split nature” of the proposed action. Scoping and consultation meetings with BLM’s Ely and Elko District Offices would assist in determining the detailed cost estimate to complete the selected NEPA process.

An EID project to evaluate the Proposed Action in terms of the potential NEPA process can be completed for a cost estimate ranging between \$30,000 and \$50,000. An EID project can be completed within 30 days.

## NEPA TIME FRAMES

This section describes estimated time frames to complete an EA or an EIS process under NEPA. Note that coordination with the BLM is required to determine an approved time frame estimate for the completion of the selected NEPA process.

Under 43 CFR 3809, BLM has 30 business days to review and accept a draft Plan of Operations and Reclamation Plan as technically complete after it is submitted by Molycor. Once the BLM determines the Draft Plan of Operations and Reclamation Plan is technically complete, the process to determine the appropriate NEPA action will commence. This would include selecting the ID Team which is comprised of the specific BLM specialists who will work on the NEPA program, and representatives of

Molycor. Experience indicates this activity can be completed within 15 to 30 business days.

Once the Interdepartmental Team is selected and the appropriate NEPA action determined, the process of selecting the NEPA contractor can start. Under an EA process, the BLM will usually allow the project proponent to select their own third-party NEPA contractor without going through a formal bid process. The BLM will review the qualifications of the contractor, but that generally is very quick, especially if they are familiar with the firm. Experience indicates this selection process can be completed within 15 to 30 working days.

Under the EA process, pre-project public scoping is not required. Once the Interdepartmental Team is in place, key EA issues will be discussed during a formal Interdepartmental Team meeting, baseline study needs will be outlined, a draft work plan may be prepared, a draft schedule will be prepared, and the process will be initiated. The EA could be completed between 12 to 24 months, assuming BLM accepts one season of baseline data for specific resources including general vegetation and wildlife, and special status vegetation and wildlife species. Other baseline studies, as described in Section 20.1 should be completed within the 12 to 24 month time period.

Under an EIS process, selection of the third party NEPA contractor can take between 3 to 6 months. This would include preparation of the draft and final EIS bid document/data adequacy standards, the 30-day bid preparation process, 15 to 30 days to review bids and select the contractor, and then preparation of the formal contract and other paperwork for the EIS process. It is an extensive process.

For an EIS, the proponent should plan on a minimum duration of 36 months to:

- complete the pre-EIS public scoping
- address comments
- prepare the work plan
- complete the required baseline studies
- complete the analysis
- complete administrative draft documents and agency reviews
- prepare the draft final document for public notice and review
- address comments
- prepare the final EIS.

An EIS process could require up to 48 months, or more, to complete.

## 20.4 SOCIAL OR COMMUNITY REQUIREMENTS

The construction and operation of dolomite quarry and processing site should not impact social or community infrastructure. Both operations will be located in areas with established social and community infrastructure, including housing, retail and commercial facilities such as stores and restaurants, and public service infrastructure including schools, medical, and public safety departments including fire and police/sheriff departments.

An estimated two full-time positions will be hired for dolomite quarry operations, while processing site operations will require an estimated 194 full-time positions. Based on quarry dolomite reserves, these positions are expected to last for at least 30 years. These positions are expected to be filled by local or regional residents of Ely, and White Pine County for the dolomite quarry, and local or regional residents of the Elko and Wendover, Wells and northern Elko County for the processing site operations. Both these regional areas provide an experienced work force for dolomite quarry and processing site operations.

An additional benefit would be the creation of additional short term positions for dolomite quarry and processing site construction activities. It is expected the majority of these construction positions would be hired from the regional labour pool, along with certain percentage of outside workers who are brought in. Although these positions would last for approximately 18 to 24 months, they would contribute to positive direct, indirect and induced economic benefits to the local and regional communities.

Dolomite quarry and processing site operations will have a positive impact in regards to direct, indirect and induced local and regional economics. These activities would be considered basic industries, as they would draw dollars from outside the area in terms of operation purchases and employee hiring (direct impacts). Additional positive economic links would result from the purchases of goods and services from the local service sectors including businesses such as restaurants, gas stations, hotels, and other retail businesses. As earnings increase in these businesses, they hire additional people and buy more inputs from other businesses (indirect impacts). Both the direct and indirect impacts would change the flow of dollars to the local households, which alter their consumption accordingly. The effect of this change in local household consumption upon businesses in a regional economic area is referred to as an induced impact. The positive change in the local and regional economic area works its way throughout the entire local economy (Harris and Dobra, 2009).

## 20.5 MINE CLOSURE

Reclamation and closure of the dolomite quarry and processing site operations will be completed in accordance with the joint BLM and BMRR approved Plan of Operations and Reclamation Plan, and other approved closure plans prepared as

part of the State of Nevada WPCP that will be issued by the BMRR. These plans will be updated on a regular basis, in consultation with the BLM and the BMRR Mining Regulation Branch and Reclamation Branch, to ensure they remain up to date in terms of the latest available reclamation and closure technology, and also to ensure the posted reclamation bond remains sufficient to reclaim and close the dolomite quarry and processing site operations, if needed.

The Nevada BLM Districts and the State of Nevada have initiated a long-term trust fund program as part of the federal and state permitting program to provide for the funding of site maintenance and monitoring activities following the completion of final reclamation and closure activities. The financial method for securing and placement of the trust fund, the trust fund cost, and the determined long-term duration varies by project. Consultation with BLM and the BMRR will determine the specifics of the long-term trust fund program.

## 20.6 CONCLUSIONS AND RECOMMENDATIONS

A multi-agency permitting and approval process must be completed to allow Molycor to construct, operate and close the Tami-Mosi project in accordance with all applicable federal, state and local regulations. This program will include the acquisition of numerous permits and approvals from various regulatory agencies.

To streamline the time required to complete the overall permitting and approval process, and to identify the specific permits and approvals required, it is recommended that representatives of Molycor hold formal scoping meetings with appropriate personnel from the BLM and the NDEP BMRR, the lead agency and cooperating agency, respectively. During these meetings, all proposed project activities and issues will be reviewed and discussed, including the identification of the required federal, state and local permits and approvals, completion of the appropriate environmental documentation program under NEPA, and a permitting and approval process schedule.

The permitting process will be aligned with the project progression in terms of schedule, function, and allocation of funds.

## 21.0 CAPITAL AND OPERATING COSTS

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### 21.1 CAPITAL COSTS

The capital cost estimate was developed for the Tami-Mosi Magnesium Project with the accuracy of +50% / -25%, which is suitable for client review, but not for project appropriation, financing, or forming the cost basis for controlling the engineering, procurement, and construction management (EPCM) stage of the project.

#### 21.1.1 SUMMARY

The capital cost estimate for the initial development of the facilities described in this report including dolomite quarry, processing and infrastructure is \$424.06 M. The capital cost estimate consists of four main parts:

- direct costs
- indirect costs
- contingency
- owner's costs.

A summary of the capital cost estimate is shown in Table 21.1. The capital cost estimate is provided in detail in Appendix B. The cost estimate was prepared in Q2 2011 US dollars.

**Table 21.1 Capital Cost Summary (US\$)**

	Labour Manhour	Labour Cost	Material Cost	Construction Equipment Cost	Mechanical Equipment Cost	Total Cost (USD)
<b>Direct Works</b>						
10 Dolomite Quarry Site General Subtotal	1,320	73,920	193,700	8,200	200,000	475,820
20 Dolomite Quarry Open Pit Subtotal	420	23,520	8,000	1,000	987,000	1,019,520
22 Dolomite Quarry Crushing Plant Subtotal	4,680	262,080	300,000	100,000	1,300,000	1,962,080
23 Dolomite Quarry Utilities Subtotal	1,512	84,672	207,500	39,000	0	331,172
25 Dolomite Quarry Temporary works Subtotal	0	0	0	0	0	0
30 Processing Site General Subtotal	83,004	4,648,217	6,770,994	896,920	4,091,540	16,407,671
31 Processing Site Stock Piles Subtotal	14,912	835,055	1,678,974	263,768	833,567	3,611,364
40 Processing Site - Processing Facilities Subtotal	425,110	23,806,178	35,598,980	4,869,741	77,492,867	141,767,766
50 Processing Site Power Plant Subtotal	357,004	19,992,249	46,139,606	3,551,460	76,564,600	146,247,915
61 Processing Site Infrastructure Subtotal	17,386	973,594	3,182,580	269,350	1,228,571	5,654,094
71 Processing Site Off-Site Infrastructure Subtotal	0	0	0	0	0	0
81 Processing Site Temporary works Subtotal	0	0	0	0	0	0
85 Closure and Reclamation (both sites) Subtotal	0	0	5,000,000	0	0	5,000,000
<b>Direct Works Subtotal</b>	<b>905,348</b>	<b>50,699,485</b>	<b>99,080,334</b>	<b>9,999,440</b>	<b>162,698,145</b>	<b>322,477,402</b>
<b>Indirects</b>						
91 Indirect Costs Subtotal	5,680	581,280	49,294,735	0	0	49,876,015
98 Owners Costs Subtotal	0	0	7,447,088	0	0	7,447,088
99 Contingency Subtotal	0	0	44,265,437	0	0	44,265,437
<b>Indirects Subtotal</b>	<b>5,680</b>	<b>581,280</b>	<b>101,007,260</b>	<b>0</b>	<b>0</b>	<b>101,588,540</b>
<b>Scoping Study Total</b>						
	<b>911,028</b>	<b>51,280,765</b>	<b>200,087,594</b>	<b>9,999,440</b>	<b>162,698,145</b>	<b>424,065,943</b>

### *21.1.2 ESTIMATE BASE CURRENCY, DATE, EXCHANGE RATE AND VALIDITY PERIOD*

The estimate has been prepared with US dollars as the base currency and using a base data of Q2 2011. Foreign exchange rate of Cdn\$1.00 to US\$1.00 was applied as required. No escalation beyond Q2 2011 has been applied to the estimate.

### *21.1.3 PROJECT AREAS*

The estimate has been assembled and coded based on the project-specific work breakdown structure (WBS). The Capital Cost Estimate Area Summary is provided in Table 21.2.

**Table 21.2 Capital Cost Estimate Area Summary**

Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechanical Eqpt Cost	Total Cost (USD)
<b>10 - Dolomite Quarry Site General</b>						
101 General Development	1,320	73,920	193,700	8,200	200,000	475,820
<b>10 - Dolomite Quarry Site General Subtotal</b>	<b>1,320</b>	<b>73,920</b>	<b>193,700</b>	<b>8,200</b>	<b>200,000</b>	<b>475,820</b>
<b>20 - Dolomite Quarry Open Pit</b>						
210 Pit	420	23,520	8,000	1,000	987,000	1,019,520
<b>20 - Dolomite Quarry Open Pit Subtotal</b>	<b>420</b>	<b>23,520</b>	<b>8,000</b>	<b>1,000</b>	<b>987,000</b>	<b>1,019,520</b>
<b>22 - Dolomite Quarry Crushing Plant</b>						
220 Dolomite Quarry Site Processing	4,680	262,080	300,000	100,000	1,300,000	1,962,080
<b>22 - Dolomite Quarry Crushing Plant Subtotal</b>	<b>4,680</b>	<b>262,080</b>	<b>300,000</b>	<b>100,000</b>	<b>1,300,000</b>	<b>1,962,080</b>
<b>23 - Dolomite Quarry Utilities</b>						
230 Electrical	0	0	50,000	0	0	50,000
231 Fuel Supply, Storage & Distribution	84	4,704	7,500	500	0	12,704
232 Water Systems	60	3,360	5,000	1,000	0	9,360
233 Waste Disposal	0	0	10,000	0	0	10,000
234 Buildings	1,368	76,608	135,000	37,500	0	249,108
<b>23 - Dolomite Quarry Utilities Subtotal</b>	<b>1,512</b>	<b>84,672</b>	<b>207,500</b>	<b>39,000</b>	<b>0</b>	<b>331,172</b>
<b>25 - Dolomite Quarry Temporary works</b>						
251 General Site	0	0	0	0	0	0
<b>25 - Dolomite Quarry Temporary works Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

*table continues...*



Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechanical Eqpt Cost	Total Cost (USD)
<b>30 - Processing Site General</b>						
301 General Development	83,004	4,648,217	6,770,994	896,920	4,091,540	16,407,671
<b>30 - Processing Site General Subtotal</b>	<b>83,004</b>	<b>4,648,217</b>	<b>6,770,994</b>	<b>896,920</b>	<b>4,091,540</b>	<b>16,407,671</b>
<b>31 - Processing Site Stock Piles</b>						
311 Stockpiles	14,912	835,055	1,678,974	263,768	833,567	3,611,364
<b>31 - Processing Site Stock Piles Subtotal</b>	<b>14,912</b>	<b>835,055</b>	<b>1,678,974</b>	<b>263,768</b>	<b>833,567</b>	<b>3,611,364</b>
<b>40 - Processing Site - Processing Facilities</b>						
401 Ferrosilicon Facility	108,686	6,086,405	12,793,743	1,128,200	11,610,000	31,618,347
402 Dolomite Grinding and Slag Loadout Facilities	36,034	2,017,892	2,061,007	432,852	4,805,000	9,316,751
403 Magnesium Facility	269,795	15,108,506	19,722,758	3,118,339	59,467,867	97,417,470
404 Cooling Tower and Distribution	10,596	593,376	1,021,472	190,350	1,610,000	3,415,198
<b>40 - Processing Site - Processing Facilities Subtotal</b>	<b>425,110</b>	<b>23,806,178</b>	<b>35,598,980</b>	<b>4,869,741</b>	<b>77,492,867</b>	<b>141,767,766</b>
<b>50 - Processing Site Power Plant</b>						
501 Power Plant	357,004	19,992,249	46,139,606	3,551,460	76,564,600	146,247,915
<b>50 - Processing Site Power Plant Subtotal</b>	<b>357,004</b>	<b>19,992,249</b>	<b>46,139,606</b>	<b>3,551,460</b>	<b>76,564,600</b>	<b>146,247,915</b>
<b>61 - Processing Site Infrastructure</b>						
613 Ancilliary Buildings	5,520	309,120	1,973,640	47,990	152,346	2,483,096
614 On-Site Mobile Equipment	14	806	102	0	1,076,225	1,077,133
615 On-Site Bulk Storage	83	4,637	19,938	360	0	24,935
616 On-Site Services / Utilities	836	46,838	88,900	21,000	0	156,738

table continues...

Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechanical Eqpt Cost	Total Cost (USD)
619 On-Site Power Supply & Transmission	10,932	612,192	1,100,000	200,000	0	1,912,192
<b>61 - Processing Site Infrastructure Subtotal</b>	<b>17,386</b>	<b>973,594</b>	<b>3,182,580</b>	<b>269,350</b>	<b>1,228,571</b>	<b>5,654,094</b>
<b>71 - Processing Site Off-Site Infrastructure</b>						
711 Temporary works	0	0	0	0	0	0
<b>71 - Processing Site Off-Site Infrastructure Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>81 - Processing Site Temporary works</b>						
811 General site	0	0	0	0	0	0
<b>81 - Processing Site Temporary works Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>85 - Closure and Reclamation (both sites)</b>						
851 Site (Both sites complete)	0	0	5,000,000	0	0	5,000,000
<b>85 - Closure and Reclamation (both sites) Subtotal</b>	<b>0</b>	<b>0</b>	<b>5,000,000</b>	<b>0</b>	<b>0</b>	<b>5,000,000</b>
<b>91 - Indirect Costs</b>						
911 Indirect	5,680	581,280	49,294,735	0	0	49,876,015
<b>91 - Indirect Costs Subtotal</b>	<b>5,680</b>	<b>581,280</b>	<b>49,294,735</b>	<b>0</b>	<b>0</b>	<b>49,876,015</b>
<b>98 - Owners Costs</b>						
981 Owners Cost	0	0	7,447,088	0	0	7,447,088
<b>98 - Owners Costs Subtotal</b>	<b>0</b>	<b>0</b>	<b>7,447,088</b>	<b>0</b>	<b>0</b>	<b>7,447,088</b>
<b>99 - Contingency</b>						
991 Project Contingency	0	0	44,265,437	0	0	44,265,437
<b>99 - Contingency Subtotal</b>	<b>0</b>	<b>0</b>	<b>44,265,437</b>	<b>0</b>	<b>0</b>	<b>44,265,437</b>
<b>Scoping Study Total</b>	<b>911,028</b>	<b>51,280,765</b>	<b>200,087,594</b>	<b>9,999,440</b>	<b>162,698,145</b>	<b>424,065,943</b>

#### 21.1.4 *AREA EXCLUSIONS*

Wardrop assumed a “green field site”.

#### 21.1.5 *SOURCES OF COSTING INFORMATION*

The capital cost estimate was based on the following:

- budget quotations for all “tagged” major equipment
- Wardrop in-house database for non-tagged and other equipment, etc
- preliminary material take-offs by discipline, as required
- electrical, instrumentation, and piping expressed as percentage

All equipment and material costs were included as free carrier (FCA) or FOB (free board marine) manufacturer plant and exclusive of spare parts, taxes, duties, freight and packaging. These costs, if appropriate, were covered in the indirect section of the estimate.

Equipment items valued under \$100,000 may be priced from in-house data and previous project data if pricing was recently updated, unless the equipment is of a specialized nature.

The estimate for installation hours was based on in-house experience and cost references.

All equipment and material costs were based on FCA manufacturer plant (INCOTERMS 2010) and were exclusive of spare parts, taxes, duties, freight, and packaging.

The freight costs and spares costs are covered in the indirect section of the estimate as an allowance, based on a percentage of the value of materials and equipment. With the exception of the mining equipment, the costs are inclusive of freight.

Wardrop assumes the construction man-hours/workweek to be 10 hour/day with a 3-week-on and 1-week-off rotation, with local accommodation.

#### 21.1.6 *QUANTITY DEVELOPMENT AND PRICING*

All quantities were developed from process design criteria, process flow diagrams, preliminary layouts (plan only), and major equipment lists. Design allowances were applied to bulk materials based on discussions between the respective discipline and the estimator. Details on the respective discipline quantities are as described in the following sections.

### 21.1.7 DIRECT COSTS

#### MINING

The quarry capital costs were derived from common market pricing and historical data. The equipment capital includes delivery to site and assembly, but does not include taxes or duties. The capital required for the quarry is included in the estimate.

Highway haul trucks, on-site fuelling, mobile equipment maintenance, and potable water have been provided as service contract costs in the operating cost estimate.

#### MAGNESIUM PLANT CAPITAL COSTS

The magnesium plant capital costs were derived from quoted pricing or in-house database. The estimates were developed by Wardrop and Alpha/Omega Engineering, U. S. of A. The equipment capital cost includes delivery to the site and assembly, but does not include taxes or duties.

#### POWER PLANT CAPITAL COSTS

Power plant capital costs were obtained from estimates prepared by EPIC Clean Technologies Corporation (EPIC).

Total budgetary quotation for the power facility is \$144 M for a total of \$146 M, including foundations, concrete, spares, etc. This estimate does not include the infrastructure such as cooling tower, water treatment plant, control system, power distribution, and coal unloading. These items have been included elsewhere in the capital cost estimate.

#### FERROSILICON PRODUCTION PLANT CAPITAL COSTS

A budgetary quotation was solicited from two vendors - Ghalsasi Engineering Systems Pvt. Ltd. (GESPL), and from Tenova Group, South Africa (Tenova) for a "turn-key" ferrosilicon plant capable of producing 88 t/d of 75% ferrosilicon (86 t/d is required to support production of 30,000 Mt/a Mg.). The resulting valuation from the received information was \$22.5 M. To this estimate, \$4.8 M was added to cover transportation and engineering. The foundation and building was priced separately. The final capital cost for the ferrosilicon facility was estimated to be \$31.6 M.

#### ANCILLARY INFRASTRUCTURE CAPITAL COSTS

The ancillary infrastructure capital costs were derived from common market pricing and in-house database. The estimates were developed by Wardrop and Alpha/Omega Engineering, U. S. of A. The costs included processing site ancillary

buildings, access roads, on-site roads, mobile equipment, material handling facilities, and services / utilities.

## LABOUR RATES AND COSTS

The blended labour rate of \$56/hr was used throughout the estimate. These labour rates were developed based on local Nevada contracts.

The labour rates include:

- vacation and statutory holiday pay
- fringe benefits and payroll burdens
- overtime and shift premiums
- small tools
- consumables
- personal protection equipment
- contractors' overhead and profit.

Wardrop assumed that 50% of the labour sources are available locally. Travel and living allowances will be included in the construction indirect section.

A productivity factor of 1.2 was applied to the labour portion of the estimate to allow for the inefficiency of long work hours, climate and rotation.

## COST BASIS BY DISCIPLINE

### *Bulk Earthworks Including Site Preparation, Access and Haul Roads*

All of the excavated material is deemed to be excavation in rock which requires blasting and assumed is stockpiled on site within 5 km.

### *Mining*

Mining quantities were based on estimated quantities involved. Mobile mining equipment is assumed to be contractor-provided, but two loaders were included in the estimate.

### *Concrete*

Concrete quantities are based on estimated quantities; no allowance was included for over-pour and wastage.

Typically, all concrete is based on a 28-day compressive strength of 30 MPa. The average installed concrete unit rate for 30 MPa concrete used in the estimate was \$626/m<sup>3</sup>. Concrete unit rates include for formwork, reinforcing steel, placement, and finishing of concrete.

#### *Structural Steel*

Structural steel quantities were based on estimated quantities with no allowance made for growth and wastage. Allowances were included for cut-offs, bolts, and connections.

An average supply unit rate of \$4,611/t for fabricated steel, based on quotations from recent similar projects, was used in this estimate. Craneage is included for all tonnages at a rate of \$250/t.

#### *Platework and Liners*

Preliminary quantities for platework and metal liners for tanks, launders, pump-boxes, and chutes were estimated using recent similar projects and in-house data.

#### *Mechanical*

The preliminary equipment estimate was prepared, based on the project supplied information and drawings, where available. The mechanical pricing was based on budgetary quotes obtained for the power plant and ferrosilicon plant.

All other mechanical equipment was based on information from recent quotes on similar applications and factored estimates.

#### *HVAC and Fire Protection*

HVAC and fire protection is included as a percentage of the process equipment cost and is based on experience with recent similar recent projects.

#### *Dust Collection*

Major dust collection equipment is covered in the mechanical section.

#### *Piping and Valves*

Piping and valves allowances were included as a percentage of process equipment, based on experience with recent similar projects.

### *Electrical*

Electrical allowances were included as a percentage of process equipment, based on experience with recent similar projects.

### *Instrumentation*

Instrumentation is included as a percentage of the equipment list allowance assigned to each area and based on experience with recent similar projects.

### *Buildings*

The estimates for the engineered steel framed buildings were included, with the exception of the power plant which was calculated by other consultants and included in the turn-key budgetary quotation.

## 21.1.8 *INDIRECT COSTS*

### CONSTRUCTION INDIRECTS

Plant site construction indirects are calculated on a percentage basis to include overheads and profit.

### INITIAL FILLS AND WAREHOUSE INVENTORIES

An allowance of \$2.7 M initial fills has been included for reagents and fuel.

### SPARES

Capital and commissioning spares were included based on a percent of the direct costs.

### FREIGHT AND LOGISTICS

Although no logistics study was performed for this project, a provision of 4% was provided for freight of most materials, and for the process equipment.

### COMMISSIONING AND START-UP

An allowance for vendor representatives, contractors' crew and management staff required on-site to supervise equipment installation, perform pre-start-up inspections, in order to satisfy equipment performance warranty requirements. Costs associated with this requirement were included in the estimate.

## ENGINEERING AND PROCUREMENT (EP)

Engineering and procurement costs are estimated as a percentage of the total direct costs at 7.5%. Mining is included at 4%.

## CONSTRUCTION MANAGEMENT

Construction management costs are estimated as a percentage of the total direct costs at 7.5%. Mining is included at 4%.

## OWNER'S COSTS

An allowance has been included for the owners' costs, based on a percent of the direct costs in keeping with typical percentage used in other similar recent projects.

### 21.1.9 EXCLUSIONS

The following items were excluded from the capital cost estimate:

- schedule delays such as those caused by:
  - major scope changes
  - unidentified ground conditions
  - labour disputes
  - environmental permitting activities
  - abnormally adverse weather conditions
- receipt of information beyond the control of the EPCM contractors
- cost of financing (including interests incurred during construction)
- royalties
- schedule acceleration costs
- working capital
- contractors camps
- catering and housekeeping
- bussing, etc
- working or deferred capital
- sustaining capital
- refundable taxes and duties
- land acquisition
- currency fluctuations



- lost time due to force majeure
- any project sunk costs including this study
- pre-production costs, excluding pre-stripping
- dolomite transportation equipment trucking from Dolomite Quarry to Processing Site. Contracted dolomite transportation cost included in Operating Estimate.
- escalation beyond June 2011
- community relations
- taxes including Canadian Goods and Services Tax (GST)/Provincial Sales Tax (PST)/Harmonized Sales Tax (HST), US state or federal
- owner's risks and exposure.

#### *21.1.10 COSTS INCURRED PRIOR TO RELEASE OF DETAIL ENGINEERING AND CONSTRUCTION ASSUMPTIONS*

The following assumptions were made in the preparation of this estimate:

- All material and installation subcontracts will be competitively tendered on an open-shop, lump-sum basis.
- Site work is continuous and is not constrained by the Owner or others.
- Skilled tradespersons, supervisors, and contractors will be readily available.
- The geotechnical nature of the site is assumed to be sound, uniform, and able to support the intended structures and activities. Adverse or unusual geotechnical conditions requiring piles or soil densification have not been allowed for in this estimate.

#### *21.1.11 CONTINGENCY*

A contingency allowance is included. It excludes the power plant which has its contingency included in the direct cost as provided in the budgetary quotation.

It is expected that this estimate will adequately cover minor changes to the current scope to be expected during the next phase of the project. The contingency for the project is calculated to be 14% of the direct costs.

### **21.2 OPERATING COSTS**

The vertically-integrated processing site is designed on a modular basis. The various major facilities (i.e. magnesium plant, power plant, ferrosilicon plant) have been sized to complement one another as a modular production unit. The dolomite

quarry operating costs have been provided for in the operating cost estimate included in the economic analysis, section 22.0 of this report.

### 21.2.1 MAGNESIUM PLANT OPERATING COST AND BASIS

The estimated process operating cost for the magnesium production is \$1.28/lb Mg ingot or \$2,820/t Mg ingot. The estimate was conducted in conjunction with Alpha/Omega Engineering, U. S. of A. and is summarized in Table 21.3. The estimate includes the costs for general management, general material receiving handling and magnesium plant operation. Major costs are ferrosilicon, which accounts 42% of the total cost, and power, which contributes approximately 18% of the total cost. The cost distribution at different areas is shown in Figure 21.1.

