



**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT - ESIA
ITAFÓS MINERAÇÃO LTDA.
ARRAIAS - TO**

April, 2011

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APPENDICES

APPENDIX 1 - Applicable Environmental Standards

APPENDIX 2 - Resettlement Policy Framework

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APPENDIX 4 - Occupational Health and Safety Guidelines for Construction

1.0 Introduction

PROJECT ARRAIAS involves the development of a phosphate mine coupled to an industrial complex that will produce fertilizers and other by-products for agriculture in the state of Tocantins, as follows:

- 330,000 tons per annum of 28% P₂O₅ concentrate;
- 94,000 tons per annum of 15% P₂O₅ concentrate;
- 600 tons per day of 98% w/w sulphuric acid; and
- 500,000 tons per annum of single superphosphate (SSP)

The Project's footprint occupies a total area of 1,621.5 hectares. This includes industrial installations covering 44.7 ha for phosphate rock processing, manufacture of sulfuric acid and single superphosphate (SSP) production as well as proven mineral resources for a 20 year life cycle. Two dams on the Bezerra River, one for water catchment and the other for tailings, are planned as part of the project.

MBAC Fertilizer Corporation, a Canadian company, through its local subsidiary ITAFÓS Mineração Ltda, is the Project Developer. PROMINER Projetos Ltda and AMBIANGER Engenharia Ambiental were retained jointly to develop the project's Environmental and Social Impact Assessment that was submitted to Naturatins (the environmental agency of the state of Tocantins) in July 30, 2010. This resulted in issuance of a Preliminary Environmental Permit (LP) in December 1, 2010. Subsequent submittal of more detailed Environmental and Social Management Programs and other complementary studies resulted in the issuance of the Installation Licence (LI) for the Project in March 28, 2011. Thus, MBAC is currently authorised to start construction of the PROJECT ARRAIAS.

As part of Environmental and Social Due Diligence procedures by Lenders, some shortcomings with respect to IFC Performance Standards and Equator Principles were identified and this has resulted in adjustments both of the project's environmental and social baseline and impact assessment and with respect to the scope and content of the required Environmental and Social Management Plans and Systems.

JGP Consultoria e Participações Ltda. prepared this document as a summary of the social and environmental assessment process of the PROJECT ARRAIAS.

This document is based on the following sources:

- Environmental Impact Assessment (Prominer Projetos Ltda. and Ambienger Engenharia Ambiental, July 2010)

- Economic Feasibility Assessments (Arraias Tocantins Definitive Feasibility Study Report, MBAC Fertilizer Corporation, October, 2010; Amendment date: 10 February, 2011).
- Naturatins Technical Opinion No. 91/2010, process 2661/2010, presenting Previous Environmental License No. 3761/2010 requirements dated December 1, 2010.
- Basic Project Environmental Plan (Itafós Mineração Ltda., December 2010)
- COLIA / DILIAM / NATURATINS Technical Opinion No. 140/2011 process 2661/2010, presented as requirements of Environmental License No. 941/2011 dated March 28, 2011.

The document is organized into 8 Sections. **Section 2** (Project Description) presents the project characteristics based on the description given in the Feasibility Study. **Section 3** (Analysis of Alternatives) describes the analysis of alternatives considered in the project including industrial processes and technologies and the location of catchment and tailings dams. The analyses of alternatives for the location of industrial facilities and internal access roads are pending. **Section 4** (Legal and Institutional Framework) presents the legal and institutional milestones in the process of environmental compliance. **Section 5** (Environmental and Social Conditions) presents the current diagnosis of physical, biotic and socio economic environments in the project area of influence. **Section 6** (Environmental and Social Impacts) presents an integrated analysis of environmental impacts resulting from the project phases of construction, operation and decommissioning associating them with environmental measures and programs. **Section 7** (Environmental and Social Management) describes environmental monitoring programs and plans that make up the Environmental Management Plan proposed to mitigate or compensate the environmental impacts. **Section 8** (Public Participation) presents research and consultations performed and in progress associated with the project to meet the requirements for public participation in the project.

2.0

Project Description

PROJECT ARRAIAS aims at the vertical production of fertilizer inputs for agriculture. The principal product will be single superphosphate (SSP), significant production of natural phosphate will also take place. The project entails the extraction of the raw material, its industrial processing and the construction of dams for water catchment and waste disposal (tailings dam). The estimated production period is 20 years.

