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# PLANT OF MAGNETIC EXTRACTION OF IRON



**FOREIGN COMMERCE**  
CONSULTATIVE SERVICES

**PROYECTO: SALITROSA DEL 1 AL 12**  
Empresa: **FOREIGN COMMERCE**  
Asesor: INNOVACIÓN Y DESARROLLO LTDA.  
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## **Introduction.**

In Chile there are numerous deposits of iron in its various forms and presentations, one of which is the common presentation of magnetite deposits of rock formation.

The typical presentation of this type of mineral is Magnetite and Ilmenite, which can be found clustered at concentrations that reach to 64% average, but unlike its counterpart found in ferrous sand, it needs a grinding process to achieve the grading necessary for their separation from other minerals and elements to which it is associated.

Prospects have been found feasible to exploit magnetite for removal of iron from the region of Antofagasta, to the coast of the Maule region, but mainly located between the second and third regions.

There are various techniques for the separation of iron ore sterile material, but one of the most commonly used at present, the grinding of mineral lick, reaching a particle size sufficient to be removed by magnetic drums high magnetic field strength , for separating iron from the other components present in the soil.

The objective of this study is to identify, quantify and assess the investment required to implement the project and estimate the costs and revenues associated with the operation of the plant in its various stages, once identified the desired production volumes and the presentation of ore iron, their "polluting" and the most appropriate mechanism to exploit the prospectus.

The prospect "Salitrosa del 1 to 12", subject of this study, is located in the Atacama Region, Province Chañaral, "Quebrada Salitrosa" Sector, 135 km from the town of Caldera and 76 km from the town of Chañaral way Mantoverde.

This study considers **only the costs of extraction and production** of iron ore, but not transfer to the ports of shipment, due to the unknown location and distances. Once identified these travel costs should be incorporated into product cost.



## BACKGROUND

### Objectives.

#### General Objective:

*The main objective of this project is to identify, quantify and assess the relevant endogenous and exogenous variables involved in this project to assess the technical and economic feasibility of mining prospect to produce 50,000 [tons/month] of Iron.*

#### Specific Objectives:

- 1) Design and size the equipment best suited to develop the field under optimal conditions, with initial capacity of 50,000 [tons/month].
- 2) Identify, quantify and assess the investment required for certain production level.
- 3) Identify, quantify and assess the costs of the project, identifying the direct costs, overhead and financing.
- 4) Identify, quantify and assess the project's expected revenue.
- 5) Evaluate the project's profitability, given the level of planned investment and taking into account the cost estimate and project revenues.
- 6) Raising the possible scenarios that directly and indirectly affect the project.
- 7) To advise on the search for the best technological and economical alternative to finance the project.



## **Description of Project.**

The purpose of this study is to determine the technical feasibility and economic desirability of design, manufacture, install and operate a plant to produce 50,000 [Tons / Month] of iron ore with a minimum purity of 63.5%.

Given the value that has reached the price of iron in international markets and its projection, makes this project especially important and profitable.

In this particular study was designed, dimensioned, quantify, shall measure and assess the manufacture of a production plant for iron ore, which is considered grinding systems, motion systems material and mineral concentration systems, from magnetics concentrators shaped stainless steel drum.

The entry of ore to the primary crushing stage is Colpa particle size between 8 "and 10" [inches], which must be ground to 6 "to feed the secondary crushing process to reduce the size of rock to 3" , and finally a tertiary crushing process, which must deliver material with a particle size between 6 and 72 [mm]. Then, the pulverized material is conveyed to the magnetic separation zone, wherein the material is processed with high capacity magnetic drums, and the gradient magnetic field type specially designed to separate the iron ore sterile material.

The drums are fed with a controlled flow of base material, iron-containing, adheres to the surface of stainless steel drum by the effect of generating a magnetic field core structure composed of a loaded peripherally of permanent magnets, which induce an magnetic field in the drum surface, adhering iron particles and dropping the other non-metallic particles each rotating drum. In this way is removed, first the metal and secondly, the sterile material. Then, a brush or "scavenger" remove iron that could remain adhering to the drum surface.

By conveyor belts iron concentrate is fed to the concentrate collection areas and other conveyors are responsible for removing the overburden in the area of selection, depositing them in landfills specifically designed for it.

Iron concentrate should be stockpiled in suitable enclosures to prevent contamination of the ore by effect of the entrained particulate filler material by the wind, and moisture.

The movement of Material Base, Sterile and Mineral Concentrate by truck will be suitable for this type of activity.

To sort the processes associated with the exploitation of this mineral, activities are classified into two areas: Area Mine Extraction and Production Area.

Then, based on geological, mineralogical and environmental relieved in the Environmental Impact Statement (EIS) for the nitrous Mining Project 1 to 12, is structured the following study:



- **Description of site.**

This plant is designed to operate at sites with high content of magnetite and hematite in clay lick, with particle sizes between input 8 "and 10" [in], so it is necessary to have 2 or 3 stage crushing to achieve particle sizes close to 6 [mm] to start the process of magnetic selection. The site has a law expected minimum of 35% and 40% magnetite and assuming a ratio of 6:1 Sterile/Mineral (S/M) and considering a continuous period of 504 monthly duty [h], we estimate a minimum processing horizon of 300,000 [ton / month] of base material to produce 50,000 [ton / month] Iron with a minimum of 63.5% law.

The deposit will be operated by 2 open pits, one to exploit the mineralization detected in the West Bank, where the iron is detected in the form of magnetite mixed with hematite, and another to remove the iron found in the Eastern Fringe which is Magnetite as sulfide mixed with copper mineralization and Chalcopyrite. The mineralization of the Middle Strip will be addressed later by the reach of primary pits.



**TECHNICAL EVALUATION OF PROJECT**  
**Engineering Study**

**I – Identification of Project Variables.**

This section will examine the relevant variables and processes involved in the project and according to initial conditions, this study will identify, quantify and shall measure the investment required for the extraction and production of 50,000 [ton/month] of Iron, however in the medium term, the plant will have a plant size that allows the production of 200,000 [tons/month] of high purity Iron.

- **Territorial and Geographic identification.**

**1) Geographic location of project**

The project “Salitrosa del 1 al 12”, subject of this study, is located in the Atacama Region, Province Chañaral, “Quebrada Salitrosa” sector, located between the towns of Caldera and Chañaral. This is a desert country, very dry and almost no tourist traffic. The nearest town is Chañaral sector, located on the northern edge of the region. The roads are mostly dirt and difficult access and steep.

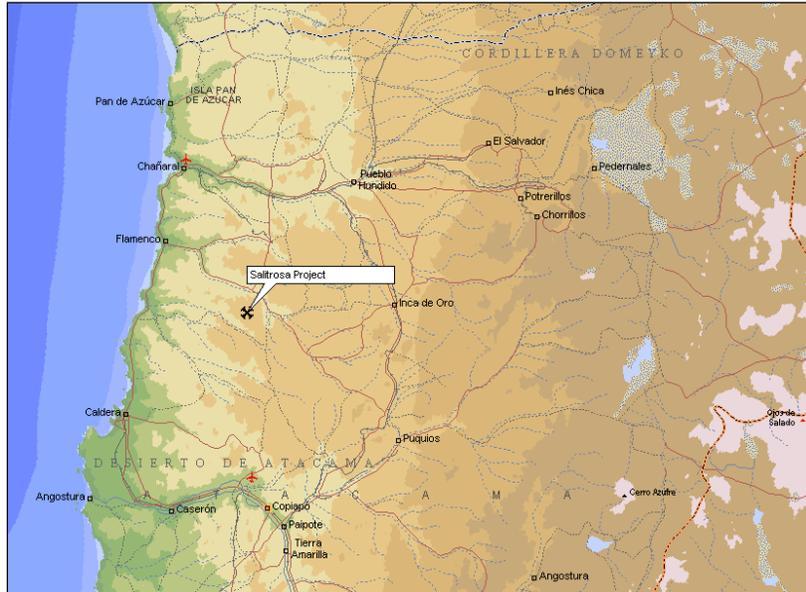




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## 2) Territorial identification.

It is a rugged, surrounded by hills of low altitude and streams of medium depth, located in a desert area, mainly dominated by a sunny and warm almost all year. It is characterized by the almost total absence of rain and humidity that hangs over the area is coming exclusively from the morning dew.

It is relatively close to the coast of the Atacama region and completely lacks any vegetation, except for the spring season, when reborn and bloom all seeds buried in the sand of the desert for a period of 3 to 4 months. The rest of the year is desert and devoid of significant tourist traffic.





- **Identifying main processes.**

For ordering purposes, the activities which are needed to produce industrially concentrated Iron will be sorted in processes are divided into two main areas the tasks of mine, that is:

**1) Mineral Extraction area (ME).**

In the area of extraction Mina, are grouped all the necessary processes to extract, load and transfer the crushing zone, the base material containing ore hosted in the excavation of two pits designed to exploit this project.

**Extraction:**

- Separation of ore rock structures.
- Extraction and collection of material Basis for transfer to production areas.
- Loading the Material Base on transport to production areas.
- Download the Material Base in feeding areas of milling equipment.

**2) Concentrated Production Area.**

In the area of production will concentrate all activities to process the base material removed in mining areas (the pits) with a result of the concentrate with the planned features.

To produce iron concentrate from Magnetite mineralization in rock formation, it is necessary to perform certain processes, which are identified below.

**Production:**

- Processes of downsizing of mineralized rocks.
- Magnetic Separation Processes Iron Ore.
- Materials storage and stockpiling of ore concentrate.
- Sterile collection processes.
- Processes of transfer of sterile waste areas.
- Processes of ore concentrate transport to distribution centers.

Besides these, are all necessary administrative processes to support the plant management and administration of the company, such as:



**3) Administration:**

- Human Resource Management and Organizational Development.
- Mineral Resources Management.
- Financial Management and Accounting.
- Marketing.
- Services Administration and Mine Operations,
- Etc.

**4) Operations:**

- Services Administration.
- Transfer of personnel.
- Food Services.
- Communications.
- Accommodation.
- Supplies.
- Security.
- Energy

- **Identification of equipment required.**

For classification the required equipment to extract and produce iron ore from rock formations, the activities were divided into two areas:

**1) Extraction Area:**

The following is a summary of the equipment for magnetite mining:

- ✘ Hydraulic Excavator
- ✘ Front Loader (Wheel Loaders).
- ✘ Trucks.
- ✘ Grader (Motor Graders).
- ✘ Backhoe Loaders.
- ✘ Light Tower.

The extraction activity begins with the action of the hydraulic excavator that lifts mineralized rocks which are generated by the blowup of the rocky walls of the pit and stockpile in a truck loading area.

The front loaders, collect and sort the base material and load it into dump trucks to transport this material to the production area.



The grader must trace the routes by which Loading Manipulation Surface Vehicles have to drive (LMSV) or Surface Mobile Equipment (SME) and smooth them when there are dangerous uneven for movement of the SME.

Backhoe loaders are used to dig ditches, build retaining walls for material, and in general for all kind of works to support the principal activities.

Finally, the light towers are designed to ensure adequate visualization of mining areas in evening activities.

Other equipments that intervene in these activities are attached at Annex 1.

## **2) Production area:**

The following is a summary of the necessary equipment for production activities of Iron:

- ✘ Lighting Tower
- ✘ Feed Hopper
- ✘ Vibratory Feeder
- ✘ Jaw Crusher
- ✘ Vibratory Feeder
- ✘ Cone Crusher Hydraulic
- ✘ Shale Shaker.
- ✘ Cone Crusher Hydraulic
- ✘ Shale Shaker.
- ✘ Magnetic Separator
- ✘ Cluster Magnetic Separation
- ✘ Conveyors

**Vibratory Feeders** are equipment used to remove large rocks from the base material of those that by their particle size can be processed.

Furthermore, the **crushers** or **breakers** in its various forms are designed reduce the size



of the rock until a particle size that allows processing in magnetic separators, which require small particle sizes.

**Cluster for magnetic separation**, are a set of large drums which are designed to separate the magnetizable material of the remaining components of the base material, making isolation between sterile and iron ore. The degree of purity that can be obtained from the magnetic separation process will depend on several factors, among which may include: the composition of the base material, of the metallic impurities present in the material accompanying the iron ore, of the granulometry of the material to be processed, humidity, density, the presence of titanium and other minerals and technical factors derived from the technical design of the magnetic separation equipment.

Another fundamental equipment in production processes are **Conveyors**, which are designed to drive a systematic, organized and calculated, flow of base material, mineral concentrate and sterile.

To order, assemble, store and load the base material, the concentrated Iron and waste **Front Loaders** will be used due to its versatility in these tasks. Front loaders will require scoop extended to beach nourishment collection, plus a front loader for transportation of concentrate and waste removal.

To move the base material, the concentrate of iron and debris into the storage areas and waste dumps, **Trucks** will be used for high capacity efficient provision of materials in process.

Other smaller equipment, such as **Skid Steer** or **Crane Fork** are used for movement of materials in process, supplies and other resources in nearby areas and small workspaces.

### **3) Administration:**

In the administration area will be required primarily to enable office equipment, ie:

- Desk
- Front Desk
- Meeting Table
- Kitchenette
- Living furniture
- Air Conditioner equipment.
- Chairs
- Lamps



#### **4) Operations:**

In the operations section will require equipment to provide the necessary services to support mining activities and production of the plant.

- Cleaning equipment.
- Vehicles for carrying personnel.
- Equipment for casinos and food service.
- Computer equipment services, telecommunications and Internet.
- Equipment for service printing, photocopying and data processing.
- Facilities for accommodation.
- Water and fuel tanks.
- Communications Security Equipment.
- Electric Power Generation Equipment.
- Gas distribution equipment.
- Water distribution equipment.
- Differential GPS.
- Supplies.

#### **• Identification of infrastructure.**

The facilities needed to support operations at the mine are required primarily for the storage of equipment, resources and supplies that support the processes of extraction and production of iron ore.

Also in this section the buildings have been identified for the services needed to support the human resource that will work in plant.

And finally, consider the facilities to shelter the processes associated with the administration of the plant. In this sense we have identified the following minimum facilities required to effectively support the productive processes of the plant.

To facilitate identification of the facilities associated with these processes, has been separated into three areas of the operation process in the plant.

#### **1) EXTRACTION**

- Preparing the Extraction Area.
- Roads and Access for entry and exit of the pits.
- Sampling Laboratory.
- Powder Keg.
- Truck parking.
- Machine Shop.



## 2) PRODUCTION

- Processing Plant
- Concentred stockpiling.
- Steril Dumps #1
- Steril Dumps #2
- Chemical Laboratory
- Material storage.
- Engine room.

## 3) ADMINISTRATION – OPERATIONS

- Headquarters
- Dining room
- Dressing room
- Bathrooms and shower
- First aids
- Access control and checkpoints
- Weight
- Supply Storage

### • **Work identification.**

#### 1) **Structural works.**

Closely related to infrastructure works studied in the previous section, are the civil works necessary to enable the mine operations, are:

- Perimeter closure.
- Compaction and stabilized of outstanding areas.
- Compaction and stabilized of surfaces for settlement facility.
- Compaction and stabilized of collection areas.
- Compaction and stabilized of Loading Areas.
- Access control booths.
- Telephone and Communications Network Installation.
- Data Network Installation.
- Electrical network installation.
- Water and sanitation network installation.