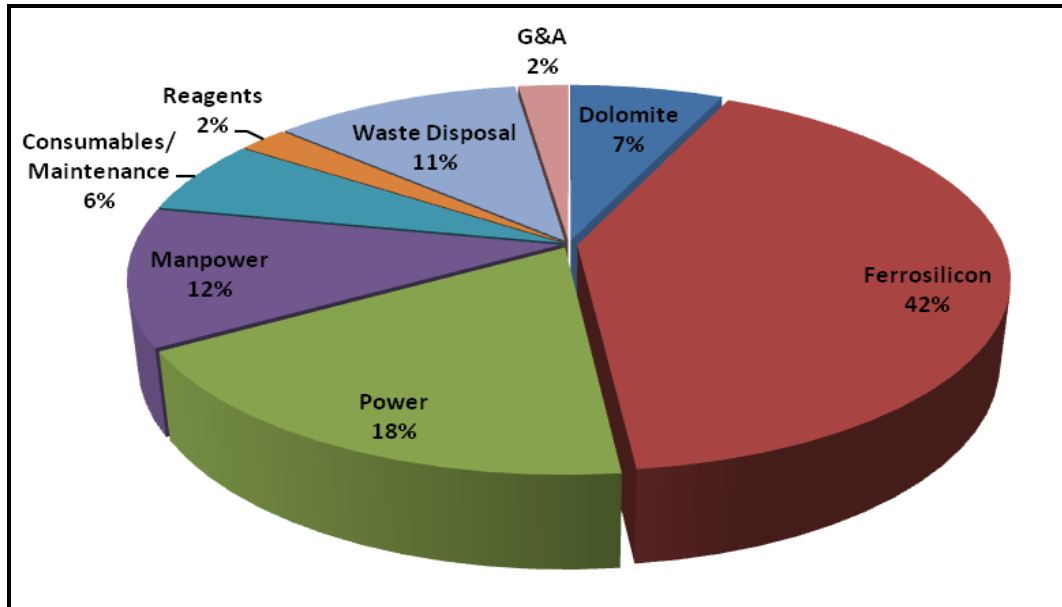
**Table 21.3 Magnesium Process Operating Cost**

Description	Manpower	Consumable/Supply		Operating Cost	
		Consumption kWh, kg/t Mg	Unit Cost \$/kg, /kWh	US\$/a (000s)	\$/lb Mg
<b>G&amp;A</b>					
- Manpower	14			1,338	0.020
- Management Related Expense				550	0.009
<b>Magnesium Plant</b>					
- Dolomite		10,300	18.74	5,784	0.087
- Ferrosilicon		1,008	1.189	35,081	0.530
- Power, including Syngas		16,800*	0.031*	15,500*	0.234*
- Manpower (Magnesium Plant Only)	116			9,849	0.149
- Consumables/Maintenance		varying	varying	5,390	0.081
- Reagents		varying	varying	1,881	0.028
- Waste Disposal				9,348	0.141
<b>Total</b>	<b>130**</b>			<b>84,720</b>	<b>1.281</b>

\*Power consumption/cost based on Magnesium Plant consumption only. Power consumption/cost for Ferrosilicon production, Dolomite quarry operation, etc. is included in the unit and operating costs for those respective areas.

\*\*Manpower head count for Magnesium production and G&A only (130). Manpower assigned to Ferrosilicon (52) and assigned to Power, including Syngas (12) are accounted for in the Unit and Operating Costs for Ferrosilicon and Power, including Syngas.

**Figure 21.1 Magnesium Plant Operating Cost Distribution**



All costs are exclusive of taxes, permitting costs, or other government-imposed costs, unless otherwise noted. The following items have been included in the process operating estimate:

- Labour requirement, including supervision, operation, and maintenance. Salary/wage levels were based on current labour rates including benefit burden of 47% to cover holiday and vacation payment, pension plan, various other benefits, and tool allowance costs.
- Power supply, from on-site coal gasification power plant. The estimated power unit cost (\$0.031/kWh) was prepared by Mr. Jim Sever of Alpha/Omega under the guidance of Dr. Fred Buckingham, Ph. D., P. E. of MPR, and with reference to budgetary power plant quotation from EPIC. The unit cost estimate was exclusive of amortization of the power plant capital cost which is included in the total project budget and major maintenance cost which is budgeted as a sustaining capital cost. The power cost estimate is detailed in Section 21.2.2.
- Ferrosilicon consumption and unit cost. Ferrosilicon consumption and unit cost were estimated by Mr. James Sever, B.S., M.S., M.B.A. of Alpha/Omega Engineering, U. S. of A. and Mr. Ralph Carter, B. S.
- The unit power cost, as above, has been used to estimate the unit ferrosilicon cost. The ferrosilicon unit cost estimate was exclusive of amortization of the ferrosilicon plant capital cost which is included in the total project budget.
- Dolomite supply, including mining, primary crushing and shipping costs.

- Consumables/maintenance, including: major consumables, maintenance supplies and safety supplies for the magnesium plant.
- Regents, including: fluorspar for magnesium reduction and flux for crown refining.
- G&A costs, including: management manpower requirement and general management expenses, and excluding: property and production insurances provided as an allowance in the capital expenditure.
- Waste disposals costs.

### 21.2.2 POWER PLANT OPERATING COSTS AND BASIS

Power unit cost estimate was prepared by Mr. Jim Sever of Alpha/Omega Engineering, U. S. of A. under the guidance of Dr. Fred Buckingham, Ph. D., P. E. of MPR, and with reference to budgetary power plant quotation from EPIC Clean Technologies Corporation.

The location of the Tami-Mosi Facility allows the use of two possible energy sources: natural gas (delivered via a pipeline located near the plant) or PRB coal (delivered via unit train). The main transcontinental rail line for the BNSFR is immediately adjacent to the processing site.

Both energy sources were evaluated for the process. Utilization of coal gasification to generate syngas from PRB coal proved to be the lowest cost option as shown in Table 21.4.

**Table 21.4 Utilization of Coal Gasification**

Fuel Source	Cost per million BTU
Natural Gas	\$6.34
Coal	\$1.88
Coal Syngas	\$2.35

Information regarding coal pricing was obtained from publications of the US Department of Energy. Transportation cost was derived from an example rate for unit train transportation of PRB coal. Operating costs for the gasifier and electric generators was obtained from the estimate provided by EPIC.

Since the power plant is incorporated within the larger Tami-Mosi facility, some traditional expenses such as G&A expenses and manpower costs were included in the magnesium plant cost estimate. The manpower listed in the power plant estimate refers to only those functions that require additional staff for sustained operation. Much of the work will be performed by personnel identified in other operating segments of the facility (e.g. due to incorporation of computer process

control only one control room operator is required to oversee the entire plant operation during normal (steady state) operation.

### *21.2.3 FERROSILICON PLANT OPERATING COSTS AND BASIS*

Ferrosilicon unit cost was estimated by Mr. James Sever, B.S., M.S., MBA of Alpha/Omega Engineering, U. S. of A. and Mr. Ralph Carter, B.S.

Quantities for all consumable materials were derived from performance data at a comparable facility, and cross-checked with information contained in a commercially-generated economic analysis of the ferrosilicon industry.

The costs of the raw materials were obtained from USGS publications and vendor pricing. Transportation costs were added to provide delivered unit cost.

The cost of power was derived from the production cost of the onsite power plant.

Since the majority of the manpower and G&A expense costs are contained within the magnesium plant cost estimate, the man power included in this estimate is the incremental labour required for the inclusion of this facility into the plant.

## 22.0 ECONOMIC ANALYSIS

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Wardrop conducted an economic evaluation of the Project that incorporated all the relevant capital, operating, working, sustaining capital costs, and royalties. The evaluation was based on a pre-tax financial model. Sensitivity analyses were developed to evaluate the project economics. A summary and the details of the economic analysis are provided in Table 22.2 to Table 22.6.

### 22.1 PRINCIPAL ASSUMPTIONS

The production schedule has been incorporated into the 100% equity pre-tax financial model to develop annual recovered metal production from the relationships of tonnage processed, head grades, and recoveries. The model considered a total of 8.8 Mt of resources to be processed over a 30-year LOM.

Revenues were calculated based on market prices. The magnesium price used for the base case is \$2.45/lb, based on the latest negotiated contract tariff spot price in the US ranging between \$2.45 and \$2.65/lb 99.9% Mg (Metal Pages, June 1, 2011). The exchange rate was set at 1.0 US\$:1.0 Cdn\$.

Unit operating costs for mining, processing, site services, G&A, and off-site charges (insurance and royalties) were applied to annual milled tonnages, to determine the overall operating cost. This cost was deducted from revenue to derive annual operating cash flow (i.e. net revenue).

Initial and sustaining capital costs were incorporated on a year-by-year basis over the mine life, and then deducted from the net revenue to determine the net cash flow before taxes. Initial capital expenditures include costs accumulated prior to first production of magnesium ingot, sustaining capital includes expenditures for mining and processing additions, replacement of equipment, and environmental/closure costs.

Working capital is estimated as three months of the first year on-site operating costs. The estimated working capital is applied to the first year of expenditures. The working capital is recovered at the end of the mine life and aggregated with the salvage value contribution and applied towards reclamation during closure.

The revenues projected in the cash flow model were based on the average metal values indicated in Table 22.1.

**Table 22.1 Metal Production from Tami-Mosi Project**

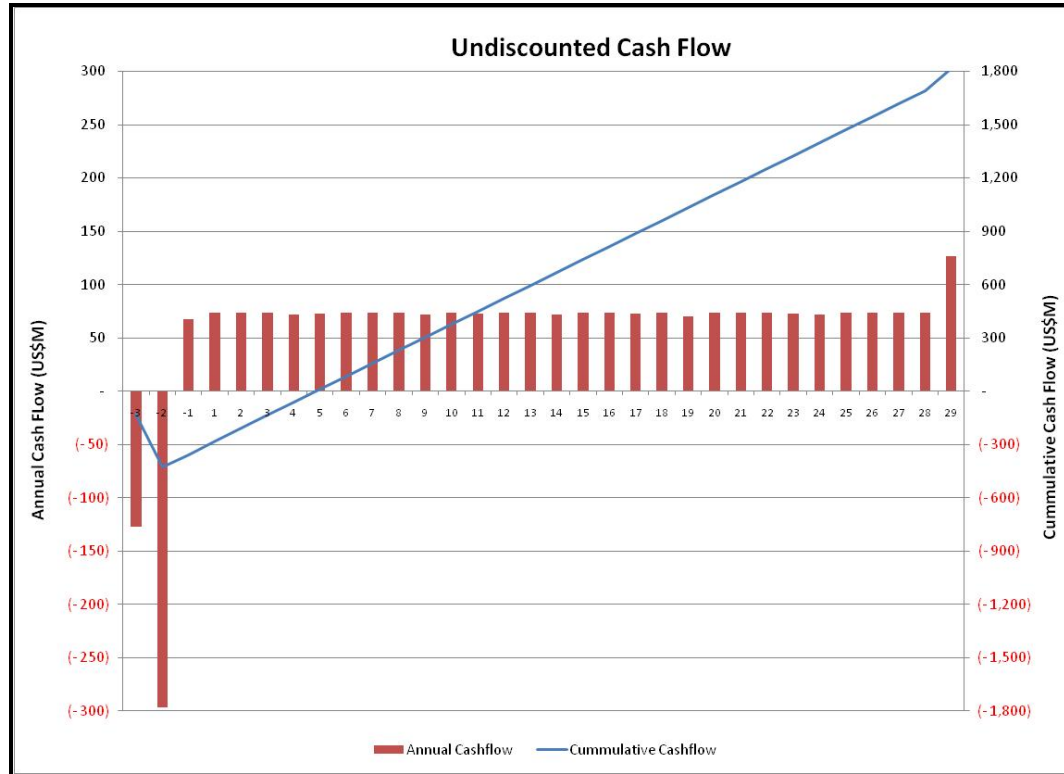
	<b>Years 1 to 5</b>	<b>LOM</b>
Total Tonnes to Mill (000s)	1,470	8,828
Annual Tonnes to Mill (000s)	294	294
<b>Average Grade</b>		
Magnesium (%)	12.60	12.59
<b>Total Production</b>		
Magnesium (000s lb)	330,690	1,984,140
<b>Average Annual Production</b>		
Magnesium (000s lb)	66,138	66,138

## 22.2 CASH FLOW

Initial capital is estimated to be \$424 M with an additional \$84 M in sustaining capital added over the life of the project. The average operating cash flow is estimated at \$78 M/a, after deducting operating costs averaging \$1.28/lb of magnesium.

The undiscounted annual cash flows are illustrated in Figure 22.1.

**Figure 22.1 Undiscounted Annual and Cumulative Cash-Flow**



## 22.3 NET PRESENT VALUE, INTERNAL RATE OF RETURN, AND PAYBACK PERIOD

The pre-tax financial model was established on a 100% equity basis, excluding debt financing and loan interest charges. The financial outcomes have been tabulated for NPV, IRR, payback of capital, and cost per pound of magnesium. Discount rates of 6% and 0% were applied. The results are presented in Table 22.2.



**Table 22.2 Summary of Pre-Tax NPV, IRR & Payback**

	Unit	Base Case
<b>Metal Price</b>		
Magnesium	US\$/lb	2.45
Exchange Rate	US\$:Cdn\$	1.0
<b>Economic Results</b>		
NPV (at 0%)	US\$ M	1,818
NPV (at 6%)	US\$ M	547
IRR	%	16.1
Payback	years	5.9
Cash Cost/lb Mg	US\$/lb	1.28
Total Cost/lb Mg	US\$/lb	1.53

Notes Total costs per pound include all start-up capital, sustaining capital and reclamation/closure costs.

The summary and the details of the economic analysis are provided in Table 22.3 to Table 22.6.

**Table 22.3 Economic Returns**

	Units	Pre-Tax
<b>Project NPV</b>		
8.0% discount rate	million US\$	361
<b>6.0% discount rate</b>	million US\$	<b>547</b>
3.0% discount rate	million US\$	993
0.0% discount rate	million US\$	1,818
<b>Project IRR</b>		<b>16.1%</b>
<b>Payback</b>	Years	5.9
<b>Mine Life</b>	Years	30.0
<b>Operating Cash Flow</b>		
Years 1-5		
Total	million US\$	387
Average	million US\$	77
LOM		
Total	million US\$	2,326
Average	million US\$	78
<b>Capital Costs</b>		
Pre-production (pre-strip)	million US\$	0
Initial Capital	million US\$	424
Working Capital	million US\$	6
Sustaining Capital	million US\$	78
<b>Total Capital Costs</b>	million US\$	<b>508</b>

**Table 22.4 Production Summary**

	Units	Years 1-5	LOM
<b>Material Mined</b>			
Mill Feed	kt	1,470	8,828
Average	kt	294	294
Total Mined	kt	1,599	9,162
Strip Ratio		0.09	0.04
<b>Mill Feed Grade</b>			
Mg	%	12.60	12.59
<b>Magnesium Ingot Production</b>			
Total Mg	klbs	330,690	1,984,140
Average Mg	klbs	66,138	66,138

**Table 22.5 Unit Cost Summary**

	Years 1-5	LOM
Operating Costs	US\$/lb Mg	US\$/lb Mg
Dolomite Mining	0.027	0.025
Dolomite Transport	0.059	0.059
Ferrosilicon	0.530	0.530
Power	0.234	0.234
GA&E	0.029	0.029
Manpower	0.149	0.149
Consumable	0.081	0.081
Reagents	0.028	0.028
Waste Disposal	0.141	0.141
<b>Total Operating Costs</b>	<b>1.279</b>	<b>1.278</b>
<b>Capital Cost/lb Mg</b>		<b>0.256</b>
<b>Total Cost/lb Mg</b>		<b>1.534</b>

**Table 22.6 Economic Analysis Details**

<b>Tami-Mosi Magnesium Project - Pre-Tax Financial Model</b>											
(100% Project Equity)		<== Preproduction ==>									
<b>PEA (30,000 tpa) rev2</b>		Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
<b>Metal Prices</b>		<b>Units</b>									
Magnesium	US\$/lb	-	-	-	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Exchange Rate	US:CDN	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>Mill Feed Production</b>											
Mill Feed Mined	kt	0	0	0	294	294	294	294	294	294	294
Waste Mined	kt	0	0	0	50	25	26	16	12	11	11
Total Mined	kt	0	0	0	344	319	320	310	306	305	305
Total Moved	kt	0	0	0	344	319	320	310	306	305	305
Strip Ratio (waste t : mill feed t)		0.00	0.00	0.00	0.17	0.09	0.09	0.05	0.04	0.04	0.04
Mill Feed Processed	kt	0	0	0	294	294	294	294	294	294	294
Magnesium Grade	%	0.00	0.00	0.00	12.60	12.60	12.60	12.60	12.60	12.60	12.60
<b>Magnesium Ingot Production (99.8% Mg)</b>											
<b>Recovery</b>											
Reduction Conversion Efficiency	%				90.0	90.0	90.0	90.0	90.0	90.0	90.0
Casting Recovery	%				90.0	90.0	90.0	90.0	90.0	90.0	90.0
Total	%				81.0	81.0	81.0	81.0	81.0	81.0	81.0
<b>Metal Recovered</b>											
Magnesium	kilbs				66,138	66,138	66,138	66,138	66,138	66,138	66,138
<b>Cash Flow (US)</b>											
Magnesium Revenues	000's US\$				162,038	162,038	162,038	162,038	162,038	162,038	162,038
<b>Direct Operating Costs</b>											
Dolomite Mining	000's US\$				1,897	1,759	1,761	1,706	1,687	1,680	1,680
Dolomite Transportation	000's US\$				3,889	3,889	3,889	3,889	3,889	3,889	3,889
Ferrosilicon	000's US\$				35,081	35,081	35,081	35,081	35,081	35,081	35,081
Power	000's US\$				15,500	15,500	15,500	15,500	15,500	15,500	15,500
GA&E	000's US\$				1,888	1,888	1,888	1,888	1,888	1,888	1,888
Manpower	000's US\$				9,849	9,849	9,849	9,849	9,849	9,849	9,849
Consumables	000's US\$				5,390	5,390	5,390	5,390	5,390	5,390	5,390
Reagents	000's US\$				1,881	1,881	1,881	1,881	1,881	1,881	1,881
Waste Disposal	000's US\$				9,348	9,348	9,348	9,348	9,348	9,348	9,348
<b>Total Operating Costs</b>	000's US\$				<b>84,722</b>	<b>84,584</b>	<b>84,586</b>	<b>84,530</b>	<b>84,511</b>	<b>84,504</b>	<b>84,505</b>
<b>Operating Cash Flow</b>	000's US\$				<b>77,316</b>	<b>77,454</b>	<b>77,452</b>	<b>77,508</b>	<b>77,527</b>	<b>77,534</b>	<b>77,533</b>

*table continues...*

Tami-Mosi Magnesium Project - Pre-Tax Financial Model												
(100% Project Equity) PEA (30,000 tpa) rev2		<== Preproduction ==>			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	
		Year -3	Year -2	Year -1								
<b>Capital Costs</b>												
Initial Capital	000's US\$	-	127,220	296,846								
Pre-production (Development & Pre-Strip)	000's US\$	-	-	-								
Working Capital	000's US\$				6,281	-	-	-	-	-	-	
Sustaining Capital	000's US\$				3,370	3,670	3,995	4,075	5,375	4,375	3,775	
Sustaining #1	000's US\$				3,370	3,670	3,995	4,075	5,375	4,375	3,775	
Sustaining #2	000's US\$				-	-	-	-	-	-	-	
Sustaining #3	000's US\$				-	-	-	-	-	-	-	
Sustaining #4	000's US\$				-	-	-	-	-	-	-	
Salvage	000's US\$				-	-	-	-	-	-	-	
Sustaining #6	000's US\$				-	-	-	-	-	-	-	
<b>Total Capital Costs</b>	000's US\$	-	127,220	296,846	9,651	3,670	3,995	4,075	5,375	4,375	3,775	
<b>Pre-tax Cash Flow</b>		000's US\$	-	(- 127,220)	(- 296,846)	67,665	73,784	73,457	73,433	72,152	73,159	73,758
	Cumulative	-	(- 127,220)	(- 424,066)	(- 356,401)	(- 282,616)	(- 209,159)	(- 135,726)	(- 63,574)	9,584	83,343	
<b>Unit Costs (US)</b>												
Dolomite Mining	US\$/lb Mg				0.029	0.027	0.027	0.026	0.026	0.025	0.025	
Dolomite Transportation	US\$/lb Mg				0.059	0.059	0.059	0.059	0.059	0.059	0.059	
Ferrosilicon	US\$/lb Mg				0.530	0.530	0.530	0.530	0.530	0.530	0.530	
Power	US\$/lb Mg				0.234	0.234	0.234	0.234	0.234	0.234	0.234	
GA&E	US\$/lb Mg				0.029	0.029	0.029	0.029	0.029	0.029	0.029	
Manpower	US\$/lb Mg				0.149	0.149	0.149	0.149	0.149	0.149	0.149	
Consumables	US\$/lb Mg				0.081	0.081	0.081	0.081	0.081	0.081	0.081	
Reagents	US\$/lb Mg				0.028	0.028	0.028	0.028	0.028	0.028	0.028	
Waste Disposal	US\$/lb Mg				0.141	0.141	0.141	0.141	0.141	0.141	0.141	
<b>Total Unit Operating Cost</b>	US\$/lb Mg				1.281	1.279	1.279	1.278	1.278	1.278	1.278	
<b>Total Unit Capital Cost</b>	US\$/lb Mg											
<b>Total Unit Cost</b>	US\$/lb Mg											

table continues...

<b>Tami-Mosi Magnesium Project - Pre-Tax Financial Model</b>											
<b>(100% Project Equity)</b>											
<b>PEA (30,000 tpa) rev2</b>		<b>Year 8</b>	<b>Year 9</b>	<b>Year 10</b>	<b>Year 11</b>	<b>Year 12</b>	<b>Year 13</b>	<b>Year 14</b>	<b>Year 15</b>	<b>Year 16</b>	<b>Year 17</b>
<b>Metal Prices</b>		<b>Units</b>									
Magnesium	US\$/lb	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Exchange Rate	US:CDN	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>Mill Feed Production</b>											
Mill Feed Mined	kt	294	294	294	294	294	294	294	294	294	294
Waste Mined	kt	11	11	11	10	10	12	12	12	9	9
Total Mined	kt	305	305	304	304	304	306	306	306	304	304
Total Moved	kt	305	305	304	304	304	306	306	306	304	304
Strip Ratio (waste t : mill feed t)		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03
Mill Feed Processed	kt	294	294	294	294	294	294	294	294	294	294
Magnesium Grade	%	12.60	12.60	12.60	12.60	12.60	12.60	12.60	12.60	12.59	12.59
<b>Magnesium Ingot Production (99.8% Mg)</b>											
<b>Recovery</b>											
Reduction Conversion Efficiency	%	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
Casting Recovery	%	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
Total	%	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0
<b>Metal Recovered</b>											
Magnesium	klbs	66,138	66,138	66,138	66,138	66,138	66,138	66,138	66,138	66,138	66,138
<b>Cash Flow (US)</b>											
Magnesium Revenues	000's US\$	162,038	162,038	162,038	162,038	162,038	162,038	162,038	162,038	162,038	162,038
<b>Direct Operating Costs</b>											
Dolomite Mining	000's US\$	1,682	1,682	1,678	1,676	1,677	1,687	1,687	1,686	1,673	1,673
Dolomite Transportation	000's US\$	3,889	3,889	3,889	3,889	3,889	3,889	3,889	3,889	3,892	3,892
Ferrosilicon	000's US\$	35,081	35,081	35,081	35,081	35,081	35,081	35,081	35,081	35,081	35,081
Power	000's US\$	15,500	15,500	15,500	15,500	15,500	15,500	15,500	15,500	15,500	15,500
GA&E	000's US\$	1,888	1,888	1,888	1,888	1,888	1,888	1,888	1,888	1,888	1,888
Manpower	000's US\$	9,849	9,849	9,849	9,849	9,849	9,849	9,849	9,849	9,849	9,849
Consumables	000's US\$	5,390	5,390	5,390	5,390	5,390	5,390	5,390	5,390	5,390	5,390
Reagents	000's US\$	1,881	1,881	1,881	1,881	1,881	1,881	1,881	1,881	1,881	1,881
Waste Disposal	000's US\$	9,348	9,348	9,348	9,348	9,348	9,348	9,348	9,348	9,348	9,348
<b>Total Operating Costs</b>	<b>000's US\$</b>	<b>84,506</b>	<b>84,506</b>	<b>84,502</b>	<b>84,501</b>	<b>84,502</b>	<b>84,512</b>	<b>84,512</b>	<b>84,511</b>	<b>84,501</b>	<b>84,501</b>
<b>Operating Cash Flow</b>	<b>000's US\$</b>	<b>77,532</b>	<b>77,532</b>	<b>77,536</b>	<b>77,537</b>	<b>77,537</b>	<b>77,526</b>	<b>77,526</b>	<b>77,527</b>	<b>77,537</b>	<b>77,537</b>

table continues...

Tami-Mosi Magnesium Project - Pre-Tax Financial Model											
(100% Project Equity) PEA (30,000 tpa) rev2		Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17
Capital Costs											
Initial Capital	000's US\$										
Pre-production (Development & Pre-Strip)	000's US\$										
Working Capital	000's US\$	-	-	-	-	-	-	-	-	-	-
Sustaining Capital	000's US\$	4,060	4,210	5,860	3,810	4,410	3,760	4,110	5,860	4,060	3,760
Sustaining #1	000's US\$	4,060	4,210	5,860	3,810	4,410	3,760	4,110	5,860	4,060	3,760
Sustaining #2	000's US\$	-	-	-	-	-	-	-	-	-	-
Sustaining #3	000's US\$	-	-	-	-	-	-	-	-	-	-
Sustaining #4	000's US\$	-	-	-	-	-	-	-	-	-	-
Salvage	000's US\$	-	-	-	-	-	-	-	-	-	-
Sustaining #6	000's US\$	-	-	-	-	-	-	-	-	-	-
Total Capital Costs	000's US\$	4,060	4,210	5,860	3,810	4,410	3,760	4,110	5,860	4,060	3,760
Pre-tax Cash Flow		000's US\$	73,472	73,322	71,676	73,727	73,127	73,766	73,416	71,667	73,477
Cumulative		156,814	230,136	301,812	375,539	448,665	522,431	595,848	667,514	740,992	814,769

**Unit Costs (US)**

Dolomite Mining	US\$/lb Mg	0.025	0.025	0.025	0.025	0.025	0.026	0.026	0.025	0.025	0.025
Dolomite Transportation	US\$/lb Mg	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059
Ferrosilicon	US\$/lb Mg	0.530	0.530	0.530	0.530	0.530	0.530	0.530	0.530	0.530	0.530
Power	US\$/lb Mg	0.234	0.234	0.234	0.234	0.234	0.234	0.234	0.234	0.234	0.234
GA&E	US\$/lb Mg	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029
Manpower	US\$/lb Mg	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149
Consumables	US\$/lb Mg	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081
Reagents	US\$/lb Mg	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
Waste Disposal	US\$/lb Mg	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141
<b>Total Unit Operating Cost</b>	US\$/lb Mg	<b>1.278</b>	<b>1.278</b>	<b>1.278</b>	<b>1.278</b>	<b>1.278</b>	<b>1.278</b>	<b>1.278</b>	<b>1.278</b>	<b>1.278</b>	<b>1.278</b>
<b>Total Unit Capital Cost</b>	US\$/lb Mg										
<b>Total Unit Cost</b>	US\$/lb Mg										

table continues...