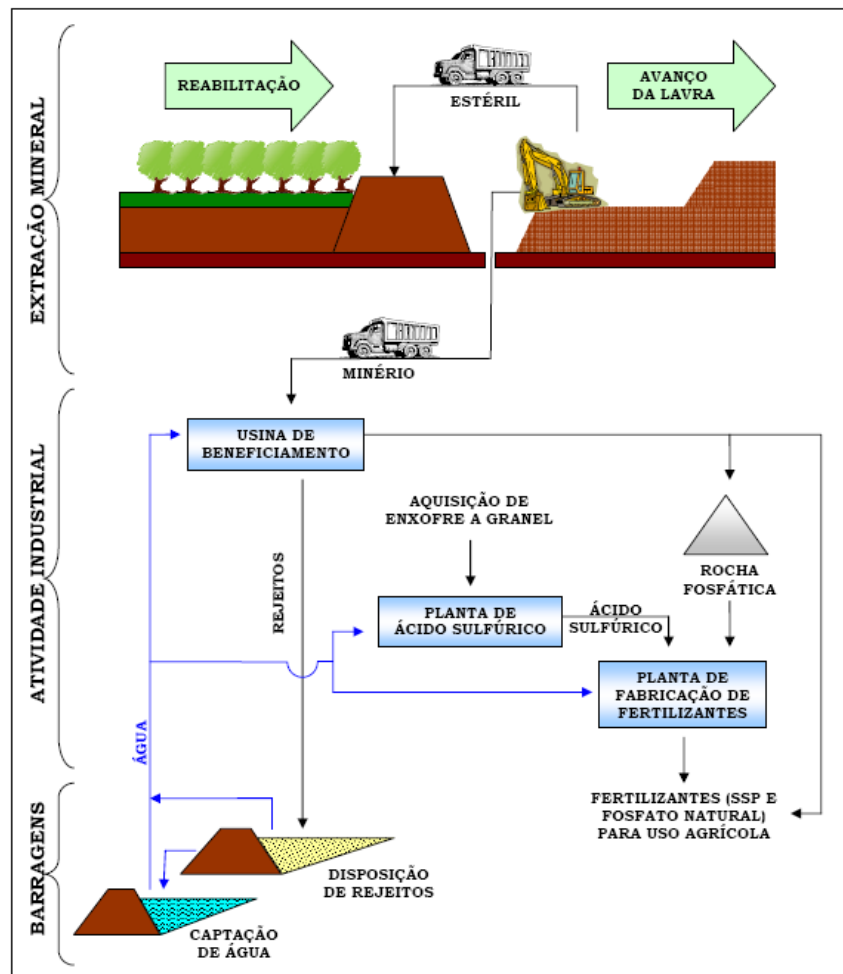
Mining and processing of the phosphate ore will produce the following:

- 330,000 tons per annum of 28% P₂O₅ concentrate;
- 94,000 tons per annum of 15% P₂O₅ concentrate;
- 600 tons per day of 98% w/w sulphuric acid (1502,000 tons per annum); and
- 500,000 tons per annum of single superphosphate (SSP) via acidulation and granulation

As shown in **Figure 2.0.a**, the project involves the following activities:

- Mining activities and restoration of the mining areas
 - Phosphate ore extraction
 - Removal of overburden
 - Restoration of mining areas
- Industrial activities:
 - Mineral treatment plant
 - Sulphuric acid plant
 - Fertilizer production plant (SSP superphosphate production)
- Activities associated with dams:
 - Tailings dam
 - Water catchment dam

Figure 2.0 a
General Project Flowchart



PROJECT ARRAIAS will extract phosphate-rich ore from mining areas near the industrial complex to be treated with sulphuric acid produced in the complex.

The reaction of phosphate ore with sulphuric acid produces single superphosphate (SSP), which is an input for soil fertilizer. The project will also produce natural phosphate from the mineral in its extracted form, without chemical treatment.

Location and Access

The project is located in Brazil and straddles the state limit between Tocantins to the north and Goiás to the south (see **Figure 2.0.b**). The exploration field office, sample preparation laboratory and other facilities are located ~7 km northeast from Campos Belos, the nearest settlement (19,000 inhabitants).

The project area is located in the municipality of Arraias Tocantins, in the southeast of Tocantins state. It lies approximately 400 km from Brasilia and 450 km from Palmas. There are two routes to reach the project area: via Arraias or via Campos Belos. Access to both cities from Brasilia is via paved roads driving through BR-020 and GO-118 and then until the project area via unpaved roads which are in fairly good conditions. Campos Belos can also be reached by air. The local airstrip is paved, approximately 1400 m long and located some 6 km from Campos Belos. Distances between the project and the nearest cities are indicated in **Table 2.0.a**, below:

Table 2.0.a

Approximate distance chart, in km

	Industrial plants	Arraias (TO)	Campos Belos (GO)
Industrial plants		22km	12km
Arraias (TO)	22km		21.6km
Campos Belos (GO)	12km	21.6km	

Figure 2.0.b indicates the project's regional location and Figure 2.0.c. illustrates the main access roads.