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The perimeter of the area closures of the mining plant including the pits, areas of extraction and production, administrative facilities and services, areas of collection, storage and dumps, is to ensure the areas of tasks, not allowing access unauthorized personnel outside the plant.

Compaction and stabilization of roads and traffic areas and operation is essential to facilitate the movement of Surface Mobile Equipment (EMS) within and outside the mine and to facilitate access to and from the operational and administrative units of the mine. Further consideration should be given space for the collection of material for processing, location of equipment and process yard and protected space for storage of concentrated material and dumps for the disposal of waste material.

Compaction and stabilization of the surface settlement of administrative and service facilities is also a priority, since it allows to provide the services necessary to support the technical and human activity within the mine.

Compaction and stabilization of the collection areas are critical because they are required for both temporary storage of concentrated ore as waste and other inputs, etc. Compaction and stabilization of the loading and storage areas is vital to ensure and guarantee the maintenance of physicochemical characteristics of the ore concentrate. The installation of checkpoints for controlling and monitoring the perimeters of the plant as well as managing access to the plant, are necessary to ensure the integrity of resources and production processes within the plant. Also necessary for the safety of personnel working in it.

Other civil works required are those of network facilities, water, electricity, gas, telephones and Internet, among other services which are extremely necessary to ensure the viability of the plant operating.



## **II – Project Variables Quantification.**

Following the above analysis sequence, from the sizing of plant size and production levels involved and depending on the E/M's own site and then be sized and quantify the needs, requirements and flows of materials and supplies will be required for the operation and production of the plant.

Knowing that the level of iron ore production will be 50,000 [ton/month] and the E/M relation assumed for the evaluation of this project will be 6:1, so the facilities and equipment must be designed to process 300,000 [tons / month] of base material, 50,000 [tons/month] and the rest concentrated sterile.

With this in mind, the equipment and infrastructure needs for the operation of the mine is immediately quantified.

- **Project territorial Quantification.**

### **1) Project location**

The “Salitrosa del 1 al 12” project in study, is located in the Atacama Region, Province Chañaral, “Quebrada Salitrosa” Sector, **135 km** from the town of Caldera and **76 km** from the town of Chañaral, on Mantoverde way.

### **2) Territory.**

This project cover a surface of **800 [há]** and is on **UTM: 358900E, 7041580N** coordinates, between broad valleys and smooth hills.

Is located to **45 [min]** from the Caldera city and by internal roads can be reached in **1.5 [hr]** from the Copiapó city.



- **Main process Quantification.**

Based on production levels and E/M relation, then quantify the amounts associated with each process identified, taking into consideration for this project working hours of **18 [hrs/day]**, **28 [days/months]** working and **12 [month/year]**.

### 1) Minerals Extraction Area.

#### Extraction:

- Separation of mineral from rock structures.  
Are extracted: **300,000 [tons/month]**, in a ratio of **595 [ton/hr]** of base material.
- Sorting and storage of base material before to transfer to production area.  
Storage **595 [ton/hr]** of base material.
- Load base material in an adequate transport mechanism to transferring to production area. Considering truck of **100 [ton]** capacity (**CAT 777F**) and service frequency of **20 [min]**, **3** trucks will be require to transfer **600 [ton/hr]** of base material to production area.
- Download Base Material in feed mechanism of milling equipment. The extraction area produce **300,000 [tons/month]** to a speed of **595 [ton/hr]** of base material.

### 2) Concentrate Production Area.

In Production Area will be processed the base material delivered by the extraction area to ratio of **600 [ton/hr]**.

#### Production:

- Size reduction processes of mineralized rock.  
Primary crushing: Input: **8"** to **10"** Output: **6"**  
Secondary crushing: Input: **6"** Output: **3"**  
Tertiary crushing: Input: **3"** Output: **6 [mm]**
- Magnetic Separation processes of Iron Ore.  
Input: **300,000 [tons/month]** of Base Material to speed of **595 [ton/hr]**  
Output: **50,000 [tons/month]** of Iron Concentrate to ratio of: **99 [ton/hr]**.



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- Storage and stockpiling Processes of concentrated ore.  
Is required to collect and store 50,000 [tons/month] Iron Concentration at a rate of: 99 [ton/hr]. If you have medium capacity trucks: 45 [ton] (CAT 772), with a mean service rate of 20 [min], will be required a truck for the storage of iron concentration
- Sterile gathering processes.  
The sterile released from the magnetic separation process will generate at a rate of 250,000 [tons/month] at a speed of 496 [tons / hr]
- Processes of transfer from sterile to waste areas.  
For the transfer of sterile to dump areas will require high-capacity trucks, type CAT 777F of 100 [ton], and assuming a service fee of 20 [min], 3 trucks will be required to satisfy transfer requirements of waste dumps.
- Processes of ore concentrate transport to distribution centers.  
Is required to move 50,000 [tons/month] of Iron Concentration.

Administrative processes have the following requirements:

**3) Administration:**

- Human Resource Management and Organizational Development.  
Administration of 29 to 32 people on average monthly.
- Mineral Resources Management.
- Financial Management and Accounting.
- Marketing.
- This function should sell annually 600,000 [tons / year] of Iron concentrated at 63% of law.
- Mina Services and Operations Administration.
- Etc.



#### **4) Operations:**

- **Service Management.**

It provides for the administration of 6 to 10 people-oriented services, and The administration of 15 general services of operation mine.

- **Transfer of staff.**

There must be plan and hire the transfer of 30 people daily to the nearest city, located at 76 [km]. And have at least 3 vans prepared for work in mines.

- **Food Services.**

You need to plan and contract food service for 30 people daily.

- **Communications.**

Shall be planned Internet and phone service for at least 13 workstations.

- **Lodgings.**

Consideration should be given night shelter for 6 to 10 people daily.

- **Supplies.**

- **Security.**

for security is provided the maintenance of 7 guards daily, on all shifts.

- **Equipment quantification.**

For this production level will require that the equipment needed to process 300,000 [tons/month] of base material being sized to meet this service level. The teams that must process the base material must be designed for these processing volumes and this will depend on the mineral strip ratio determined from the geological characteristics of the site.

For purposes of this study, we used an E/M 6:1 relation as a security factor for the quantification and valuation of project teams.

Depending on the initial parameters of the project, identified the following amounts of equipment and features:



**1) Extraction area:**

For this production volume in the extraction step is required to have equipment that can extract, load and move 300,000 [tons/month] of base material extracted from the two pits designed for this plant.

To comply this production level will be required to have the following equipment, with the indicated features:

TYPE OF EQUIPMENT	BRAND	MODEL	WIDTH	LONG	HIGH	CAPACITY	CONSUM	DENSITY	POWER	AMOUNT
Stage I : 50 [Ton/mes]			[mm]	[mm]	[mm]	[Ton]	[Lt/hr]	[Ton/m3]	[KW]	Unids
<b>EXTRACTION AREA</b>										
HYDRAULIC EXCAVATOR	CATERPILLAR	CAT 320 D	2800	9.440	2.950	3,5	21,5	3,5	138 HP	2
WHEEL LOADERS	CATERPILLAR	CAT 966 H	3145	8.500	3.600	18,9	32		195	1
TRUCKS	CATERPILLAR	CAT 777F	6494	10.535	5.170	101,6	12	3,5	700	3
MOTOR GRADERS	CATERPILLAR	CAT 140M	2791	9412	3535		24		193	1
BACKHOE LOADERS	CATERPILLAR	CAT 416E	2262	7.500	2.651	2,7	26		55	1
LIGHT TOWER	WACKER	LTC-4L	1220	3890	1600	8500 W	3,0		8,5	1

Source: Prepared by Innovación y Desarrollo Ltda.

**2) Production area:**

For the production area will require vibratory feeding equipment, crushers, rollers, drums magnetic selection and conveyors capable of processing a flow of 300,000 [tons/month] to get 50,000 [tons / month] of Iron concentrate.

In production the following is required to separate and select of Iron ore:



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TYPE OF EQUIPMENT	BRAND	MODEL	WIDTH	LONG	HIGH	CAPACITY	CONSUM	DENSITY	POWER	AMOUNT
PRODUCTION AREA			[mm]	[mm]	[mm]	[Ton]	[Lt/hr]	[Ton/m3]	[KW]	Unids
LIGHT TOWER	WACKER	LTC-4L	1220	3890	1600	8500 W	3		8,5	3
FEED HOPPER	ZENITH	LC 5000 X 5000	5000	5.000	3.000	800	E.E			1
VIBRATORY FEEDER	ZENITH	GZD1500X6000	1500	6.000	1.000	500-700	E.E		30	1
JAW CRUSHER	ZENITH	PE1200X1500	1200	1.500	800	400-850	E.E		220	1
VIBRATORY FEEDER	ZENITH	GZG-300	1500	3.000	750	300-600	E.E		15	2
CONIC CRUSHER	ZENITH	HPC400	1200	1.500	800	400-700	E.E		400	1
SHALE SHAKER	ZENITH	2YK2460	2400	6.000	1.000	100-810	E.E		37	1
CONIC CRUSHER	ZENITH	HPF400	1200	1.500	800	400-700	E.E		400	2
SHALE SHAKER	ZENITH	2YK2460	2400	6.000	1.000	100-810	E.E		37	1
MAGNETIC SEPARATOR	ZENITH	RCYC-12	500	1.500	700	800	E.E		3	1
CLUSTER OG MAGNETIC SEPARATOR	I&D	SM1HD	900	3.000	5	30	E.E		60	3
CONVEYOR	ROLLIER	60" X 15 mL x 6 mh	1524	15.000	6.000	800	E.E		22	1
CONVEYOR	ROLLIER	60" X 12 mL x 6 mh	1524	12.000	6.000	800	E.E		23	2
CONVEYOR	ROLLIER	60" x 15 mL	1524	15.000	1.000	800	E.E		11	1
ENTER CONVEYOR	ROLLIER	42" x 24 mL x 6 mh	1067	24.000	6.000	800	E.E		19	1
EXIT CONVEYOR	ROLLIER	42" x 15 mL x 9 mh	1067	15.000	9.000	800	E.E		15	1
EXIT CONVEYOR	ROLLIER	42" x 15 mL x 6 mh	1067	15.000	6.000	350	E.E		11	2
EXIT CONVEYOR	ROLLIER	42" x 12 mL x 9 mh	1067	12.000	9.000	500	E.E		15	2
EXIT CONVEYOR	ROLLIER	42" x 12 mL x 6 mh	1067	12.000	6.000	500	E.E		11	2
CONCENTRATE TRUCK	CATERPILLAR	CAT 772	6494	10.535	5.170	101,6	12	3,5	700	1
ESTERILE TRUCK	CATERPILLAR	CAT 777F	6494	10.535	5.170	101,6	12	3,5	700	3
WHEEL LOADERS	CATERPILLAR	CAT 966 H	3145	8.500	3.600	18,9	32		195	1
CONTROL SYSTEM	ZENITH	---	---	---	---	---	E.E			1

Source: Prepared by Innovación y Desarrollo Ltda.

The vibratory feeders are used to separate and select the base material according to the size of rocks that enter to the process of downsizing, should receive and process 300,000 [tons/month] of rocks and base material.

Then they is required crushers equipment or primary grinding to reduce the size of the base material that reaches at the production process sizes from 8 " to 10" [in] and return material with 6 " [in].

Then equipment is required to implement the secondary crushing stage to which the base material comes with 6 " [in] and comes with a particle size of 3" that requires a third stage of milling to deliver a base material with grain sizes ranging from 6 to 72 [mm].

Once reached the granulometry suitable for the separation process, the 300,000 [ton/month] at a rate of 595 [ton/hr] of base material is moved to the area of magnetic selection and for this purpose will require variable length conveyor, equipped with Magnetic Conveyor field induced by neodymium magnets of 5,000 [Gauss] at one end, primarily to separate the of Iron from the rest of the base material.



**Conveyor with Magnetics drums**

The pre-concentrated material is conveyed by conveyor belts to the area elementary drum magnetic selection, where in three stages separates Iron Ore of sterile material.

To extract separately the 50,000 [tons/month] of Iron Concentrate at a rate of: 99 [ton/hr], and the 250,000 [tons/month], of sterile material at a rate of 496 [tons/hr] of residual waste material in the selection process separate conveyors will be used to transport the concentrate iron to the areas of collection and sterile material to the residual area of waste collection.

With the help of front loaders, concentrate Iron will be loaded on a truck type CAT 772, up to 45 [ton], to transport the ore to the storage facilities of the final product, which will maintain appropriate environmental conditions to preserve its purity and mineralogical characteristics.

Moreover, front loaders will load the sterile in trucks type 3 CAT 777F with a capacity of 100 [tons] to remove the waste dumps or areas planned for it.

This structure of teams, is possible to ensure the extraction and production of Iron concentrate, but, to achieve the production level of 50,000 [tons/month] of Iron, considering for this processing 300,000 [tons/month] or raw material base.

### **3) Concentrate equipment dimentioning.**

In order to cover the minimum volume with required production, a plant of separation and concentration of Iron material sets out, cradle in 3 clusters of 4 drums of magnetic selection each one, which totalizes a structure of 12 drums of selection, separation and concentration of material, with induction of magnetic field of between 1,500 and 1,600 [Gaussian] of power or perimetral magnetic gradient and variable speed.

Each concentrator consists of a hopper and four rollers of selection and mineral concentration.



Each hopper must be fed with material base at the rate of between 180 and 270 [tons/hr], which is equivalent to monthly process between 15,000 and 23,000 [tons/month] of concentrated of Iron to cluster.

In each equipment of concentration, the material base is fed by gravity generating a layer on 20 [mm] on thickness on each roller, where] of power is put under a magnetic field of 1,500 [Gaussian, induced in each drum of selection, arranged in series to the interior of each equipment of selection. The mineral that is not captured in first stage of selection, happens through an additional, later instance of selection, ready sequentially to assure an optimal capture the dispersed mineral in the material base and to mitigate the losses of mineral.

The material flows of a drum from selection to another one, separating the residual mineral in each one of these phases of independent way.

The concentrated mineral is derived to a processed mineral section and it is arranged to its processing like so. The residual or material of remainder (without Iron excellent mineral presence) is rejected and gathered together by means of transporting tapes, far from the zone of selection for its final disposition. Each concentrator will have to count on a hopper of feeding and independent conveyor belt.

**The optimal operation of the equipment of selection and Iron mineral concentration obtains by means of the optimal combination of the Gradient of Magnetic induction (GIM) and the Tip speed or Angular of the Drums of Concentration (VPTC).**

Another endogenous variable of the concentrators whose control allows to improve the indices of productivity of these equipment, is the thickness of the layer of material base whereupon the speed is fed each equipment and on selection that is printed to him to each drum; for which, each cluster or series of equipment it counts on tools that allow to control suitable and reliably these parameters; always obtaining the optimal combination that allows to assure an also optimal volume of production.