**Tami-Mosi Magnesium Project - Pre-Tax Financial Model**

(100% Project Equity) PEA (30,000 tpa) rev2	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27
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Metal Prices	Units									
Magnesium	US\$/lb	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Exchange Rate	US:CDN	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

**Mill Feed Production**

Mill Feed Mined	kt	294	294	294	294	294	295	295	295	295
Waste Mined	kt	9	8	8	8	8	5	5	5	4
Total Mined	kt	304	302	302	302	302	300	299	299	299
Total Moved	kt	304	302	302	302	302	300	299	299	299
Strip Ratio (waste t : mill feed t)		0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.01
Mill Feed Processed	kt	294	294	294	294	294	295	295	295	295
Magnesium Grade	%	12.59	12.58	12.58	12.58	12.58	12.57	12.57	12.57	12.55

**Magnesium Ingot Production (99.8% Mg)**

<b>Recovery</b>										
Reduction Conversion Efficiency	%	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
Casting Recovery	%	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
Total	%	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0
<b>Metal Recovered</b>										
Magnesium	kilbs	66,138	66,138	66,138	66,138	66,138	66,138	66,138	66,138	66,138

**Cash Flow (US)**

<b>Magnesium Revenues</b>	000's US\$	<b>162,038</b>	<b>162,038</b>	<b>162,038</b>	<b>162,038</b>	<b>162,038</b>	<b>162,038</b>	<b>162,038</b>	<b>162,038</b>	<b>162,038</b>
<b>Direct Operating Costs</b>										
Dolomite Mining	000's US\$	1,673	1,667	1,664	1,664	1,664	1,650	1,650	1,650	1,645
Dolomite Transportation	000's US\$	3,892	3,894	3,895	3,895	3,895	3,898	3,898	3,898	3,904
Ferrosilicon	000's US\$	35,081	35,081	35,081	35,081	35,081	35,081	35,081	35,081	35,081
Power	000's US\$	15,500	15,500	15,500	15,500	15,500	15,500	15,500	15,500	15,500
GA&E	000's US\$	1,888	1,888	1,888	1,888	1,888	1,888	1,888	1,888	1,888
Manpower	000's US\$	9,849	9,849	9,849	9,849	9,849	9,849	9,849	9,849	9,849
Consumables	000's US\$	5,390	5,390	5,390	5,390	5,390	5,390	5,390	5,390	5,390
Reagents	000's US\$	1,881	1,881	1,881	1,881	1,881	1,881	1,881	1,881	1,881
Waste Disposal	000's US\$	9,348	9,348	9,348	9,348	9,348	9,348	9,348	9,348	9,348
<b>Total Operating Costs</b>	000's US\$	<b>84,501</b>	<b>84,496</b>	<b>84,495</b>	<b>84,495</b>	<b>84,495</b>	<b>84,484</b>	<b>84,484</b>	<b>84,484</b>	<b>84,485</b>
<b>Operating Cash Flow</b>	000's US\$	<b>77,537</b>	<b>77,542</b>	<b>77,543</b>	<b>77,543</b>	<b>77,543</b>	<b>77,554</b>	<b>77,554</b>	<b>77,554</b>	<b>77,553</b>

table continues...

<b>Tami-Mosi Magnesium Project - Pre-Tax Financial Model</b>											
<b>(100% Project Equity)</b>											
<b>PEA (30,000 tpa) rev2</b>		<b>Year 18</b>	<b>Year 19</b>	<b>Year 20</b>	<b>Year 21</b>	<b>Year 22</b>	<b>Year 23</b>	<b>Year 24</b>	<b>Year 25</b>	<b>Year 26</b>	<b>Year 27</b>
<b>Capital Costs</b>											
Initial Capital	000's US\$										
Pre-production (Development & Pre-Strip)	000's US\$										
Working Capital	000's US\$	-	-	-	-	-	-	-	-	-	-
Sustaining Capital	000's US\$	4,560	3,760	7,360	4,160	4,060	3,760	4,460	5,410	4,060	4,260
Sustaining #1	000's US\$	4,560	3,760	7,360	4,160	4,060	3,760	4,460	5,410	4,060	4,260
Sustaining #2	000's US\$	-	-	-	-	-	-	-	-	-	-
Sustaining #3	000's US\$	-	-	-	-	-	-	-	-	-	-
Sustaining #4	000's US\$	-	-	-	-	-	-	-	-	-	-
Salvage	000's US\$	-	-	-	-	-	-	-	-	-	-
Sustaining #6	000's US\$	-	-	-	-	-	-	-	-	-	-
<b>Total Capital Costs</b>	000's US\$	<b>4,560</b>	<b>3,760</b>	<b>7,360</b>	<b>4,160</b>	<b>4,060</b>	<b>3,760</b>	<b>4,460</b>	<b>5,410</b>	<b>4,060</b>	<b>4,260</b>
<b>Pre-tax Cash Flow</b>	000's US\$	<b>72,977</b>	<b>73,782</b>	<b>70,183</b>	<b>73,383</b>	<b>73,483</b>	<b>73,794</b>	<b>73,094</b>	<b>72,144</b>	<b>73,494</b>	<b>73,293</b>
	Cumulative	887,746	961,528	1,031,711	1,105,095	1,178,578	1,252,372	1,325,466	1,397,610	1,471,104	1,544,397

**Unit Costs (US)**

Dolomite Mining	US\$/lb Mg	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Dolomite Transportation	US\$/lb Mg	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059
Ferrosilicon	US\$/lb Mg	0.530	0.530	0.530	0.530	0.530	0.530	0.530	0.530	0.530	0.530
Power	US\$/lb Mg	0.234	0.234	0.234	0.234	0.234	0.234	0.234	0.234	0.234	0.234
GA&E	US\$/lb Mg	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029
Manpower	US\$/lb Mg	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149
Consumables	US\$/lb Mg	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081
Reagents	US\$/lb Mg	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
Waste Disposal	US\$/lb Mg	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141
<b>Total Unit Operating Cost</b>	US\$/lb Mg	<b>1.278</b>	<b>1.278</b>	<b>1.278</b>	<b>1.278</b>	<b>1.278</b>	<b>1.277</b>	<b>1.277</b>	<b>1.277</b>	<b>1.277</b>	<b>1.277</b>
<b>Total Unit Capital Cost</b>	US\$/lb Mg										
<b>Total Unit Cost</b>	US\$/lb Mg										

table continues...



Tami-Mosi Magnesium Project - Pre-Tax Financial Model				
(100% Project Equity)				
PEA (30,000 tpa) rev2	Year 28	Year 29	Year 30	TOTAL/AVG

Metal Prices		Units			
Magnesium	US\$/lb	2.45	2.45	2.45	2.45
Exchange Rate	US:CDN	1.00	1.00	1.00	1.00

Mill Feed Production					
Mill Feed Mined	kt	295	295	295	8,828
Waste Mined	kt	3	3	3	334
Total Mined	kt	299	299	299	9,162
Total Moved	kt	299	299	299	9,162
Strip Ratio (waste t : mill feed t)		0.01	0.01	0.01	0.04
Mill Feed Processed	kt	295	295	295	8,828
Magnesium Grade	%	12.55	12.55	12.55	12.59

Magnesium Ingot Production (99.8% Mg)					
<b>Recovery</b>					
Reduction Conversion Efficiency	%	90.0	90.0	90.0	90.0
Casting Recovery	%	90.0	90.0	90.0	90.0
Total	%	81.0	81.0	81.0	81.0
<b>Metal Recovered</b>					
Magnesium	kilbs	66,138	66,138	66,138	1,984,140

Cash Flow (US)					
Magnesium Revenues	000's US\$	162,038	162,038	162,038	4,861,143
<b>Direct Operating Costs</b>					
Dolomite Mining	000's US\$	1,645	1,645	1,645	50,483
Dolomite Transportation	000's US\$	3,904	3,904	3,904	116,798
Ferrosilicon	000's US\$	35,081	35,081	35,081	1,052,418
Power	000's US\$	15,500	15,500	15,500	464,999
GA&E	000's US\$	1,888	1,888	1,888	56,630
Manpower	000's US\$	9,849	9,849	9,849	295,467
Consumables	000's US\$	5,390	5,390	5,390	161,690
Reagents	000's US\$	1,881	1,881	1,881	56,427
Waste Disposal	000's US\$	9,348	9,348	9,348	280,442
<b>Total Operating Costs</b>	000's US\$	<b>84,485</b>	<b>84,485</b>	<b>84,485</b>	<b>2,535,355</b>
<b>Operating Cash Flow</b>	000's US\$	<b>77,553</b>	<b>77,553</b>	<b>77,553</b>	<b>2,325,788</b>

table continues...

Tami-Mosi Magnesium Project - Pre-Tax Financial Model					
(100% Project Equity)					
PEA (30,000 tpa) rev2		Year 28	Year 29	Year 30	TOTAL/AVG
<b>Capital Costs</b>					
Initial Capital	000's US\$				424,066
Pre-production (Development & Pre-Strip)	000's US\$				-
Working Capital	000's US\$	-	-	(- 6,281)	-
Sustaining Capital	000's US\$	4,060	3,760	(- 42,407)	83,798
Sustaining #1	000's US\$	4,060	3,760	-	126,205
Sustaining #2	000's US\$	-	-	-	-
Sustaining #3	000's US\$	-	-	-	-
Sustaining #4	000's US\$	-	-	-	-
Salvage	000's US\$	-	-	(- 42,407)	(- 42,407)
Sustaining #6	000's US\$	-	-	-	-
<b>Total Capital Costs</b>	000's US\$	<b>4,060</b>	<b>3,760</b>	<b>(- 48,688)</b>	<b>507,864</b>
<b>Pre-tax Cash Flow</b>	000's US\$	<b>73,493</b>	<b>73,793</b>	<b>126,241</b>	<b>1,817,924</b>
Cumulative		1,617,890	1,691,683	1,817,924	

**Unit Costs (US)**

Dolomite Mining	US\$/lb Mg	0.025	0.025	0.025	0.025
Dolomite Transportation	US\$/lb Mg	0.059	0.059	0.059	0.059
Ferrosilicon	US\$/lb Mg	0.530	0.530	0.530	0.530
Power	US\$/lb Mg	0.234	0.234	0.234	0.234
GA&E	US\$/lb Mg	0.029	0.029	0.029	0.029
Manpower	US\$/lb Mg	0.149	0.149	0.149	0.149
Consumables	US\$/lb Mg	0.081	0.081	0.081	0.081
Reagents	US\$/lb Mg	0.028	0.028	0.028	0.028
Waste Disposal	US\$/lb Mg	0.141	0.141	0.141	0.141
<b>Total Unit Operating Cost</b>	US\$/lb Mg	<b>1.277</b>	<b>1.277</b>	<b>1.277</b>	<b>1.278</b>
<b>Total Unit Capital Cost</b>	US\$/lb Mg				<b>0.256</b>
<b>Total Unit Cost</b>	US\$/lb Mg				<b>1.534</b>

## 22.4 TAXES AND ROYALTIES

No taxes or royalties were applied to the Tami-Mosi mining leases of interest in this study.

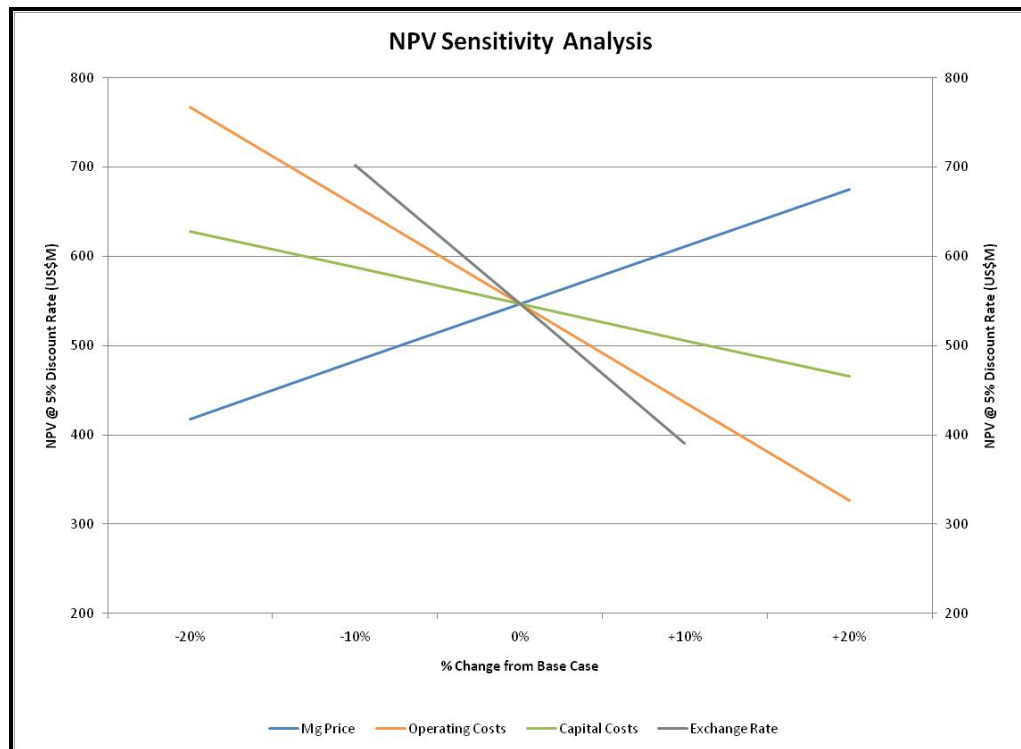
## 22.5 SENSITIVITY

Sensitivity analyses were carried out on the following parameters:

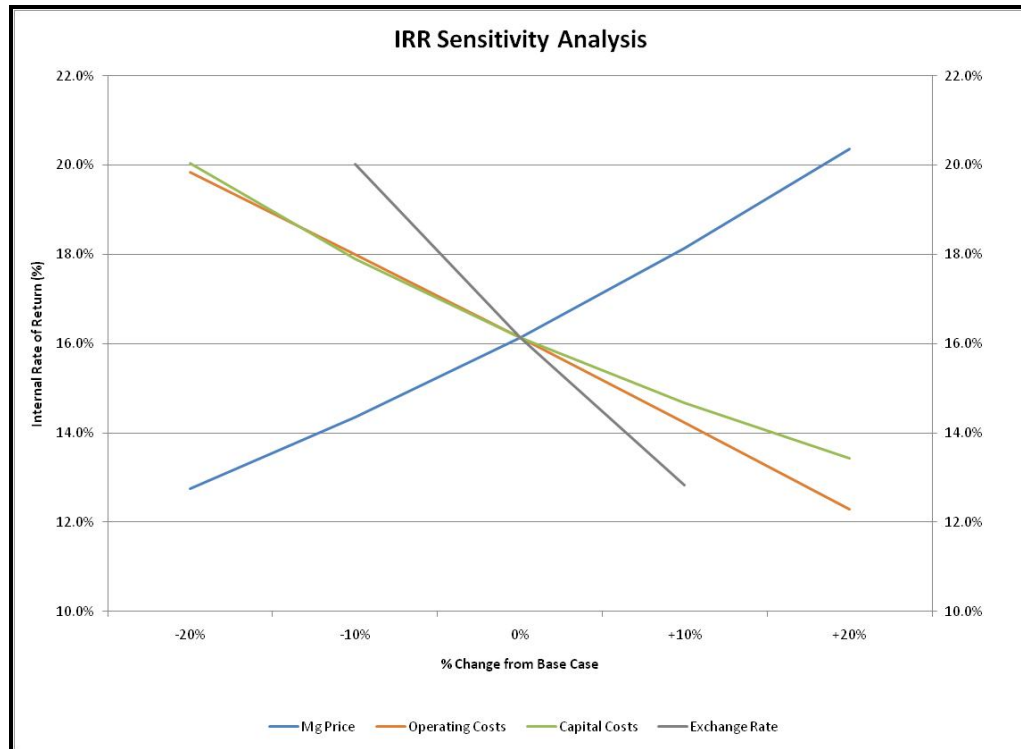
- magnesium metal price
- initial capital expenditure
- on-site operating costs
- exchange rate.

The analyses are presented graphically as financial outcomes in terms of NPV and IRR. The project NPV is most sensitive to operating costs, followed by exchange rate and magnesium price, while the project IRR is most sensitive to magnesium price, followed by operating costs and capital. The NPV and IRR sensitivities are shown in Figure 22.2 and Figure 22.3.

**Figure 22.2 NPV Sensitivity Analysis**



**Figure 22.3 IRR Sensitivity Analysis**



## 22.6 CONCLUSION AND RECOMMENDATIONS

A pre-tax economic evaluation of the Project incorporating all the relevant capital, operating, working, sustaining costs, and royalties was developed. Using a base case price of \$2.45/lb, the 30-year production period processes 8.8 Mt of resources resulting in the following economic returns:

- 16.1% IRR
- 5.9-year payback on US\$424 M capital
- US\$547 M NPV at 6% discount value.

The potential for increasing the value of the project, through increased processed resources and production rates, can be assessed in future studies. The current plan involves processing only small amounts of the total resource; increasing the production rate should lower operating costs, which is one of the more sensitive parameters on the project economics.

## 23.0 ADJACENT PROPERTIES

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The Tami-Mosi property is considered to be within the Carlin Trend although considerably removed to the south.

There are three notable properties in proximity to the Tami-Mosi claims. Just southwest (north) of Ely, the Ruth Mine, recently run by Magna Copper Inc., is 15 km from the Tami-Mosi Property. The Taylor Mine is a silver mine adjacent to the Property to the south. The Taylor deposit is considered to be a typical Carlin Trend deposit high in silver.

Finally, the Duer Mine is a small operation that recovered gold, silver and manganese. This mine has not been operating for more than 60 years. Patented claims remain on this property; these are surrounded by the Tami-Mosi claims.

## 24.0 OTHER REVEVANT DATA

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This section is not applicable to this report.

## 25.0 INTERPRETATION AND CONCLUSIONS

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Molycor retained Wardrop together with a number of specialists with expertise in the magnesium, ferrosilicon and power generation industries to complete this PEA for a proposed 30,000 t/a magnesium project. This report has been prepared to an accuracy level of +50% / -25%.

The current study should be followed by a prefeasibility study, to further assess the technical and economic viability of the Project.

### 25.1 PROJECT ECONOMICS

Wardrop developed a pre-tax economic evaluation of the Project that incorporated all the relevant capital, operating, working, sustaining costs, and royalties was developed. Using a base case magnesium price of US\$2.45/lb, the 30-year production period processes 8.8 Mt of resources, generating 30 kt/a, 99.9% Mg ingot, resulted in the following economic returns:

- 16.1% IRR
- 5.9-year payback on \$424 M capital
- \$547 M NPV at 6% discount value.

The current plan only processes a small amount of the total resource while ramping up the production rate should lower the operating costs, which is one of the more sensitive parameters on the project economics.

### 25.2 GEOLOGY

The Tami-Mosi Project shows promise as a magnesium producer selling into the US domestic market.

Dolomite outcrop is plentiful on the property. Surface continuation was established by field-mapping in 2010, which identified boundaries between limestone and dolomite areas. The dolomite within these boundaries was conceptualized as a wireframe. The upper-most 200 m of this wireframe was interpolated as a block model, which yielded an Inferred Resource of 412 Mt of dolomite at an average grade of 12.3% Mg above a cut-off of 12%.

Due to the speculative nature of Inferred resources, there is no certainty that these resources will be realized. More drilling is required to convert Inferred Resources into Indicated and Measured, to quantify possible reserves in future studies.

## 25.3 MINING

An open-pit was designed containing 8.8 Mt of resource which is enough material for the proposed processing site to produce 30 kt/a Mg over 30 years of production. This represents only a small portion of the overall resource available so future expansion is easily achievable.

## 25.4 METALLURGY AND PROCESS

### 25.4.1 *METALLURGICAL TESTING*

The test work showed that the drill core samples tested by Hazen are mainly dolomite, containing 19.8% to 21.6% MgO. The  $\text{MgCO}_3$  of the dolomite can be differentially decomposed at approximately 800°C. The results appear to indicate that the chemical composition of the Tami-Mosi dolomite is favourable to magnesium recovery by conventional processes.

### 25.4.2 *PROCESS*

Vertical integration of the magnesium process with coal gasification power plant and ferrosilicon plant is preliminarily estimated to be low in terms of contribution to the overall operating cost, and capable of maintaining the stability and consistency of the magnesium production operation. Coal gasification coupled with syngas fired turbine generator and a waste heat steam turbine generator will generate electric power, steam and syngas which are required for the magnesium production and processing site ancillary requirements.

The modified Bolzano Process would offer one of the best approaches for magnesium ingot production through dolomite reduction. Further studies should be conducted to assess the optimum process for the magnesium recovery from the dolomite.

## 25.5 MARKET STUDIES AND CONTRACTS

The project timing seems to be very good for the establishment of a new source of primary magnesium located in the US, and with direct access to US-based magnesium die casters in particular. There is a steady upward pressure on world prices. China is experiencing increased production costs due to increases in labour costs, electricity costs, and environmental regulations. The internal Chinese export



tax on magnesium and magnesium alloys is a further cost burden for the Chinese producers servicing the world market.

## 25.6 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

A multi-agency permitting and approval process must be completed to allow Molycor to construct, operate and close the Tami-Mosi Project in accordance with all applicable federal, state and local regulations. This program will include the acquisition of permits and approvals from various regulatory agencies. The program will be planned to align with project progression.

## 26.0 RECOMMENDATIONS

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This section outlines a number of potential project improvements and opportunities. A prefeasibility study is recommended to pursue these recommendations and further develop the project definition. A high-level budgetary estimate for the completion of each recommended item is provided.

### 26.1 RECOMMENDATIONS

#### 26.1.1 *PROJECT ECONOMICS*

The overall value of the project may be increased by increasing the rate of production. This PEA contemplates the processing of a small percentage of the total resource. Increasing the production rate should lower operating costs, which is one of the most sensitive parameters of the project economics.

Further recommendations include the following:

- secure detailed quotations, including transportation costs, to acquire raw materials, and then construct a rigorous mass and energy balance across all unit operations in the proposed plant to validate the operating cost model, and clarify areas which can be improved upon
- perform a cost/benefit analysis on possible changes to the process that may lead to improved unit production cost
- compare costs and associated engineering requirements for stick-built versus pre-engineered buildings
- contact potential users for waste streams and convert them into co products.

The estimated budget for these future works is approximately \$200,000.

#### 26.1.2 *GEOLOGY*

The northern extent of the wireframe model was based on the location of a fault crossing the property. Surface mapping showed that dolomite without noticeable limestone contamination occurs north of this fault. No drilling information is currently available from this area.

Wardrop recommends conducting a drill program consisting of 15 drill-holes in this area. This program will include:

- three drillcore holes on the periphery of the area of interest to confirm the geology
- twelve rotary percussion reverse circulation holes as infill drilling to define the grade more accurately.

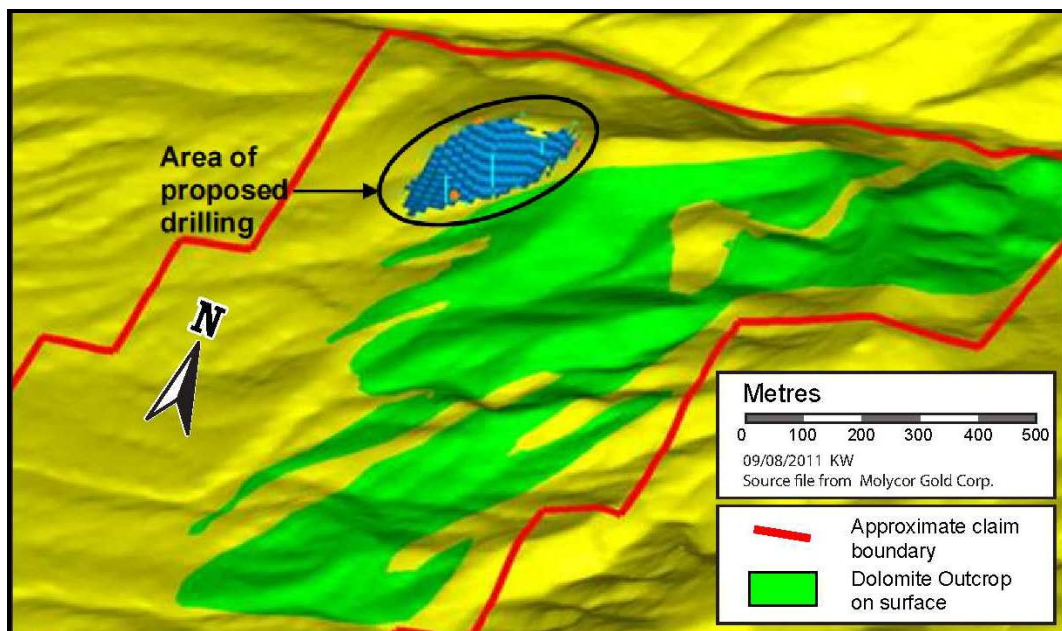
The approximate locations of recommended core holes are shown in Figure 26.1; the actual collar locations will be determined by the geologist on site. The location of the recommended reverse circulation holes will be determined following completion of the core holes the results of assays from the extracted cores are favourable.

Cost estimates for these recommended drill-holes are:

- three NQ core holes, estimated to cost \$360/m, with maximum depths of 200 m: \$72,000 per drill-hole for a total of \$216,000
- twelve rotary percussion reverse circulation holes, estimated to cost \$260/m, with maximum depths of 200 m: \$52,000 per drill-hole, for a total of \$624,000.

Total project cost for all 15 drill-holes is estimated to be \$840,000.

**Figure 26.1 Recommended Locations of Core Holes**



### 26.1.3 MINING

An open pit, containing 8.8 Mt of resource, was designed to produce 30 kt/a of magnesium over 30 years of production. The design will mine only a small portion of the overall resource available; future expansion is easily achievable. A production

rate increase would likely benefit the projects economics and should be assessed in future studies.

Further recommendations include the following:

- Detail the usage of the reduction residue for staging areas and roadways.
- Review local labour and supply costs, as well as services and support, for a mining operation in the project area.
- Develop more detailed cost estimates for G&A, mining operating and capital, and infrastructure capital (power distribution, roads, sedimentation structures, field facilities in the mine area, etc.).
- Investigate efficiency/cost of using pit-run grizzly and transporting -30 cm to process plant for all size reduction.
- Detail reclamation designs and costs to minimize the project impact and optimize future closure costs.
- Define a contractor to provide transportation of the product to the reduction plant, and obtain a detailed cost estimate for these services.
- Investigate the opportunity to utilize the existing narrow gauge railroad as an alternative to trucking.

The estimated budget for these future works is approximately \$100,000.

#### 26.1.4 *METALLURGY AND PROCESS*

Wardrop recommends further test work to investigate the optimum magnesium reduction process technology, the effect of impurities of the mineralization on recovery of magnesium, and process-related parameters. The major parameters, including those concerning calcination and mill feed, to be defined through this bench scale test program are:

- impact of the degree of calcination of the dolomite on productivity and yield
- briquette geometry and process parameters as they impact heat transfer, friability and permeability to magnesium vapour
- furnace operating conditions such as reduction temperature and pressure to define optimum productivity and yield
- condenser structure and operating parameters to optimize recovery and purity.

The estimated budget for this test work is approximately \$500,000.