Figure 2.0.b
Project Location



Figure 2.0.c
Project Location and access roads

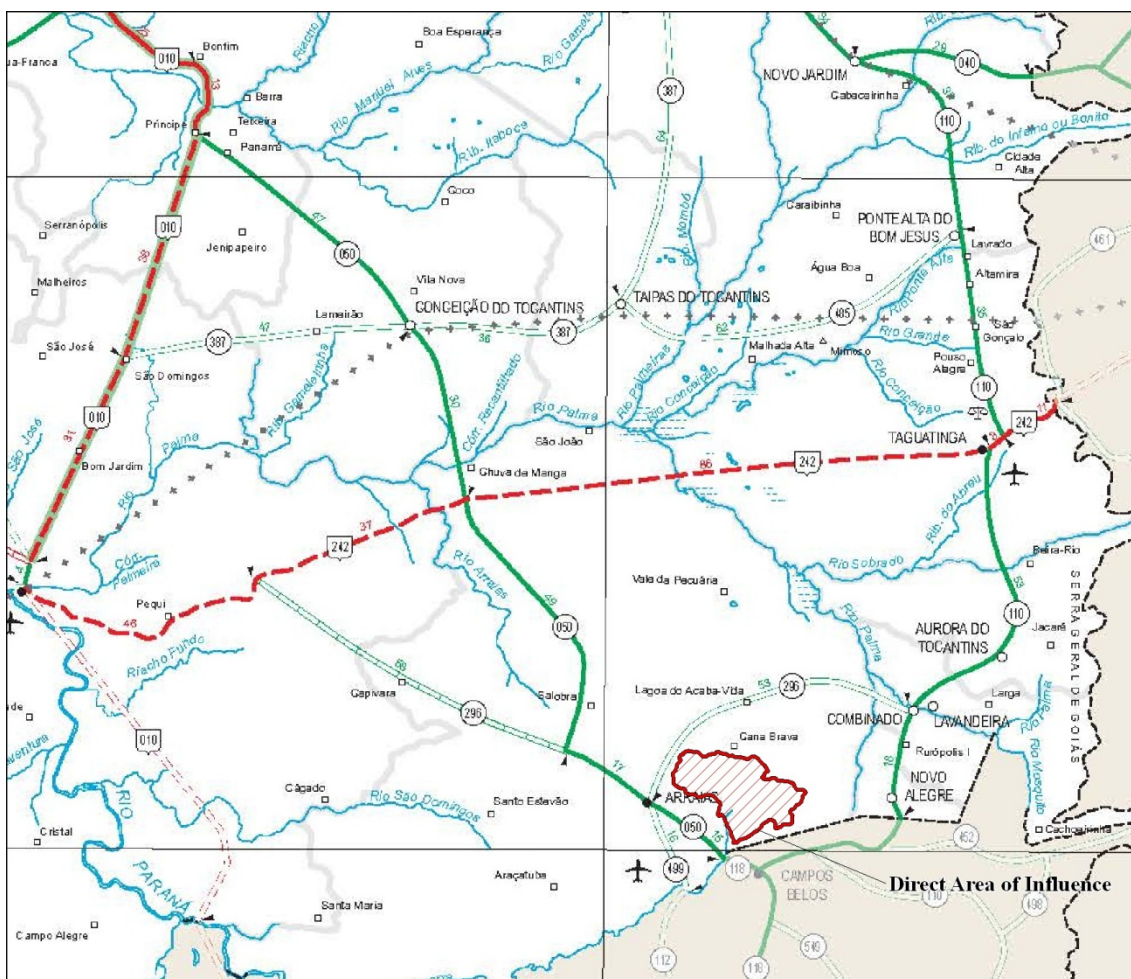
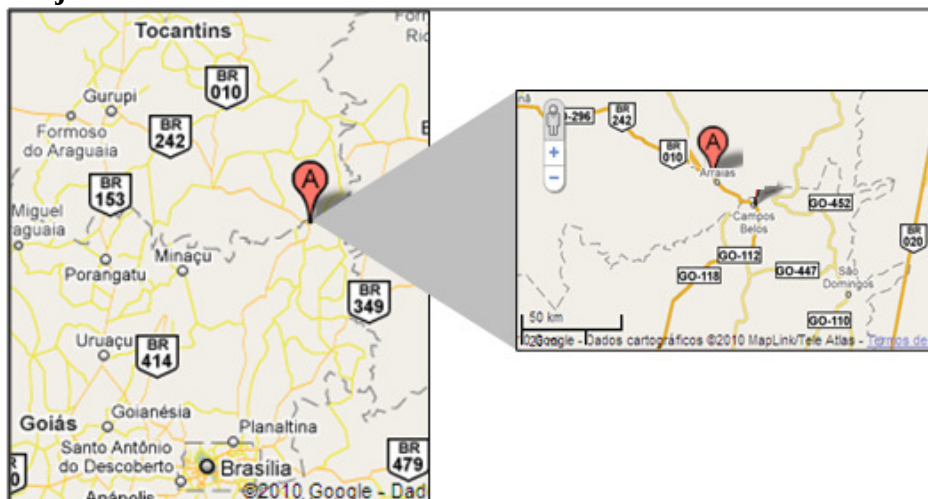
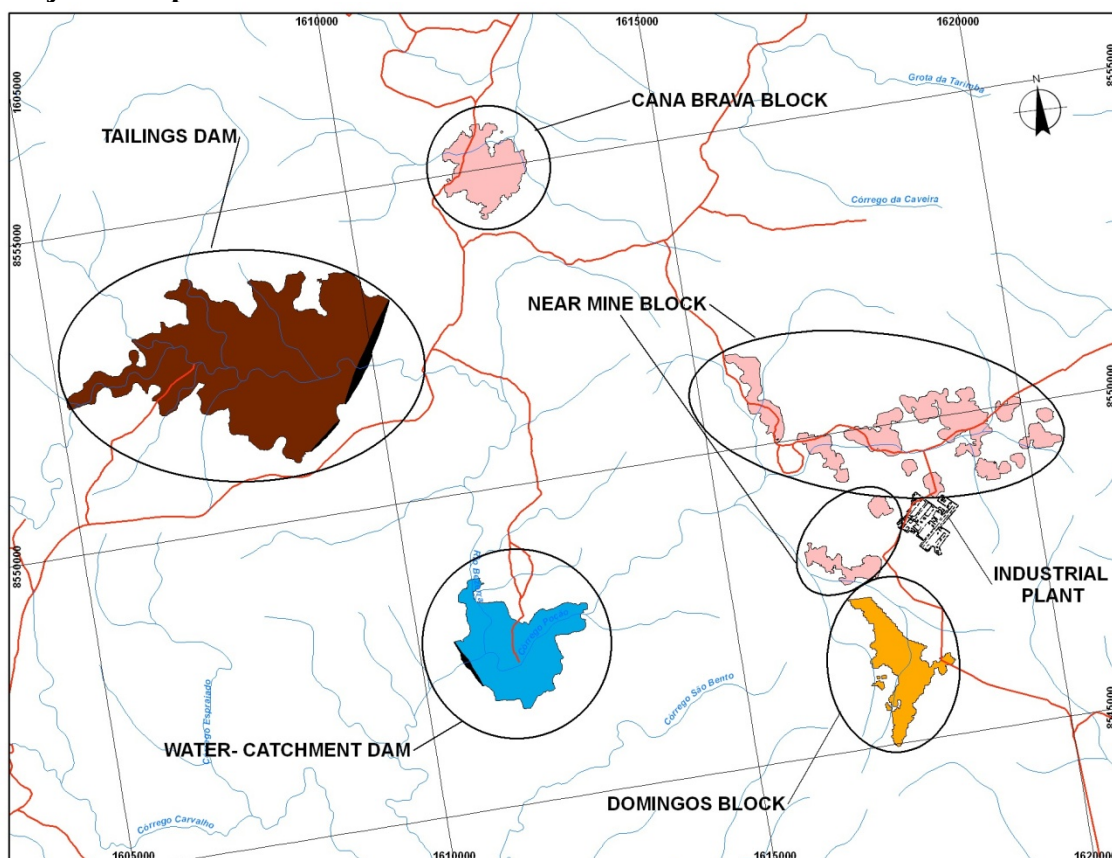