#### **4) Management Area:**

In order to implement the areas of administration and services of the plant, few elements, those will be required that basically can be classified in:

- 15 Desk
- 1 Reception
- 3 Library furniture
- 1 Kitchenette
- 7 Aire Conditioner



- 1 Living
- 1 Board Meetings 12 posts
- 12 chairs meetings
- 3 Management chair
- 12 Chairs Desk
- 15 Lamps

**5) Area of Operations:**

In the operational area mine however, it will be required of the following basic equipment to take care of the necessities of operations of the plant:

TYPE OF EQUIPMENT	BRAND	MODEL	WIDTH	LENGTH	HEIGHT	CAPACITY	CONSUM	DENSITY	POWER	AMOUNT
<b>OPERACIONES</b>			[mm]	[mm]	[mm]	[Ton]	[Lt/hr]	[Ton/m3]	[kW]	Unids
Soundproof Generator Diesel	CATERPILLAR	3516B-HD TA	2180	4.120	2.030	2275 kva prime	347		1.924	1
Soundproof Generator Diesel	CATERPILLAR	XQE 150	1130	3.558	1.943	150 KVA	32,5		120	1
Small Trucks						1000 Kg.				3
Light Tower	WACKER	LTC-4L	1220	3890	1600	8500 W	2		8,5	1
Tablero Distribución						4x4 380/220V				2
Distribution Boards	SULLAIR	750HDTQ				750 cfm			250HP	1
Workstation	HP	WORKSTATION Z400								7
Multifuncional Printer HP CM2320N	HP	CM2320N								2
Laptop	HP	PROBOOK 6560B	Intel, Core i5	4 GB RAM	500 GB HD					5
Stand Alone PRINTER	HP	HP LJ M1132 BN MFP								7
Servers	SUN		4 Procesadores Quad Core							1
U.P.S.	APC	Smart-UPS 2200VA								1

Source: Prepared by Innovación y Desarrollo Ltda.

In order to supply of electrical energy to the plant, for example, soundproof and independent Generators Diesel for each area of the plant will be required; but it is required to also have in consideration the administrative necessities of energy, reason why one is due to consider at least an additional equipment for its administrative facilities, on watch and personnel. The responsibility by the administration, monitoring and maintenance of this type of equipment falls to the Unit of Operations that depends on the Administrative Area.

- **Infrastructure work quantification.**

In this section the infrastructure requirements necessary will study to support and to support the activities of operation of the plant; for this, based on the proposal of Layout of Plant, that is



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enclosed in Annexed the 2 of this report, all the calculations of space and surfaces required for each designed installation are made.

In the following picture the dimensions required for each one of the facilities planned for this project are enclosed, based on their requirements of space, respecting the effective norm and the necessities of space that must be taken part directly by the project.

In the following picture the designed necessities of space for these facilities are enclosed.

<b>PROJECT SURFACES CALCULATION</b>					
<b>SPACE AND COST</b>					
ID	FACILITIES	SURFACE	LENGTH	WIDTH	AREA
		[Hás]	[m]	[m]	[m <sup>2</sup> ]
<b>EXTRACTION</b>					
1	Extraction Area	15	750	200	150.000
2	Roads and Access	9,21	6140	15	92100
3	Sampling's laboratory	0,003	12	2,5	30
4	Powder Keg	0,03	20	15	300
5	Truck parking	0,084	70	12	840
6	Mechanical workshop	0,06	30	20	600
<b>PRODUCTION</b>					
7	Prosecution facilities	4	200	200	40000
8	Stacking Iron	0,5	100	50	5000
9	Sterile Dumps #1	20	1000	200	200000
10	Sterile Dumps #2	20	500	400	200000
11	Chemical laboratory	0,003	12	2,5	30
12	Material storages	0,075	50	15	750
13	Engine Room	0,0015	5	3	15
<b>ADMINISTRATION - STAFF</b>					
14	Headquarters	0,06	30	20	600
15	Dining room	0,0375	25	15	375
16	Dressing room	0,0027	9	3	27
17	Bathrooms and shower	0,0045	15	3	45
18	First aids	0,0009	3	3	9
19	Access control and checkpoints	0,0004	2	2	20
20	Weight	0,004	20	2	40
<b>INVESTMENT</b>	<b>TOTAL FACILITIES</b>	<b>69,0765</b>	<b>8993</b>	<b>Built Area:</b>	<b>8.681</b>

Source: Prepared by Innovación y Desarrollo Ltda.



- **Work quantification.**

Based on the location of the rajos and the location considered for the facilities and areas of operation and production, defined in the Layout, the following dimensions are considered.

**1) Perimeter closure.**

Linear meters are considered in 4.354 [m] the perimeter of the mining plant, that must be surrounded and be protected, by means of walls, sentry boxes of monitoring and system of control and permanent monitoring.

**2) Compaction and stabilized Area Load**

For the designed size of plant is required to prepare 750 [m<sup>2</sup>] of land to destine to mineral load and material bases.

**3) Compaction and stabilized areas of Storing.**

In the same way is required to prepare a minimum space of 5,000 [m<sup>2</sup>] for the areas of concentrated and sterile mineral storing.

**4) Compaction and stabilized Area Circulation.**

It is estimated that this project will require 92,100 [m<sup>2</sup>] of roads and access, both inside and outside the plant.

**5) Stabilized compaction and of the surface for establishment of facilities.**

It has been estimated to be cleaned and searched about 8,681 [m<sup>2</sup>] surface for installation of units at the plant.



#### **6) Shelter Access Control.**

To ensure the security perimeter and outside the plant, is estimated to require **7 guards**, distributed between **1 checkpoint** leading access control and **4 peripheral shelter located** each in the four cardinal corners of the enclosure which contains the plant.

#### **7) Wire net and Communications .**

This project contemplates to the installation of 3,024 [m] linear meters of Networks of weak currents for Telephone communications and Communications, that arrive until the remotest place of the plant.

#### **8) Data Network.**

In parallel, the project includes the installation of 2,524 [m] data network to connect all computers in a local area network (LAN) and connect it to the corporate network (WAN), through dedicated link of 100 [Mbps], for security.

We also studied the option of installing WiFi data networks, with connectivity through Access Points (Access Point) controlled and monitored remotely, but the investment to be done to raise the level of open network security through the incorporating safe access channels, the purchase of certificates and licenses for software protection and routers generally allow all devices to the wireless network a secure network, about the costs of installing a conventional network.

#### **9) Electrical Network.**

It is estimated that **3,024 [m]** will be required of cable networks for the transmission of electrical energy to the point of generation to point of consumption planned.

#### **10) Network Water and sanitation.**

The pipe has been planned to install **2,524 [m]** to supply of water to all the planned points of consumption.



### III – Valuation of Project Variables.

Based on the location of the pits and the location considered for the facilities and areas of operation and production, the following costs for each one of these works are considered.

- **Land valuation of the project**

The land that understands this project, located in the coordinates UTM: 358900E, 7041580N, with a surface of 800 [Hás] has a value of USD \$ 4,063 [\$/Há], what represents a value of:

**USD \$ 3.250.400**

- **Valuation of the main processes.**

The valuation of the processes of exploitation of this project was carried out taking into consideration the processing of **300,000 [tons/month]** of base material, for **50,000 [Tons/month]** of iron concentrate to a law of 63.5%; also taking into consideration the workday as shown: **18 [hrs/day]**, **28 [day month]** and **12 [month/year]**.

#### 1) Mineral extraction area.

For the extraction area has been estimated a operational cost distributed in the following way:

- Annual Labor Cost: **USD \$ 278,400**

- Direct Operational Cost: **USD \$ \$ 1.446.631**

#### 2) Concentrated production area.

In production instead operating costs have been calculated in the following way:

- Annual Labor qualified: **USD \$ 247,200**

- Direct annual operating costs by: **USD \$ 3.839.450**



### 3) Administration:

Concept of Administration is expected to generate an expense as described below:

- Annual Labor qualified: **USD \$ \$ 674.400**
- Direct annual administration costs by: **\$ 0**

### 4) Operations:

Operations (which depends on the administration area), describes the following costs:

- Annual labor qualified: **USD \$ \$ 204.000**
- Direct annual operating costs by: **USD \$ \$ 1.602.557**

- **Appreciation of Equipment.**

Below is the valorization of the equipments identified and quantified in the previous sections, using an E/M ratio of 6: 1 as a safety factor for its quantification.

Depending on the initial parameters of the project, identified the following costs of equipment:

#### 1) Extraction Area:

The goal of the extraction area is get, extract, load and move 300,000 [tons/month] of base material, monthly, and so must have the equipment below indicated valorized with the costs of market to December 31, 2011.

TYPE OF EQUIPMENT	BRAND	MODEL	AMOUNT	Unid.	Costo Estimado Unitario	Costo Total
Stage I : 50 [Ton/mes]			Unids		[USD \$]	[USD \$]
<b>EXTRACTION AREA</b>					<b>Nuevo</b>	
HYDRAULIC EXCAVATOR	CATERPILLAR	CAT 320 D	2	Un	320.000	640.000
WHEEL LOADERS	CATERPILLAR	CAT 966 H	1	Un	420.000	420.000
TRUCKS	CATERPILLAR	CAT 777F	3	Un	950.000	2.850.000
MOTOR GRADERS	CATERPILLAR	CAT 140M	1	Un	302.478	302.478
BACKHOE LOADERS	CATERPILLAR	CAT 416E	1	Un	185.873	185.873
LIGHT TOWER	WACKER	LTC-4L	1	Un	14.000	14.000

Source: Prepared by Innovación y Desarrollo Ltda.

The investment needed for the extraction area is of: **USD \$ 4.412.351**



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**2) Production Area:**

The goal of the production area, on the other hand, is to produce 50,000 [tons/month] of iron concentrate.

Following are the equipment needed for this and its market value, evaluated on December 31, 2011:

TYPE OF EQUIPMENT	BRAND	MODEL	AMOUNT	Unid.	Costo Estimado Unitario	Costo Total
PRODUCTION AREA			Unids		[USD \$]	[USD \$]
LIGHT TOWER	WACKER	LTC-4L	3	Un	14.000	42.000
FEED HOPPER	ZENITH	LC 5000 X 5000	1	Un	18.681	18.681
VIBRATORY FEEDER	ZENITH	GZD1500X6000	1	Un	38.714	38.714
JAW CRUSHER	ZENITH	PE1200X1500	1	Un	379.354	379.354
VIBRATORY FEEDER	ZENITH	GZG-300	2	Un	5.466	10.932
CONIC CRUSHER	ZENITH	HPC400	1	Un	662.897	662.897
SHALE SHAKER	ZENITH	2YK2460	1	Un	45.981	45.981
CONIC CRUSHER	ZENITH	HPF400	2	Un	662.897	1.325.794
SHALE SHAKER	ZENITH	2YK2460	1	Un	45.981	45.981
MAGNETIC SEPARATOR	ZENITH	RCYC-12	1	Un	50.000	50.000
CLUSTER OG MAGNETIC SEPARATOR	I&D	SM1HD	3	Un	450.962	1.352.886
CONVEYOR	ROLLIER	60" X 15 mL x 6 mh	1	Un	115.856	115.856
CONVEYOR	ROLLIER	60" X 12 mL x 6 mh	2	Un	92.685	185.370
CONVEYOR	ROLLIER	60" x 15 mL	1	Un	81.000	81.000
ENTER CONVEYOR	ROLLIER	42" x 24 mL x 6 mh	1	Un	63.333	63.333
EXIT CONVEYOR	ROLLIER	42" x 15 mL x 9 mh	1	Un	42.729	42.729
EXIT CONVEYOR	ROLLIER	42" x 15 mL x 6 mh	2	Un	34.955	69.910
EXIT CONVEYOR	ROLLIER	42" x 12 mL x 9 mh	2	Un	34.183	68.366
EXIT CONVEYOR	ROLLIER	42" x 12 mL x 6 mh	2	Un	34.183	68.366
DISCHARGE CHUTE			0	Un	996	0
Rascadores de banda de tungsteno			0	Un	3.182	0
Encausador Lateral			0	m	372	0
Protección Lateral			0	m	51	0
Protección Inferior			0	m	61	0
Capotaje CAPOTEX			0	m	242	0
Sistema de control de desvío de banda			0	Un	1.127	0
Sistemas control rotación de tambor			0	Un	310	0
Sistema parada de emergencia			0	Un	419	0
CONCENTRATE TRUCK	CATERPILLAR	CAT 772	1	Un	950.000	950.000
ESTERILE TRUCK	CATERPILLAR	CAT 777F	3	Un	950.000	2.850.000
WHEEL LOADERS	CATERPILLAR	CAT 966 H	1	Un	420.000	420.000
SKID STEER LOADERS	CATERPILLAR	CAT 246C	0	Un	83.236	0
FORKLIFTS	CATERPILLAR	DP50K-D	0	Un	42.000	0
CONTROL SYSTEM	ZENITH	---	1	Un	47.867	47.867

Source: Prepared by Innovación y Desarrollo Ltda.

The investment needed for the area of production is of: **USD \$ 8.936.017**



### 3) Administration Area:

Implement the areas of administration and services of the plant, will require the following equipment evaluated to December 31, 2011.

TYPE OF EQUIPMENT	BRAND	MODEL	AMOUNT	Unid.	Costo Estimado Unitario	Costo Total
<b>ADMINISTRACIÓN</b>			Unids		[USD \$]	[USD \$]
DESK			15	Un	595	8.925
RECEPTION			1	Un	1.785	1.785
LYBRARY FURNITURE			3	Un	262	785
Kitchenette			1	Un	2.856	2.856
AIR CONDITIONER			7	Un	595	4.165
LIVING FURNITURE			1	Un	762	762
MEETING TABLE			1	Un	1.904	1.904
MEETING CHAIRS			12	Un	179	2.142
CHAIRS			3	Un	3.094	9.282
DESK CHAIR			12	Un	202	2.428
LAMPS			15	Un	48	714
Environment			7	Un	48	333

Source: Prepared by Innovación y Desarrollo Ltda.

The investment required for the administration area is of: **\$ 36.081**

### 4) Area of Operations:

In the area of operations mine on the other hand, will require the following basic equipment valued at 31 December 2011:

TYPE OF EQUIPMENT	BRAND	MODEL	AMOUNT	Unid.	Costo Estimado Unitario	Costo Total
<b>OPERACIONES</b>			Unids		[USD \$]	[USD \$]
Soundproof Generator Diesel	CATERPILLAR	3516B-HD TA	1	Un	420.000	420.000
Soundproof Generator Diesel	CATERPILLAR	XQE 150	1	Un	28.560	28.560
Small Trucks			3	Un	30.000	90.000
Light Tower	WACKER	LTC-4L	1	Un	14.000	14.000
Tablero Distribución			2	Un	4.000	8.000
Distribution Boards	SULLAIR	750HDTQ	1	Un	57.428	57.428
Workstation	HP	WORKSTATION Z400	7	Un	1.654	11.578
Multifuncional Printer HP CM2320N	HP	CM2320N	2	Un	1.142	2.283
Laptop	HP	PROBOOK 6560B	5	Un	1.200	6.000
Stand Alone PRINTER	HP	HP LJ M1132 BN MFP	7	Un	204	1.428
Servers	SUN		1	Un	3.570	3.570
U.P.S.	APC	Smart-UPS 2200VA	1	Un	640	640

Source: Prepared by Innovación y Desarrollo Ltda.