#### 26.1.5 INFRASTRUCTURE

The power plant is a key element of the vertically-integrated processing site. Wardrop recommends process modeling and development of the process definition for the power plant, to properly define the equipment and operation of the power plant.

The estimated budget for this modeling and development is approximately \$250,000.

The ferrosilicon plant is also a key element of the vertical integration of the processing site; Wardrop recommends assessing economic benefit of the ferrosilicon plant by conducting a pilot test to evaluate and select the raw materials, and to define the process and operating parameters required to produce ferrosilicon using the same type of coal that will be used in the power plant.

Wardrop recommends the following investigations:

- Select and commission an engineering group specializing in ferro-alloy production to design the proposed ferrosilicon facility.
- Identify and quantify the necessary raw materials.
- Obtain a current worldwide production cost report for all ferrosilicon producers, and update the cost model accordingly.
- Identify and hire a vender to provide the operating and commissioning technology for the ferrosilicon plant.

The estimated budget for this modeling and development is approximately \$230,000.

#### 26.1.6 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

A multi-agency permitting and approval process must be completed to allow Molycor to construct, operate and close the Tami-Mosi Project. This program will include the acquisition of permits and approvals from various regulatory agencies.

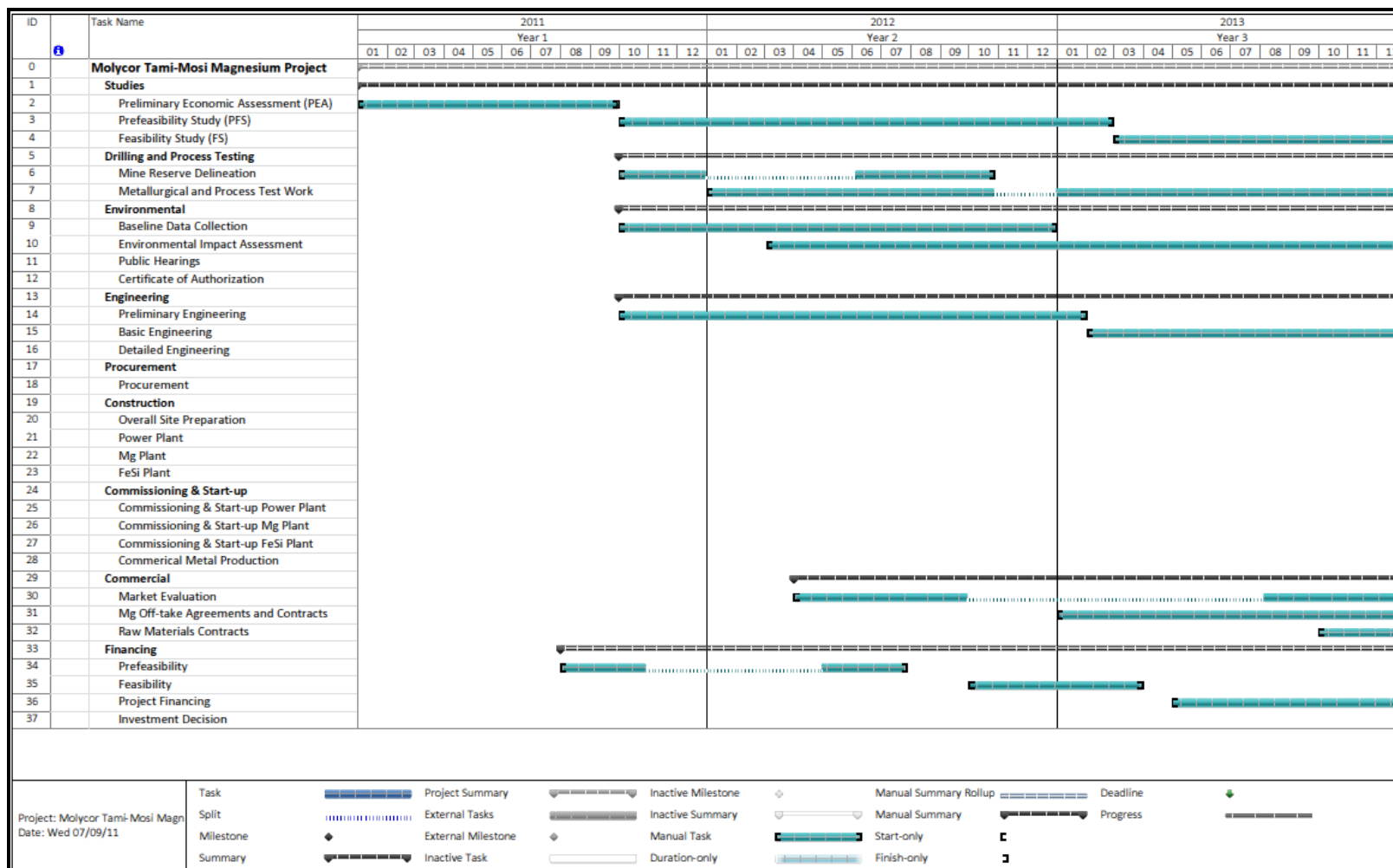
To streamline the permitting process, and to identify the specific permits and approvals required, Wardrop recommends that representatives of Molycor hold formal scoping meetings with appropriate personnel from BLM and the NDEP, BMRR, the lead agency and cooperating agency, respectively. These meetings will provide an opportunity to review all proposed project activities and issues, including the identification of the required federal, state and local permits and approvals. In addition, these meetings will provide an opportunity to discuss the appropriate environmental documentation program under NEPA, and establish a schedule to complete the permitting and approval process.

The estimated budget for these permitting and approval activities is approximately \$450,000.

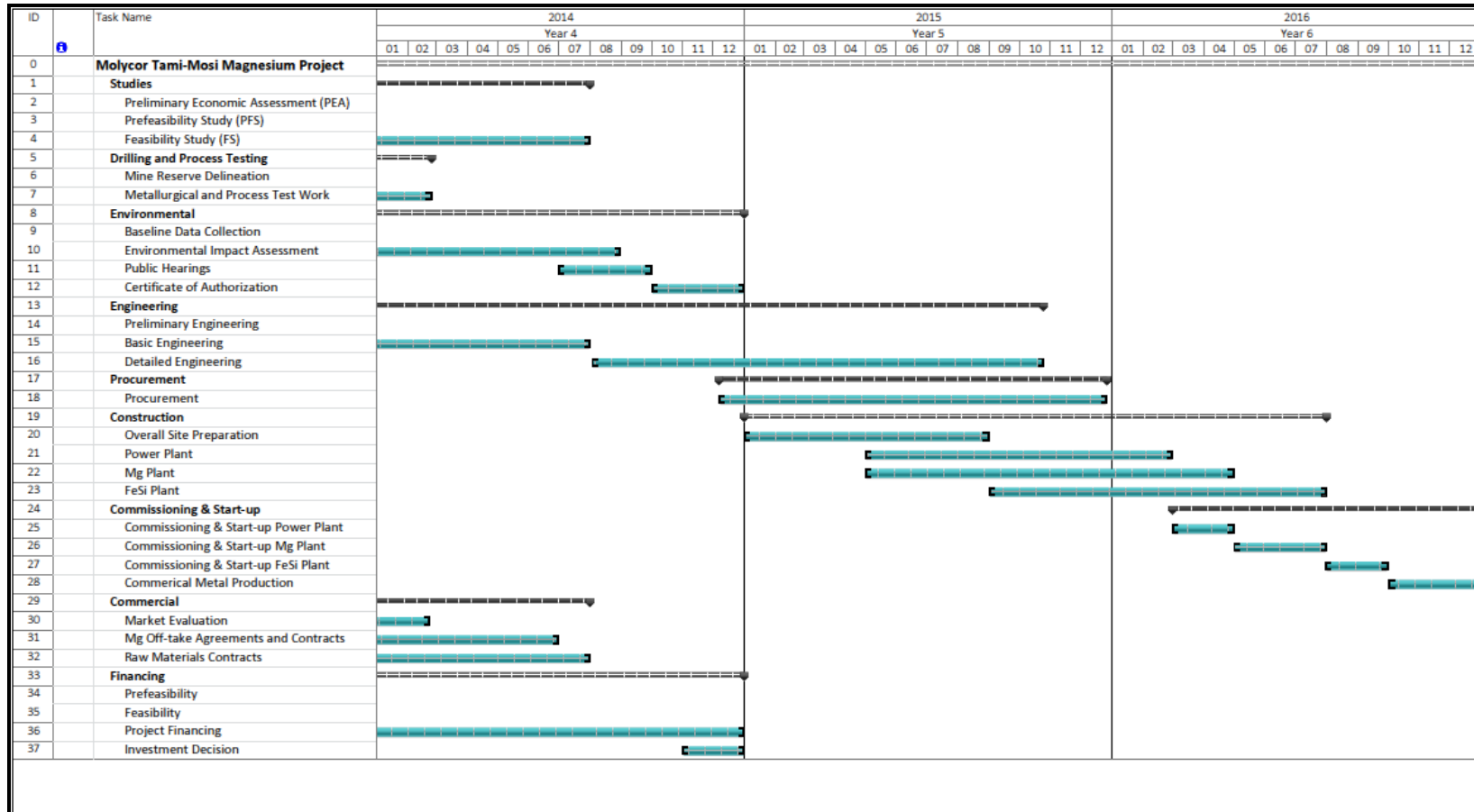
#### 26.1.7 PROJECT SCHEDULE

A preliminary high-level project schedule has been prepared for the Tami-Mosi Magnesium Project. This schedule is provided in Table 26.1.

**Table 26.1 Preliminary High Level Project Schedule**



*schedule continues...*





## 26.2 OPPORTUNITIES

The result of the economic analysis provided in this PEA indicated an operating cost of \$1.281/lb Mg.

A number of opportunities have been identified to potentially improve the overall project economics by reducing operating costs and/or increasing revenues. These potential opportunities have not been included in the cost estimates or economic analyses provided in this PEA.

Exploration of these opportunities will require additional studies, trade-off analyses, and in many cases bench and/or pilot testing. These opportunities and their potential economic benefit to the project are pre-scoping estimates only; the economic benefits of these opportunities are subject to trade-off studies.

The potential economics of these opportunities have been divided into product cost opportunities and revenue opportunities.

Some of the product cost opportunities are:

- Operational improvements:
  - Specification versus Actual Magnesium Furnace Throughput – Optimize the magnesium process to utilize the total magnesium furnace capacity of 4 t/h for each furnace group, versus the designed process throughput of only 3.5 t/h.
- Raw materials:
  - Quartz – Source a local quartz deposit capable of producing the required ferrosilicon plant raw material
  - Coal – Replace metallurgical coal requirement with PRB coal in the ferrosilicon production process
  - Reagent – Eliminate fluorspar from the reduction process
  - Soderburg Past Production – Produce Soderburg electrode paste with power plant coal tar as raw material.
- Process change:
  - Ferrosilicon Recycling – Recycle spent ferrosilicon from the magnesium reduction process to reduce ferrosilicon production requirement
  - Magnesium Burning - Elimination of burning at time of condenser separation, reducing salt cake sludge and increasing magnesium recovery
  - Two-cycle per Day – A historic cycle time of 24 hours was used for this assessment; current publications suggest a 10 to 12 hour cycle is possible

- Continuous Operation – Development of a continuous reduction process.
- Energy:
  - Direct the calcination carbon dioxide gas and stream to gasifier to increase carbon and hydrogen in the syn gas while capturing the thermal energy in the off gas stream
  - Low Grade Energy – Investigate recovery of energy from various process sources.

Revenue opportunities include:

- Conversion of Waste into Co-Products:
    - Fume Silica – Investigate the marketing of fume silica to the cement industry as a strengthening additive
    - Residual Ferrosilicon – Investigate the marketing of residual ferrosilicon for alloying in the iron industry
    - Reduction Residue – Investigate the marketing of reduction residue as a feed material for the production of Portland Cement
- Sulfur – Investigate the marketing of sulfur extracted from the gas stream for use in various industries.

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## APPENDIX A

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### CERTIFICATES OF QUALIFIED PERSONS

BARRIE D. FRASER, P.ENG.

I, Barrie D. Fraser, P. Eng., of Coquitlam, British Columbia, do hereby certify:

- I am a Project Manager with Wardrop Engineering Inc. with a business address at #800-555 West Hastings Street, Vancouver, British Columbia, V6B 1M1.
- This certificate applies to the technical report entitled Preliminary Economic Assessment and Technical Report of the Tami-Mosi Magnesium Project, Nevada, dated September 15, 2011 (the "Technical Report").
- I am a graduate of The University of New Brunswick, (Bachelor of Science in Mechanical Engineering, 1997). I am a member in good standing of the Association of Professional Engineers and Geoscientists of British Columbia (License # 32960), Professional Engineers Ontario (License #100012294). My relevant experience is 14+ years experience in industrial and mining projects from concept through operation involving various aspects of engineering and management. I am a "Qualified Person" for purposes of National Instrument 43-101 (the "Instrument").
- My most recent personal inspection of the Dolomite Property was December 12, 2010 for 3 days.
- I am responsible for Sections 1.1, 1.6, 1.9, 2, 3, 18.1, 18.2, 18.3, 18.5, 18.7, 18.8, 18.9, 21.1 (except 21.1.7), 25 (introduction), 26.1.5, 26.1.7, 26.2, 27, of the Technical Report.
- I am independent of Molycor Gold Corp as defined by Section 1.5 of the Instrument.
- I have no prior involvement with the Property that is the subject of the Technical Report.
- I have read the Instrument and the sections of the Technical Report that I am responsible for have been prepared in compliance with the Instrument.
- As of the date of this certificate, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Signed and dated this 15<sup>th</sup> day of September, 2011 at Vancouver, British Columbia.

*"Original document signed and  
sealed by Barrie D. Fraser, P.Eng."*

---

Barrie D. Fraser, P.Eng.  
Project Manager  
Wardrop Engineering Inc.

DOUG RAMSEY, R.P. Bio. (BC)

I, Doug Ramsey, R.P. Bio. (BC), of Vancouver, BC, do hereby certify:

- I am a Manager of Environmental Assessment, Permitting and Natural Resources with Tetra Tech, with a business address at #800-555 West Hastings Street, Vancouver, British Columbia, V6B 1M1.
- This certificate applies to the technical report entitled Preliminary Economic Assessment and Technical Report of the Tami-Mosi Magnesium Project, Nevada, dated September 15, 2011 (the "Technical Report").
- I am a graduate of the University of Manitoba, Winnipeg, Manitoba (B.Sc. (Hons.), Zoology, 1979, and M.Sc. Zoology, 1985). I am a member in good standing of the College of Applied Biology, British Columbia, as a Registered Professional Biologist (License #1581).
- My relevant experience is 29+ years of experience as an environmental consultant working in environmental permitting, and 23 years of experience in the environmental permitting monitoring and closure of mining projects. My mining permitting and planning experience includes NB, NL, PQ, ON, MB, SK, NWT, YK, and BC and includes coal, gold, base metal, rare earth elements, and potash. I am a "Qualified Person" for purposes of National Instrument 43-101 (the "Instrument").
- I have not personally inspected the Dolomite Property.
- I am responsible for Sections 1.8, 20, 25.6, and 26.1.6 of the Technical Report.
- I am independent of Molycor Gold Corp. as defined by Section 1.5 of the Instrument.
- I have no prior involvement with the Property that is the subject of the Technical Report.
- I have read the Instrument and the sections of the Technical Report for which I am responsible have been prepared in compliance with the Instrument.
- As of the date of this certificate, to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Signed and dated this 15<sup>th</sup> day of September, 2011 at Vancouver, British Columbia.

*"Original document signed and sealed  
by Doug Ramsey, R.P. Bio. (BC)"*

---

Doug Ramsey, R.P. Bio. (BC)  
Manager – Environmental Assessment,  
Permitting, and Natural Resources  
Tetra Tech

FRED P. BUCKINGHAM, PH.D., P.E.

I, Fred P. Buckingham, of Houston, Texas, USA, do hereby certify:

- I am a Mechanical Engineer with MPR Associates Inc., with a business address at Suite 3325, 1221 McKinney Street, Houston, Texas, USA, 77010.
- This certificate applies to the technical report entitled Preliminary Economic Assessment and Technical Report of the Tami-Mosi Magnesium Project, Nevada, dated September 15, 2011 (the "Technical Report").
- I am a graduate of the University of Texas at Austin (BSME, 1975), University of Texas at Arlington (MSME, 1980), and University of Texas at Arlington (Ph.D., 1993). I am a licensed Professional Engineer in the State of Texas (License #47271), as well as a member in good standing of the American Society of Mechanical Engineers (Member #153312) and the American Nuclear Society. My relevant experience is over 30 years of executing numerous projects for electric utility, petro-chemical, and marine clients; developing processes and procedures for implementation of retrofit projects for electric utility boilers, designed fuel handling, blending and delivery systems for many applications. I am a "Qualified Person" for purposes of National Instrument 43-101 (the "Instrument").
- I have not personally inspected the Dolomite Property.
- I am responsible for Sections 18.4, 21.1.7 (power plant only), and 21.2.2 of the Technical Report.
- I am independent of Molycor Gold Corp. as defined by Section 1.5 of the Instrument.
- I have no prior involvement with the Property that is the subject of the Technical Report.
- I have read the Instrument and the sections of the Technical report that I am responsible for have been prepared in compliance with the Instrument.
- As of the date of this certificate, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the technical report not misleading.

Signed and dated this 15<sup>th</sup> day of September, 2011 at Houston, Texas, USA.

*"Original document signed and sealed  
by Fred P. Buckingham, P.Eng."*

---

Fred P. Buckingham, P.Eng.  
Mechanical Engineer  
MPR Associates Inc.

HASSAN GHAFFARI, P.ENG.

I, Hassan Ghaffari, P.Eng, of Vancouver, BC, do hereby certify:

- I am a Manager of Metallurgy with Wardrop Engineering Inc., with a business address at #800-555 West Hastings Street, Vancouver, British Columbia, V6B 1M1.
- This certificate applies to the technical report entitled Preliminary Economic Assessment and Technical Report of the Tami-Mosi Magnesium Project, Nevada, dated September 15, 2011 (the "Technical Report").
- I am a graduate of the University of Tehran (M.A.Sc., Mining Engineering, 1990) and the University of British Columbia (M.A.Sc., Mineral Process Engineering, 2004). I am a member in good standing of the Association of Professional Engineers and Geoscientists of the Province of British Columbia (#30408). My relevant experience with respect to mineral process engineering includes 22 years of experience in mining and plant operation, project studies, management, and engineering. I am a "Qualified Person" for purposes of National Instrument 43-101 (the "Instrument").
- I have not personally inspected the Dolomite Property.
- I am responsible for Sections 18.6, 21.1.7 (ferrosilicon plant only), and 21.2.3 of the Technical Report.
- I am independent of Molycor Gold Corp. as defined by Section 1.5 of the Instrument.
- I have no prior involvement with the Property that is the subject of the Technical Report.
- I have read the Instrument and the sections of the Technical Report that I am responsible for have been prepared in compliance with the Instrument.
- As of the date of this certificate, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Signed and dated this 15<sup>th</sup> day of September, 2011 at Vancouver, British Columbia.

*"Original document signed and  
sealed by Hassan Ghaffari, P.Eng."*

Hassan Ghaffari, P.Eng.  
Manager of Metallurgy  
Wardrop Engineering Inc.



JIANHUI (JOHN) HUANG, PH.D., P.ENG.

I, Jianhui (John) Huang, Ph.D., P.Eng., of Burnaby, British Columbia, do hereby certify:

- I am a Senior Metallurgist with Wardrop Engineering Inc., with a business address at #800-555 West Hastings Street, Vancouver, British Columbia, V6B 1M1.
- This certificate applies to the technical report entitled Preliminary Economic Assessment and Technical Report of the Tami-Mosi Magnesium Project, Nevada, dated September 15, 2011 (the "Technical Report").
- I am a graduate of North-East University, (Eng. Bachelor, 1982), Beijing General Research Institute for Non-ferrous Metals (Eng, Master, 1988) and Birmingham University (Ph.D, 2000). I am a member in good standing of the Association of Professional Engineers and Geoscientists of the Province of British Columbia (License #30898). My relevant experience with respect to mineral engineering including over 28-year involvement in mineral process for base metal ores, gold and silver ores, and rare metal ores. I am a "Qualified Person" for purposes of National Instrument 43-101 (the "Instrument").
- I have not personally inspected the Dolomite Property.
- I am responsible for Sections responsible for Sections 1.4, 1.10, 13, 17, 21.1.7 (magnesium plant costs only), 21.2.1, 25.4, 26.1.4 of the Technical Report.
- I am independent of Molycor Gold Corp. as defined by Section 1.5 of the Instrument.
- I have no prior involvement with the Property that is the subject of the Technical Report.
- I have read the Instrument and the sections of the Technical Report that I am responsible for have been prepared in compliance with the Instrument.
- As of the date of this certificate, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the technical report not misleading.

Signed and dated this 15th day of September, 2011 at Vancouver, British Columbia.

*"Original document signed and sealed by  
Jianhui (John) Huang, Ph.D., P.Eng."*

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Jianhui (John) Huang, Ph.D., P.Eng.  
Senior Metallurgist  
Wardrop Engineering Inc.

KLAUS TRIEBEL, CPG

I, Klaus Triebel, CPG, of Blaine, Washington, USA, do hereby certify:

- I am a Principal Geologist with Wardrop Engineering Inc., with a business address at #800-555 West Hastings Street, Vancouver, British Columbia, V6B 1M1.
- This certificate applies to the technical report entitled Preliminary Economic Assessment and Technical Report of the Tami-Mosi Magnesium Project, Nevada, dated September 15, 2011 (the "Technical Report").
- I am a graduate of the University of Alaska, Fairbanks (M.Sc. Geological Engineering, 1990) and the University of Applied Science, Bochum, Germany (B.Sc. Mining Engineering, 1981). I am a member in good standing of the American Institute of Professional Geologist (License CPG 10657), the BDG - Professional Geologist Association Germany (Registration # 1372) and the State of Alaska (Registration #GEO G 545.I. My relevant experience includes 30 years of post-graduate experience, seven years of which are in the fields of geological modelling and geostatistical resource estimation. I am a "Qualified Person" for purposes of National Instrument 43-101 (the "Instrument").
- My most recent personal inspection of the Dolomite Property was December 12, 2010 for 3 days.
- I am responsible for Sections 1.3, 14, 25.2, and 26.1.2 Technical Report.
- I am independent of Molycor Gold Corp. as defined by Section 1.5 of the Instrument.
- I have no prior involvement with the Property that is the subject of the Technical Report.
- I have read the Instrument and the sections of the Technical Report that I am responsible for have been prepared in compliance with the Instrument.
- As of the date of this certificate, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Signed and dated this 15<sup>th</sup> day of September, 2011 at Vancouver, British Columbia.

*"Original document signed and  
sealed by Klaus Triebel, CPG"*

---

Klaus Triebel, CPG  
Principal Geologist  
Wardrop Engineering Inc.

NORM L. TRIBE, P.ENG.

I, Norm L. Tribe, P.Eng., of Kelowna, BC, do hereby certify:

- I am the President and Principal of N. Tribe & Associates Ltd. with a business address at 2611 Springfield Road, Kelowna, British Columbia, V1X 1B9.
- This certificate applies to the technical report entitled Preliminary Economic Assessment and Technical Report of the Tami-Mosi Magnesium Project, Nevada, dated September 15, 2011 (the "Technical Report").
- I am a graduate of the University of British Columbia (B.A.Sc., Geological Engineering, 1964). I am a member in good standing of the Association of Professional Engineers and Geoscientists of the Province of British Columbia (License #11330). My relevant experience is 47 years of experience in my profession including underground grade control, pit grade control, mine development and evaluation, property evaluation, project and exploration management, plant design, exploration geology and reporting to the various governments and stock exchanges. I am a "Qualified Person" for purposes of National Instrument 43-101 (the "Instrument").
- My most recent personal inspection of the Dolomite Property was May 17 to May 20, 2009.
- I am responsible for Sections 1.2, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 23 of the Technical Report.
- I am independent of Molycor Gold Corp. as defined by Section 1.5 of the Instrument.
- I have no prior involvement with the Property that is the subject of the Technical Report.
- I have read the Instrument and the sections of the Technical Report that I am responsible for have been prepared in compliance with the Instrument.
- As of the date of this certificate, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Signed and dated this 15<sup>th</sup> day of September, 2011 at Kelowna, British Columbia.

*"Original document signed and  
sealed by Norm L. Tribe, P.Eng."*

---

Norm L. Tribe, P.Eng.  
President and Principal  
N. Tribe & Associates Ltd.

ROBERT E. BROWN

I, Robert E. Brown, of Prattville, Alabama, U.S.A., do hereby certify:

- I am a Magnesium Technical Specialist and President of Magnesium Assistance Group, Inc., with a business address at 226 Deer Trace, Prattville, Alabama, U.S.A. 36067.
- This certificate applies to the technical report entitled Preliminary Economic Assessment and Technical Report of the Tami-Mosi Magnesium Project, Nevada, dated September 15, 2011 (the "Technical Report").
- I am a graduate of Michigan Technological University with a Bachelor of Science in Metallurgical Engineering, 1963. I am a member in good standing of the American Institute of Mining and Metallurgical Engineers, License # 35443. My relevant experience is 50 years of varied metals industry experience in both ferrous and non-ferrous materials. Twenty (20) years in the technical management areas of light metal foundries or reduction plants. I am a "Qualified Person" for purposes of National Instrument 43-101 (the "Instrument").
- I have not completed a personal inspection the Dolomite Property.
- I am responsible for Section 19, as well as contributions to Sections 1, 2, 3, 18, 21, 25, 26, and 27 of the Technical Report.
- I am independent of Molycor Gold Corp. as defined by Section 1.5 of the Instrument.
- I have no prior involvement with the Property that is the subject of the Technical Report.
- I have read the Instrument and the sections of the Technical Report that I am responsible for have been prepared in compliance with the Instrument.
- As of the date of this certificate, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Signed and dated this 15<sup>th</sup> day of September, 2011 at Prattville, Alabama.

*"Original document signed and sealed  
by Robert E. Brown"*

---

Robert E. Brown  
President and Magnesium Technical Specialist  
Magnesium Assistance Group, Inc.

TYSEN HANTELMANN, P.ENG., M.ENG.

I, Tysen Hantelmann, P.Eng., M.Eng., of Edmonton, Alberta, do hereby certify:

- I am a Senior Mining Engineer with Wardrop Engineering Inc., with a business address at: 14940-123 Avenue, Edmonton, AB, T5V 1B4.
- This certificate applies to the technical report entitled Preliminary Economic Assessment and Technical Report of the Tami-Mosi Magnesium Project, Nevada, dated September 15, 2011 (the "Technical Report").
- I am a graduate of the University of Alberta (B.Sc., Mining Engineering, 2001; M.Eng., Mining Engineering, 2003). I am a member in good standing of the Association of Professional Engineers and Geoscientists of Alberta (License #M71697). My relevant experience is 11 years of mine engineering and mine operations experience including financial analysis, operating and capital cost estimation, long-range and short-range production scheduling, operational support for various truck/shovel mining activities
- I am a "Qualified Person" for purposes of National Instrument 43-101 (the "Instrument").
- I have not personally inspected the Dolomite Property.
- I am responsible for Sections 1.5, 1.11, 15, 16, 21.1.7 (dolomite quarry costs only), 22, 25.1, 25.3, 26.1.1, 26.1.3 of the Technical Report.
- I am independent of Molycor Gold Corp. as defined by Section 1.5 of the Instrument.
- I have no prior involvement with the Property that is the subject of the Technical Report.
- I have read the Instrument and the sections of the Technical Report that I am responsible for have been prepared in compliance with the Instrument.
- As of the date of this certificate, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Signed and dated this 15<sup>th</sup> day of September, 2011 at Edmonton, Alberta.