Figure 2.0.d illustrates the project's components.

Figure 2.0.d
Project Components



2.1 Mineral Reserves

The project includes 59 mineral rights, consisting of one Mining Application and 58 other exploration permits and applications located in the States of Goiás and Tocantins. Each mineral right has been granted to Itafós according to the Brazilian Mining Code, and if applicable, by authorizations issued by the Ministry of Mines and Energy. According to the Brazilian Mining Code, the mining concession is valid for the Project's lifespan, as long as simple statutory requirements are met. The exploration permits are valid for a renewable period of three years.

In the PROJECT ARRAIAS area, there are nine mineral rights, being one mining application and eight exploration permits placed by Itafós Mineração Ltda. All nine mineral rights are priority and cover 100% of the pit areas and the industrial complex.

The four mineral rights numbered 864.550/2010 to 864.553/2010 were placed to cover the dam areas and to facilitate the easement process.

The relative location of the 5 Project components and 9 mineral rights are shown below.

Table 2.1.a
Mining rights by Itafós Mineração Ltda in the PROJECT ARRAIAS area

Project DAA	Application Number / Year of procedure	Phase of Application	Name of Applicant	Substance	Área (ha)
Tailings dam	864550/2010	Exploration Application	ITAFÓS Mineração Ltda	Gold	321.14
	864551/2010	Exploration Application	ITAFÓS Mineração Ltda	Gold	287.13
Catchment dam	864553/2010	Exploration Application	ITAFÓS Mineração Ltda	Gold	54.73
	864552/2010	Exploration Application	ITAFÓS Mineração Ltda	Gold	98.69
Mining areas	864113/2003	Mining Application	ITAFÓS Mineração Ltda	Phosphate	1062.56
	864173/2004	Exploration Permit	ITAFÓS Mineração Ltda	Gold/Phosphate (*)	2000
	864174/2004	Exploration Permit	ITAFÓS Mineração Ltda	Gold/Phosphate (*)	2000
	864175/2004	Exploration Permit	ITAFÓS Mineração Ltda	Gold/Phosphate (*)	2000
	864176/2004	Exploration Permit	ITAFÓS Mineração Ltda	Gold/Phosphate (*)	1000
Industrial Complex	864113/2003	Request to mine	ITAFÓS Mineração Ltda	Phosphate	1062.56
Landfill	864175/2004	Exploration Permit	ITAFÓS Mineração Ltda	Gold/Phosphate (*)	2000

Source: www.dnpm.gov.br (accessed on 01.04.2011)

(*) Exploration leases previously issued for gold shall be later changed for Phosphate

The mining applications on behalf of Itafós that are located within the mining areas and currently targeting gold will be updated to exploiting phosphate by Itafós with the National Department of Mineral Production (DNPM). The Exploration Leases numbered 864.173/2004 to 864.176/2004 were originally issued for gold. On October 28, 2008 Itafós informed DNPM about occurrence of phosphate in the four areas.

The following mineral resource map of the Arraias deposits includes the principal Near Mine Block (**Figure 2.1.a**).

Figure 2.1.a

Near Mine, Domingos and Canabrava Blocks showing Soil (brown) and Siltstone (yellow) Domains