The investment required for the operations unit is of: **USD \$ 643.487**



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- **Enhancement of infrastructure works.**

Construction of structures and infrastructure were calculated on the basis of the various structures required and respecting the rules for construction, based on the exempt resolution N ° 8413, December 20, 2010, the technical division of study and promoting housing, the Ministry of housing and urbanism.

In the table below the planned space needs and the values of construction for these facilities are attached.

PROJECT SURFACES AND COST CALCULATION						
SPACE AND COST						
ID	FACILITIES	LENGTH	WIDTH	AREA	UNIT COST	TOTAL COST
		[m]	[m]	[m <sup>2</sup> ]	[Pesos/USD \$]	[Pesos/USD \$]
<b>EXTRACTION</b>						
1	Extraction Area	750	200	150.000		
2	Roads and Access	6140	15	92100		
3	Sampling's laboratory	12	2,5	30	\$ 122.275 \$ 245	\$ 3.668.264 \$ 7.337
4	Powder Keg	20	15	300	\$ 444.638 \$ 889	\$ 133.391.400 \$ 266.783
5	Truck parking	70	12	840	\$ 266.783 \$ 534	\$ 224.097.552 \$ 448.195
6	Mechanical workshop	30	20	600	\$ 266.783 \$ 534	\$ 160.069.680 \$ 320.139
<b>PRODUCTION</b>						
7	Prosecution facilities	200	200	40000		
8	Stacking Iron	100	50	5000	\$ 355.710 \$ 711	\$ 1.778.552.000 \$ 3.557.104
9	Sterile Dumps #1	1000	200	200000		
10	Sterile Dumps #2	500	400	200000		
11	Chemical laboratory	12	2,5	30	\$ 122.275 \$ 245	\$ 3.668.264 \$ 7.337
12	Material storages	50	15	750	\$ 266.783 \$ 534	\$ 200.087.100 \$ 400.174
13	Engine Room	5	3	15	\$ 266.783 \$ 534	\$ 4.001.742 \$ 8.003
<b>ADMINISTRATION - STAFF</b>						
14	Headquarters	30	20	600	\$ 122.275 \$ 245	\$ 73.365.270 \$ 146.731
15	Dining room	25	15	375	\$ 122.275 \$ 245	\$ 45.853.294 \$ 91.707
16	Dressing room	9	3	27	\$ 122.275 \$ 245	\$ 3.301.437 \$ 6.603
17	Bathrooms and shower	15	3	45	\$ 122.275 \$ 245	\$ 5.502.395 \$ 11.005
18	First aids	3	3	9	\$ 122.275 \$ 245	\$ 1.100.479 \$ 2.201
19	Access control and checkpoints	2	2	20	\$ 122.275 \$ 245	\$ 2.445.509 \$ 4.891
20	Weight	20	2	40	\$ 122.275 \$ 245	\$ 4.891.018 \$ 9.782
<b>INVESTMENT</b>	<b>TOTAL FACILITIES</b>	<b>8993</b>	<b>Built Area:</b>	<b>8.681</b>	<b>Pesos \$:</b> <b>USD \$:</b>	<b>\$ 2.122.768.508</b> <b>\$ 4.245.537</b>

Source: Prepared by Innovación y Desarrollo Ltda.

Foregoing, must add the cost for labor and structural works associated with the construction of the infrastructure, which amounts to:



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<b>Pesos \$</b>	<b>\$ 253.000.000</b>
<b>USD \$</b>	<b>\$ 506.000</b>

This valuation, considered the various construction require and also respecting the rules on buildings.

For example, for the mechanical workshop (6), is enough to lift a light structure "Shed light" type that has a cost of 12 [U.F./m<sup>2</sup>]; in comparison with the construction material for the Tinderbox (4), that rule must be of solid structure, at a cost of 20 [U.F./m<sup>2</sup>].

Taking these requirements into consideration, we calculated the cost of building each of the necessary facilities, based on the market values for different types of construction, existing at the date of this study.

In the table below, show the current values to 31 December 2011 and that were taken into consideration in this phase of recovery.

[m/Hás]	Valor Compra en Container [UFxm <sup>2</sup> ]	Valor Construcción Pre-Fabricada [UFxm <sup>2</sup> ]	Valor Construcción Galpón Liviano [UFxm <sup>2</sup> ]	Valor Construcción Liviana [UFxm <sup>2</sup> ]	Valor Construcción Sólida [UFxm <sup>2</sup> ]	Valor Construcción Galpón [UFxm <sup>2</sup> ]
10.000	5,5	7	12	16	20	25

Valor Arriendo Container [UFxm <sup>2</sup> ]	Valor U.F. [\$/UF]	Tipo de Cambio [\$/USD\$]	Perímetro A [m]	Perímetro B [m]	Perímetro C [m]	Perímetro D [m]
0,3	22.231,90	\$ 500	1.174	1.250	600	1.330

Source: Prepared by Innovación y Desarrollo Ltda.  
 Valores al 31 de Diciembre de 2011.



- **Structural Works Valorization.**

Civil works that is necessary to implement the areas of extraction and production; as well as the routes of access and movement of the plant are then delivered to the following table.

The following table summarizes the costs associated to the necessary civil works.

WORK	AMOUNT	Unid.	Estimated Cost Unit	Total Cost
<b>STRUCTURAL WORKS</b>	[m]		USD \$	USD \$
STAY CLOSE	4.354	mL	29	124.350
COMPACTION AND STABILIZED LOADING AREA	750	m2	2	1.250
COMPACTION AND STABILIZED STORAGE AREAS	5.000	m2	2	8.330
COMPACTION AND STABILIZED CIRCULATION AREAS	92.100	m2	2	153.439
CHECK POINT	20	m2	245	4.891
TELEFONIC NETWORK	3.024	mL	22	65.520
DATA NETWORK	2.524	mL	83	210.249
ELECTRICAL NETWORK	3.024	mL	62	186.405
WATER NETWORK	2.524	mL	24	60.071

Source: Prepared by Innovación y Desarrollo Ltda.

Investment in civil works, reaches to **USD \$ 814.505**

The costs summarized in the table above, are explained in the following way:

✂ **Stay Close (Perimetral close).**

Are estimated at 4.354 linear meters the perimeter of the mining plant, which must be fencing and protected, through surveillance and control posts along.

It is estimated a unit cost of USD \$29 per linear meter; what means investing USD \$124,350 for this purpose.

✂ **Compaction and stabilized Area Load**

The designed size of plant requires conditioning 750 [m<sup>2</sup>] of land for cargo of minerals and base material.

With a unit cost of USD \$ 2 [\$/m<sup>2</sup>],, needs to invest USD \$ 1,250 for these works.



✘ **Compaction and stabilized storage areas.**

In the same way is required to put up a minimum space of 5,000 [m<sup>2</sup>] for the storage areas of ore concentrate and sterile at a unit cost of \$ 2 [\$/m<sup>2</sup>],; which means invest USD \$ 8,330 in compacted areas of collection.

✘ **Compaction and stabilized Area Circulation.**

It is estimated that this project will require 92.100 [m<sup>2</sup>] of roads and access, both within and outside of the plant.

The above at a unit cost of \$ 2 [\$/m<sup>2</sup>], means having an investment of USD \$ 153,439 for conditioning the circulation and access to the mine areas.

✘ **Access Control huts and security.**

This project will require building 20 [m<sup>2</sup>] of posts along guard and access control. Quoting the value of construction of posts along based on containers, has a unit value of \$245 [\$/m<sup>2</sup>], so that a total of USD \$ 4,891.

✘ **Telephone network and of Communications.**

Based on the distribution of plant proposed in annex 2, it is estimated having to wire 3,024 linear meters to communicate different dependencies on the plant and it abroad. This a price of USD 22 [\$/m], has a total cost of USD \$ 65,520.

✘ **Other networks.**

It is estimated that this project will require wiring a similar distance with data networks, electricity and water; It is estimated an investment of approximately USD \$ 456,726.



## ECONOMIC EVALUATION OF THE PROJECT

After identify, quantify and enhance the main cost factors involved in the project, an analysis of the economic structure of the project can be.

To do so, should identify and sort the main economic variables of the project and classify them in investment, costs and revenues.

- **Investment.**

All that is needed only once at the beginning of the planning horizon and purchases which are necessary to perform to launch own project operations are sorted in this category.

In this category are classified:

- The Land.
- The Structural Works
- The construction of dependences.
- The equipment.
- Working capital

In the previous section already studied and explained in detail the determination of the amounts of the investment needed. The following table summarizes these values.

<b>ECONOMIC FACTOR</b>	<b>VALUE [USD \$]</b>
Land	\$ 3.250.400
Infrastructure	\$ 4.245.537
Structural Work	\$ 814.505
Equipment	\$ 14.538.287
<b>TOTAL INVESTMENT</b>	<b>\$ 22.848.729</b>

Source: Prepared by Innovación y Desarrollo Ltda.  
Valued currency on December 31, 2011.

The Working Capital estimated for the first months of implementation underway of the project is estimated at USD \$468,000, to finance salary the first 4 months of operation.



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- **Revenues.**

Revenues of the project, are calculated based on monthly sales projected at the price of the concentrate ore given the law of the product and to the exchange rate prevailing at the date of the evaluation.

Other factors that affect revenues, are: the planning horizon of the evaluation, adjustments in prices, increase in sales, etc.

Taking this into consideration, here are the parameters that were taken into consideration at the time of the evaluation.

Sales volumen	:	40,000 [tons/month]
Price of the Concentrated of Iron	:	\$ 75 [USD \$/ton]
Law of the iron ore concentrated	:	63%
Exchange Rate	:	500 [\$/USD]
Quarterly Increment in the sales	:	5%
Horizon of Planning of the project	:	10 [years]

With all this in mind, below projected revenues annually in a 10 year horizon, whereas 5% adjustment in annual sales every 3 years.

<b>ANNUAL REVENUES</b>	<b>YEAR 1</b>	<b>YEAR 2</b>	<b>YEAR 3</b>	<b>YEAR 4</b>	<b>YEAR 5</b>
<b>USD \$</b>	\$ 36.000.000	\$ 36.000.000	\$ 37.800.000	\$ 37.800.000	\$ 37.800.000
<b>PESOS</b>	\$ 18.000.000.000	\$ 18.000.000.000	\$ 18.900.000.000	\$ 18.900.000.000	\$ 18.900.000.000

Source: Prepared by Innovación y Desarrollo Ltda.

Valued currency on December 31, 2011.

<b>ANNUAL REVENUES</b>	<b>YEAR 6</b>	<b>YEAR 7</b>	<b>YEAR 8</b>	<b>YEAR 9</b>	<b>YEAR 10</b>
<b>USD \$</b>	\$ 39.690.000	\$ 39.690.000	\$ 39.690.000	\$ 41.674.500	\$ 41.674.500
<b>PESOS \$</b>	\$ 19.845.000.000	\$ 19.845.000.000	\$ 19.845.000.000	\$ 20.837.250.000	\$ 20.837.250.000

Source: Prepared by Innovación y Desarrollo Ltda.

Valued currency on December 31, 2011.

All the values expressed in this estimate and projection of sales you can change, assuming other values, allowing to simulate the productive and commercial behaviour of the business and, therefore, to simulate the economic behavior of the project.



- **Costs.**

The major sources of costs are operational activities, where mining supplies, human and industrial resources, energy and other economic factors are consumed.

From this perspective, then identifies costs that will describe this project, which we ordenaremos depending on its structure of incidence on the value of the final product, costs in human resources, direct, indirect and general financial.

**Costs in human resources.**

The cost in human resources relates to expenditure which should incur the company to pay the salaries of personnel working directly in the processes of extraction plant.

They are salary pay monthly, but reported in this paper annually.

Salaries are subject to the respective social security or legal and tax discounts.

With this information, the following costs in human resources in the project planning horizon are obtained.

PERIODS	ADMINISTRATION		EXTRACTION AREA		PRODUCTION AREA		MAINTENANCE AREA		TOTAL ANNUAL	
	Pesos	USD	Pesos	USD	Pesos	USD	Pesos	USD	Pesos	USD
<b>0 - 2</b>	\$ 337.200.000	\$ 674.400	\$ 139.200.000	\$ 278.400	\$ 123.600.000	\$ 247.200	\$ 102.000.000	\$ 204.000	\$ 702.000.000	\$ 1.404.000
<b>3 - 5</b>	\$ 337.200.000	\$ 674.400	\$ 168.660.000	\$ 337.320	\$ 150.720.000	\$ 301.440	\$ 102.000.000	\$ 204.000	\$ 758.580.000	\$ 1.517.160
<b>6 - 8</b>	\$ 337.200.000	\$ 674.400	\$ 184.260.000	\$ 368.520	\$ 150.720.000	\$ 301.440	\$ 102.000.000	\$ 204.000	\$ 774.180.000	\$ 1.548.360
<b>9 - 11</b>	\$ 337.200.000	\$ 674.400	\$ 184.260.000	\$ 368.520	\$ 135.120.000	\$ 270.240	\$ 102.000.000	\$ 204.000	\$ 758.580.000	\$ 1.517.160

Source: Prepared by Innovación y Desarrollo Ltda.  
 Valorizado en moneda del 31 de Diciembre de 2011.

**Direct costs.**

The direct costs of the project represent all those concepts of expenditures that are incurred to produce an additional ton of product; that is, they are costs that increase directly proportional with the amount of produced iron concentrate.

These are the costs that can be directly assigned to the production cost of a unit of product.



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In this case, the costs of the project that can be classified as direct, the following costs of the teams in the areas of extraction and production:

- **Consume of fuel.**
- **Consume oils and lubricants.**
- **Consume liquid hydraulic.**
- **Consume of replacements.**
- **Consume of energy.**

In this way, and whereas a three-year adjustment of 5% in the price of inputs has the following table of direct costs of the project.

DIRECT COSTS			
PERIODS	% GROWTH	PESOS	USD
<b>0 - 2</b>	<b>0%</b>	\$ 2.643.040.520	\$ 5.286.081
<b>3 - 5</b>	<b>5%</b>	\$ 2.775.192.546	\$ 5.550.385
<b>6 - 8</b>	<b>5%</b>	\$ 2.913.952.173	\$ 5.827.904
<b>9 - 11</b>	<b>5%</b>	\$ 3.059.649.782	\$ 6.119.300
<b>12 - 15</b>	<b>5%</b>	\$ 3.212.632.271	\$ 6.425.265

Source: Prepared by Innovación y Desarrollo Ltda.  
 Valorizado en moneda del 31 de Diciembre de 2011.

### Indirect costs.

The indirect costs are all those expenses they must incur the company always and which are not directly related to the number of tons of concentrate produced.

In this category fall the telephone accounts, expenditure on food and transfer of staff, guards, rental of offices, the consumption of fuel, but vehicles that are not directly related to the productive areas, etc. To study in more detail these costs, it is suggested with detention review the accompanying tables in annex 3 of this document.

The following table presents a summary of the indirect costs that originate from the operation of the project.