*"Original document signed and sealed by  
Tysen Hantelmann, P.Eng., M.Eng."*

Tysen Hantelmann, P.Eng. M.Eng.  
Senior Mining Engineer  
Wardrop Engineering Inc.

## APPENDIX B

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### DETAILED CAPITAL COST ESTIMATE

Project No: 1191380100

Tami - Mosi Project

Report Date: 09-Sep-11

Client: Molycor Gold Corp.

Scoping Study - Level 2 Summary

Rev 00

Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechancial Eqpt Cost	Total Cost (USD)
<b>10 - Dolomite Quarry Site General</b>						
101 General Development	1,320	73,920	193,700	8,200	200,000	475,820
<b>10 - Dolomite Quarry Site General Subtotal</b>	<b>1,320</b>	<b>73,920</b>	<b>193,700</b>	<b>8,200</b>	<b>200,000</b>	<b>475,820</b>
<b>20 - Dolomite Quarry Open Pit</b>						
210 Pit	420	23,520	8,000	1,000	987,000	1,019,520
<b>20 - Dolomite Quarry Open Pit Subtotal</b>	<b>420</b>	<b>23,520</b>	<b>8,000</b>	<b>1,000</b>	<b>987,000</b>	<b>1,019,520</b>
<b>22 - Dolomite Quarry Crushing Plant</b>						
220 Dolomite Quarry Site Processing	4,680	262,080	300,000	100,000	1,300,000	1,962,080
<b>22 - Dolomite Quarry Crushing Plant Subtotal</b>	<b>4,680</b>	<b>262,080</b>	<b>300,000</b>	<b>100,000</b>	<b>1,300,000</b>	<b>1,962,080</b>
<b>23 - Dolomite Quarry Utilities</b>						
230 Electrical	0	0	50,000	0	0	50,000
231 Fuel Supply, Storage & Distribution	84	4,704	7,500	500	0	12,704
232 Water Systems	60	3,360	5,000	1,000	0	9,360
233 Waste Disposal	0	0	10,000	0	0	10,000
234 Buildings	1,368	76,608	135,000	37,500	0	249,108
<b>23 - Dolomite Quarry Utilities Subtotal</b>	<b>1,512</b>	<b>84,672</b>	<b>207,500</b>	<b>39,000</b>	<b>0</b>	<b>331,172</b>
<b>25 - Dolomite Quarry Temporary works</b>						
251 General Site	0	0	0	0	0	0
<b>25 - Dolomite Quarry Temporary works Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Project No: 1191380100  
Client: Molycor Gold Corp.

Tami - Mosi Project  
Scoping Study - Level 2 Summary

Report Date: 09-Sep-11  
Rev 00

Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechancial Eqpt Cost	Total Cost (USD)
<b>30 - Processing Site General</b>						
301 General Development	83,004	4,648,217	6,770,994	896,920	4,091,540	16,407,671
<b>30 - Processing Site General Subtotal</b>	<b>83,004</b>	<b>4,648,217</b>	<b>6,770,994</b>	<b>896,920</b>	<b>4,091,540</b>	<b>16,407,671</b>
<b>31 - Processing Site Stock Piles</b>						
311 Stockpiles	14,912	835,055	1,678,974	263,768	833,567	3,611,364
<b>31 - Processing Site Stock Piles Subtotal</b>	<b>14,912</b>	<b>835,055</b>	<b>1,678,974</b>	<b>263,768</b>	<b>833,567</b>	<b>3,611,364</b>
<b>40 - Processing Site - Processing Facilities</b>						
401 Ferrosilicon Facility	108,686	6,086,405	12,793,743	1,128,200	11,610,000	31,618,347
402 Dolomite Grinding and Slag Loadout Facilities	36,034	2,017,892	2,061,007	432,852	4,805,000	9,316,751
403 Magnesium Facility	269,795	15,108,506	19,722,758	3,118,339	59,467,867	97,417,470
404 Cooling Tower and Distribution	10,596	593,376	1,021,472	190,350	1,610,000	3,415,198
<b>40 - Processing Site - Processing Facilities Subtotal</b>	<b>425,110</b>	<b>23,806,178</b>	<b>35,598,980</b>	<b>4,869,741</b>	<b>77,492,867</b>	<b>141,767,766</b>
<b>50 - Processing Site Power Plant</b>						
501 Power Plant	357,004	19,992,249	46,139,606	3,551,460	76,564,600	146,247,915
<b>50 - Processing Site Power Plant Subtotal</b>	<b>357,004</b>	<b>19,992,249</b>	<b>46,139,606</b>	<b>3,551,460</b>	<b>76,564,600</b>	<b>146,247,915</b>
<b>61 - Processing Site Infrastructure</b>						
613 Ancilliary Buildings	5,520	309,120	1,973,640	47,990	152,346	2,483,096
614 On-Site Mobile Equipment	14	806	102	0	1,076,225	1,077,133
615 On-Site Bulk Storage	83	4,637	19,938	360	0	24,935
616 On-Site Services / Utilities	836	46,838	88,900	21,000	0	156,738



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Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechancial Eqpt Cost	Total Cost (USD)
619 On-Site Power Supply & Transmission	10,932	612,192	1,100,000	200,000	0	1,912,192
<b>61 - Processing Site Infrastructure Subtotal</b>	<b>17,386</b>	<b>973,594</b>	<b>3,182,580</b>	<b>269,350</b>	<b>1,228,571</b>	<b>5,654,094</b>
<b>71 - Processing Site Off-Site Infrastructure</b>						
711 Temporary works	0	0	0	0	0	0
<b>71 - Processing Site Off-Site Infrastructure Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>81 - Processing Site Temporary works</b>						
811 General site	0	0	0	0	0	0
<b>81 - Processing Site Temporary works Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>85 - Closure and Reclamation (both sites)</b>						
851 Site (Both sites complete)	0	0	5,000,000	0	0	5,000,000
<b>85 - Closure and Reclamation (both sites) Subtotal</b>	<b>0</b>	<b>0</b>	<b>5,000,000</b>	<b>0</b>	<b>0</b>	<b>5,000,000</b>
<b>91 - Indirect Costs</b>						
911 Indirect	5,680	581,280	49,294,735	0	0	49,876,015
<b>91 - Indirect Costs Subtotal</b>	<b>5,680</b>	<b>581,280</b>	<b>49,294,735</b>	<b>0</b>	<b>0</b>	<b>49,876,015</b>
<b>98 - Owners Costs</b>						
981 Owners Cost	0	0	7,447,088	0	0	7,447,088
<b>98 - Owners Costs Subtotal</b>	<b>0</b>	<b>0</b>	<b>7,447,088</b>	<b>0</b>	<b>0</b>	<b>7,447,088</b>
<b>99 - Contingency</b>						
991 Project Contingency	0	0	44,265,437	0	0	44,265,437



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**Client: Molycor Gold Corp.**

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Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechancial Eqpt Cost	Total Cost (USD)
99 - Contingency Subtotal	0	0	44,265,437	0	0	44,265,437
Scoping Study Total	911,028	51,280,765	200,087,594	9,999,440	162,698,145	424,065,943

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Sub-Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechancial Eqpt Cost	Total Cost (USD)
<b>101 - General Development</b>						
10110 Dolomite Quarry Bulk Earthworks / Site Preparation	108	6,048	5,000	8,000	0	19,048
10120 Dolomite Quarry Existing Access Road Improvement	0	0	0	0	0	0
10130 Dolomite Quarry Site Roads At Mine	1,200	67,200	30,000	0	200,000	297,200
10140 Dolomite Quarry Site Drainage	0	0	0	0	0	0
10150 Dolomite Quarry Fencing/Gates (Site Control)	0	0	150,000	0	0	150,000
10160 Dolomite Quarry Control System	0	0	0	0	0	0
10170 Dolomite Quarry Communication System	0	0	5,000	0	0	5,000
10180 Dolomite Quarry Fire Alarm System	2	134	200	0	0	334
10190 Dolomite Quarry Yard Lighting	10	538	3,500	200	0	4,238
<b>101 - General Development Subtotal</b>	<b>1,320</b>	<b>73,920</b>	<b>193,700</b>	<b>8,200</b>	<b>200,000</b>	<b>475,820</b>
<b>210 - Pit</b>						
20120 Dolomite Quarry Mobile Equipment	180	10,080	0	1,000	971,000	982,080
20130 Dolomite Quarry Explosive Store	240	13,440	8,000	0	16,000	37,440
<b>210 - Pit Subtotal</b>	<b>420</b>	<b>23,520</b>	<b>8,000</b>	<b>1,000</b>	<b>987,000</b>	<b>1,019,520</b>
<b>220 - Dolomite Quarry Site Processing</b>						
22110 Dolomite Quarry Crushing Plant	4,680	262,080	300,000	100,000	1,300,000	1,962,080
<b>220 - Dolomite Quarry Site Processing Subtotal</b>	<b>4,680</b>	<b>262,080</b>	<b>300,000</b>	<b>100,000</b>	<b>1,300,000</b>	<b>1,962,080</b>

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Sub-Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechanical Eqpt Cost	Total Cost (USD)
<b>230 - Electrical</b>						
23010 Dolomite Quarry Powerlines	0	0	50,000	0	0	50,000
23020 Dolomite Quarry Gensets (Construction and Emergency)	0	0	0	0	0	0
23030 Dolomite Quarry Main Substations	0	0	0	0	0	0
23040 Dolomite Quarry Lightning Protection	0	0	0	0	0	0
<b>230 - Electrical Subtotal</b>	<b>0</b>	<b>0</b>	<b>50,000</b>	<b>0</b>	<b>0</b>	<b>50,000</b>
<b>231 - Fuel Supply, Storage &amp; Distribution</b>						
23110 Dolomite Quarry Fuel Storage	84	4,704	7,500	500	0	12,704
<b>231 - Fuel Supply, Storage &amp; Distribution Subtotal</b>	<b>84</b>	<b>4,704</b>	<b>7,500</b>	<b>500</b>	<b>0</b>	<b>12,704</b>
<b>232 - Water Systems</b>						
23210 Dolomite Quarry Water Distribution System	60	3,360	5,000	1,000	0	9,360
23220 Dolomite Quarry Potable Water	0	0	0	0	0	0
23230 Dolomite Quarry Site Drainage	0	0	0	0	0	0
23240 Dolomite Quarry Water Treatment (Pit Run-Off)	0	0	0	0	0	0
<b>232 - Water Systems Subtotal</b>	<b>60</b>	<b>3,360</b>	<b>5,000</b>	<b>1,000</b>	<b>0</b>	<b>9,360</b>
<b>233 - Waste Disposal</b>						
23310 Dolomite Quarry Solid Waste Disposal	0	0	0	0	0	0

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23320 Dolomite Quarry Sewage	0	0	10,000	0	0	10,000
<b>233 - Waste Disposal Subtotal</b>	<b>0</b>	<b>0</b>	<b>10,000</b>	<b>0</b>	<b>0</b>	<b>10,000</b>
<b>234 - Buildings</b>						
23410 Dolomite Quarry Truck Maintenance, Office and First Aid and Mine Dry	1,368	76,608	135,000	37,500	0	249,108
<b>234 - Buildings Subtotal</b>	<b>1,368</b>	<b>76,608</b>	<b>135,000</b>	<b>37,500</b>	<b>0</b>	<b>249,108</b>
<b>251 - General Site</b>						
25110 Dolomite Quarry Laydown Area	0	0	0	0	0	0
25120 Dolomite Quarry Construction Camp	0	0	0	0	0	0
25130 Dolomite Quarry Catering and House Keeping	0	0	0	0	0	0
<b>251 - General Site Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>301 - General Development</b>						
30105 Processing Site Bulk Earthworks / Site Preparation	1,728	96,768	0	129,915	0	226,683
30110 Processing Site New Roads and Parking	5,700	319,200	495,500	0	484,000	1,298,700
30115 Processing Site Site Drainage	16,752	938,112	1,733,750	140,000	0	2,811,862
30120 Processing Site Fencing/Gates (Site Control)	3,234	181,104	314,000	53,260	0	548,364
30125 Processing Site Communication System	3,000	168,000	1,200,000	50,000	0	1,418,000
30130 Processing Site Fire Alarm System	474	26,544	71,000	7,168	0	104,712

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Sub-Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechanical Eqpt Cost	Total Cost (USD)
30135 Processing Site Yard Lighting	96	5,376	150,000	10,000	0	165,376
30140 Processing Site Power Supply	23,115	1,294,447	1,423,844	131,900	0	2,850,190
30145 Processing Site Rail Siding	11,712	655,872	730,500	63,012	0	1,449,384
30150 Processing Site Rail Offloading Including Conveyors	17,193	962,795	652,400	311,665	3,607,540	5,534,400
<b>301 - General Development Subtotal</b>	<b>83,004</b>	<b>4,648,217</b>	<b>6,770,994</b>	<b>896,920</b>	<b>4,091,540</b>	<b>16,407,671</b>
<b>311 - Stockpiles</b>						
31110 Processing Site Woodchip Stockpile	1,004	56,246	50,265	13,080	203,080	322,671
31120 Processing Site Power Plant Coal Stockpile	13,907	778,808	1,628,709	250,688	630,487	3,288,693
<b>311 - Stockpiles Subtotal</b>	<b>14,912</b>	<b>835,055</b>	<b>1,678,974</b>	<b>263,768</b>	<b>833,567</b>	<b>3,611,364</b>
<b>401 - Ferrosilicon Facility</b>						
40110 Processing Site Ferrosilicon Production Plant	108,686	6,086,405	12,793,743	1,128,200	11,610,000	31,618,347
<b>401 - Ferrosilicon Facility Subtotal</b>	<b>108,686</b>	<b>6,086,405</b>	<b>12,793,743</b>	<b>1,128,200</b>	<b>11,610,000</b>	<b>31,618,347</b>
<b>402 - Dolomite Grinding and Slag Loadout Facilities</b>						
40210 Processing Site Dolomite Grinding and Slag Loadout	17,006	952,328	1,459,297	345,430	1,407,000	4,164,056
40220 Processing Site Crushing and Grinding Area	19,028	1,065,564	601,710	87,422	3,398,000	5,152,696
<b>402 - Dolomite Grinding and Slag Loadout Facilities Subtotal</b>	<b>36,034</b>	<b>2,017,892</b>	<b>2,061,007</b>	<b>432,852</b>	<b>4,805,000</b>	<b>9,316,751</b>
<b>403 - Magnesium Facility</b>						
40310 Processing Site Calciner Area	97,654	5,468,639	1,404,935	203,914	49,984,280	57,061,769

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Sub-Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechanical Eqpt Cost	Total Cost (USD)
40320 Processing Site Bricquetting Area	32,311	1,809,397	4,094,256	388,983	3,323,350	9,615,986
40330 Processing Site Reduction Building Area	92,668	5,189,423	9,461,968	1,689,794	2,405,197	18,746,382
40340 Processing Site Casting Area	47,162	2,641,046	4,761,599	835,648	3,755,040	11,993,333
<b>403 - Magnesium Facility Subtotal</b>	<b>269,795</b>	<b>15,108,506</b>	<b>19,722,758</b>	<b>3,118,339</b>	<b>59,467,867</b>	<b>97,417,470</b>
<b>404 - Cooling Tower and Distribution</b>						
40410 Processing Site Cooling Systems	10,596	593,376	1,021,472	190,350	1,610,000	3,415,198
<b>404 - Cooling Tower and Distribution Subtotal</b>	<b>10,596</b>	<b>593,376</b>	<b>1,021,472</b>	<b>190,350</b>	<b>1,610,000</b>	<b>3,415,198</b>
<b>501 - Power Plant</b>						
50110 Processing Site Power Plant	355,860	19,928,160	46,062,874	3,535,200	76,500,000	146,026,234
50120 Processing Site Ash Loadout	1,144	64,089	76,732	16,260	64,600	221,681
50130 Processing Site Coal Gas Surge Storage	0	0	0	0	0	0
<b>501 - Power Plant Subtotal</b>	<b>357,004</b>	<b>19,992,249</b>	<b>46,139,606</b>	<b>3,551,460</b>	<b>76,564,600</b>	<b>146,247,915</b>
<b>613 - Ancilliary Buildings</b>						
61310 Processing Site Administration and Change House	5,508	308,448	1,968,600	47,940	2,346	2,327,334
61320 Processing Site Emergency Response Including Medical Clinic	0	0	0	0	0	0
61330 Processing Site Gatehouses and Fencing	12	672	5,040	50	150,000	155,762
<b>613 - Ancilliary Buildings Subtotal</b>	<b>5,520</b>	<b>309,120</b>	<b>1,973,640</b>	<b>47,990</b>	<b>152,346</b>	<b>2,483,096</b>

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Sub-Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechanical Eqpt Cost	Total Cost (USD)
<b>614 - On-Site Mobile Equipment</b>						
61410 Processing Site Mobile Maintenance Equipment	14	806	102	0	1,076,225	1,077,133
<b>614 - On-Site Mobile Equipment Subtotal</b>	<b>14</b>	<b>806</b>	<b>102</b>	<b>0</b>	<b>1,076,225</b>	<b>1,077,133</b>
<b>615 - On-Site Bulk Storage</b>						
61510 Processing Site Water	0	0	15,000	0	0	15,000
61520 Processing Site Fuel	83	4,637	4,938	360	0	9,935
<b>615 - On-Site Bulk Storage Subtotal</b>	<b>83</b>	<b>4,637</b>	<b>19,938</b>	<b>360</b>	<b>0</b>	<b>24,935</b>
<b>616 - On-Site Services / Utilities</b>						
61610 Processing Site Water Distribution System	120	6,720	1,500	3,000	0	11,220
61620 Processing Site Potable Water	0	0	0	0	0	0
61630 Processing Site Process Water	0	0	0	0	0	0
61640 Processing Site Fire Water	86	4,838	2,400	0	0	7,238
61650 Processing Site Solid Waste Disposal	0	0	0	0	0	0
61660 Processing Site Sewage Treatment Plant	240	13,440	25,000	3,000	0	41,440
61670 Processing Site Effluent Treatment Distribution	0	0	0	0	0	0
61680 Processing Site Water Treatment	390	21,840	60,000	15,000	0	96,840
<b>616 - On-Site Services / Utilities Subtotal</b>	<b>836</b>	<b>46,838</b>	<b>88,900</b>	<b>21,000</b>	<b>0</b>	<b>156,738</b>

**619 - On-Site Power Supply & Transmission**



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Sub-Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechanical Eqpt Cost	Total Cost (USD)
61910 Processing Site Power Distribution	10,932	612,192	1,100,000	200,000	0	1,912,192
<b>619 - On-Site Power Supply &amp; Transmission Subtotal</b>	<b>10,932</b>	<b>612,192</b>	<b>1,100,000</b>	<b>200,000</b>	<b>0</b>	<b>1,912,192</b>
<b>711 - Temporary works</b>						
71110 Temporary works	0	0	0	0	0	0
<b>711 - Temporary works Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>811 - General site</b>						
81110 Processing Site Laydown Area	0	0	0	0	0	0
81120 Processing Site Construction Camp	0	0	0	0	0	0
81130 Processing Site Catering and House Keeping	0	0	0	0	0	0
<b>811 - General site Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>851 - Site (Both sites complete)</b>						
85110 Processing Site General Site	0	0	5,000,000	0	0	5,000,000
<b>851 - Site (Both sites complete) Subtotal</b>	<b>0</b>	<b>0</b>	<b>5,000,000</b>	<b>0</b>	<b>0</b>	<b>5,000,000</b>
<b>911 - Indirect</b>						
91110 Construction Indirects	0	0	13,716,093	0	0	13,716,093
91120 Initial Fills	0	0	2,700,000	0	0	2,700,000
91130 Spares	0	0	1,282,712	0	0	1,282,712
91140 Freight and Logistics	0	0	6,086,966	0	0	6,086,966

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Sub-Area	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechanical Eqpt Cost	Total Cost (USD)
91150 Commissioning and Start-up	5,280	521,280	0	0	0	521,280
91160	0	0	25,508,963	0	0	25,508,963
91170 Vendor Commissioning and Assistance	400	60,000	0	0	0	60,000
<b>911 - Indirect Subtotal</b>	<b>5,680</b>	<b>581,280</b>	<b>49,294,735</b>	<b>0</b>	<b>0</b>	<b>49,876,015</b>
<b>981 - Owners Cost</b>						
98100 Owners Cost	0	0	7,447,088	0	0	7,447,088
<b>981 - Owners Cost Subtotal</b>	<b>0</b>	<b>0</b>	<b>7,447,088</b>	<b>0</b>	<b>0</b>	<b>7,447,088</b>
<b>991 - Project Contingency</b>						
99110 Project Contingency	0	0	44,265,437	0	0	44,265,437
<b>991 - Project Contingency Subtotal</b>	<b>0</b>	<b>0</b>	<b>44,265,437</b>	<b>0</b>	<b>0</b>	<b>44,265,437</b>
<b>Scoping Study Total</b>	<b>911,028</b>	<b>51,280,765</b>	<b>200,087,594</b>	<b>9,999,440</b>	<b>162,698,145</b>	<b>424,065,943</b>

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Scoping Study - Expenditure Code Summary

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Expenditure Number	Description	Labour Manhour	Labour Cost	Material Cost	Construction Eqpt Cost	Mechanical Eqpt Cost	Total Cost (USD)
<b>1 - Direct Costs</b>							
		0	0	0	0	0	0
9	Rail	11,712	655,872	730,500	63,012	0	1,449,384
10	Bulk Earthworks	33,402	1,870,519	3,803,150	437,275	684,000	6,794,944
20	Concrete	72,555	4,063,067	5,588,613	408,038	0	10,059,718
30	Structural Steel	93,680	5,246,052	12,109,400	1,075,770	11,500,000	29,931,222
40	Architectural	88,278	4,943,568	15,085,000	1,748,460	18,300	21,795,328
50	Mechanical	530,754	29,722,231	50,197,852	5,379,937	145,671,945	230,971,965
55	Platework	4,518	253,008	391,500	7,530	0	652,038
57	Building Services	337	18,877	34,726	1,326	29,270	84,199
58	Plant Mobile Equipment	528	29,559	182,605	8,392	35,280	255,837
60	Piping	19,325	1,082,227	1,798,436	297,534	335,370	3,513,567
70	Electrical	23,779	1,331,600	2,492,501	406,740	1,428,698	5,659,539
80	Instrumentation and Controls	26,480	1,482,905	1,666,050	165,425	2,995,282	6,309,662
87	Close out	0	0	5,000,000	0	0	5,000,000
89	Temporary facilities	0	0	0	0	0	0
<b>1 - Direct Costs Subtotal</b>		<b>905,348</b>	<b>50,699,485</b>	<b>99,080,334</b>	<b>9,999,440</b>	<b>162,698,145</b>	<b>322,477,402</b>
<b>2 - Indirect Costs</b>							
91	Construction Indirects	0	0	13,716,093	0	0	13,716,093
92	Initial Fills	0	0	2,700,000	0	0	2,700,000
93	Spares	0	0	1,282,712	0	0	1,282,712
94	Freight and Logistics	0	0	6,086,966	0	0	6,086,966
95	Commissioning and Start-up	5,280	521,280	0	0	0	521,280
96	EPCM	0	0	25,508,963	0	0	25,508,963
97	Vendors assistance	400	60,000	0	0	0	60,000
98	Owners Costs	0	0	7,447,088	0	0	7,447,088
<b>2 - Indirect Costs Subtotal</b>		<b>5,680</b>	<b>581,280</b>	<b>56,741,823</b>	<b>0</b>	<b>0</b>	<b>57,323,103</b>
<b>3 - Owner's Costs</b>							
99	Contingency	0	0	44,265,437	0	0	44,265,437
<b>3 - Owner's Costs Subtotal</b>		<b>0</b>	<b>0</b>	<b>44,265,437</b>	<b>0</b>	<b>0</b>	<b>44,265,437</b>

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**Scoping Study - Expenditure Code Summary**

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<b>Expenditure Number</b>	<b>Description</b>	<b>Labour Manhour</b>	<b>Labour Cost</b>	<b>Material Cost</b>	<b>Construction Eqpt Cost</b>	<b>Mechancial Eqpt Cost</b>	<b>Total Cost (USD)</b>
Scoping Study Total		911,028	51,280,765	200,087,594	9,999,440	162,698,145	424,065,943



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SubArea-Exp-Seq	Qty	Labour Unit Mhr	Labour Mhr	Productivity Factor	Total Labour Manhour	Labour Rate	Labour Cost	Material Unit Cost	Material Cost	Const Eqt Unit Cost	Const Eqt Cost	Process Eqt Unit Cost	Process Eqt Cost	Total Unit Cost	Total Cost (USD)
10110 - Dolomite Quarry Bulk Earthworks / Site Preparation															
10110-10-1.00	Bulk earthworks														
	1.sum	90.00	108.00	1.2	108.00	56.00	6,048	5,000.00	5,000	8,000.00	8,000	0.00	0	19,048.00	19,048
10110 - Dolomite Quarry Bulk Earthworks / Site Preparation Subtotal					108.00		6,048		5,000		8,000		0		19,048
10120 - Dolomite Quarry Existing Access Road Improvement															
10120-10-1.00	Existing Access Road improvement Not Included														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
10120 - Dolomite Quarry Existing Access Road Improvement Subtotal					0.00		0		0		0		0		0
10130 - Dolomite Quarry Site Roads At Mine															
10130-10-1.00	Upgrade existing - road improvement Allowance 2 km approved Material (dical material from pit and backhaul)														
	1.sum	1,000.00	1,200.00	1.2	1,200.00	56.00	67,200	30,000.00	30,000	0.00	0	200,000.00	200,000	297,200.00	297,200
10130 - Dolomite Quarry Site Roads At Mine Subtotal					1,200.00		67,200		30,000		0		200,000		297,200
10140 - Dolomite Quarry Site Drainage															
10140-10-1.00	Site drainage allowance Not Included														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
10140 - Dolomite Quarry Site Drainage Subtotal					0.00		0		0		0		0		0
10150 - Dolomite Quarry Fencing/Gates (Site Control)															
10150-10-1.00	Fencing/Gates (Site Control) Allowance														
	1.lot	0.00	0.00	1.2	0.00	56.00	0	150,000.00	150,000	0.00	0	0.00	0	150,000.00	150,000
10150 - Dolomite Quarry Fencing/Gates (Site Control) Subtotal					0.00		0		150,000		0		0		150,000
10160 - Dolomite Quarry Control System															
10160-80-1.00	Control System Not Included														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
10160 - Dolomite Quarry Control System Subtotal					0.00		0		0		0		0		0
10170 - Dolomite Quarry Communication System															