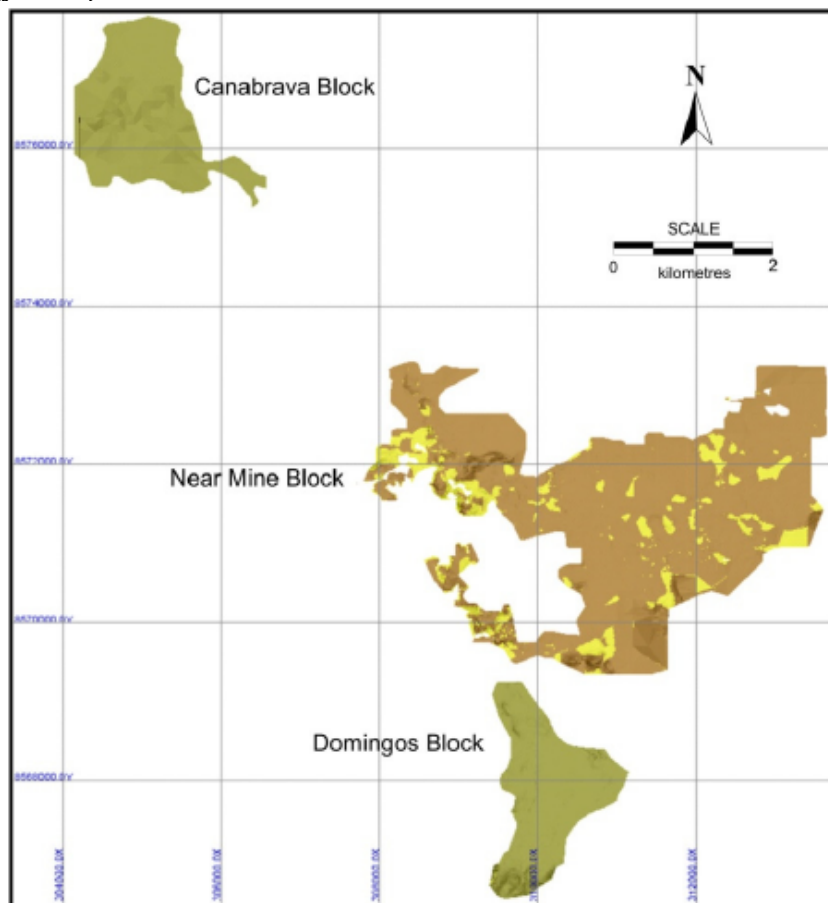


Figure 2.6.1.a, further below, illustrates the blocks composing the Near Mine Block (which is made up of five blocks: Coité, São Bento, Juscelino, Mateus and Gaúcho), the Canabrava and Domingos blocks.

The reserves estimation and mine design was prepared by NCL Brasil, a consulting company specialized in mine design. Resource estimation for the Arraias Tocantins deposit was undertaken using Ordinary Kriging (OK) as the principal estimation methodology for P2O₅. The OK estimates were completed using Gems mining software.

The updated mineral resources for the Arraias - Campos Belos property as of July 16, 2010, can be summarized as follows (**Table 2.1.a**):

Table 2.1.a
Arraias Campos Belos Mineral Resource Summary at a 2.8 % P₂O₅ (Cut-off July 2010)

	Density	Tonnage (Mt)	P ₂ O ₅ (%)
Measured and Indicated	1.53	58.81	5.01
Inferred	1.54	24.02	5.27

The breakdown of the individual zones making up the total accumulated for the property (table above) is set out as follows (**Table 2.1.b**):

Table 2.1.b
Near Mine Area Resource Distribution, (Cut-off July 2010)

	Tonnage (Mt)	P ₂ O ₅ (%)	Al ₂ O ₃ (%)	CaO (%)	Fe ₂ O ₃ (%)	SiO ₂ (%)
<u>Near Mine Blocks:</u>						
Measured	17.5	4.5	9.0	7.8	4.3	63.8
Indicated	10.1	4.2	9.1	7.5	4.3	63.2
Measured & Indicated	27.6	4.4	9.1	7.7	4.3	63.6
Inferred	4.0	4.0	8.4	6.3	4.9	66.9
<u>Canabrava :</u>						
Measured	-	-	-	-	-	-
Indicated	19.1	5.1	10.1	7.8	3.7	61.8
Measured & Indicated	19.1	5.1	10.1	7.8	3.7	61.8
Inferred	3.5	4.1	7.1	6.6	2.8	67.4
<u>Domingos:</u>						
Measured	-	-	-	-	-	-
Indicated	12.1	6.4	7.9	9.9	3.6	60.6
Measured & Indicated	12.1	6.4	7.9	9.9	3.6	60.6
Inferred	0.7	3.8	8.7	5.7	3.8	69.7

In addition to the overall Near Mine Area resources listed above, three zones drilled at 400 m centres have also been estimated using a two dimensional (2D) polygonal method as follows (**Table 2.1.c** and **Table 2.1.d**):

Table 2.1.c

Updated Inferred Resources for Avião, Brejo and Cabeçuda, all at a 2.8% grade (Cut-off July 2010)

	Tonnage (Mt)	P₂O₅ (%)
	Mt	%
Avião	0.55	5.7
Brejo	14.37	6.0
Cabeçuda	0.81	4.8
Total	15.74	5.9

Table 2.1.d

Total Mining Reserve Summary (1)(2)(3)

Ore Source	Ktonnes	P₂O₅ (%)
Proven Reserve	13,021	4.53
Probable Reserve	31,223	5.47
Total Reserve	44,244	5.39
Total Material	151,004	Strip ratio 2.41 (Includes Pre-stripping)

(1) Based on a price for SSP (Super Simple Phosphate) of US\$250.00 per tonne

(2) The Mineral Reserves as set out in the table above have been estimated by Carlos Guzmán of NCL Brasil Ltda, who is a Qualified Person under NI 43-101 and Member of the AusIMM.

(3) Numbers may not add up due to rounding.

2.2

Project Components and Design

2.2.1

Mining Operations

A mine plan was developed for the PROJECT ARRAIAS to process a maximum of 3.5 M tons of ore per year at an average grade of about 5.0% P₂O₅, with a peak total material movement rate of 17.4 M tons per year. This scenario results in the production of approximately 330 K tons per year of phosphate concentrate at a grade of 28% P₂O₅ during 15 years. The mine is scheduled to work seven days per week or 356 days per year. Each day will consist of three 8-hour shifts. Four mining crews will cover the operation.

The open pit mine will be operated with excavators with capacities of 3.5 cubic meters for ore and excavators with capacities of 4.6 cubic meters for waste, both with trucks of a capacity of 39 tons. This type of equipment is able to develop the required productivity to achieve a maximum annual total material movement of 17.4 M tons from different pits; and also to have good mining selectivity with the excavators as defined by the grade control activities.

The final pit design was based on the economic shell generated at a revenue factor equal to 1.0 and a minimum cut-off grade of 1.6% P2O5 at Domingos, 3.2% P2O5 at Cana Brava and 3.3% P2O5 at Near Mine, with constant 49.0° inter ramp angle. **Table 2.2.1.a** shows the key open pit design parameters.