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INDIRECTS COSTS			
PERIODS	% GROWTH	PESOS	USD
0 - 2	0%	\$ 720.638.486	\$ 1.441.277
3 - 5	5%	\$ 756.670.411	\$ 1.513.341
6 - 8	5%	\$ 794.503.931	\$ 1.589.008
9 - 11	5%	\$ 834.229.128	\$ 1.668.458
12 - 15	5%	\$ 875.940.584	\$ 1.751.881

Source: Prepared by Innovación y Desarrollo Ltda.  
 Valorizado en moneda del 31 de Diciembre de 2011.

### General Indirect costs.

The General indirect costs (IGC) correspond to administrative fixed costs that should incur the company to cover the mining patents secure payments and administrative expenses associated with the operation of the plant and the company.

The following table lists estimated by these concepts.

ADMINISTRATION AREA		
ITEM	TYPE COST	ANNUAL COST
Administration	Annual Flow	\$ 3.000.000
Warrants	Annual Flow	\$ 7.000.000
Assurance	Annual Flow	\$ 7.000.000
	<b>Total</b>	<b>\$ 17.000.000</b>
<b>General Indirect Cost USD \$:</b>		<b>\$ 34.000</b>

Source: Prepared by Innovación y Desarrollo Ltda.  
 Valorizado en moneda del 31 de Diciembre de 2011.



## FINANCIAL EVALUATION OF PROJECT

To carry out the financial evaluation of the project is needed, as in the previous section, identify, quantify and enhance investments, expected income and the estimated costs.

In addition, other nature rather economic parameters to measure the degree of profitability of the project and its "flexibility" or versatility to adapt to the various plausible scenarios that could eventually affect its operation should be defined in this study,.

Before starting with the financial study, it is necessary to determine some parameters and establish evaluation criteria according to the preferences of the owner of the project and establish its profile of risk (his way of perceiving it). Above, to establish measures, criteria, rates, and in general establish the financial perspective with which the decision-maker is interested in measuring the project in terms of its profitability, safety, sensitivity, recovery of investment, sensitivity to fluctuations of market, etc.

### 1) Discount Rate of Capital ( $T_d$ )

To this end, one of the main attributes that must be established is the position of the company at risk and this is represented by the "rate of discount ( $T_d$ )" or "Rate of cost of Capital" of the company; which seeks to determine the degree of economic efficiency or economic performance or profitability that the company will be required to draft, in exchange for assuming the risk of investing in it.

All rate above the interests that offer banks for term deposits, or mutual or sovereign bonds, etc., are attractive rates for any investor; However, the  $T_d$  will depend on its position before the risk of capital.

The financial evaluation of this project it was decided to use a realistic rate heavily used in projects of this nature.

For this evaluation will be used a discount rate of 18% and a horizon of 10-year assessment.



And, subsequently, to measure the degree of sensitivity of the project to the discount rate, will be assessed in addition 3 likely scenarios:

- Scenario optimistic, in that slightly punished the project with **Td= 15%**
- Conservative scenario, in which punished tepidly project **Td=20%**
- Scenario hard, that strongly punishes the project with **Td=25%**

## 2) Horizon of Evaluation of the project.

Another aspect that must be defined before starting the assessment, is the number of periods that will assess the project; in other words, the amount of periods or years of operation in which their economic performance will be studied.

A horizon of evaluation of the project will be used in this evaluation to 10 years; However to measure the degree of sensitivity of the project, will be assessed in addition scenarios to 10 and 15 years, for each of the sensitized discount rates.

## 3) Working capital (KT)

Another important economic factor is the Working Capital, because it is as a short-term return of investment for the purposes of assessment, but is a variable that affects significantly to the internal rate of return (T.I.R.) project.

Put another way, the internal rate of return (T.I.R.) is highly sensitive to the amount of investment, in particular the Working Capital.

For purposes of evaluation of this project, the Working Capital was established as the capital needed to cover the costs of remuneration of the plant during the first 4 months of operation of the project.

In this way, as is required monthly salaries by USD \$ 117,000; which is why KT, estimated to finance the first 4 months of operation, amounted to:

**USD \$ 468.000**



#### 4) Depreciations

In terms of depreciation, there are 2 aspects that must be evaluated separately:

- 1) The depreciation of the infrastructure.
- 2) The depreciation of the equipment.

The above due to the nature of both generates different horizon of depreciation accounting mechanisms.

For this reason, this study proposes depreciate annually both assets in the following periods:

- 1) Depreciate infrastructure in 10 [years]; and
- 2) Equipment in 5 [years].

With these parameters are calculated cash flows for each of the sessions of the project planning horizon and in result occurs in the following tables.



**Financial evaluation of the project:**

Considering the amount of investments, revenues and costs estimated in the previous section, below are the results of the financial evaluation of the project, using a Discount Rate of Capital of **18%** and a **10-year** planning horizon.

Considering a price of **USD \$75 [\$/ ton]** of iron with a purity of 63 per cent, have the following costs of production:

	Sale Price	Unit Cost	Depreciation Cost
[USD \$/Ton]	\$ 75	17	6

With this, you have the following table of income and expenses:

YEAR	REVENUE	LABOR	DIRECT	INDIRECT COST
	M\$	M\$	M\$	M\$
0				
1	36.000	1.404	5.286	1.475
2	36.000	1.474	5.286	1.475
3	37.800	1.548	5.550	1.547
4	37.800	1.625	5.550	1.547
5	37.800	1.707	5.550	1.547
6	39.690	1.792	5.828	1.623
7	39.690	1.881	5.828	1.623
8	39.690	1.976	5.828	1.623
9	41.675	2.074	6.119	1.702
10	41.675	2.178	6.119	1.702

Source: Prepared by Innovación y Desarrollo Ltda.  
 Valorizado en moneda del 31 de Diciembre de 2011.

Taking into account the structure of investment is described as shown in the following tables:



**Investment Infrastructure:**

Infrastructure Investment	Año	M\$
	0	8.816
	1	0
	2	0
	3	0

**Investment Equipment:**

Equipment Investment	Año	M\$
	0	14.538
	1	
	2	
	3	

**Working capital (Kw) for 4 months of operation:**

Working Capital (Kw)	Año	M\$
	0	468
	1	0
	2	0
	3	0

**Periods of Depreciation:**

	YEAR		
Infrastructure Depreciación	10	Mensual	
Equipment Depreciation	5	Anual	x



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**Cash flow:**

Period	0	1	2	3	4	5	6	7	8	9	10
Working Capital	468										
Infrastructure Investment M\$	8.816										
Equipment Investment M\$	14.538										
Total Investment	23.823										
Total Investment Accumulated	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823
Net Revenues M\$		36.000	36.000	37.800	37.800	37.800	39.690	39.690	39.690	41.675	41.675
Labor Cost M\$		1.404	1.474	1.548	1.625	1.707	1.792	1.881	1.976	2.074	2.178
Direct costs and overhead M\$		5.286	5.286	5.550	5.550	5.550	5.828	5.828	5.828	6.119	6.119
Indirect cost and overhead M\$		1.475	1.475	1.547	1.547	1.547	1.623	1.623	1.623	1.702	1.702
Infrastructure Depreciation M\$		882	882	882	882	882	882	882	882	882	882
Equipment Depreciation M\$		2.908	2.908	2.908	2.908	2.908	0	0	0	0	0
Accumulated Depreciation of Period		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882
Total Accumulated Depreciation M\$		3.789	7.579	11.368	15.157	18.947	19.828	20.710	21.591	22.473	23.355
Operating Profit		24.045	23.975	25.365	25.288	25.206	29.566	29.476	29.382	30.897	30.793
Interests		4.204	3.759	3.233	2.613	1.882	1.019				
Earnings before taxes		19.841	20.217	22.132	22.674	23.325	28.547	29.476	29.382	30.897	30.793
Taxes		3.373							4.920	5.252	5.235
Earnings after taxes		16.468	20.217	22.132	22.674	23.325	28.547	29.476	24.462	25.644	25.558
Depreciation		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882
Amortization		2.474	2.919	3.444	4.064	4.796	5.659				
Residual Value of Project											468
Cash Flow	-468	17.784	21.087	22.477	22.400	22.318	23.770	30.358	25.344	26.526	26.908
Actualized Flow	-468	15.071	15.144	13.680	11.553	9.756	8.805	9.530	6.742	5.980	5.141

Source: Prepared by Innovación y Desarrollo Ltda.

Valorizado en moneda del 31 de Diciembre de 2011.

Con lo que se obtiene los siguientes resultados de rentabilidad del negocio:

**Indices of profit Value:**

RATE	USD \$
NPV	100.936.165
I.R.R.	3818,25%

**Conclusions:**

Investors will get a wealth of USD \$100 million over the 10 years of operation of this project, evaluated to a Capital discount rate of 18 per cent; assuming a selling price of USD 75 [\$/ ton] iron concentrate and a cost of USD 17 [\$/ ton] production unit and a unit cost for depreciation of 6 [\$/ ton]; without considering the costs of freight port and shipping F.O.B.

It is a robust project, because the discount rate could stressed 18% up to 3,818% to let the project recently being profitable.



### ANALISIS OF SENSIBILITY OF THE PROJECT

#### SCENARY #1:

Discount rate : **Td=15%**  
 Period of Evaluation : **10 Years**

With these parameters and the values of investment, revenues and costs identified in the previous section, are the following results in the financial evaluation of the project:

**Table of revenues and costs:**

YEAR	REVENUE	LABOR	DIRECT	INDIRECT COST
	M\$	M\$	M\$	M\$
0				
1	36.000	1.404	5.286	1.475
2	36.000	1.474	5.286	1.475
3	37.800	1.548	5.550	1.547
4	37.800	1.625	5.550	1.547
5	37.800	1.707	5.550	1.547
6	39.690	1.792	5.828	1.623
7	39.690	1.881	5.828	1.623
8	39.690	1.976	5.828	1.623
9	41.675	2.074	6.119	1.702
10	41.675	2.178	6.119	1.702

#### Cash flows

Period	0	1	2	3	4	5	6	7	8	9	10
Working Capital	468										
Infrastructure Investment M\$	8.816										
Equipment Investment M\$	14.538										
Total Investment	23.823										
Total Investment Accumulated	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823
Net Revenues M\$		36.000	36.000	37.800	37.800	37.800	39.690	39.690	39.690	41.675	41.675
Labor Cost M\$		1.404	1.474	1.548	1.625	1.707	1.792	1.881	1.976	2.074	2.178
Direct costs and overhead M\$		5.286	5.286	5.550	5.550	5.550	5.828	5.828	5.828	6.119	6.119
Indirect cost and overhead M\$		1.475	1.475	1.547	1.547	1.547	1.623	1.623	1.623	1.702	1.702
Infrastructure Depreciation M\$		882	882	882	882	882	882	882	882	882	882
Equipment Depreciation M\$		2.908	2.908	2.908	2.908	2.908	0	0	0	0	0
Accumulated Depreciation of Period		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882
Total Accumulated Depreciation M\$		3.789	7.579	11.368	15.157	18.947	19.828	20.710	21.591	22.473	23.355
Operating Profit		24.045	23.975	25.365	25.288	25.206	29.566	29.476	29.382	30.897	30.793
Interests		4.204	3.759	3.233	2.613	1.882	1.019				
Earnings before taxes		19.841	20.217	22.132	22.674	23.325	28.547	29.476	29.382	30.897	30.793
Taxes		3.373							4.920	5.252	5.235
Earnings after taxes		16.468	20.217	22.132	22.674	23.325	28.547	29.476	24.462	25.644	25.558
Depreciation		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882
Amortization		2.474	2.919	3.444	4.064	4.796	5.659				
Residual Value of Project											468
Cash Flow	-468	17.784	21.087	22.477	22.400	22.318	23.770	30.358	25.344	26.526	26.908
Actualized Flow	-468	15.465	15.945	14.779	12.807	11.096	10.276	11.413	8.285	7.540	6.651

#### Ratio of profit Value:

RATE	USD \$
NPV	113.789.053
I.R.R.	3818,25%



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**SCENARIO #2:**

Discount rate : **Td=20%**  
 Period of Evaluation : **10 Years**

With these parameters and the values of investment, revenues and costs identified in the previous section, are the following results in the financial evaluation of the project:

**Table of revenues and costs: They do not change with respect to the previous scenario**

**Cash flows:**

Period	0	1	2	3	4	5	6	7	8	9	10
Working Capital	468										
Infrastructure Investment M\$	8.816										
Equipment Investment M\$	14.538										
Total Investment	23.823										
Total Investment Acumulated	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823
Net Revenues M\$		36.000	36.000	37.800	37.800	37.800	39.690	39.690	39.690	41.675	41.675
Labor Cost M\$		1.404	1.474	1.548	1.625	1.707	1.792	1.881	1.976	2.074	2.178
Direct costs and overhead M\$		5.286	5.286	5.550	5.550	5.550	5.828	5.828	5.828	6.119	6.119
Indirect cost and overhead M\$		1.475	1.475	1.547	1.547	1.547	1.623	1.623	1.623	1.702	1.702
Infrastructure Depreciation M\$		882	882	882	882	882	882	882	882	882	882
Equipment Depreciation M\$		2.908	2.908	2.908	2.908	2.908	0	0	0	0	0
Accumulated Depreciation of Period		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882
Total Accumulated Depreciation M\$		3.789	7.579	11.368	15.157	18.947	19.828	20.710	21.591	22.473	23.355
Operating Profit		24.045	23.975	25.365	25.288	25.206	29.566	29.476	29.382	30.897	30.793
Interests		4.204	3.759	3.233	2.613	1.882	1.019				
Earnings before taxes		19.841	20.217	22.132	22.674	23.325	28.547	29.476	29.382	30.897	30.793
Taxes		3.373							4.920	5.252	5.235
Earnings after taxes		16.468	20.217	22.132	22.674	23.325	28.547	29.476	24.462	25.644	25.558
Depreciation		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882
Amortization		2.474	2.919	3.444	4.064	4.796	5.659				
Residual Value of Project											468
Cash Flow	-468	17.784	21.087	22.477	22.400	22.318	23.770	30.358	25.344	26.526	26.908
Actualized Flow	-468	14.820	14.644	13.008	10.802	8.969	7.960	8.472	5.894	5.141	4.346

**Ratio of profit Value:**

RATE	USD \$
NPV	93.588.645
I.R.R.	3818,25%

Source: Prepared by Innovación y Desarrollo Ltda.