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10170-80-1.00	Communication System Allowance for cell phone repeater In quarry														
	1.sum	0.00	0.00	1.2	0.00	56.00	0	5,000.00	5,000	0.00	0	0.00	0	5,000.00	5,000
10170-80-2.00	Communication System cell phone with 2 way capability Included above														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
10170 - Dolomite Quarry Communication System Subtotal					0.00		0	5,000		0		0			5,000
10180 - Dolomite Quarry Fire Alarm System															
10180-70-1.00	Fire extinguishers local only Class C Fire extinguishers														
	1.sum	2.00	2.40	1.2	2.40	56.00	134	200.00	200	0.00	0	0.00	0	334.40	334
10180 - Dolomite Quarry Fire Alarm System Subtotal					2.40		134	200		0		0			334
10190 - Dolomite Quarry Yard Lighting															
10190-70-1.00	Yard Lighting allowance Building flood lights, fuel station pole and floods														
	1.sum	8.00	9.60	1.2	9.60	56.00	538	3,500.00	3,500	200.00	200	0.00	0	4,237.60	4,238
10190 - Dolomite Quarry Yard Lighting Subtotal					9.60		538	3,500		200		0			4,238
20120 - Dolomite Quarry Mobile Equipment															
20120-50-1.00	Front end loaders CAT 988 9cyd														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	0.00	0	0.00	0	727,000.00	727,000	727,000.00	727,000
20120-50-2.00	Front end loaders Cat 966H 6yd														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	0.00	0	0.00	0	244,000.00	244,000	244,000.00	244,000
20120-50-3.00	Installation and first service														
	1.lot	150.00	180.00	1.2	180.00	56.00	10,080		0	1,000.00	1,000	0.00	0	11,080.00	11,080
20120 - Dolomite Quarry Mobile Equipment Subtotal					180.00		10,080	0		1,000		971,000			982,080
20130 - Dolomite Quarry Explosive Store															
20130-40-1.00	Explosive store road, berms etc 100m allowance														
	1.sum	200.00	240.00	1.2	240.00	56.00	13,440	8,000.00	8,000	0.00	0	16,000.00	16,000	37,440.00	37,440
20130-40-2.00	Explosive store By Contractor														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-



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20130 - Dolomite Quarry Explosive Store Subtotal					240.00		13,440		8,000		0		16,000		37,440
22110 - Dolomite Quarry Crushing Plant															
22110-50-6.00	Mobile Crushing Plant Mobile hopper, crusher, stacker and diesel power and controls Allowance														
	1.sum	3,900.00	4,680.00	1.2	4,680.00	56.00	262,080	300,000.00	300,000	100,000.00	100,000	1,300,000.00	1,300,000	1,962,080.00	1,962,080
22110 - Dolomite Quarry Crushing Plant Subtotal					4,680.00		262,080		300,000		100,000		1,300,000		1,962,080
23010 - Dolomite Quarry Powerlines															
23010-70-1.00	Power Lines Residential quality Drop down transformer and lines 1Km poles etc														
	1.sum	0.00	0.00	1.2	0.00	56.00	0	50,000.00	50,000	0.00	0	0.00	0	50,000.00	50,000
23010 - Dolomite Quarry Powerlines Subtotal					0.00		0		50,000		0		0		50,000
23020 - Dolomite Quarry Gensets (Construction and Emergency)															
23020-70-1.00	Gensets (Construction and Emergency) not required														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
23020 - Dolomite Quarry Gensets (Construction and Emergency) Subtotal					0.00		0		0		0		0		0
23030 - Dolomite Quarry Main Substations															
23030-70-1.00	Sub-station allowance included with power lines														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
23030 - Dolomite Quarry Main Substations Subtotal					0.00		0		0		0		0		0
23040 - Dolomite Quarry Lightning Protection															
23040-70-1.00	Lightning Protection Not Included														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
23040 - Dolomite Quarry Lightning Protection Subtotal					0.00		0		0		0		0		0
23110 - Dolomite Quarry Fuel Storage															
23110-58-1.00	Fuel Storage concrete slab Allowance for Diesel tank														
	1.sum	70.00	84.00	1.2	84.00	56.00	4,704	7,500.00	7,500	500.00	500	0.00	0	12,704.00	12,704
23110-20-2.00	Tanks and distribution by vendor														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-



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23110 - Dolomite Quarry Fuel Storage Subtotal					84.00		4,704		7,500		500		0		12,704
23210 - Dolomite Quarry Water Distribution System															
23210-60-1.00	Water Distribution System Allowance for tanks and distribution														
	1.sum	50.00	60.00	1.2	60.00	56.00	3,360	5,000.00	5,000	1,000.00	1,000	0.00	0	9,360.00	9,360
23210 - Dolomite Quarry Water Distribution System Subtotal					60.00		3,360		5,000		1,000		0		9,360
23220 - Dolomite Quarry Potable Water															
23220-60-1.00	Potable Water not included - using bottles														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
23220 - Dolomite Quarry Potable Water Subtotal					0.00		0		0		0		0		0
23230 - Dolomite Quarry Site Drainage															
23230-10-1.00	Site Drainage Not Included														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
23230 - Dolomite Quarry Site Drainage Subtotal					0.00		0		0		0		0		0
23240 - Dolomite Quarry Water Treatment (Pit Run-Off)															
23240-50-1.00	Water Treatment (pit run-off) Not Included														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
23240 - Dolomite Quarry Water Treatment (Pit Run-Off) Subtotal					0.00		0		0		0		0		0
23310 - Dolomite Quarry Solid Waste Disposal															
23310-50-1.00	Solid Waste Disposal Not Included														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
23310 - Dolomite Quarry Solid Waste Disposal Subtotal					0.00		0		0		0		0		0
23320 - Dolomite Quarry Sewage															
23320-40-1.00	Sewage Allowance for Tanks single toilet														
	1.sum	0.00	0.00	1.2	0.00	56.00	0	10,000.00	10,000	0.00	0	0.00	0	10,000.00	10,000
23320 - Dolomite Quarry Sewage Subtotal					0.00		0		10,000		0		0		10,000
23410 - Dolomite Quarry Truck Maintenance, Office and First Aid and Mine Dry															





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23410-40-1.00	Workshop Size 150m2 Including excavations and Concrete														
	1.sum	1,140.00	1,368.00	1.2	1,368.00	56.00	76,608	125,000.00	125,000	37,500.00	37,500	0.00	0	239,108.00	239,108
23410-50-2.00	Tools and equipment miscellaneous - Major equipment By contractor														
	1.sum	0.00	0.00	1.2	0.00	56.00	0	10,000.00	10,000	0.00	0	0.00	0	10,000.00	10,000
ite Quarry Truck Maintenance, Office and First Aid and Mine Dry Subtotal					1,368.00		76,608		135,000		37,500		0		249,108
25110 - Dolomite Quarry Laydown Area															
25110-10-1.00	Laydown Area included in site development														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
25110 - Dolomite Quarry Laydown Area Subtotal					0.00		0		0		0		0		0
25120 - Dolomite Quarry Construction Camp															
25120-89-1.00	Construction Camp Not Included														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
25120 - Dolomite Quarry Construction Camp Subtotal					0.00		0		0		0		0		0
25130 - Dolomite Quarry Catering and House Keeping															
25130-89-1.00	Catering and House keeping Not Included														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
25130 - Dolomite Quarry Catering and House Keeping Subtotal					0.00		0		0		0		0		0
30105 - Processing Site Bulk Earthworks / Site Preparation															
30105-10-1.00	Clear site including drainage and grading														
	45.ha	32.00	38.40	1.2	1,728.00	56.00	96,768	0.00	0	2,887.00	129,915	0.00	0	5,037.40	226,683
30105-10-2.00	Site levelling included in site development														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
30105 - Processing Site Bulk Earthworks / Site Preparation Subtotal					1,728.00		96,768		0		129,915		0		226,683
30110 - Processing Site New Roads and Parking															
30110-10-1.00	Road - gravel surface														
	52,500.m2	0.06	0.07	1.2	3,780.00	56.00	211,680	7.00	367,500	0.00	0	8.00	420,000	19.03	999,180



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30110-10-2.00	Parking area tar macadam														
	4,000.m2	0.40	0.48	1.2	1,920.00	56.00	107,520	32.00	128,000	0.00	0	16.00	64,000	74.88	299,520
30110 - Processing Site New Roads and Parking Subtotal					5,700.00		319,200		495,500		0		484,000		1,298,700
30115 - Processing Site Site Drainage															
30115-10-1.00	Site storm water Drainage and evaporation pond Allowance														
	1.sum	2,000.00	2,400.00	1.2	2,400.00	56.00	134,400	3,750.00	3,750	60,000.00	60,000	0.00	0	198,150.00	198,150
30115-10-2.00	Facility drainage to catchment lined pond allowance for catchment around each building and piping Allowance														
	1.sum	910.00	1,092.00	1.2	1,092.00	56.00	61,152	80,000.00	80,000	50,000.00	50,000	0.00	0	191,152.00	191,152
30115-10-3.00	Facility drainage collection pond lined Allowance														
	1.sum	2,300.00	2,760.00	1.2	2,760.00	56.00	154,560	500,000.00	500,000	0.00	0	0.00	0	654,560.00	654,560
30115-10-4.00	Asphalt paving between buildings Levelling, binder and surfacing														
	20,000.m2	0.10	0.12	1.2	2,400.00	56.00	134,400	20.00	400,000	0.00	0	0.00	0	26.72	534,400
30115-10-5.00	3m wide apron around building concrete and curbs														
	1,500.m3	4.50	5.40	1.2	8,100.00	56.00	453,600	500.00	750,000	20.00	30,000	0.00	0	822.40	1,233,600
30115 - Processing Site Site Drainage Subtotal					16,752.00		938,112		1,733,750		140,000		0		2,811,862
30120 - Processing Site Fencing/Gates (Site Control)															
30120-10-1.00	Fencing 8 ' high														
	2,100.m	1.25	1.50	1.2	3,150.00	56.00	176,400	140.00	294,000	25.00	52,500	0.00	0	249.00	522,900
30120-40-2.00	Gates for vehicle														
	2.ea	25.00	30.00	1.2	60.00	56.00	3,360	8,000.00	16,000	300.00	600	0.00	0	9,980.00	19,960
30120-40-3.00	Gates for pedestrian														
	2.ea	10.00	12.00	1.2	24.00	56.00	1,344	2,000.00	4,000	80.00	160	0.00	0	2,752.00	5,504
30120 - Processing Site Fencing/Gates (Site Control) Subtotal					3,234.00		181,104		314,000		53,260		0		548,364
30125 - Processing Site Communication System															
30125-80-1.00	Communication System 50 phones and 6 tie lines Included in Process and accounting cost														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	0.00	0	0.00	0	0.00	0	0.00	0



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30125-80-2.00	Communication System Process and accounting data														
	1.ea	2,500.00	3,000.00	1.2	3,000.00	56.00	168,000	1,200,000.00	1,200,000	50,000.00	50,000	0.00	0	1,418,000.00	1,418,000
30125-80-3.00	Communication System Internet site wide Included in Process and accounting cost														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	0.00	0	0.00	0	0.00	0	0.00	0
30125-80-4.00	Site Communication system, PA, Alarms etc Included in Process and accounting cost														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	0.00	0	0.00	0	0.00	0	0.00	0
30125 - Processing Site Communication System Subtotal					3,000.00		168,000		1,200,000		50,000		0		1,418,000
30130 - Processing Site Fire Alarm System															
30130-70-1.00	Incident Alarm System (fire and H2S, ) PA as required by local code														
	1.ea	240.00	288.00	1.2	288.00	56.00	16,128	50,000.00	50,000	6,568.00	6,568	0.00	0	72,696.00	72,696
30130-70-2.00	Sprinklers to Admin building only (Not Magnesium, Power Or Silicon)														
	50.ea	2.50	3.00	1.2	150.00	56.00	8,400	300.00	15,000	12.00	600	0.00	0	480.00	24,000
30130-70-3.00	Fire alarm systems included in PA System Control, Canteen And Admin allowance														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
30130-70-4.00	Fire Hoses not included														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
30130-70-5.00	Fire extinguishers Allowance														
	30.ea	1.00	1.20	1.2	36.00	56.00	2,016	200.00	6,000	0.00	0	0.00	0	267.20	8,016
30130 - Processing Site Fire Alarm System Subtotal					474.00		26,544		71,000		7,168		0		104,712
30135 - Processing Site Yard Lighting															
30135-70-1.00	Yard Lighting Allowance including concrete base														
	10.ea	8.00	9.60	1.2	96.00	56.00	5,376	15,000.00	150,000	1,000.00	10,000	0.00	0	16,537.60	165,376
30135 - Processing Site Yard Lighting Subtotal					96.00		5,376		150,000		10,000		0		165,376
30140 - Processing Site Power Supply															
30140-70-1.00	Power supply power lines to grid included with Power plant														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-



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30140-70-2.00	Substations not required included with plant														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
30140-70-3.00	Temporary power distribution (construction), emergency, back-up and start up and connection to grid, transformer etc Included in power plant 1MW, allowance														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
30140-70-4.00	Temporary power distribution pole and service transformers, allowance														
	1.sum	0.00	0.00	1.2	0.00	56.00	0	25,000.00	25,000	0.00	0	0.00	0	25,000.00	25,000
30140-20-5.00	Power Distribution tunnels excavation Main Utility tunnel														
	7,200.m3	0.10	0.12	1.2	864.00	56.00	48,384	0.00	0	4.00	28,800	0.00	0	10.72	77,184
30140-20-6.00	Power Distribution tunnels backfill Main Utility tunnel														
	2,880.m3	0.12	0.14	1.2	414.72	56.00	23,224	10.00	28,800	5.00	14,400	0.00	0	23.06	66,424
30140-20-7.00	Power Distribution tunnels Concrete base Main Utility tunnel														
	432.m3	4.50	5.40	1.2	2,332.80	56.00	130,637	356.62	154,060	20.00	8,640	0.00	0	679.02	293,337
30140-20-8.00	Power Distribution tunnels slip cast tunnel size 2 x 3m Main Utility tunnel														
	1,512.m3	4.50	5.40	1.2	8,164.80	56.00	457,229	500.00	756,000	20.00	30,240	0.00	0	822.40	1,243,469
30140-20-9.00	Power Distribution tunnels Manhole access with cover Manhole ring and cover allowance														
	20.ea	40.00	48.00	1.2	960.00	56.00	53,760	1,000.00	20,000	10.00	200	0.00	0	3,698.00	73,960
30140-80-10.00	Power Distribution tunnels Cable racks one side allowance														
	360.m	5.00	6.00	1.2	2,160.00	56.00	120,960	75.00	27,000	15.00	5,400	0.00	0	426.00	153,360
30140-80-11.00	Power Distribution tunnels Pipe racks allowance														
	360.m	3.00	3.60	1.2	1,296.00	56.00	72,576	50.00	18,000	15.00	5,400	0.00	0	266.60	95,976
30140-20-12.00	Power Distribution tunnels excavation Branch tunnels														
	3,000.m3	0.10	0.12	1.2	360.00	56.00	20,160	0.00	0	4.00	12,000	0.00	0	10.72	32,160
30140-20-13.00	Power Distribution tunnels backfill Branch tunnels														
	1,200.m3	0.12	0.14	1.2	172.80	56.00	9,677	10.00	12,000	5.00	6,000	0.00	0	23.06	27,677



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30140-20-14.00	Power Distribution tunnels Concrete base Branch tunnels														
	180.m3	4.50	5.40	1.2	972.00	56.00	54,432	356.62	64,192	20.00	3,600	0.00	0	679.02	122,224
30140-20-15.00	Power Distribution tunnels slip cast tunnel size 2 x 3m Branch tunnels														
	630.m3	4.50	5.40	1.2	3,402.00	56.00	190,512	457.21	288,042	20.00	12,600	0.00	0	779.61	491,154
30140-30-16.00	Power Distribution tunnels Manhole access with cover Manhole ring and cover allowance														
	12.ea	40.00	48.00	1.2	576.00	56.00	32,256	1,000.00	12,000	10.00	120	0.00	0	3,698.00	44,376
30140-80-17.00	Power Distribution tunnels Cable racks one side allowance														
	150.m	5.00	6.00	1.2	900.00	56.00	50,400	75.00	11,250	15.00	2,250	0.00	0	426.00	63,900
30140-80-18.00	Power Distribution tunnels Pipe rack one side only allowance														
	150.m	3.00	3.60	1.2	540.00	56.00	30,240	50.00	7,500	15.00	2,250	0.00	0	266.60	39,990
30140 - Processing Site Power Supply Subtotal					23,115.12		1,294,447		1,423,844		131,900		0		2,850,190
30145 - Processing Site Rail Siding															
30145-9-1.00	Rail siding														
	2,300.m	4.00	4.80	1.2	11,040.00	56.00	618,240	250.00	575,000	20.00	46,000	0.00	0	538.80	1,239,240
30145-9-2.00	Junctions "Y"														
	4.ea	20.00	24.00	1.2	96.00	56.00	5,376	15,000.00	60,000	2,000.00	8,000	0.00	0	18,344.00	73,376
30145-9-3.00	Crossover tracks "X"														
	3.ea	40.00	48.00	1.2	144.00	56.00	8,064	20,000.00	60,000	2,000.00	6,000	0.00	0	24,688.00	74,064
30145-9-4.00	Signalling upgrade for spur line allowance														
	1.sum	160.00	192.00	1.2	192.00	56.00	10,752	16,000.00	16,000	1,712.00	1,712	0.00	0	28,464.00	28,464
30145-9-6.00	Road crossing over tracks ( Railway to provide lights and alarms on main line)														
	1.ea	100.00	120.00	1.2	120.00	56.00	6,720	7,500.00	7,500	500.00	500	0.00	0	14,720.00	14,720
30145-9-7.00	Manual switches of loop														
	2.ea	25.00	30.00	1.2	60.00	56.00	3,360	3,000.00	6,000	200.00	400	0.00	0	4,880.00	9,760



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30145-9-8.00	Main switches of loop on main line														
	2.ea	25.00	30.00	1.2	60.00	56.00	3,360	3,000.00	6,000	200.00	400	0.00	0	4,880.00	9,760
30145 - Processing Site Rail Siding Subtotal					11,712.00		655,872		730,500		63,012		0		1,449,384
30150 - Processing Site Rail Offloading Including Conveyors															
30150-55-1.00	Coal Head chute														
	3,000.kg	0.05	0.06	1.2	180.00	56.00	10,080	5.00	15,000	0.10	300	0.00	0	8.46	25,380
30150-50-2.00	Coal Conveyor train offload 2 m wide excavation continuous off load system														
	90.m3	0.03	0.04	1.2	3.24	56.00	181	0.00	0	3.50	315	0.00	0	5.52	496
30150-50-3.00	Coal Conveyor train offload 2 m wide concrete continuous off load system														
	30.sum	7.00	8.40	1.2	252.00	56.00	14,112	710.00	21,300	20.00	600	0.00	0	1,200.40	36,012
30150-50-4.00	Coal Conveyor train offload 2 m wide continuous off load system														
	1.sum	3,000.00	3,600.00	1.2	3,600.00	56.00	201,600	10,000.00	10,000	10,000.00	10,000	1,250,000.00	1,250,000	1,471,600.00	1,471,600
30150-50-5.00	Coal Inclined conveyor 450mm wide														
	120.m	12.00	14.40	1.2	1,728.00	56.00	96,768	600.00	72,000	600.00	72,000	3,600.00	432,000	5,606.40	672,768
30150-30-6.00	Coal Inclined conveyor 450mm wide support steel														
	20.T	21.30	25.56	1.2	511.20	56.00	28,627	3,000.00	60,000	180.00	3,600	0.00	0	4,611.36	92,227
30150-50-7.00	Coal Tripper Conveyor 450mm Wide														
	100.m	18.00	21.60	1.2	2,160.00	56.00	120,960	700.00	70,000	700.00	70,000	4,250.00	425,000	6,859.60	685,960
30150-30-8.00	Coal Tripper Conveyor 450mm Wide support steel														
	15.T	21.30	25.56	1.2	383.40	56.00	21,470	3,000.00	45,000	180.00	2,700	0.00	0	4,611.36	69,170
30150-55-9.00	Process head chute														
	5,000.kg	0.05	0.06	1.2	300.00	56.00	16,800	5.00	25,000	0.10	500	0.00	0	8.46	42,300
30150-50-10.00	Process Conveyor train off load system excavation non-continuous off load system														
	180.m3	0.03	0.04	1.2	6.48	56.00	363	0.00	0	3.50	630	0.00	0	5.52	993



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30150-50-11.00	Process Conveyor train off load system concrete non-continuous off load system														
	60.m3	7.00	8.40	1.2	504.00	56.00	28,224	710.00	42,600	20.00	1,200	0.00	0	1,200.40	72,024
30150-50-12.00	Process Conveyor train off load system non-continuous off load system														
	1.sum	2,000.00	2,400.00	1.2	2,400.00	56.00	134,400	5,000.00	5,000	3,000.00	3,000	638,400.00	638,400	780,800.00	780,800
30150-50-13.00	Process Inclined conveyor 450mm wide														
	135.m	12.00	14.40	1.2	1,944.00	56.00	108,864	600.00	81,000	600.00	81,000	3,600.00	486,000	5,606.40	756,864
30150-30-14.00	Process Inclined conveyor 450mm wide support steel														
	25.t	21.30	25.56	1.2	639.00	56.00	35,784	3,000.00	75,000	180.00	4,500	0.00	0	4,611.36	115,284
30150-50-15.00	Process Tripper conveyor 450 mm wide for dumping area														
	80.m	18.00	21.60	1.2	1,728.00	56.00	96,768	700.00	56,000	700.00	56,000	4,250.00	340,000	6,859.60	548,768
30150-30-16.00	Process Tripper conveyor 450 mm wide support steel														
	24.t	21.30	25.56	1.2	613.44	56.00	34,353	3,000.00	72,000	180.00	4,320	0.00	0	4,611.36	110,673
30150-55-17.00	Process 450mm wide Bins not included - assume stockpile														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
30150-50-18.00	Process 450mm wide Remainder of equipment assumed in FeSi facility														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
30150-50-19.00	Process 20 t remote control Continuous winch for moving trucks to be confirmed														
	1.ea	200.00	240.00	1.2	240.00	56.00	13,440	2,500.00	2,500	1,000.00	1,000	36,140.00	36,140	53,080.00	53,080

30150 - Processing Site Rail Offloading Including Conveyors Subtotal	17,192.76	962,795	652,400	311,665	3,607,540	5,534,400
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31110 - Processing Site Woodchip Stockpile

31110-20-1.00	Hopper support system excavation														
	20.m3	0.10	0.12	1.2	2.40	56.00	134	0.00	0	4.00	80	0.00	0	10.72	214
31110-20-2.00	Hopper support system concrete														
	20.m3	4.50	5.40	1.2	108.00	56.00	6,048	356.62	7,132	20.00	400	0.00	0	679.02	13,580





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31110-55-3.00	Hopper	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31110-20-4.00	Foundation excavation allowance	50.m3	0.10	0.12	6.00	56.00	336	0.00	0	4.00	200	0.00	0	10.72	536
31110-20-5.00	Foundation concrete allowance	20.m3	4.50	5.40	108.00	56.00	6,048	356.62	7,132	20.00	400	0.00	0	679.02	13,580
31110-40-6.00	Stockpile cover wood chip sprung structure not included	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31110-50-7.00	Truck Unloading System Allowance 18T chip trucks	1.ea	500.00	600.00	600.00	56.00	33,600	30,000.00	30,000	6,000.00	6,000	125,600.00	125,600	195,200.00	195,200
31110-50-8.00	Pneumatic conveying system	1.ea	150.00	180.00	180.00	56.00	10,080	6,000.00	6,000	6,000.00	6,000	77,480.00	77,480	99,560.00	99,560
31110 - Processing Site Woodchip Stockpile Subtotal					1,004.40		56,246		50,265		13,080		203,080		322,671
31120 - Processing Site Power Plant Coal Stockpile															
31120-10-1.00	Clear Site included	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31120-10-2.00	Gravel 100m Thick	2,500.m3	0.03	0.04	90.00	56.00	5,040	7.00	17,500	0.00	0	0.00	0	9.02	22,540
31120-20-3.00	Excavate For Tunnel Coal stockpile reclaim	1,600.m3	0.10	0.12	192.00	56.00	10,752	0.00	0	4.00	6,400	0.00	0	10.72	17,152
31120-10-4.00	Multiplate Tunnel Coal stockpile reclaim	240.m	7.00	8.40	2,016.00	56.00	112,896	2,000.00	480,000	200.00	48,000	0.00	0	2,670.40	640,896
31120-10-5.00	Backfill With Granular Material Coal stockpile reclaim	1,400.m3	0.06	0.07	100.80	56.00	5,645	6.00	8,400	4.00	5,600	0.00	0	14.03	19,645





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31120-30-6.00	Ladder Coal stockpile reclaim														
	20.m	7.00	8.40	1.2	168.00	56.00	9,408	710.00	14,200	20.00	400	0.00	0	1,200.40	24,008
31120-20-7.00	Concrete Slab Coal stockpile reclaim														
	1,800.m3	2.30	2.76	1.2	4,968.00	56.00	278,208	356.62	641,916	20.00	36,000	0.00	0	531.18	956,124
31120-30-8.00	Steel Insert Coal stockpile reclaim														
	9.t	21.30	25.56	1.2	230.04	56.00	12,882	3,000.00	27,000	180.00	1,620	0.00	0	4,611.36	41,502
31120-55-9.00	Chutes Coal stockpile reclaim														
	4,500.kg	0.05	0.06	1.2	270.00	56.00	15,120	5.00	22,500	0.10	450	0.00	0	8.46	38,070
31120-55-10.00	Chute work Incl Liners power plant coal														
	5,000.kg	0.05	0.06	1.2	300.00	56.00	16,800	5.00	25,000	0.10	500	0.00	0	8.46	42,300
31120-60-11.00	Head chute														
	2,000.kg	0.05	0.06	1.2	120.00	56.00	6,720	5.00	10,000	0.10	200	0.00	0	8.46	16,920
31120-50-12.00	Conveyor 450mm Wide power plant coal Under stock pile														
	100.m	14.00	16.80	1.2	1,680.00	56.00	94,080	600.00	60,000	600.00	60,000	3,000.00	300,000	5,140.80	514,080
31120-50-13.00	Conveyor 450mm Wide to top bin														
	100.m	14.00	16.80	1.2	1,680.00	56.00	94,080	600.00	60,000	600.00	60,000	3,000.00	300,000	5,140.80	514,080
31120-30-14.00	Conveyor 450mm Wide to top bin support steel														
	18.T	21.30	25.56	1.2	460.08	56.00	25,764	3,000.00	54,000	180.00	3,240	0.00	0	4,611.36	83,004
31120-60-15.00	Coal hopper included in power plant														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
31120-60-16.00	Piping Misting allowance 1.5%														
	1.sum	184.12	184.12	1	184.12	56.00	10,311	21,397.74	21,398	3,426.15	3,426	10,162.20	10,162	45,297.02	45,297
31120-70-17.00	Electrical Allowance 2.0%														
	1.sum	245.50	245.50	1	245.50	56.00	13,748	28,530.32	28,530	4,568.20	4,568	13,549.60	13,550	60,396.03	60,396