Table 2.2.1.a
Pit Design Parameters

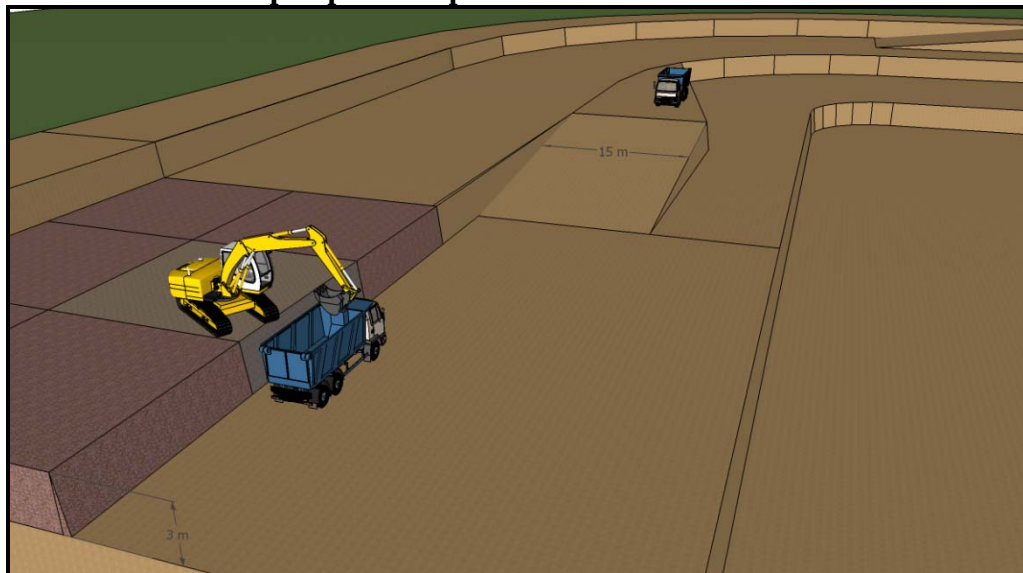
Bench Height	6 m (two stacked 3m benches)
Berm Width	3 m
Batter Angle	70.0°
Inter-ramp Angle	49.0°
Ramp Width	15 m
Ramp Gradient	10%

The ramp width of 15 meters can accommodate up to 39 ton trucks. Road gradient of 10% is common in the industry for this type of trucks. The current mine plan is designed with 3m benches stacked to 6 meters (i.e. two stacked benches) – **Figure 2.2.1.a**.

For the required mining rate, the appropriate loading equipment is medium-sized front-end loaders or hydraulic excavators, ranging between capacities of 4 to 6 cubic yards. The minimum operating widths to achieve the required productivities with this equipment is about 25m.

Figure 2.2.1.a

Illustration of the open pit mine planned for PROJECT ARRAIAS



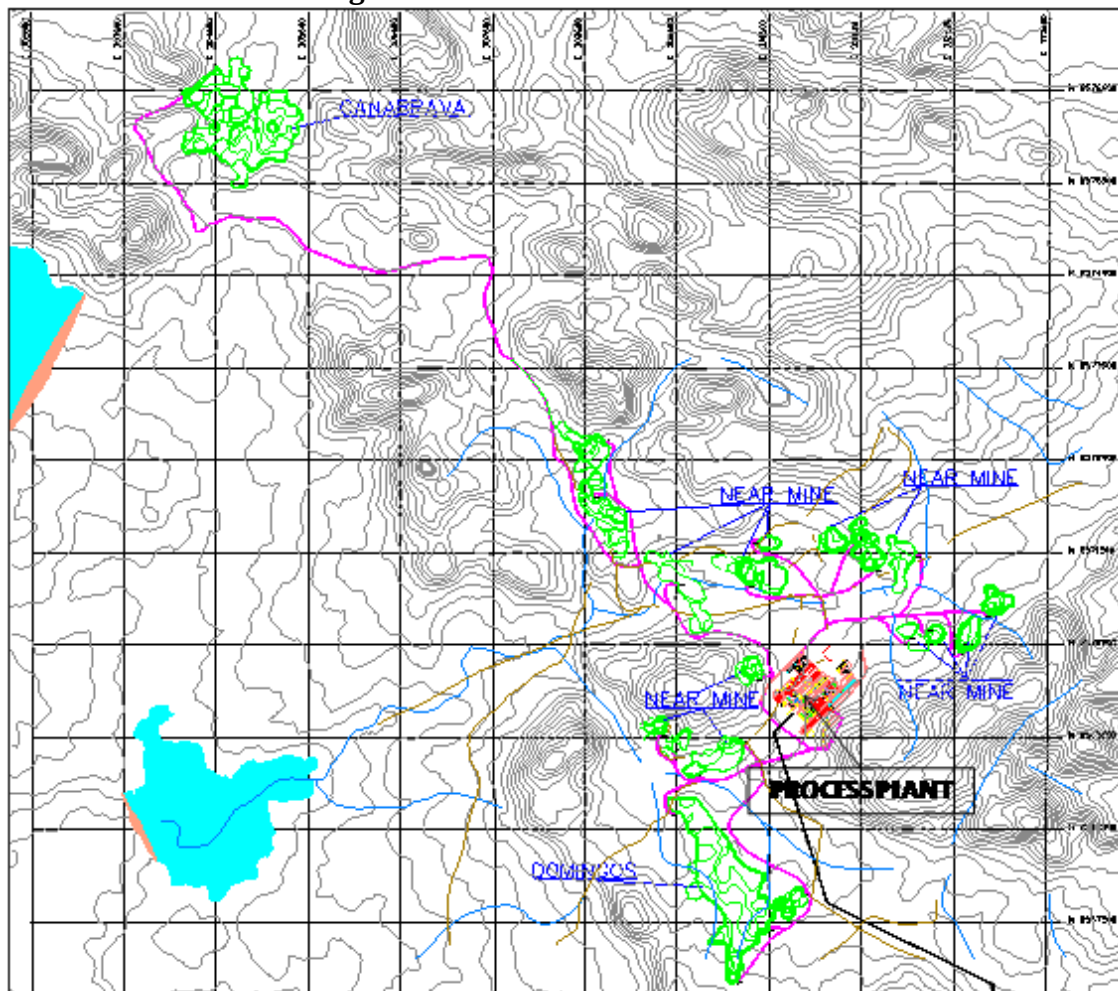
The mines may reach a total depth of 50 to 60 m. If groundwater is reached, the following procedures will be performed:

- Installation of pumping system
- Installation of temporary surface drainage and erosion control system
- Water conduction and discharge in natural hydric body

Assessments regarding hydrogeology are presented in **Section 5.2.1.8**, proposed Groundwater Monitoring Points are displayed in **Figure 5.2.1.3.a**, and an analysis of project impacts related to the groundwater is shown in impact chart OF-8 (impacts on the physical environment during the operation phase).

Figure 2.2.1.b shows the final pit design which is a result of different pits for the seven sectors, Five at Near Mine, plus Domingos and plus Cana Brava, designed according to the obtained pit shell of the optimization process. The pit exits were orientated to the selected position of the processing plant. The lower pit bottom is at 624 m RL. The total area disturbed by the pits is about 673 hectares.

Figure 2.2.1.b
Plan View Final Pits Design



Mine Production Schedule

Table 2.2.1.b shows the mine production of ore for each mining year. The schedule is based on 3.5 M tons maximum per year to the processing plant and a production of 330 K tons of phosphate concentrate at 28% P₂O₅. The table also shows the total material movement from the mine per year, which peaks at 17.4 M tons per year during commercial production. It is important to note that this production schedule is being revised and will be adjusted for the Project's minimum 20 year life-cycle by Itafos. However, yearly peak volume will not be altered.

The pre-production period requires the mining of 4.7 M tons to expose sufficient ore to make it a reliable source to start commercial production in Year 1. It will take approximately 12 months. The ore mined will be stockpiled in the ROM-pad area near the primary crusher and then re-handled to feed the plant during commercial production.

Table 2.2.1.b
Current Mine Production Schedule

Period	Ore ktonnes	(%)P ₂ O ₅	Waste ktonnes	Total ktonnes	Strip Ratio
Y-1	217	3.33	4,483	4,700	20.66
Y01	1,171	6.77	2,349	3,520	2.01
Y02	2,239	6.37	3,683	5,923	1.64
Y03	2,768	6.30	6,329	9,096	2.29
Y04	2,744	6.35	7,392	10,136	2.69
Y05	3,089	5.65	6,951	10,039	2.25
Y06	2,916	5.98	2,747	5,663	0.94
Y07	2,872	6.07	3,967	6,839	1.38
Y08	3,136	5.56	3,429	6,565	1.09
Y09	3,033	5.75	7,047	10,080	2.32
Y10	3,244	5.38	6,285	9,529	1.94
Y11	3,483	4.70	11,134	14,617	3.20
Y12	3,500	4.31	7,620	11,120	2.18
Y13	3,141	5.21	9,571	12,712	3.05
Y14	3,500	4.31	13,874	17,374	3.96
Y15	3,191	4.14	9,899	13,091	3.10
Totals	44,244	5.39	106,760	151,004	2.41

Mine Equipment

The Itafós mine will operate with backhoe excavators with a capacity of 3.5 cubic meters each for ore, and 4.6 cubic meters for waste, and 40 ton conventional haul trucks. List of equipment for final production capacity of 3.5 M tons / year is presented in the table below.

Table 2.2.1.c
Mine Equipment

Equipment Type	Preproduction Fase	Commercial Production
Atlas copco Explorac R50	1	1
Volvo EC450 B (3,5 cu m)	1	1
Volvo L 220 F (4,4 cu m)	0	1
Volvo EC 700 B (4,6 cu m)	2	6
Scania Truck (39mt)	4	23
CATD 9T Track Dozer	2	3
CAT 160 M grader	2	2
Scania water truck 20.000 liter	2	2

Destination of sterile material and reinstatement of mining areas

Trucks loaded with sterile material will be sent to resource-exhausted mining areas where this material will then be unloaded to proceed with surface reinstatement for recovery. Crawler tractors will perform any necessary corrections in the landfills. At the initial stages of the project, before any mines are exhausted, sterile material will be set in piles in chosen areas between the mines. The definition of those areas is not to be taken before the detailing of the mining plan, when the proper place for waste material will be defined. Itafós will then need to proceed the licensing specifically for the waste disposal.

As mining sites are exhausted, surface reinstatement works will be performed in the corresponding open pit mine areas and sterile material disposal areas. The first sector to be mined in the first 5 years of operation is equivalent to the Domingos mining sector.