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**ESCENARY #3:**

Discount rate : **Td=25%**  
 Period of Evaluation : **10 Years**

With these parameters and the values of investment, revenues and costs identified in the previous section, are the following results in the financial evaluation of the project:

**Table of revenues and costs: They do not change with respect to the previous scenario**

**Cash flows:**

Period	0	1	2	3	4	5	6	7	8	9	10
Working Capital	468										
Infrastructure Investment M\$	8.816										
Equipment Investment M\$	14.538										
Total Investment	23.823										
Total Investment Accumulated	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823
Net Revenues M\$		36.000	36.000	37.800	37.800	37.800	39.690	39.690	39.690	41.675	41.675
Labor Cost M\$		1.404	1.474	1.548	1.625	1.707	1.792	1.881	1.976	2.074	2.178
Direct costs and overhead M\$		5.286	5.286	5.550	5.550	5.550	5.828	5.828	5.828	6.119	6.119
Indirect cost and overhead M\$		1.475	1.475	1.547	1.547	1.547	1.623	1.623	1.623	1.702	1.702
Infrastructure Depreciation M\$		882	882	882	882	882	882	882	882	882	882
Equipment Depreciation M\$		2.908	2.908	2.908	2.908	2.908	0	0	0	0	0
Accumulated Depreciation of Period		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882
Total Accumulated Depreciation M\$		3.789	7.579	11.368	15.157	18.947	19.828	20.710	21.591	22.473	23.355
Operating Profit		24.045	23.975	25.365	25.288	25.206	29.566	29.476	29.382	30.897	30.793
Interests		4.204	3.759	3.233	2.613	1.882	1.019				
Earnings before taxes		19.841	20.217	22.132	22.674	23.325	28.547	29.476	29.382	30.897	30.793
Taxes		3.373							4.920	5.252	5.235
Earnings after taxes		16.468	20.217	22.132	22.674	23.325	28.547	29.476	24.462	25.644	25.558
Depreciation		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882
Amortization		2.474	2.919	3.444	4.064	4.796	5.659				
Residual Value of Project											468
Cash Flow	-468	17.784	21.087	22.477	22.400	22.318	23.770	30.358	25.344	26.526	26.908
Actualized Flow	-468	14.227	13.496	11.508	9.175	7.313	6.231	6.366	4.252	3.560	2.889

**Ratio of profit Value:**

RATE	USD \$
NPV	78.550.549
I.R.R.	3818,25%

Source: Prepared by Innovación y Desarrollo Ltda.

These first 3 scenarios, it is clear that to punish the project with one higher discount rate, the net current value (N.P.V.) of the project degrades significantly; But even so the profitability of the project is of such magnitude, that strong variations in this rate (Td), the project will continue to be profitable; and will remain it until the discount rate should be increased to a 3,818%.



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### SCENARIO #4:

Discount rate : **Td=15%**  
 Period of Evaluation : **15 Años**

With these parameters and the values of investment, revenues and costs identified in the previous section, are the following results in the financial evaluation of the project:

**Table of revenues and costs:**

YEAR	REVENUE	LABOR	DIRECT	INDIRECT COST
	M\$	M\$	M\$	M\$
0				
1	36.000	1.404	5.286	1.475
2	36.000	1.474	5.286	1.475
3	37.800	1.548	5.550	1.547
4	37.800	1.625	5.550	1.547
5	37.800	1.707	5.550	1.547
6	39.690	1.792	5.828	1.623
7	39.690	1.881	5.828	1.623
8	39.690	1.976	5.828	1.623
9	41.675	2.074	6.119	1.702
10	41.675	2.178	6.119	1.702
11	41.675	2.287	6.119	1.702
12	43.758	2.401	6.425	1.786
13	43.758	2.521	6.425	1.786
14	43.758	2.647	6.425	1.786
15	43.758	2.780	6.425	1.786

**Cash flows:**

Period	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Working Capital	468															
Infrastructure Investment M\$	8.816															
Equipment Investment M\$	14.538															
Total Investment	23.823															
Total Investment Accumulated	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823
Net Revenues M\$		36.000	36.000	37.800	37.800	37.800	39.690	39.690	39.690	41.675	41.675	41.675	43.758	43.758	43.758	43.758
Labor Cost M\$		1.404	1.474	1.548	1.625	1.707	1.792	1.881	1.976	2.074	2.178	2.287	2.401	2.521	2.647	2.780
Direct costs and overhead M\$		5.286	5.286	5.550	5.550	5.550	5.828	5.828	5.828	6.119	6.119	6.119	6.425	6.425	6.425	6.425
Indirect cost and overhead M\$		1.475	1.475	1.547	1.547	1.547	1.623	1.623	1.623	1.702	1.702	1.702	1.786	1.786	1.786	1.786
Infrastructure Depreciation M\$		882	882	882	882	882	882	882	882	882	882	0	0	0	0	0
Equipment Depreciation M\$		2.908	2.908	2.908	2.908	2.908	0	0	0	0	0	0	0	0	0	0
Accumulated Depreciation of Period		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882					
Total Accumulated Depreciation M\$		3.789	7.579	11.368	15.157	18.947	19.828	20.710	21.591	22.473	23.355	23.355	23.355	23.355	23.355	23.355
Operating Profit		24.045	23.975	25.365	25.288	25.206	29.566	29.476	29.382	30.897	30.793	31.566	33.146	33.026	32.900	32.767
Interests		4.204	3.759	3.233	2.613	1.882	1.019									
Earnings before taxes		19.841	20.217	22.132	22.674	23.325	28.547	29.476	29.382	30.897	30.793	31.566	33.146	33.026	32.900	32.767
Taxes		3.373							4.920	5.252	5.235	5.366	5.635	5.614	5.593	5.570
Earnings after taxes		16.468	20.217	22.132	22.674	23.325	28.547	29.476	24.462	25.644	25.558	26.200	27.511	27.411	27.307	27.197
Depreciation		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882					
Amortization		2.474	2.919	3.444	4.064	4.796	5.659									
Residual Value of Project																468
Cash Flow	-468	17.784	21.087	22.477	22.400	22.318	23.770	30.358	25.344	26.526	26.440	26.200	27.511	27.411	27.307	27.665
Actualized Flow	-468	15.465	15.945	14.779	12.807	11.096	10.276	11.413	8.285	7.540	6.536	5.631	5.142	4.455	3.859	3.400

**Indices of profit Value:**

RATE	USD \$
NPV	136.160.974
I.R.R.	3818,25%



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**SCENARY #5:**

Discount rate : **Td=20%**  
 Period of Evaluation : **15 Años**

With these parameters and the values of investment, revenues and costs identified in the previous section, are the following results in the financial evaluation of the project:

**Table of revenues and costs: No change on the previous stage**

**Cash flows:**

Period	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Working Capital	468															
Infrastructure Investment M\$	8.816															
Equipment Investment M\$	14.538															
Total Investment	23.823															
Total Investment Accumulated	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823
Net Revenues M\$		36.000	36.000	37.800	37.800	37.800	39.690	39.690	39.690	41.675	41.675	41.675	43.758	43.758	43.758	43.758
Labor Cost M\$		1.404	1.474	1.548	1.625	1.707	1.792	1.881	1.976	2.074	2.178	2.287	2.401	2.521	2.647	2.780
Direct costs and overhead M\$		5.286	5.286	5.550	5.550	5.550	5.828	5.828	5.828	6.119	6.119	6.119	6.425	6.425	6.425	6.425
Indirect cost and overhead M\$		1.475	1.475	1.547	1.547	1.547	1.623	1.623	1.623	1.702	1.702	1.702	1.786	1.786	1.786	1.786
Infrastructure Depreciation M\$		882	882	882	882	882	882	882	882	882	882	0	0	0	0	0
Equipment Depreciation M\$		2.908	2.908	2.908	2.908	2.908	0	0	0	0	0	0	0	0	0	0
Accumulated Depreciation of Period		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882					
Total Accumulated Depreciation M\$		3.789	7.579	11.368	15.157	18.947	19.828	20.710	21.591	22.473	23.355	23.355	23.355	23.355	23.355	23.355
Operating Profit		24.045	23.975	25.365	25.288	25.206	29.566	29.476	29.382	30.897	30.793	31.566	33.146	33.026	32.900	32.767
Interests		4.204	3.759	3.233	2.613	1.882	1.019									
Earnings before taxes		19.841	20.217	22.132	22.674	23.325	28.547	29.476	29.382	30.897	30.793	31.566	33.146	33.026	32.900	32.767
Taxes		3.373							4.920	5.252	5.235	5.366	5.635	5.614	5.593	5.570
Earnings after taxes		16.468	20.217	22.132	22.674	23.325	28.547	29.476	24.462	25.644	25.558	26.200	27.511	27.411	27.307	27.197
Depreciation		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882					
Amortization		2.474	2.919	3.444	4.064	4.796	5.659									
Residual Value of Project																468
Cash Flow	-468	17.784	21.087	22.477	22.400	22.318	23.770	30.358	25.344	26.526	26.440	26.200	27.511	27.411	27.307	27.665
Actualized Flow	-468	14.820	14.644	13.008	10.802	8.969	7.960	8.472	5.894	5.141	4.270	3.526	3.086	2.562	2.127	1.796

**Indices of profit Value:**

RATE	USD \$
NPV	106.609.143
I.R.R.	3818,25%

Source: Prepared by Innovación y Desarrollo Ltda.



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**SCENARY #6:**

Discount rate : **Td=25%**  
 Period of Evaluation : **15 Años**

With these parameters and the values of investment, revenues and costs identified in the previous section, are the following results in the financial evaluation of the project:

**Table of revenues and costs: No change on the previous stage**

**Cash flows:**

Period	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Working Capital	468															
Infrastructure Investment M\$	8.816															
Equipment Investment M\$	14.538															
Total Investment	23.823															
Total Investment Accumulated	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823	23.823
Net Revenues M\$		36.000	36.000	37.800	37.800	37.800	39.690	39.690	39.690	41.675	41.675	41.675	43.758	43.758	43.758	43.758
Labor Cost M\$		1.404	1.474	1.548	1.625	1.707	1.792	1.881	1.976	2.074	2.178	2.287	2.401	2.521	2.647	2.780
Direct costs and overhead M\$		5.286	5.286	5.550	5.550	5.550	5.828	5.828	5.828	6.119	6.119	6.119	6.425	6.425	6.425	6.425
Indirect cost and overhead M\$		1.475	1.475	1.547	1.547	1.547	1.623	1.623	1.623	1.702	1.702	1.702	1.786	1.786	1.786	1.786
Infrastructure Depreciation M\$		882	882	882	882	882	882	882	882	882	882	0	0	0	0	0
Equipment Depreciation M\$		2.908	2.908	2.908	2.908	2.908	0	0	0	0	0	0	0	0	0	0
Accumulated Depreciation of Period		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882					
Total Accumulated Depreciation M\$		3.789	7.579	11.368	15.157	18.947	19.828	20.710	21.591	22.473	23.355	23.355	23.355	23.355	23.355	23.355
Operating Profit		24.045	23.975	25.365	25.288	25.206	29.566	29.476	29.382	30.897	30.793	31.566	33.146	33.026	32.900	32.767
Interests		4.204	3.759	3.233	2.613	1.882	1.019									
Earnings before taxes		19.841	20.217	22.132	22.674	23.325	28.547	29.476	29.382	30.897	30.793	31.566	33.146	33.026	32.900	32.767
Taxes		3.373							4.920	5.252	5.235	5.366	5.635	5.614	5.593	5.570
Earnings after taxes		16.468	20.217	22.132	22.674	23.325	28.547	29.476	24.462	25.644	25.558	26.200	27.511	27.411	27.307	27.197
Depreciation		3.789	3.789	3.789	3.789	3.789	882	882	882	882	882					
Amortization		2.474	2.919	3.444	4.064	4.796	5.659									
Residual Value of Project																468
Cash Flow	-468	17.784	21.087	22.477	22.400	22.318	23.770	30.358	25.344	26.526	26.440	26.200	27.511	27.411	27.307	27.665
Actualized Flow	-468	14.227	13.496	11.508	9.175	7.313	6.231	6.366	4.252	3.560	2.839	2.251	1.891	1.507	1.201	973

**Indices of profit Value:**

RATE	USD \$
<b>NPV</b>	<b>86.322.651</b>
<b>I.R.R.</b>	<b>3818,25%</b>

Source: Prepared by Innovación y Desarrollo Ltda.



## CONCLUSIONS

- 1) The best alternative assessment occurs at a low rate of discount ( $Td = 15\%$ ) and obtained a net present value to the greater horizon of planning (15 years);:  
(V.A.N.) = **\$ 136,160,974** (I.R.R. : 3,818%).
- 2) It needs to know the degree of sensitivity that has the draft of other economic variables of the project; so it is imperative in this section to carry out an analysis of sensitivity for measuring the behavior of other economic variables and its flexibility to changes in the market.

The values presented in these tables are in thousands of Pesos, with the exception of the VAN that occurs in pesos.

(In currency of December 2011)



## RECOMMENDATIONS

- 1) To reduce the amount of the initial investment, you can rent some surface (EMS) mobile equipment, such as hydraulic excavators, front loaders, backhoes, motor graders, trucks, among others. But in any case it is suggested lease sensitive equipment forming part of the production process, such as crushers, vibratory, separators sieves magnetic or conveyor belts; because the equipment used for rent always have malfunction of in the short term, jeopardizing the continuity of the production process.
- 2) The higher incidence of the investment cost is represented by the value of the CAT Caterpillar 777F and CAT 772 trucks, which together explain a **45.7%** of total investment in equipment; in other words, of the USD \$ **14.538.287** of investment in equipment, half is occupied by trucks for loading and unloading of material base, concentrated and waste, which cost: USD \$ **6.650.000**. The obvious recommendation to optimize the profitability of the project, will replace them by new teams of similar ability, but most convenient price, or replace them with used trucks or simply consider the outsourcing service. In many cases the service outsourcing entails quite convenient service conditions and investment savings.