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31120-80-18.00	Instrumentation Allowance	1.0%													
	1.sum	122.75	122.75	1	122.75	56.00	6,874	14,265.16	14,265	2,284.10	2,284	6,774.80	6,775	30,198.02	30,198
31120-50-19.00	Pan feeder under chutes														
	3.ea	300.00	360.00	1.2	1,080.00	56.00	60,480	48,000.00	144,000	6,000.00	18,000	0.00	0	74,160.00	222,480
31120 - Processing Site Power Plant Coal Stockpile Subtotal					13,907.29		778,808		1,628,709		250,688		630,487		3,288,693
40110 - Processing Site Ferrosilicon Production Plant															
40110-30-1.00	Ferro Silicon Production Plant allowance														
	1.sum	65,000.00	78,000.00	1.2	78,000.00	56.00	4,368,000	10,500,000.00	10,500,000	1,000,000.00	1,000,000	11,500,000.00	11,500,000	27,368,000.00	27,368,000
40110-30-2.00	Ferro Silicon Production Plant Manganese Ore Sintering Plant excluded from quote	TBD													-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
40110-20-2.00	Ferro Silicon Production Plant foundations - excavate	Assumed no Piling													
	2,500.m3	0.10	0.12	1.2	300.00	56.00	16,800	0.00	0	4.00	10,000	0.00	0	10.72	26,800
40110-20-3.00	Ferro Silicon Production Plant 3 floors suspended concrete														
	2,250.m3	4.50	5.40	1.2	12,150.00	56.00	680,400	283.47	637,808	20.00	45,000	0.00	0	605.87	1,363,208
40110-20-3.00	Ferro Silicon Production Plant Foundations -														
	1,875.m3	4.50	5.40	1.2	10,125.00	56.00	567,000	500.00	937,500	20.00	37,500	0.00	0	822.40	1,542,000
40110-30-4.00	Ferro Silicon Production Plant Insulated Cladding Walls														
	3,600.m2	0.95	1.14	1.2	4,104.00	56.00	229,824	115.00	414,000	5.00	18,000	0.00	0	183.84	661,824
40110-30-5.00	Ferro Silicon Production Plant Insulated Cladding Roofing														
	2,500.m2	0.95	1.14	1.2	2,850.00	56.00	159,600	115.00	287,500	5.00	12,500	0.00	0	183.84	459,600
40110-60-6.00	Service connections Piping included														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
40110-70-7.00	Service connections Electrical included														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-



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40110-80-8.00	Coal gas service connections Piping 50 m line														
	200.m	0.32	0.38	1.2	76.80	56.00	4,301	9.68	1,935	1.00	200	0.00	0	32.18	6,436
40110-80-9.00	Pneumatic conveyor from FeSi to Briquetting assumed included in plant														
	1.sum	900.00	1,080.00	1.2	1,080.00	56.00	60,480	15,000.00	15,000	5,000.00	5,000	110,000.00	110,000	190,480.00	190,480
40110 - Processing Site Ferrosilicon Production Plant Subtotal					108,685.80		6,086,405		12,793,743		1,128,200		11,610,000		31,618,347
40210 - Processing Site Dolomite Grinding and Slag Loadout															
40210-10-1.00	Earth Ramp														
	3,600.m3	0.03	0.04	1.2	129.60	56.00	7,258	0.00	0	3.00	10,800	0.00	0	5.02	18,058
40210-20-2.00	Concrete														
	20.m3	4.50	5.40	1.2	108.00	56.00	6,048	356.62	7,132	20.00	400	0.00	0	679.02	13,580
40210-10-2.00	MSE Wall Wire basket wall														
	720.m2	1.00	1.20	1.2	864.00	56.00	48,384	462.50	333,000	15.00	10,800	0.00	0	544.70	392,184
40210-30-3.00	Steel insert grating 4m x 2m														
	3.5T	21.30	25.56	1.2	89.46	56.00	5,010	3,000.00	10,500	180.00	630	0.00	0	4,611.36	16,140
40210-55-4.00	Hopper 10t 25mm thick														
	5,500.kg	0.05	0.06	1.2	330.00	56.00	18,480	5.00	27,500	0.10	550	0.00	0	8.46	46,530
40210-55-5.00	Chute														
	2,000.kg	0.05	0.06	1.2	120.00	56.00	6,720	5.00	10,000	0.10	200	0.00	0	8.46	16,920
40210-10-6.00	Hopper support structure														
	7.T	21.30	25.56	1.2	178.92	56.00	10,020	3,000.00	21,000	180.00	1,260	0.00	0	4,611.36	32,280
40210-50-7.00	Ferro Silicon Production Plant analytical cell including spectro photometer, robot, mill, computer house and AC														
	1.ea	20.00	24.00	1.2	24.00	56.00	1,344	1,000.00	1,000	500.00	500	57,000.00	57,000	59,844.00	59,844
40210-50-8.00	Ferro Silicon Production Plant cooling tower included														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-



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40210-50-9.00	Conveyor 100 x 900mm wide top stockpile														
	100.m	20.00	24.00	1.2	2,400.00	56.00	134,400	800.00	80,000	800.00	80,000	5,400.00	540,000	8,344.00	834,400
40210-50-10.00	Conveyor 450mm Wide Reclaim system dolomite														
	100.m	12.00	14.40	1.2	1,440.00	56.00	80,640	600.00	60,000	600.00	60,000	3,600.00	360,000	5,606.40	560,640
40210-30-11.00	Conveyor support steel														
	20.T	21.30	25.56	1.2	511.20	56.00	28,627	3,000.00	60,000	180.00	3,600	0.00	0	4,611.36	92,227
40210-50-12.00	Pan feeder apron feeder														
	1.ea	300.00	360.00	1.2	360.00	56.00	20,160	48,000.00	48,000	6,000.00	6,000	0.00	0	74,160.00	74,160
40210-30-13.00	Tripper support steel														
	20.T	21.30	25.56	1.2	511.20	56.00	28,627	3,000.00	60,000	180.00	3,600	0.00	0	4,611.36	92,227
40210-20-14.00	Concrete apron slab														
	750.m3	3.00	3.60	1.2	2,700.00	56.00	151,200	356.62	267,465	20.00	15,000	0.00	0	578.22	433,665
40210-10-15.00	Gravel bedding														
	1,200.m3	0.15	0.18	1.2	216.00	56.00	12,096	3.00	3,600	4.00	4,800	0.00	0	17.08	20,496
40210-30-16.00	Steel Insert Coal stockpile reclaim														
	3.t	21.30	25.56	1.2	76.68	56.00	4,294	3,000.00	9,000	180.00	540	0.00	0	4,611.36	13,834
40210-55-17.00	Chutes Reclaim system dolomite														
	1,500.kg	0.05	0.06	1.2	90.00	56.00	5,040	5.00	7,500	0.10	150	0.00	0	8.46	12,690
40210-50-18.00	Cone Crusher HP 500														
	1.sum	3,500.00	4,200.00	1.2	4,200.00	56.00	235,200	90,000.00	90,000	90,000.00	90,000	450,000.00	450,000	865,200.00	865,200
40210-50-19.00	Tripper														
	20.m	27.00	32.40	1.2	648.00	56.00	36,288	3,000.00	60,000	900.00	18,000	0.00	0	5,714.40	114,288
40210-20-20.00	Excavate For Tunnel Reclaim system dolomite														
	1,600.m3	0.10	0.12	1.2	192.00	56.00	10,752	0.00	0	4.00	6,400	0.00	0	10.72	17,152



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40210-10-21.00	Multiplate Tunnel Reclaim system dolomite														
	100.m	7.00	8.40	1.2	840.00	56.00	47,040	2,000.00	200,000	200.00	20,000	0.00	0	2,670.40	267,040
40210-10-22.00	Backfill With Granular Material Reclaim system dolomite														
	1,400.m3	0.06	0.07	1.2	100.80	56.00	5,645	6.00	8,400	4.00	5,600	0.00	0	14.03	19,645
40210-30-23.00	Ladder Reclaim system dolomite														
	20.m	7.00	8.40	1.2	168.00	56.00	9,408	710.00	14,200	20.00	400	0.00	0	1,200.40	24,008
40210-10-24.00	Concrete footings for conveyor														
	50.m3	3.80	4.56	1.2	228.00	56.00	12,768	460.00	23,000	0.00	0	0.00	0	715.36	35,768
40210-55-25.00	Head Chute 1m x 1 x1m														
	2,000.kg	0.05	0.06	1.2	120.00	56.00	6,720	5.00	10,000	0.10	200	0.00	0	8.46	16,920
40210-50-26.00	Pan feeder Reclaim system dolomite														
	1.ea	300.00	360.00	1.2	360.00	56.00	20,160	48,000.00	48,000	6,000.00	6,000	0.00	0	74,160.00	74,160
40210 - Processing Site Dolomite Grinding and Slag Loadout Subtotal					17,005.86		952,328		1,459,297		345,430		1,407,000		4,164,056
40220 - Processing Site Crushing and Grinding Area															
40220-40-1.00	Concrete pad 15m x 70m														
	750.m3	4.50	5.40	1.2	4,050.00	56.00	226,800	500.00	375,000	20.00	15,000	0.00	0	822.40	616,800
40220-40-2.00	excavate and backfill														
	800.m3	0.10	0.12	1.2	96.00	56.00	5,376	0.00	0	4.00	3,200	0.00	0	10.72	8,576
40220-55-3.00	Day tank 120m3														
	10,000.kg	0.05	0.06	1.2	600.00	56.00	33,600	5.00	50,000	0.10	1,000	0.00	0	8.46	84,600
40220-55-4.00	Ball mill feed chute														
	5,000.sum	0.05	0.06	1.2	300.00	56.00	16,800	5.00	25,000	0.10	500	0.00	0	8.46	42,300
40220-50-5.00	Weigh belt feeder on load cells														
	1.ea	325.00	390.00	1.2	390.00	56.00	21,840	48,500.00	48,500	6,500.00	6,500	0.00	0	76,840.00	76,840



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40220-50-6.00	Ball mill 40tph -120micron input 1in minus dolomite install and foundations														
	1.sum	9,000.00	10,800.00	1.2	10,800.00	56.00	604,800	50,000.00	50,000	50,000.00	50,000	3,000,000.00	3,000,000	3,704,800.00	3,704,800
40220-50-7.00	Cyclone separator including fan 40tph - 120micron product														
	1.ea	580.00	696.00	1.2	696.00	56.00	38,976	5,000.00	5,000	2,500.00	2,500	100,000.00	100,000	146,476.00	146,476
40220-57-8.00	HVAC 0														
	1.ea	0.00	0.00	1	0.00	56.00	0	0.00	0	0.00	0	0.00	0	0.00	0
40220-60-9.00	Piping and ducting allowance 1.0%														
	1.sum	169.32	169.32	1	169.32	56.00	9,482	5,535.00	5,535	787.00	787	31,000.00	31,000	46,803.92	46,804
40220-70-10.00	Electrical allowance 3.0%														
	1.sum	507.96	507.96	1	507.96	56.00	28,446	16,605.00	16,605	2,361.00	2,361	93,000.00	93,000	140,411.76	140,412
40220-80-11.00	Instrumentation allowance allowance 2.0%														
	1.sum	338.64	338.64	1	338.64	56.00	18,964	11,070.00	11,070	1,574.00	1,574	62,000.00	62,000	93,607.84	93,608
40220-50-12.00	Pneumatic conveyor -120micron dolomite 20 m														
	1.ea	900.00	1,080.00	1.2	1,080.00	56.00	60,480	15,000.00	15,000	4,000.00	4,000	112,000.00	112,000	191,480.00	191,480
40220 - Processing Site Crushing and Grinding Area Subtotal					19,027.92		1,065,564		601,710		87,422		3,398,000		5,152,696
40310 - Processing Site Calciner Area															
40310-20-1.00	Concrete slab 75 x 50														
	1,125.m3	3.00	3.60	1.2	4,050.00	56.00	226,800	356.62	401,198	20.00	22,500	0.00	0	578.22	650,498
40310-20-2.00	Equipment foundations concrete cylinders 2ft x 3ft deep														
	96.ea	4.00	4.80	1.2	460.80	56.00	25,805	1,500.00	144,000	100.00	9,600	0.00	0	1,868.80	179,405
40310-50-3.00	Plant wide Bag Houses including installation, 700 SCFM for pneumatic conveyor														
	1.ea	7,800.00	9,360.00	1.2	9,360.00	56.00	524,160	500,000.00	500,000	10,000.00	10,000	900,000.00	900,000	1,934,160.00	1,934,160
40310-50-4.00	Calciners 700 tpd dolomite input = 250,000tpa														
	1.sum	65,000.00	78,000.00	1.2	78,000.00	56.00	4,368,000	205,000.00	205,000	125,000.00	125,000	47,000,000.00	47,000,000	51,698,000.00	51,698,000



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40310-50-5.00	Gas supply 300m dia. schedule steel welded, power plant to calciner														
	275.m	3.40	4.08	1.2	1,122.00	56.00	62,832	325.00	89,375	65.00	17,875	0.00	0	618.48	170,082
40310-50-6.00	Pneumatic conveyor /dust collector -150 micron 25tph included with dust collection from calciner to briquette in tunnel														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
40310-50-7.00	10 t Bridge crane on rails														
	1.ea	680.00	816.00	1.2	816.00	56.00	45,696	750.00	750	750.00	750	82,500.00	82,500	129,696.00	129,696
40310-80-8.00	BET Analyser allowance														
	1.ea	65.00	78.00	1.2	78.00	56.00	4,368	10,000.00	10,000	10,000.00	10,000	75,000.00	75,000	99,368.00	99,368
40310-80-9.00	Liquid Nitrogen By Vendor														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
40310-57-10.00	HVAC .0%														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
40310-60-11.00	Piping and ducting .0%														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
40310-70-12.00	Electrical allowance 2.0%														
	1.sum	1,877.74	1,877.74	1	1,877.74	56.00	105,153	27,306.45	27,306	3,994.50	3,995	963,390.00	963,390	1,099,844.17	1,099,844
40310-80-13.00	Instrumentation allowance allowance 2.0%														
	1.sum	1,877.74	1,877.74	1	1,877.74	56.00	105,153	27,306.45	27,306	3,994.50	3,995	963,390.00	963,390	1,099,844.17	1,099,844
40310-50-14.00	Testing crane														
	1.ea	10.00	12.00	1.2	12.00	56.00	672	0.00	0	200.00	200	0.00	0	872.00	872
40310 - Processing Site Calciner Area Subtotal					97,654.27		5,468,639		1,404,935		203,914		49,984,280		57,061,769
40320 - Processing Site Bricquetting Area															
40320-40-1.00	Building size Pre-engineered (steel faced insulated cladding) including excavation and foundations														
	900.m2	0.00	0.00	1.2	0.00	56.00	0	3,200.00	2,880,000	0.00	0	0.00	0	3,200.00	2,880,000





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40320-50-2.00	Overhead Crane - 30 t bridge														
	1.ea	130.00	156.00	1.2	156.00	56.00	8,736	100.00	100	125.00	125	80,000.00	80,000	88,961.00	88,961
40320-50-3.00	Overhead Crane - 10 t Jib boom														
	1.ea	40.00	48.00	1.2	48.00	56.00	2,688	125.00	125	200.00	200	35,000.00	35,000	38,013.00	38,013
40320-50-4.00	Overhead Crane - 30 t bridge load cell														
	1.ea		0.00	1.2	0.00	56.00	0	2,000.00	2,000		0		0	2,000.00	2,000
40320-50-5.00	Overhead Crane - 10 t Jib boom load cell														
	1.ea		0.00	1.2	0.00	56.00	0	2,000.00	2,000		0		0	2,000.00	2,000
40320-50-6.00	Testing 30T crane														
	1.ea	16.00	19.20	1.2	19.20	56.00	1,075	0.00	0	300.00	300	0.00	0	1,375.20	1,375
40320-55-7.00	Dolime Fine Dolime Storage Bin size 40t 1.2 SG = t/m3														
	5,500.kg	0.05	0.06	1.2	330.00	56.00	18,480	5.00	27,500	0.10	550	0.00	0	8.46	46,530
40320-50-8.00	Testing 10 T crane														
	1.ea	10.00	12.00	1.2	12.00	56.00	672	0.00	0	200.00	200	0.00	0	872.00	872
40320-50-9.00	Dolime load cells for dolime storage bin														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	2,000.00	2,000		0		0	2,000.00	2,000
40320-55-10.00	FeSi Tote bin 5 no 5T capacity 1x 1 x1m														
	500.kg	0.05	0.06	1.2	30.00	56.00	1,680	5.00	2,500	0.10	50	0.00	0	8.46	4,230
40320-30-11.00	FeSi load cell platform steel 1 x1m no 1														
	1,000.kg	0.05	0.06	1.2	60.00	56.00	3,360	5.00	5,000	0.10	100	0.00	0	8.46	8,460
40320-50-12.00	Dolime Bin Reclaim Feeder vibrating feeder														
	1.ea	580.00	696.00	1.2	696.00	56.00	38,976	5,000.00	5,000	2,500.00	2,500	100,000.00	100,000	146,476.00	146,476
40320-50-13.00	FeSi load cells for tote bin no 1														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	2,000.00	2,000	0.00	0	0.00	0	2,000.00	2,000





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40320-50-14.00	FeSi Bin Reclaim Feeder														
	1.ea		0.00	1.2	0.00	56.00	0	77,000.00	77,000		0		0	77,000.00	77,000
40320-50-15.00	Pneumatic offloading system CaF2 from CaF2 silo to briquetting														
	1.ea	900.00	1,080.00	1.2	1,080.00	56.00	60,480	15,000.00	15,000	4,000.00	4,000	112,000.00	112,000	191,480.00	191,480
40320-55-16.00	CaF2 Storage Bin size 40t 1.2 SG = t/m3														
	15,000.kg	0.05	0.06	1.2	900.00	56.00	50,400	5.00	75,000	0.10	1,500	0.00	0	8.46	126,900
40320-50-17.00	CaF2 silo assumed not required - use storage bin														-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40320-50-18.00	CaF2 load cells storage bin														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	2,000.00	2,000		0		0	2,000.00	2,000
40320-55-19.00	Weigh bin 2 x2 x1 m														
	1,300.kg	0.05	0.06	1.2	78.00	56.00	4,368	5.00	6,500	0.10	130	0.00	0	8.46	10,998
40320-50-20.00	CaF2 Bin Reclaim Feeder vibrating feeder														
	1.ea	580.00	696.00	1.2	696.00	56.00	38,976	5,000.00	5,000	2,500.00	2,500	100,000.00	100,000	146,476.00	146,476
40320-50-21.00	Load cell														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	2,000.00	2,000	0.00	0	0.00	0	2,000.00	2,000
40320-55-22.00	Bin 2 x2 x1 m														
	1,000.kg	0.05	0.06	1.2	60.00	56.00	3,360	5.00	5,000	0.10	100	0.00	0	8.46	8,460
40320-50-23.00	Dolime/FeSi/Fluorspar Blender Irich Mixer 2.5 t dolime FeSi and CaF2														
	1.ea	870.00	1,044.00	1.2	1,044.00	56.00	58,464	400.00	400	3,750.00	3,750	150,000.00	150,000	212,614.00	212,614
40320-50-24.00	Briquetter Press Feeder														
	1.ea	290.00	348.00	1.2	348.00	56.00	19,488	2,500.00	2,500	1,250.00	1,250	50,000.00	50,000	73,238.00	73,238
40320-55-25.00	Bin 2 x2 x1 m														
	1,000.kg	0.05	0.06	1.2	60.00	56.00	3,360	5.00	5,000	0.10	100	0.00	0	8.46	8,460



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40320-80-26.00	Processing Cassette , rotary valve, resistor plate cassette, hydraulic push cylinder, 6 eyes, Hydraulic elevator with rotate														
	1.ea	10,000.00	12,000.00	1.2	12,000.00	56.00	672,000	25,000.00	25,000	30,000.00	30,000	1,600,000.00	1,600,000	2,327,000.00	2,327,000
40320-50-27.00	Briquetter Press Roll crusher 1m x 0.75m dia. 30000t/sq in														
	1.ea	3,000.00	3,600.00	1.2	3,600.00	56.00	201,600	4,000.00	4,000	5,000.00	5,000	500,000.00	500,000	710,600.00	710,600
40320-50-28.00	Turntable 12m Dia. 150T over a third Allowance including motors gears controls														
	1.ea	3,200.00	3,840.00	1.2	3,840.00	56.00	215,040	80,000.00	80,000	80,000.00	80,000	200,000.00	200,000	575,040.00	575,040
40320-50-29.00	Disk and spent briquette recapture facility														
	1.ea	5,000.00	6,000.00	1.2	6,000.00	56.00	336,000	700,000.00	700,000	250,000.00	250,000	250,000.00	250,000	1,536,000.00	1,536,000
40320-57-30.00	HVAC 1.0%														
	1.ea	250.69	250.69	1	250.69	56.00	14,039	32,326.25	32,326	1,325.55	1,326	29,270.00	29,270	76,960.55	76,961
40320-60-31.00	Piping and ducting allowance 1.0%														
	1.sum	250.69	250.69	1	250.69	56.00	14,039	32,326.25	32,326	1,325.55	1,326	29,270.00	29,270	76,960.55	76,961
40320-70-32.00	Electrical allowance 2.0%														
	1.sum	501.38	501.38	1	501.38	56.00	28,078	64,652.50	64,653	2,651.10	2,651	58,540.00	58,540	153,921.10	153,921
40320-80-33.00	Instrumentation allowance allowance 1.0%														
	1.sum	250.69	250.69	1	250.69	56.00	14,039	32,326.25	32,326	1,325.55	1,326	29,270.00	29,270	76,960.55	76,961
40320 - Processing Site Bricquetting Area Subtotal					32,310.66		1,809,397		4,094,256		388,983		3,323,350		9,615,986
40330 - Processing Site Reduction Building Area															
40330-40-1.00	Building size 50 x 60m including crane rails Pre-engineered (steel faced insulated cladding) including excavation sand foundations														
	3,000.m2	12.50	15.00	1.2	45,000.00	56.00	2,520,000	1,920.00	5,760,000	320.00	960,000	0.00	0	3,080.00	9,240,000
40330-40-2.00	Control room PC's, and monitors, furniture														
	1.m2	250.00	300.00	1.2	300.00	56.00	16,800	50,000.00	50,000	10,000.00	10,000	0.00	0	76,800.00	76,800
40330-30-3.00	Internal steel work floor grating steel stairs rails														
	3,000.m2	1.00	1.20	1.2	3,600.00	56.00	201,600	125.00	375,000	5.00	15,000		0	197.20	591,600



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40330-50-4.00	Overhead Crane - 30 t RC control -not pendant														
	2.ea	150.00	180.00	1.2	360.00	56.00	20,160	100.00	200	125.00	250	100,000.00	200,000	110,305.00	220,610
40330-50-5.00	Overhead Crane - 30 t load cell														
	2.ea	0.00	0.00	1.2	0.00	56.00	0	2,000.00	4,000	0.00	0	0.00	0	2,000.00	4,000
40330-50-6.00	Hydraulic wrench system 24 hydraulic wrench on 2m circle 2" nuts														
	2.ea	780.00	936.00	1.2	1,872.00	56.00	104,832	20,000.00	40,000	20,000.00	40,000	100,000.00	200,000	192,416.00	384,832
40330-50-7.00	Fume collection on crane into ducts Allowance														
	2.ea	1,140.00	1,368.00	1.2	2,736.00	56.00	153,216	137,500.00	275,000	25,000.00	50,000	0.00	0	239,108.00	478,216
40330-50-8.00	Testing 30T crane														
	2.ea	16.00	19.20	1.2	38.40	56.00	2,150	0.00	0	300.00	600	0.00	0	1,375.20	2,750
40330-50-9.00	Furnace Reduction includes electrodes and installation														
	100.ea	80.00	96.00	1.2	9,600.00	56.00	537,600	6,250.00	625,000	2,500.00	250,000	10,000.00	1,000,000	24,126.00	2,412,600
40330-50-10.00	Condenser 12mm wall steel cap, 2m Dia. 3m high														
	30,000.kg	0.10	0.12	1.2	3,600.00	56.00	201,600	5.00	150,000	0.10	3,000	0.00	0	11.82	354,600
40330-50-11.00	Water jacket 12mm wall steel cap, 2m Dia. 3m high														
	30,000.kg	0.10	0.12	1.2	3,600.00	56.00	201,600	5.00	150,000	0.10	3,000	0.00	0	11.82	354,600
40330-50-12.00	Rails in floor 40kg/m														
	120.m	2.00	2.40	1.2	288.00	56.00	16,128	138.00	16,560	2.50	300	0.00	0	274.90	32,988
40330-50-13.00	Rail Carts														
	2.ea	50.00	60.00	1.2	120.00	56.00	6,720		0		0	50,000.00	100,000	53,360.00	106,720
40330-50-14.00	Cable tugger rope tow remote control 200 m														
	2.ea	20.00	24.00	1.2	48.00	56.00	2,688	0.00	0	0.00	0	50,000.00	100,000	51,344.00	102,688
40330-50-15.00	Cooling tower included in power plant														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-



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40330-55-16.00	Liquid argon tank by Vendor														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
40330-50-17.00	Vacuum system steam eductor														
	6.ea	30.00	36.00	1.2	216.00	56.00	12,096	500.00	3,000	300.00	1,800	50,000.00	300,000	52,816.00	316,896
40330-80-18.00	Valves remote ball valves 4"														
	200.ea	0.75	0.90	1.2	180.00	56.00	10,080	75.00	15,000	0.00	0		0 0	125.40	25,080
40330-80-19.00	Valves remote ball valves 1"														
	100.ea	0.50	0.60	1.2	60.00	56.00	3,360	45.00	4,500	0.00	0		0 0	78.60	7,860
40330-60-20.00	Piping to valves 4" Carbon steel, schedule 40														
	70.m	0.50	0.60	1.2	42.00	56.00	2,352	47.50	3,325	10.00	700		0 0	91.10	6,377
40330-60-21.00	Piping to valves 1" Carbon steel, schedule 40														
	70.m	1.30	1.56	1.2	109.20	56.00	6,115	125.00	8,750	25.00	1,750		0 0	237.36	16,615
40330-60-22.00	Duct 60m x 1m Dia. Trunk and collection ducting manifold cooling area														
	24,000.kg	0.10	0.12	1.2	2,880.00	56.00	161,280	5.00	120,000	0.10	2,400	0.00	0 0	11.82	283,680
40330-57-23.00	HVAC - heat only allowance														
	1.sum	0.00	0.00	1	0.00	56.00	0	0.00	0	0.00	0	0.00	0	0.00	0
40330-60-24.00	Piping and ducting allowance 10.0%														
	1.sum	8,190.31	8,190.31	1	8,190.31	56.00	458,657	846,196.63	846,197	159,542.78	159,543	229,635.00	229,635	1,694,031.54	1,694,032
40330-70-25.00	Electrical allowance 10.0%														
	1.sum	8,190.31	8,190.31	1	8,190.31	56.00	458,657	846,196.63	846,197	159,542.78	159,543	229,635.00	229,635	1,694,031.54	1,694,032
40330-80-26.00	Instrumentation allowance allowance 2.0%														
	1.sum	1,638.06	1,638.06	1	1,638.06	56.00	91,731	169,239.33	169,239	31,908.56	31,909	45,927.00	45,927	338,806.31	338,806
40330-50-27.00	Liquid argon evaporator by Vendor														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
40330 - Processing Site Reduction Building Area Subtotal					92,668.27		5,189,423		9,461,968		1,689,794		2,405,197		18,746,382



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40340 - Processing Site Casting Area															
40340-40-1.00	Casting Building	Building size 70 x 30m (steel faced insulated cladding) including excavation sand foundations													
	2,100.m2	12.50	15.00	1.2	31,500.00	56.00	1,764,000	1,920.00	4,032,000	320.00	672,000	0.00	0	3,080.00	6,468,000
40340-50-2.00	Overhead Crane - 10 t														
	2.ea	130.00	156.00	1.2	312.00	56.00	17,472	100.00	200	125.00	250	80,000.00	160,000	88,961.00	177,922
40340-50-3.00	Overhead Crane - 10 t load cell														
	2.ea	0.00	0.00	1.2	0.00	56.00	0	2,000.00	4,000	0.00	0	0.00	0	2,000.00	4,000
40340-50-4.00	Testing 10T crane														
	2.ea	16.00	19.20	1.2	38.40	56.00	2,150	0.00	0	300.00	600	0.00	0	1,375.20	2,750
40340-20-5.00	Crane rails on floors	40kg/m													
	140.m	2.00	2.40	1.2	336.00	56.00	18,816	138.00	19,320	2.50	350	0.00	0	274.90	38,486
40340-40-6.00	Shipping Building including in Casting building														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
40340-50-7.00	2Ton cranes on floor rails for shipping with load cell														
	2.ea	100.00	120.00	1.2	240.00	56.00	13,440	15,000.00	30,000	2,500.00	5,000	0.00	0	24,220.00	48,440
40340-50-8.00	Melting Furnaces (4 melters, 8 holding and 20 pumps)														
	1.sum	2,200.00	2,640.00	1.2	2,640.00	56.00	147,840	100,000.00	100,000	40,000.00	40,000	2,240,000.00	2,240,000	2,527,840.00	2,527,840
40340-50-9.00	Refining/casting Furnace co vibratory crucible	4 crucible s, included with melting furnaces													
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
40340-50-10.00	Flux pumps High temp sump pumps elect VSD size 38m head 12m 30 gals/min molten salt 750 Degree C, Included in melting furnace														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
40340-80-11.00	Spectrometer Cell including robotics analyzer, milling machine, single robot arm, computer														
	1.ea	180.00	216.00	1.2	216.00	56.00	12,096	4,000.00	4,000	2,000.00	2,000	50,000.00	50,000	68,096.00	68,096
40340-50-12.00	metal pumps High temp sump pumps elect VSD size 38m head 12m 30 gals/min molten salt 750 Degree C, Included in melting furnace														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-



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40340-50-13.00	Cover Gas Generating and Protecting System														
	1.ea	150.00	180.00	1.2	180.00	56.00	10,080	3,000.00	3,000	1,000.00	1,000	50,000.00	50,000	64,080.00	64,080
40340-50-14.00	Off-gas Collecting and wet Scrubbing System 200000ACFM included in cover gas system														
	1.sum	3,000.00	3,600.00	1.2	3,600.00	56.00	201,600	250,000.00	250,000	20,000.00	20,000	500,000.00	500,000	971,600.00	971,600
40340-50-15.00	Automated ingot stacker														
	1.ea	2,050.00	2,460.00	1.2	2,460.00	56.00	137,760	22,500.00	22,500	22,500.00	22,500	247,500.00	247,500	430,260.00	430,260
40340-50-16.00	Sludge pans, tools, and loading														
	1.ea	90.00	108.00	1.2	108.00	56.00	6,048	1,000.00	1,000	1,000.00	1,000	11,000.00	11,000	19,048.00	19,048
40340-50-17.00	Ingot Casting machine 50 lb														
	1.ea	2,050.00	2,460.00	1.2	2,460.00	56.00	137,760	22,500.00	22,500	22,500.00	22,500	247,500.00	247,500	430,260.00	430,260
40340-50-18.00	Pump cleaning station recirculating dilute sulphuric acid and filter press														
	1.ea	185.00	222.00	1.2	222.00	56.00	12,432	2,000.00	2,000	2,000.00	2,000	22,000.00	22,000	38,432.00	38,432
40340-60-19.00	Syngas piping from power plant CS Piping size 37mm														
	400.m	0.15	0.18	1.2	72.00	56.00	4,032	50.00	20,000	0.10	40	0.00	0	60.18	24,072
40340-58-20.00	HVAC 1.0%														
	1.ea	443.84	443.84	1	443.84	56.00	24,855	45,105.20	45,105	7,892.40	7,892	35,280.00	35,280	113,132.86	113,133
40340-60-21.00	Piping and ducting allowance 1.0%														
	1.sum	443.84	443.84	1	443.84	56.00	24,855	45,105.20	45,105	7,892.40	7,892	35,280.00	35,280	113,132.86	113,133
40340-70-22.00	Electrical allowance 2.0%														
	1.sum	887.69	887.69	1	887.69	56.00	49,711	90,210.40	90,210	15,784.80	15,785	70,560.00	70,560	226,265.73	226,266
40340-80-23.00	Instrumentation allowance allowance 1.5%														
	1.sum	665.77	665.77	1	665.77	56.00	37,283	67,657.80	67,658	11,838.60	11,839	52,920.00	52,920	169,699.30	169,699
40340-50-24.00	Condenser cleaning system pit, hood, flail														
	4.ea	70.00	84.00	1.2	336.00	56.00	18,816	750.00	3,000	750.00	3,000	8,250.00	33,000	14,454.00	57,816
40340 - Processing Site Casting Area Subtotal					47,161.54		2,641,046		4,761,599		835,648		3,755,040		11,993,333



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40410 - Processing Site Cooling Systems															
40410-20-1.00	Cooling tower and distribution foundations excavations														
	800.m3	0.10	0.12	1.2	96.00	56.00	5,376	0.00	0	4.00	3,200	0.00	0	10.72	8,576
40410-20-2.00	Cooling tower and distribution excavations for pond														
	3,750.m3	0.10	0.12	1.2	450.00	56.00	25,200	0.00	0	4.00	15,000	0.00	0	10.72	40,200
40410-20-3.00	Cooling tower and distribution foundations concrete														
	600.m3	4.50	5.40	1.2	3,240.00	56.00	181,440	356.62	213,972	20.00	12,000	0.00	0	679.02	407,412
40410-55-4.00	Cooling tower and distribution reserve tank 10000gal														
	1,500.kg	0.05	0.06	1.2	90.00	56.00	5,040	5.00	7,500	0.10	150	0.00	0	8.46	12,690
40410-60-5.00	Cooling tower and distribution distribution piping Allowance														
	1.ea	5,200.00	6,240.00	1.2	6,240.00	56.00	349,440	500,000.00	500,000	100,000.00	100,000	0.00	0	949,440.00	949,440
40410-50-6.00	Cooling tower and distribution Cooling tower including hot and cold wells, pumps, heat exchangers, manifolds and instruments														
	1.ea	400.00	480.00	1.2	480.00	56.00	26,880	300,000.00	300,000	60,000.00	60,000	1,610,000.00	1,610,000	1,996,880.00	1,996,880
40410 - Processing Site Cooling Systems Subtotal					10,596.00		593,376		1,021,472		190,350		1,610,000		3,415,198
50110 - Processing Site Power Plant															
50110-20-1.00	Power plant footings excavations														
	4,000.m3	0.10	0.12	1.2	480.00	56.00	26,880	0.00	0	4.00	16,000	0.00	0	10.72	42,880
50110-20-2.00	Power plant footings Concrete														
	2,700.m3	4.50	5.40	1.2	14,580.00	56.00	816,480	356.62	962,874	20.00	54,000	0.00	0	679.02	1,833,354
50110-60-3.00	Service connections														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	100,000.00	100,000	0.00	0	0.00	0	100,000.00	100,000
50110-60-4.00	Power plant water supply softened water tanks and steel supports included in quote														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
50110-50-5.00	Plant by others freight or spares included in Quote														
	1.ea	284,000.00	340,800.00	1.2	340,800.00	56.00	19,084,800	45,000,000.00	45,000,000	3,465,200.00	3,465,200	76,500,000.00	76,500,000	144,050,000.00	144,050,000





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50110 - Processing Site Power Plant Subtotal					355,860.00		19,928,160		46,062,874		3,535,200		76,500,000		146,026,234
50120 - Processing Site Ash Loadout															
50120-20-1.00	Foundation to bucket elevator excavations														
	12.m3	0.10	0.12	1.2	1.44	56.00	81	0.00	0	4.00	48	0.00	0	10.72	129
50120-20-2.00	Foundation to bucket elevator concrete														
	12.ea	4.50	5.40	1.2	64.80	56.00	3,629	500.00	6,000	20.00	240	0.00	0	822.40	9,869
50120-20-3.00	Bin foundation excavations														
	20.m3	0.10	0.12	1.2	2.40	56.00	134	0.00	0	4.00	80	0.00	0	10.72	214
50120-20-4.00	Bin foundation Concrete														
	20.m3	4.50	5.40	1.2	108.00	56.00	6,048	356.62	7,132	20.00	400	0.00	0	679.02	13,580
50120-55-5.00	Steel bin 70T density 1.3t/m3														
	6,000.kg	0.05	0.06	1.2	360.00	56.00	20,160	5.00	30,000	0.10	600	0.00	0	8.46	50,760
50120-30-6.00	Support steelwork for bin														
	5.t	21.30	25.56	1.2	127.80	56.00	7,157	3,000.00	15,000	180.00	900	0.00	0	4,611.36	23,057
50120-50-6.00	Bucket elevator 300 m x 17m high														
	17.m	20.00	24.00	1.2	408.00	56.00	22,848	800.00	13,600	800.00	13,600	3,800.00	64,600	6,744.00	114,648
50120-50-7.00	Manual gates below bin														
	1.ea	60.00	72.00	1.2	72.00	56.00	4,032	5,000.00	5,000	392.00	392	0.00	0	9,424.00	9,424
50120 - Processing Site Ash Loadout Subtotal					1,144.44		64,089		76,732		16,260		64,600		221,681
50130 - Processing Site Coal Gas Surge Storage															
50130-55-1.00	Coal Gas Surge Storage included in Power plant														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
50130 - Processing Site Coal Gas Surge Storage Subtotal					0.00		0		0		0		0		0
61310 - Processing Site Administration and Change House															
61310-40-1.00	Administration and change house, first aid including foundations Building size 40 x 25m														
	1,000.m2	4.50	5.40	1.2	5,400.00	56.00	302,400	1,800.00	1,800,000	47.00	47,000	2.30	2,300	2,151.70	2,151,700





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61310-58-2.00	Furniture and office equipment														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	100,000.00	100,000	0.00	0	0.00	0	100,000.00	100,000
61310-58-3.00	Lockers benches allowance														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	30,000.00	30,000	0.00	0	0.00	0	30,000.00	30,000
61310-57-4.00	HVAC														
	1.ea	0.00	0.00	1	0.00	56.00	0	0.00	0	0.00	0	0.00	0	0.00	0
61310-60-5.00	Piping allowance 1.0%														
	1.sum	54.00	54.00	1	54.00	56.00	3,024	19,300.00	19,300	470.00	470	23.00	23	22,817.00	22,817
61310-70-6.00	Electrical/Instrumentation allowance 1.0%														
	1.sum	54.00	54.00	1	54.00	56.00	3,024	19,300.00	19,300	470.00	470	23.00	23	22,817.00	22,817
61310 - Processing Site Administration and Change House Subtotal					5,508.00		308,448		1,968,600		47,940		2,346		2,327,334
61320 - Processing Site Emergency Response Including Medical Clinic															
61320-40-1.00	Emergency Response including Medical Clinic included in administration building														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
20 - Processing Site Emergency Response Including Medical Clinic Subtotal					0.00		0		0		0		0		0
61330 - Processing Site Gatehouses and Fencing															
61330-80-1.00	Gatehouses included in administration building														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
61330-50-2.00	Truck Weight Scale - including software														
	1.ea	10.00	12.00	1.2	12.00	56.00	672	40.00	40	50.00	50	150,000.00	150,000	150,762.00	150,762
61330-50-3.00	Barrier controller														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	5,000.00	5,000	0.00	0	0.00	0	5,000.00	5,000
61330 - Processing Site Gatehouses and Fencing Subtotal					12.00		672		5,040		50		150,000		155,762
61410 - Processing Site Mobile Maintenance Equipment															
61410-50-1.00	Loader F/E Cat 966H 2yd														
	2.ea	0.00	0.00	1.2	0.00	56.00	0	0.00	0	0.00	0	125,000.00	250,000	125,000.00	250,000



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61410-50-2.00	Ambulance/Quarry Rescue F450														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	0.00	0	0.00	0	141,225.00	141,225	141,225.00	141,225
61410-50-3.00	Truck 1/2 tonne 2 wheel drive, regular cab														
	6.ea	0.00	0.00	1.2	0.00	56.00	0	0.00	0	0.00	0	25,000.00	150,000	25,000.00	150,000
61410-50-4.00	Bobcat small skid steer														
	2.ea	0.00	0.00	1.2	0.00	56.00	0	1.00	2	0.00	0	30,000.00	60,000	30,001.00	60,002
61410-50-5.00	Utility Crane - 20t														
	1.ea	12.00	14.40	1.2	14.40	56.00	806	100.00	100	0.00	0	225,000.00	225,000	225,906.40	225,906
61410-50-6.00	Fork lift 1 side shift hi mast 4 regular 5T electric														
	5.ea		0.00		0.00	56.00	0		0		0	50,000.00	250,000	50,000.00	250,000
61410 - Processing Site Mobile Maintenance Equipment Subtotal					14.40		806		102		0		1,076,225		1,077,133
61510 - Processing Site Water															
61510-55-1.00	Tanks and piping Allowance tank on stand														
	1.sum	0.00	0.00	1.2	0.00	56.00	0	15,000.00	15,000	0.00	0	0.00	0	15,000.00	15,000
61510 - Processing Site Water Subtotal					0.00		0		15,000		0		0		15,000
61520 - Processing Site Fuel															
61520-20-1.00	Excavate														
	15.m3	0.10	0.12	1.2	1.80	56.00	101	0.00	0	4.00	60	0.00	0	10.72	161
61520-20-2.00	Concrete slab														
	15.m3	4.50	5.40	1.2	81.00	56.00	4,536	329.19	4,938	20.00	300	0.00	0	651.59	9,774
61520-55-3.00	Fuel tanks and pumps by vendor														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
61520 - Processing Site Fuel Subtotal					82.80		4,637		4,938		360		0		9,935
61610 - Processing Site Water Distribution System															
61610-60-1.00	Water Distribution System allowance														
	1.sum	100.00	120.00	1.2	120.00	56.00	6,720	1,500.00	1,500	3,000.00	3,000	0.00	0	11,220.00	11,220



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61610--2.00	Power Plant water distribution include with power plant														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	0.00	0	0.00	0	0.00	0	0.00	0
61610 - Processing Site Water Distribution System Subtotal					120.00		6,720		1,500		3,000		0		11,220
61620 - Processing Site Potable Water															
61620-58-1.00	Potable Water water coolers														
	1.ea	0.00	0.00	1.2	0.00	56.00	0		0	0.00	0	0.00	0	0.00	0
61620 - Processing Site Potable Water Subtotal					0.00		0		0		0		0		0
61630 - Processing Site Process Water															
61630-60-1.00	Process Water														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
61630 - Processing Site Process Water Subtotal					0.00		0		0		0		0		0
61640 - Processing Site Fire Water															
61640-57-1.00	Fire suppression extinguishers														
	6.ea	6.00	7.20	1.2	43.20	56.00	2,419	200.00	1,200		0	0.00	0	603.20	3,619
61640-57-2.00	Fire suppression control room computers allowance														
	6.ea	6.00	7.20	1.2	43.20	56.00	2,419	200.00	1,200		0	0.00	0	603.20	3,619
61640 - Processing Site Fire Water Subtotal					86.40		4,838		2,400		0		0		7,238
61650 - Processing Site Solid Waste Disposal															
61650-50-1.00	Solid Waste Disposal in operating costs														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
61650 - Processing Site Solid Waste Disposal Subtotal					0.00		0		0		0		0		0
61660 - Processing Site Sewage Treatment Plant															
61660-40-1.00	Sewage Treatment Plant Septic tank														
	1.sum	200.00	240.00	1.2	240.00	56.00	13,440	25,000.00	25,000	3,000.00	3,000	0.00	0	41,440.00	41,440
61660 - Processing Site Sewage Treatment Plant Subtotal					240.00		13,440		25,000		3,000		0		41,440
61670 - Processing Site Effluent Treatment Distribution															



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61670-40-1.00	Effluent Treatment Distribution	Not required													-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
61670 - Processing Site Effluent Treatment Distribution Subtotal					0.00		0		0		0		0		0
61680 - Processing Site Water Treatment															
61680-60-1.00	Compressed Air allowance														
	1.sum	325.00	390.00	1.2	390.00	56.00	21,840	60,000.00	60,000	15,000.00	15,000	0.00	0	96,840.00	96,840
61680-50-1.00	Water Treatment By Vendor at power plant														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
61680 - Processing Site Water Treatment Subtotal					390.00		21,840		60,000		15,000		0		96,840
61910 - Processing Site Power Distribution															
61910-70-1.00	Power Distribution on site														
	1.sum	9,110.00	10,932.00	1.2	10,932.00	56.00	612,192	1,100,000.00	1,100,000	200,000.00	200,000	0.00	0	1,912,192.00	1,912,192
61910-70-2.00	Power Distribution transformers and substation plant station														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
61910 - Processing Site Power Distribution Subtotal					10,932.00		612,192		1,100,000		200,000		0		1,912,192
71110 - Temporary works															
71110-89-1.00	Temporary works off site not included														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
71110 - Temporary works Subtotal					0.00		0		0		0		0		0
81110 - Processing Site Laydown Area															
81110-10-1.00	Lay down Area included with site clearance														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
81110 - Processing Site Laydown Area Subtotal					0.00		0		0		0		0		0
81120 - Processing Site Construction Camp															
81120-89-1.00	Construction Camp	Excluded by Client													-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-



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81120-89-2.00	Living out allowance	Excluded by Client													-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
81120 - Processing Site Construction Camp Subtotal					0.00		0		0		0		0		0
81130 - Processing Site Catering and House Keeping															
81130-89-1.00	Catering By Contractor														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
81130 - Processing Site Catering and House Keeping Subtotal					0.00		0		0		0		0		0
85110 - Processing Site General Site															
85110-87-1.00	Closure and Reclamation General Site	As requested by Client													
	1.ea	0.00	0.00	1.2	0.00	56.00	0	5,000,000.00	5,000,000	0.00	0	0.00	0	5,000,000.00	5,000,000
85110 - Processing Site General Site Subtotal					0.00		0		5,000,000		0		0		5,000,000
91110 - Construction Indirects															
91110-91-1.00	Construction Indirects Quarry Site	8.0%													
	1.ea	0.00	0.00	1.2	0.00	56.00	0	238,528.00	238,528	0.00	0	0.00	0	238,528.00	238,528
91110-91-2.00	Construction Indirects Process, rails, stockpiles, ancillary buildings etc	8.0%													
	1.ea	0.00	0.00	1.2	0.00	56.00	0	11,288,125.47	11,288,125	0.00	0	0.00	0	11,288,125.47	11,288,125
91110-91-3.00	Construction Indirects Power plant	.0% included in direct cost													-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
91110-91-4.00	Construction Indirects Ferro Silicon	8.0%													
	1.ea	0.00	0.00	1.2	0.00	56.00	0	2,189,440.00	2,189,440	0.00	0	0.00	0	2,189,440.00	2,189,440
91110 - Construction Indirects Subtotal					0.00		0		13,716,093		0		0		13,716,093
91120 - Initial Fills															
91120-92-1.00	Initial fills Mining														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
91120-92-2.00	Initial fills Process														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	2,700,000.00	2,700,000	0.00	0	0.00	0	2,700,000.00	2,700,000



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91120 - Initial Fills Subtotal					0.00		0		2,700,000		0		0		2,700,000
91130 - Spares															
91130-93-1.00	Spares Commissioning spares only Capital spares Excluded from Estimate. To be covered in Vendor packages.														
	1.ea	0.00	0.00	1	0.00	56.00	0	1,282,712.17	1,282,712	0.00	0	0.00	0	1,282,712.17	1,282,712
91130 - Spares Subtotal					0.00		0		1,282,712		0		0		1,282,712
91140 - Freight and Logistics															
91140-94-1.00	Freight and Logistics														
	1.ea	0.00	0.00	1	0.00	56.00	0	6,086,966.21	6,086,966	0.00	0	0.00	0	6,086,966.21	6,086,966
91140 - Freight and Logistics Subtotal					0.00		0		6,086,966		0		0		6,086,966
91150 - Commissioning and Start-up															
91150-95-1.00	Commissioning and Start-Up Facility Allow for 8men 30 days @ \$150 ph														
	2,400.hrs	1.00	1.00	1	2,400.00	150.00	360,000	0.00	0	0.00	0	0.00	0	150.00	360,000
91150-95-2.00	Commissioning and Start-Up Facility Allow for 8 Tradesmen 30 days @ \$64 ph														
	2,400.hrs	1.00	1.20	1.2	2,880.00	56.00	161,280	0.00	0	0.00	0	0.00	0	67.20	161,280
91150 - Commissioning and Start-up Subtotal					5,280.00		521,280		0		0		0		521,280
91160 -															
91160-96-1.00	EP Mining 4.0%														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	119,264.00	119,264	0.00	0	0.00	0	119,264.00	119,264
91160-96-2.00	EP Process 7.5%														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	10,582,617.63	10,582,618	0.00	0	0.00	0	10,582,617.63	10,582,618
91160-96-3.00	EP Power plant 7.5% included in directs														
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
91160-96-4.00	EP Ferro Silicon 7.5%														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	2,052,600.00	2,052,600	0.00	0	0.00	0	2,052,600.00	2,052,600
91160-96-5.00	CM Mining 4.0%														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	119,264.00	119,264	0.00	0	0.00	0	119,264.00	119,264



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91160-96-6.00	CM Process 7.5%														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	10,582,617.63	10,582,618	0.00	0	0.00	0	10,582,617.63	10,582,618
91160-96-7.00	CM Power plant 7.5% included in directs														-
	-	-	-		-	-	-	-	-	-	-	-	-	-	-
91160-96-8.00	CM Ferro Silicon 7.5%														
	1.ea	0.00	0.00	1.2	0.00	56.00	0	2,052,600.00	2,052,600	0.00	0	0.00	0	2,052,600.00	2,052,600
					91160 - Subtotal		0.00		25,508,963		0		0		25,508,963
91170 - Vendor Commissioning and Assistance															
91170-97-1.00	Vendor Reps (during construction)	Allow for 4men 10 days @ \$150 ph													
	400.ea	1.00	1.00	1	400.00	150.00	60,000	0.00	0	0.00	0	0.00	0	150.00	60,000
					91170 - Vendor Commissioning and Assistance Subtotal		400.00		60,000		0		0		60,000
98100 - Owners Cost															
98100-98-1.00	Owner's Costs allowance 2.00%														
	1.lot	0.00	0.00	1	0.00	56.00	0	7,447,088.33	7,447,088	0.00	0	0.00	0	7,447,088.33	7,447,088
					98100 - Owners Cost Subtotal		0.00		7,447,088		0		0		7,447,088
99110 - Project Contingency															
99110-99-1.00	Contingency Mining 20.0%														
	1.lot	0.00	0.00	1.2	0.00	56.00	0	691,731.20	691,731	0.00	0	0.00	0	691,731.20	691,731
99110-99-2.00	Contingency Process 20.0%														
	1.lot	0.00	0.00	1.2	0.00	56.00	0	36,841,177.50	36,841,178	0.00	0	0.00	0	36,841,177.50	36,841,178
99110-99-3.00	Contingency Power plant 20.0% included in directs														
	1.lot	0.00	0.00	1.2	0.00	56.00	0	0.00	0	0.00	0	0.00	0	0.00	0
99110-99-4.00	Contingency Ferro Silicon 20.0% Based on quote														
	1.lot	0.00	0.00	1.2	0.00	56.00	0	6,732,528.00	6,732,528	0.00	0	0.00	0	6,732,528.00	6,732,528
99110-99-5.00	Contingency Owners cost	Included in Owners cost													
	1.lot	0.00	0.00	1.2	0.00	56.00	0	0.00	0	0.00	0	0.00	0	0.00	0



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99110 - Project Contingency Subtotal					0.00		0		44,265,437		0		0		44,265,437
Scoping Study Total					911,027.94		51,280,765		200,087,594		9,999,440		162,698,145		424,065,943



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		Labour Manhour	Labour Cost	Material Cost	Construction Equipment Cost	Mechanical Equipment Cost	Total Cost (USD)
<b>Direct Works</b>							
10	Dolomite Quarry Site General Subtotal	1,320	73,920	193,700	8,200	200,000	475,820
20	Dolomite Quarry Open Pit Subtotal	420	23,520	8,000	1,000	987,000	1,019,520
22	Dolomite Quarry Crushing Plant Subtotal	4,680	262,080	300,000	100,000	1,300,000	1,962,080
23	Dolomite Quarry Utilities Subtotal	1,512	84,672	207,500	39,000	0	331,172
25	Dolomite Quarry Temporary works Subtotal	0	0	0	0	0	0
30	Processing Site General Subtotal	83,004	4,648,217	6,770,994	896,920	4,091,540	16,407,671
31	Processing Site Stock Piles Subtotal	14,912	835,055	1,678,974	263,768	833,567	3,611,364
40	Processing Site - Processing Facilities Subtotal	425,110	23,806,178	35,598,980	4,869,741	77,492,867	141,767,766
50	Processing Site Power Plant Subtotal	357,004	19,992,249	46,139,606	3,551,460	76,564,600	146,247,915
61	Processing Site Infrastructure Subtotal	17,386	973,594	3,182,580	269,350	1,228,571	5,654,094
71	Processing Site Off-Site Infrastructure Subtotal	0	0	0	0	0	0
81	Processing Site Temporary works Subtotal	0	0	0	0	0	0
85	Closure and Reclamation (both sites) Subtotal	0	0	5,000,000	0	0	5,000,000
	<b>Direct Works Subtotal</b>	<b>905,348</b>	<b>50,699,485</b>	<b>99,080,334</b>	<b>9,999,440</b>	<b>162,698,145</b>	<b>322,477,402</b>
<b>Indirects</b>							
91	Indirect Costs Subtotal	5,680	581,280	49,294,735	0	0	49,876,015
98	Owners Costs Subtotal	0	0	7,447,088	0	0	7,447,088
99	Contingency Subtotal	0	0	44,265,437	0	0	44,265,437
	<b>Indirects Subtotal</b>	<b>5,680</b>	<b>581,280</b>	<b>101,007,260</b>	<b>0</b>	<b>0</b>	<b>101,588,540</b>

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<b>Scoping Study Total</b>	<b>911,028</b>	<b>51,280,765</b>	<b>200,087,594</b>	<b>9,999,440</b>	<b>162,698,145</b>	<b>424,065,943</b>