**EDGARDO MATAMALA PÉREZ**  
INGENIERO CIVIL INDUSTRIAL  
Nº REGISTRO: 1283(13075)072 Gr.152/94



**ANEX 1**

**List of equipment and machinery.**



**1) AREA OF EXTRACTION:**

Detailed listing of equipment and machinery required for the area of extraction:

- TOOLS FOR EXCAVATION.
- TOOLS FOR BLASTINGS.
- EXCAVATOR HYDRAULICS
- WHEEL LOADERS
- TRUCKS
- MOTOR GRADERS
- BACKHOE LOADERS
- TOWER OF LIGHTING

**2) AREA OF PRODUCTION:**

- VIBRATING feeder GRIZZLY (grid)
- Crusher primary of jaw tape conveyor
- STOCKPILE tape conveyor
- CRUSHERS side of cone 5 1/2
- CHUTE pants belt conveyor towards
- BELT CONVEYOR TO TESTUZ
- RETURN CONVEYOR BELT
- VIBRATORY SIEVE
- TAPE TRANSPORTADORA A CONCENTRATOR PLANT
- TOWER OF LIGHTING
- BELT CONVEYOR WITH MAGNETIC PULLEYS
- CHUTE TROUSERS
- CONCENTRATE 1° POLEAS MAGNETICS
- TRANSPORTING TAPE FOR COLLECTION CONCENTRATED
- TRANSPORTING TAPE TO THE CHANCADOR 3°
- CHANCADOR 3° CONE 4 1/4
- CHUTE TROUSERS
- TRANSPORTING TAPE AT THE OUTSET
- VIBRATORY SIEVE
- TRANSPORTING TAPE AT THE OUTSET
  
- Stockpile of the 2 magnetic concentrator °
- ENTRANCE CONVEYOR BELT
- CHUTE TROUSERS
- HUB 2 ° MAGNETIC DRUMS
- CHUTE TROUSERS



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- TRANSPORTING TAPE EXIT OF CONCENTRATED
- TRANSPORTING TAPE Exit to Stockpile of Sterile
- STOCKPILE STERILE
- TRANSPORTING TAPE Exit Sterile from Stockpile
- CONCENTRADOR 3° MAGNETIC DRUMS
- SHOT PANTS
- TRANSPORTING TAPE Exit of Concentrated to Load
- TRUCKS CONCENTRATED
- TRANSPORTING TAPE Exit of Sterile to Load
- STERILE TRUCKS

All the transporters tapes have devices for security and emergency which requires the standard:

- Hopper of discharge C600 B1600
- tungsten band Scrapers
- Encausador Lateral
- Lateral Protection
- Lower Protection
- Capotaje CAPOTEX
- band bypass control System
- drum rotation control Systems
- emergency stop System



**ANEX 2**

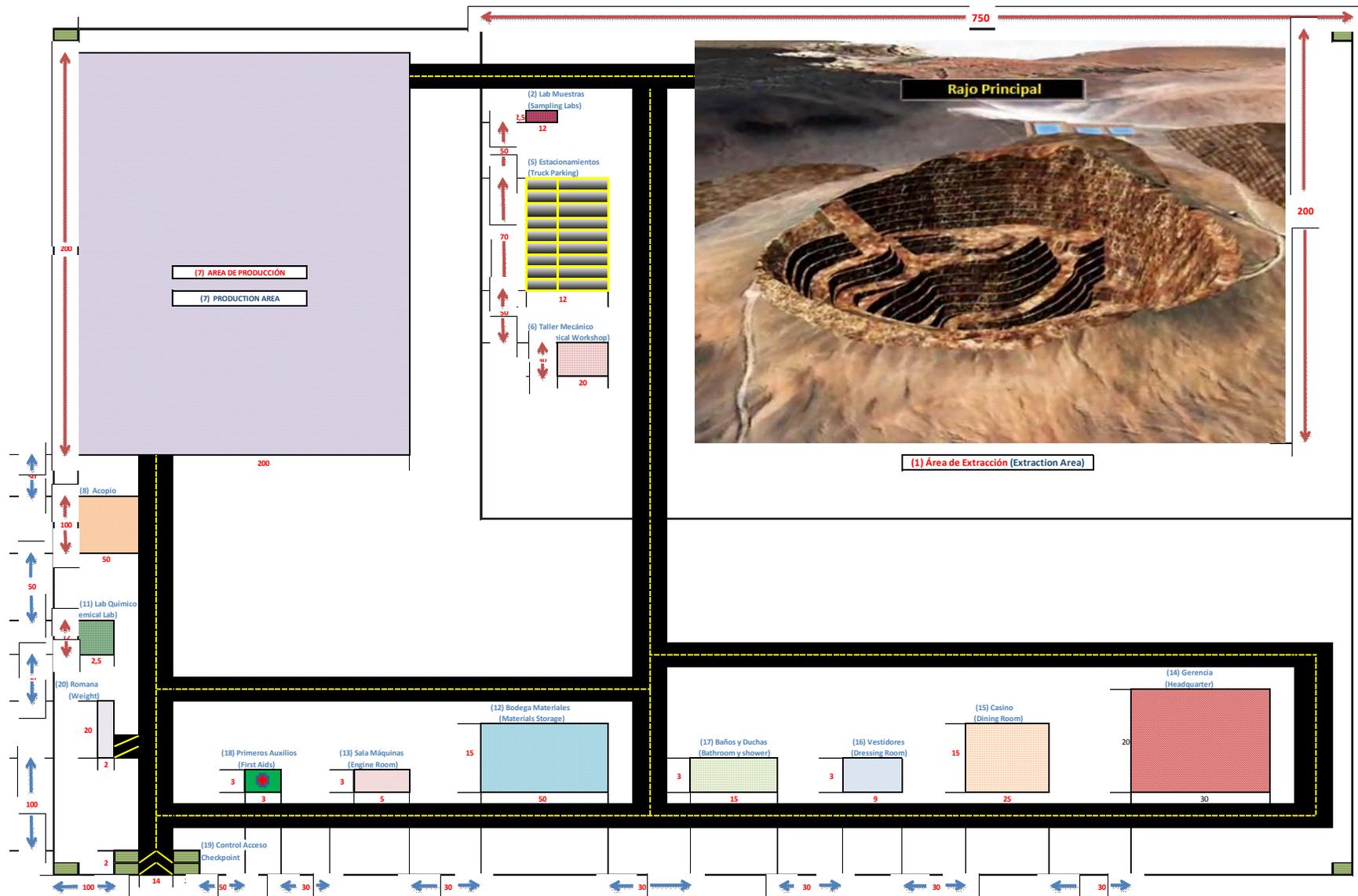
**Extraction and production of iron plant layout.**



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**ANEX 3**

**Pictures of investments, income and costs of the project..**



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### 1) INVESTMENT

TIPO DE EQUIPO	MARCA	MODELO	ANCHO	LARGO	ALTO	CAPACIDAD	CONSUMO	DENSIDAD	POTENCIA	CANTIDAD	Unid.	Tasa Eficiencia Técnica	Tasa Eficiencia Operacional	Costo Estimado Unitario	Costo Total	Costo estimado en Pesos
Etapa I : 50 [Ton/mes]			[mm]	[mm]	[mm]	[Ton]	[Lt/hr]	[Ton/m3]	[KW]		Unids	20%	80%	[USD \$]	[USD \$]	[\$]
<b>AREA EXTRACCIÓN</b>																
															Nuevo	
EXCAVADORA HIDRÁULICA	CATERPILLAR	CAT 320 D	2800	9440	2950	3,5	21,5	3,5	138 HP	2	Un			320.000	640.000	320.000.000
CARGADOR FRONTAL (WHEEL LOADERS)	CATERPILLAR	CAT 966 H	3145	8.500	3.600	18,9	32		195	1	Un			420.000	420.000	210.000.000
CAMIONES	CATERPILLAR	CAT 777F	6494	10535	5.170	101,6	12	3,5	700	3	Un			950.000	2.850.000	1.425.000.000
MOTONIVELADORA (MOTOR GRADERS)	CATERPILLAR	CAT 140M	2791	9412	3535		24		193	1	Un			302.478	302.478	151.239.169
RETROEXCAVADORA (BACKHOE LOADERS)	CATERPILLAR	CAT 416E	2262	7.500	2.651	2,7	26		55	1	Un			185.873	185.873	92.936.456
TORRE DE ILUMINACIÓN	WACKER	LTC-4L	1220	3890	1600	8500 W	3,0		8,5	1	Un			14.000	14.000	7.000.000
															4.412.351	2.206.175.626
TIPO DE EQUIPO	MARCA	MODELO	ANCHO	LARGO	ALTO	CAPACIDAD	CONSUMO	DENSIDAD	POTENCIA	CANTIDAD	Unid.	Tasa Eficiencia Técnica	Tasa Eficiencia Operacional	Costo Estimado Unitario	Costo Total	Costo estimado en Pesos
<b>AREA PRODUCCIÓN</b>																
TORRE DE ILUMINACIÓN	WACKER	LTC-4L	1220	3890	1600	8500 W	3		8,5	3	Un			14.000	42.000	21.000.000
TOLVA DE ALIMENTACIÓN	ZENITH	LC 5000 X 5000	5000	5.000	3.000	800	E.E			1	Un			18.681	18.681	9.340.500
ALIMENTADOR VIBRATORIO	ZENITH	GZD1500X6000	1500	6.000	1.000	500-700	E.E		30	1	Un			38.714	38.714	19.357.000
TRITURADOR DE MANDIBULA	ZENITH	PE1200X1500	1200	1.500	800	400-850	E.E		220	1	Un			379.354	379.354	189.677.000
ALIMENTADOR VIBRATORIO	ZENITH	GZG-300	1500	3.000	750	300-600	E.E		15	2	Un			5.466	10.932	5.466.000
TRITURADOR CONO HIDRAULICO	ZENITH	HPC400	1200	1.500	800	400-700	E.E		400	1	Un			662.897	662.897	331.448.500
ZARANDA VIBRATORIA	ZENITH	2YK2460	2400	6.000	1.000	100-810	E.E		37	1	Un			45.981	45.981	22.990.500
TRITURADOR CONO HIDRAULICO	ZENITH	HPF400	1200	1.500	800	400-700	E.E		400	2	Un			662.897	1.325.794	662.897.000
ZARANDA VIBRATORIA	ZENITH	2YK2460	2400	6.000	1.000	100-810	E.E		37	1	Un			45.981	45.981	22.990.500
SEPARADOR MAGNETICO	ZENITH	RCYC-12	500	1.500	700	800	E.E		3	1	Un			50.000	50.000	25.000.000
CLUSTER DE SEPARACIÓN MAGNETICA	I&D	SM1HD	900	3.000	5	30	E.E		15	3	Un			450.962	1.352.886	676.443.000
CINTA TRANSPORTADORA	ROLLIER	60" X 15 mL x 6 mh	1524	15.000	6.000	800	E.E		22	1	Un			115.856	115.856	57.928.000
CINTA TRANSPORTADORA	ROLLIER	60" X 12 mL x 6 mh	1524	12.000	6.000	800	E.E		23	2	Un			92.685	185.370	92.685.000
CINTA TRANS CON POLEAS MAGNÉTICAS	ROLLIER	60" x 15 mL	1524	15.000	1.000	800	E.E		11	1	Un			81.000	81.000	40.500.000
CINTA TRANSPORTADORA DE ENTRADA	ROLLIER	42" x 24 mL x 6 mh	1067	24.000	6.000	800	E.E		19	1	Un			63.333	63.333	31.666.500
CINTA TRANSPORTADORA DE SALIDA	ROLLIER	42" x 15 mL x 9 mh	1067	15.000	9.000	800	E.E		15	1	Un			42.729	42.729	21.364.500
CINTA TRANSPORTADORA DE SALIDA	ROLLIER	42" x 15 mL x 6 mh	1067	15.000	6.000	350	E.E		11	2	Un			34.955	69.910	34.955.000
CINTA TRANSPORTADORA DE SALIDA	ROLLIER	42" x 12 mL x 9 mh	1067	12.000	9.000	500	E.E		15	2	Un			34.183	68.366	34.183.000
CINTA TRANSPORTADORA DE SALIDA	ROLLIER	42" x 12 mL x 6 mh	1067	12.000	6.000	500	E.E		11	2	Un			34.183	68.366	34.183.000
Tolva de descarga C600 B1200										0	Un			996	0	0
Rascadores de banda de tungsteno										0	Un			3.182	0	0
Encausador Lateral										0	m			372	0	0
Protección Lateral										0	m			51	0	0
Protección Inferior										0	m			61	0	0
Capotaje CAPOTEX										0	m			242	0	0
Sistema de control de desvío de banda										0	Un			1.127	0	0
Sistemas control rotación de tambor										0	Un			310	0	0
Sistema parada de emergencia										0	Un			419	0	0
CAMIONES CONCENTRADO	CATERPILLAR	CAT 772	6494	10535	5.170	101,6	12	3,5	700	1	Un			950.000	950.000	475.000.000
CAMIONES ESTÉRIL	CATERPILLAR	CAT 777F	6494	10535	5.170	101,6	12	3,5	700	3	Un			950.000	2.850.000	1.425.000.000
CARGADOR FRONTAL (WHEEL LOADERS)	CATERPILLAR	CAT 966 H	3145	8.500	3.600	18,9	32		195	1	Un			420.000	420.000	210.000.000
MINICARGADOR (SKID STEER LOADERS)	CATERPILLAR	CAT 246C	1890	3692	2080	0,98	11,2		75 HP	0	Un			83.236	0	0
GRÚA HORQUILLA (FORKLIFTS)	CATERPILLAR	DP50K-D	1900	4000	2080	5	10		75 HP	0	Un			42.000	0	0
SISTEMA DE CONTROL	ZENITH	---	---	---	---	---	E.E			1	Un			47.867	47.867	23.933.500
															8.936.017	4.468.008.500



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TIPO DE EQUIPO	MARCA	MODELO	ANCHO	LARGO	ALTO	CAPACIDAD	CONSUMO	DENSIDAD	POTENCIA	CANTIDAD	Unid.	Tasa Eficiencia Técnica	Tasa Eficiencia Operacional	Costo Estimado Unitario	Costo Total	Costo estimado en Pesos		
			[mm]	[mm]	[mm]	[Ton]	[L/h]	[Ton/m3]	[KW]			20%	80%	[USD \$]	[USD \$]	[\$]		
<b>ADMINISTRACIÓN</b>																		
Escritorios										15	Un			595	8.925	4.462.500		
Recepción										1	Un			1.785	1.785	892.500		
Estantes Biblioteca										3	Un			262	785	392.700		
Kitchenette										1	Un			2.856	2.856	1.428.000		
Aire Acondicionado										7	Un			595	4.165	2.082.500		
Living										1	Un			762	762	380.800		
Mesa Reuniones 12 prs										1	Un			1.904	1.904	952.000		
Sillas reuniones										12	Un			179	2.142	1.071.000		
Silla Gerencia										3	Un			3.094	9.282	4.641.000		
Sillas Escritorio										12	Un			202	2.428	1.213.800		
Lámparas										15	Un			48	714	357.000		
Ambientación										7	Un			48	333	166.600		
																	18.040.400	
<b>OPERACIONES</b>																		
			[mm]	[mm]	[mm]	[Ton]	[L/h]	[Ton/m3]	[KW]			20%	80%	[USD \$]	[USD \$]	[\$]		
Generador Insonoro Diesel	CATERPILLAR	3516B-HD TA	2180	4.120	2.030	2275 kva prime	347		1.789	1	Un			420.000	420.000	210.000.000		
Generador Insonoro Diesel	CATERPILLAR	XQE 150	1130	3.558	1.943	150 KVA	32,5		120	1	Un			28.560	28.560	14.280.000		
Camionetas						1000 Kg.				3	Un			30.000	90.000	45.000.000		
Torre de Iluminación Diesel	WACKER	LTC-4L	1220	3890	1600	8500 W	2		8,5	1	Un			14.000	14.000	7.000.000		
Tablero Distribución						4x4 380/220V				2	Un			4.000	8.000	4.000.000		
Compresor	SULLAIR	750HDTQ				750 cfm			250HP	1	Un			57.428	57.428	28.714.000		
WorkStation HP	HP	WORKSTATION Z400								7	Un			1.654	11.578	5.788.937		
Impresoras Multifuncional HP CM2320N	HP	CM2320N								2	Un			1.142	2.283	1.141.646		
Notebooks	HP	PROBOOK 6560B	Intel, Core i5	4 GB RAM	500 GB HD					5	Un			1.200	6.000	3.000.000		
Impresora Stand Alone	HP	HP LJ M1132 BN MFP								7	Un			204	1.428	713.930		
Servidores	SUN		4 Procesadores Quad Core							1	Un			3.570	3.570	1.785.000		
U.P.S.	APC	Smart-UPS 2200VA								1	Un			640	640	320.000		
																	321.743.513	
<b>Inversión Adicional Maquinaria</b>																		
mbores de Selección Magnética Redundantes	I&D	SM1HD	500	3.000						1	Un			450.962	450.962	225.481.000		
Correas Transportadoras Redundantes		B1200X15	1200	15.000	6.000					1	Un			42.729	42.729	21.364.500		
Acumulador										1	Un			16.660	16.660	8.330.000		
																	510.351	
																	255.175.500	
<b>TOTAL INVERSIÓN EN EQUIPAMIENTO</b>																	14.538.287	<b>7.269.143.539</b>

TRABAJOS	MARCA	MODELO	ANCHO	LARGO	ALTO	CAPACIDAD	CONSUMO	DENSIDAD	POTENCIA	CANTIDAD	Unid.	Tasa Eficiencia Técnica	Tasa Eficiencia Operacional	Costo Estimado Unitario	Costo Total	Costo estimado en Pesos	
										[m]				USD \$	USD \$	Pesos	
<b>OBRAS CIVILES</b>																	
Cierre Perimetral										4.354	mL			29	124.350	62.175.120	
Compactación y estabilizado Área Carga										750	m2			2	1.250	624.750	
Compactación y estabilizado áreas de Acopio										5.000	m2			2	8.330	4.165.000	
Compactación y estabilizado Área Circulación										92.100	m2			2	153.439	76.719.300	
Garitas de Control de Acceso										20	m2			245	4.891	2.445.509	
Red Telefónica y Comunicaciones										3.024	mL			22	65.520	32.759.851	
Red de Datos										2.524	mL			83	210.249	105.124.600	
Red Eléctrica										3.024	mL			62	186.405	93.202.704	
Red de Agua										2.524	mL			24	60.071	30.035.600	
																	814.505
<b>Inversión Inicial Terrenos</b>																	
Terrenos										800	Hás			4.063	3.250.400	1.625.200.000	
																	4.064.905
<b>INVERSIÓN EN TERRENOS Y OBRAS CIVILES</b>																	<b>2.032.452.434</b>



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**Investments in Infrastructure.**

SUPERFICIE Y COSTOS DEL PROYECTO						
SPACE AND COST						
ID	INSTALACIONES	LARGO	ANCHO	AREA	COSTO UNITARIO	COSTO TOTAL
	FACILITIES	LENGTH	WIDTH	AREA	UNIT COST	COST
		[m]	[m]	[m <sup>2</sup> ]	[Pesos/USD \$]	[Pesos/USD \$]
<b>EXTRACCION</b>						
1	Área de Extracción Extraction área	750	200	150.000		
2	Caminos y Accesos Roads and Access	6140	15	92100		
3	Laboratorio de Muestreo Sampling's laboratory	12	2,5	30	\$ 122.275 \$ 245	\$ 3.668.264 \$ 7.337
4	Polvorin Powder Keg	20	15	300	\$ 444.638 \$ 889	\$ 133.391.400 \$ 266.783
5	Estacionamiento Camiones Truck parking	70	12	840	\$ 266.783 \$ 534	\$ 224.097.552 \$ 448.195
6	Taller Mecánico Mechanical workshop	30	20	600	\$ 266.783 \$ 534	\$ 160.069.680 \$ 320.139
<b>PRODUCCION</b>						
7	Planta de procesamiento Prosecution facilities	200	200	40000		
8	Acopio Concentrado Stacking Iron	100	50	5000	\$ 355.710 \$ 711	\$ 1.778.552.000 \$ 3.557.104
9	Botadero Estéril #1 Esteril Dumps #1	1000	200	200000		
10	Botadero Estéril #2 Esteril Dumps #2	500	400	200000		
11	Laboratorio químico Chemical laboratory	12	2,5	30	\$ 122.275 \$ 245	\$ 3.668.264 \$ 7.337
12	Bodegas de materiales Material storages	50	15	750	\$ 266.783 \$ 534	\$ 200.087.100 \$ 400.174
13	Sala de Máquinas Engine Room	5	3	15	\$ 266.783 \$ 534	\$ 4.001.742 \$ 8.003
<b>ADMINISTRACIÓN - STAFF</b>						
14	Gerencia Headquarters	30	20	600	\$ 122.275 \$ 245	\$ 73.365.270 \$ 146.731
15	Casino Dining room	25	15	375	\$ 122.275 \$ 245	\$ 45.853.294 \$ 91.707
16	Vestidores Dressing room	9	3	27	\$ 122.275 \$ 245	\$ 3.301.437 \$ 6.603
17	Baños y duchas Bathrooms and shower	15	3	45	\$ 122.275 \$ 245	\$ 5.502.395 \$ 11.005
18	Primeros auxilios First aids	3	3	9	\$ 122.275 \$ 245	\$ 1.100.479 \$ 2.201
19	Control acceso y 4 garitas Access control and checkpoints	2	2	20	\$ 122.275 \$ 245	\$ 2.445.509 \$ 4.891
20	Romana Weight	20	2	40	\$ 122.275 \$ 245	\$ 4.891.018 \$ 9.782
<b>INVERSIÓN</b>	<b>TOTAL INSTALACIONES</b>		Area Construida:	8.681	<b>Pesos \$:</b>	<b>\$ 2.122.768.508</b>
	<b>TOTAL SURFACE</b>				<b>USD \$:</b>	<b>\$ 4.245.537</b>

**Investments in Infrastructure**

FACTOR ECONÓMICO	VALOR [USD \$]	VALOR [€]
Terrenos	\$ 3.250.400	\$ 1.625.200.000
Infraestructura	\$ 4.245.537	\$ 2.122.768.508
Obras Civiles	\$ 814.505	\$ 407.252.434
Equipamiento	\$ 14.538.287	\$ 7.269.143.539
<b>TOTAL INVERSIONES</b>	<b>\$ 22.848.729</b>	<b>\$ 11.424.364.480</b>



## 2) REVENUE

Consider:

<b>Valor Dólar USD:</b>	\$ 500	[Pesos/USD]
<b>Valor Unit Hierro:</b>	\$ 75	[USD/Ton]
<b>Relación Estéril /Mineral</b>	6	1
<b>Tasa Crecimiento Ventas: (Crecimiento Triannual)</b>	5,00%	
<b>PARÁMETROS LABORALES</b>		
<b>HORAS/DÍA</b>	<b>DÍAS/AÑO</b>	<b>MESES/AÑO</b>
[Hrs]	[Días]	[Meses]
<b>18</b>	<b>28</b>	<b>12</b>

<b>PRODUCCIÓN</b>	<b>HORA</b>	<b>DIARIA</b>	<b>MENSUAL</b>	<b>ANUAL</b>	<b>TASA VENTAS</b>
	[Ton/Hr]	[Ton/Día]	[Ton/Mes]	[Ton/Año]	[%/Triannual]
Nivel Producción Inicial (años 1-2)	79	1.429	40.000	480.000	0%
Producción 2° Período (años 3-5)	83	1.500	42.000	504.000	5%
Producción 3° Período (años 6-8)	88	1.575	44.100	529.200	5%
Producción 4° Período (años 9-11)	92	1.654	46.305	555.660	5%
Producción 5° Período (años 12-15)	96	1.736	48.620	583.443	5%

<b>INGRESOS</b>	<b>VENTAS</b>	<b>MENSUAL</b>	<b>ANUAL</b>
	[Ton/Mes]	[USD/Mes]	[USD/Año]
Nivel Producción Inicial (años 1-2)	40.000	\$ 3.000.000	\$ 36.000.000
Producción 2° Período (años 3-5)	42.000	\$ 3.150.000	\$ 37.800.000
Producción 3° Período (años 6-8)	44.100	\$ 3.307.500	\$ 39.690.000
Producción 4° Período (años 9-11)	46.305	\$ 3.472.875	\$ 41.674.500
Producción 5° Período (años 12-15)	48.620	\$ 3.646.519	\$ 43.758.225



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INGRESOS ANUALES	AÑO 1	AÑO 2	AÑO 3	AÑO 4	AÑO 5
USD \$	\$ 36.000.000	\$ 36.000.000	\$ 37.800.000	\$ 37.800.000	\$ 37.800.000
PESOS \$	\$ 18.000.000.000	\$ 18.000.000.000	\$ 18.900.000.000	\$ 18.900.000.000	\$ 18.900.000.000

INGRESOS ANUALES	AÑO 6	AÑO 7	AÑO 8	AÑO 9	AÑO 10
USD \$	\$ 39.690.000	\$ 39.690.000	\$ 39.690.000	\$ 41.674.500	\$ 41.674.500
PESOS \$	\$ 19.845.000.000	\$ 19.845.000.000	\$ 19.845.000.000	\$ 20.837.250.000	\$ 20.837.250.000

INGRESOS ANUALES	AÑO 11	AÑO 12	AÑO 13	AÑO 14	AÑO 15
USD \$	\$ 41.674.500	\$ 43.758.225	\$ 43.758.225	\$ 43.758.225	\$ 43.758.225
PESOS \$	\$ 20.837.250.000	\$ 21.879.112.500	\$ 21.879.112.500	\$ 21.879.112.500	\$ 21.879.112.500

PARÁMETROS DE SENSIBILIZACIÓN		
Nivel Producción:	50.000	[Ton/Mes]
Precio del Hierro:	100	[USD/Ton]
Tipo de Cambio:	500	[Pesos/USD]
Nivel de Ventas	40.000	[Ton/Mes]
Tasa Crecimiento Ventas: (Triannual)	5%	





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### Indirect costs

EQUIPO	Marca	Modelo	Diesel	Aceite	Repuestos / Mantención	Unidades	COSTOS ANUALES			REPUESTOS	COSTO ANUAL	
			[Lts/Hr]	[Lts/Hr]	[\$/Año]		DIESEL		Aceite	[\$/Año]	[\$/Año]	
Generador Insonoro Diesel (GENERATOR)	CATERPILLAR	XQE 150	34,5	0,034	600.000	1	125.193.600		616.896	600.000	126.410.496	
Camionetas	CHEVROLET	0	4,3	0,013	1.000.000	3	15.552.000		235.872	1.000.000	50.363.616	
Torre de Iluminación Diesel	DIVERMAQ	LT-6000	3,0	0,003	250.000	1	10.886.400		45.360	250.000	11.181.760	
Tablero Distribución	GENERIC	GENERIC	Generador	N.U.	100.000	2				100.000	200.000	
Compresor 380V	CATERPILLAR	750HDTQ	Generador	0,000	100.000	1			1.814	100.000	101.814	
WorkStation HP	HP	WORKSTATION Z400	Generador	N.U.	100.000	10				100.000	1.000.000	
Impresoras Multifuncional HP CM2320N	HP	CM2320N	Generador	N.U.	100.000	1				100.000	100.000	
Notebooks	HP	PROBOOK 6560B	Generador	N.U.	100.000	3				100.000	300.000	
Impresora Stand Alone	HP	HP LJ M1132 BN MFP	Generador	N.U.	100.000	10				100.000	1.000.000	
Servidores	SUN	0	Generador	N.U.	250.000	1				250.000	250.000	
U.P.S.	APC	Smart-UPS 2200VA	Generador	N.U.	100.000	1				100.000	100.000	
							Costos Directos en \$	151.632.000	0	899.942	2.800.000	191.007.686
							Indirect Cost USD \$:	303.264	-	1.800	5.600	382.015

DEPARTAMENTO OPERACIONES	Frecuencia	Costo Unitario	Costo Diario	Costo Mensual	Costo Anual
	[n/Día]	[\$/Persona]	[\$/Día]	[\$/Mes]	[\$/Año]
Arriendo de Oficinas	24	150.000	53.571	1.500.000	18.000.000
Arriendo de Equipamiento	24	---	0	0	0
Servicios Traslado Personal	3	3.000	288.000	8.064.000	96.768.000
Servicio de Alimentación	2	5.000	320.000	8.960.000	107.520.000
Servicio de Agua Potable	1	500	16.000	448.000	5.376.000
Servicios Sanitarios	0,1	500	1.600	44.800	537.600
Servicio Vigilancia y Seguridad	24	1.250	450.000	12.600.000	151.200.000
<b>Total Costos Directos en \$</b>					<b>379.401.600</b>
<b>Indirect Cost USD \$:</b>					<b>758.803</b>

DEPARTAMENTO MANTENCIÓN	ACEITE	LIQ HIDRAULICO	GRASA	DETERGENTE	AGUA	DIESEL	INSUMOS	REPUESTOS	Total Mes	Total Anual
	[\$/Mes]	[\$/Mes]	[\$/Mes]	[\$/Mes]	[\$/Mes]	[\$/Mes]	[\$/Mes]	[\$/Mes]	[\$/Mes]	[\$/Año]
Mantención de Servicios	\$0	\$0	\$0	\$100.000	\$250.000	\$250.000	\$3.137.500	\$200.000	\$3.937.500	\$47.250.000
Mantención Eléctrica	\$0	\$0	\$0	\$15.000	\$30.000	\$150.000	\$300.000	\$750.000	\$1.245.000	\$14.940.000
Mantención Mecánica	\$150.000	\$190.000	\$425.000	\$36.000	\$90.000	\$380.600	\$250.000	\$1.500.000	\$3.021.600	\$36.259.200
Mantención área Mina	\$100.000	\$150.000	\$120.000	\$15.000	\$500.000	\$580.000	\$5.255.000	\$3.670.000	\$10.390.000	\$124.680.000
Mantención Seguridad	\$0	\$0	\$0	\$0	\$90.000	\$360.000	\$75.000	\$120.000	\$645.000	\$7.740.000
									Total en Pesos:	\$230.869.200
									USD:	\$461.738





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With These Costs, is possible to build the following picture summary.

<b>MATRIZ DE COSTOS EN PESOS</b>				
<b>CONCEPTO:</b>	<b>COSTO RRHH</b>	<b>COSTO DIRECTO</b>	<b>COSTO INDIRECTO</b>	<b>COSTO GRAL INDIRECTO</b>
<b>Año</b>	<b>M\$</b>	<b>M\$</b>	<b>M\$</b>	<b>M\$</b>
<b>0</b>				
<b>1</b>	702.000	2.643.041	801.278	17.000
<b>2</b>	702.000	2.643.041	801.278	17.000
<b>3</b>	758.580	2.775.193	841.342	17.000
<b>4</b>	758.580	2.775.193	841.342	17.000
<b>5</b>	758.580	2.775.193	841.342	17.000
<b>6</b>	774.180	2.913.952	883.410	17.000
<b>7</b>	774.180	2.913.952	883.410	17.000
<b>8</b>	774.180	2.913.952	883.410	17.000
<b>9</b>	758.580	3.059.650	927.580	17.000
<b>10</b>	758.580	3.059.650	927.580	17.000



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MATRIZ DE COSTOS EN USD				
CONCEPTO:	COSTO RRHH	COSTO DIRECTO	COSTO INDIRECTO	COSTO GRAL INDIRECTO
Año	USD M\$	USD M\$	USD M\$	M\$
0				
1	1.514	5.286	1.603	34
2	1.514	5.286	1.603	34
3	1.587	5.550	1.683	34
4	1.587	5.550	1.683	34
5	1.587	5.550	1.683	34
6	1.734	5.828	1.767	34
7	1.734	5.828	1.767	34
8	1.734	5.828	1.767	34
9	1.855	6.119	1.855	34
10	1.855	6.119	1.855	34