The reinstatement process shall be carried out through the filling of pits with sterile material. Depending on the mining site, the strip ratio factor can vary from 0.94 to 4.0. In the case of flat areas the filing of depleted pits should be conducted until reaching the original land quota. In the case of areas with slopes, the land reconfiguration may occur provided that stability requirements of slopes are met. The general rule to be followed is the reinstatement of terrains with the lower possible volume of material to reduce shortage of sterile material at the end of the process, which will lead to alterations in land configurations, but always following the necessary principles for terrain stability and to avoid the formation of lakes or pits in the final resulting topography. At this phase of the Project, the definition of a Plan with the final configuration of reinstated and recovered areas is not yet possible. This will be part of the specific projects for the mining areas.

2.2.2

Fertilizer Plant

The fertiliser plant industrial process will include three main units:

- Ore Processing Unit;
- Sulphuric Acid Production Unit;
- Single Super Phosphate (SSP) Production Unit.

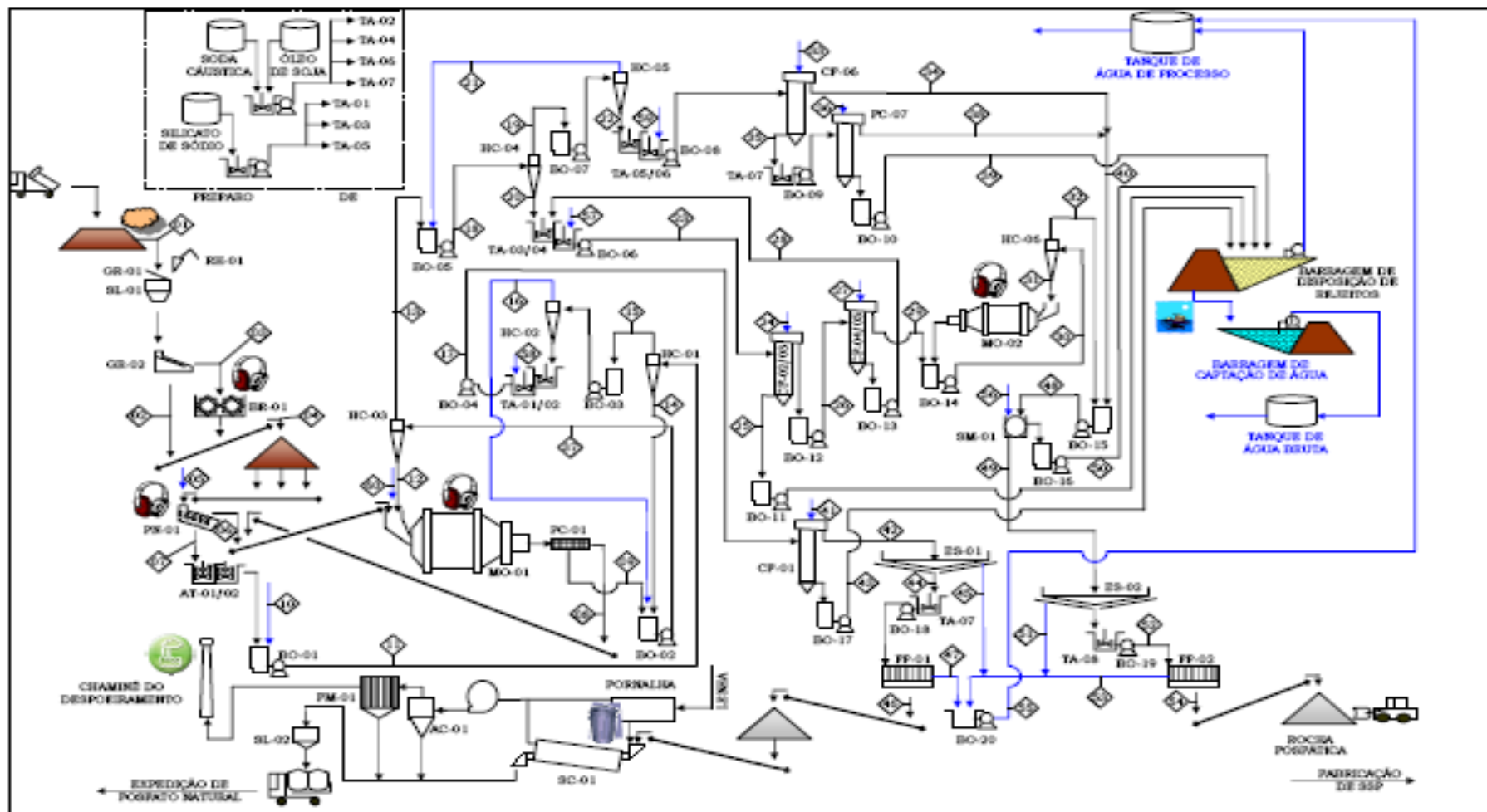
Ore processing unit

Ore processing includes screening, crushing and grinding of the material. A flotation operation is planned to separate the phosphorous-rich rock (phosphate rock) from other minerals (waste) through flotation in water tanks (**Figure 2.2.2.a**).

The process adopted consists of the following steps:

- Primary crushing of the run of mine – ROM - material;
- Grinding of the coarse fractions in a semi autogenic mill- SAG -; and
- Classification of the ore into three size fraction streams to produce the materials denominated as natural slimes, produced slimes and conventional.
- Flotation
- Regrind and Magnetic Separation
- Thickening and Filtration
- Drying

Figure 2.2.2.a
Ore Processing Diagram



Sulphuric Acid Plant

Sulphuric acid production uses bulk sulphur to be purchased by ITAFÓS from external suppliers. Sulphur can be supplied by several producers, and Itafós has not started negotiations to acquire sulphur yet.

The sulphur is heated and reacts with atmospheric oxygen and steam to form sulphuric acid. The sulphuric acid plant will have capacity to produce 600 tons per day. The technology adopted is the wet catalytic process.

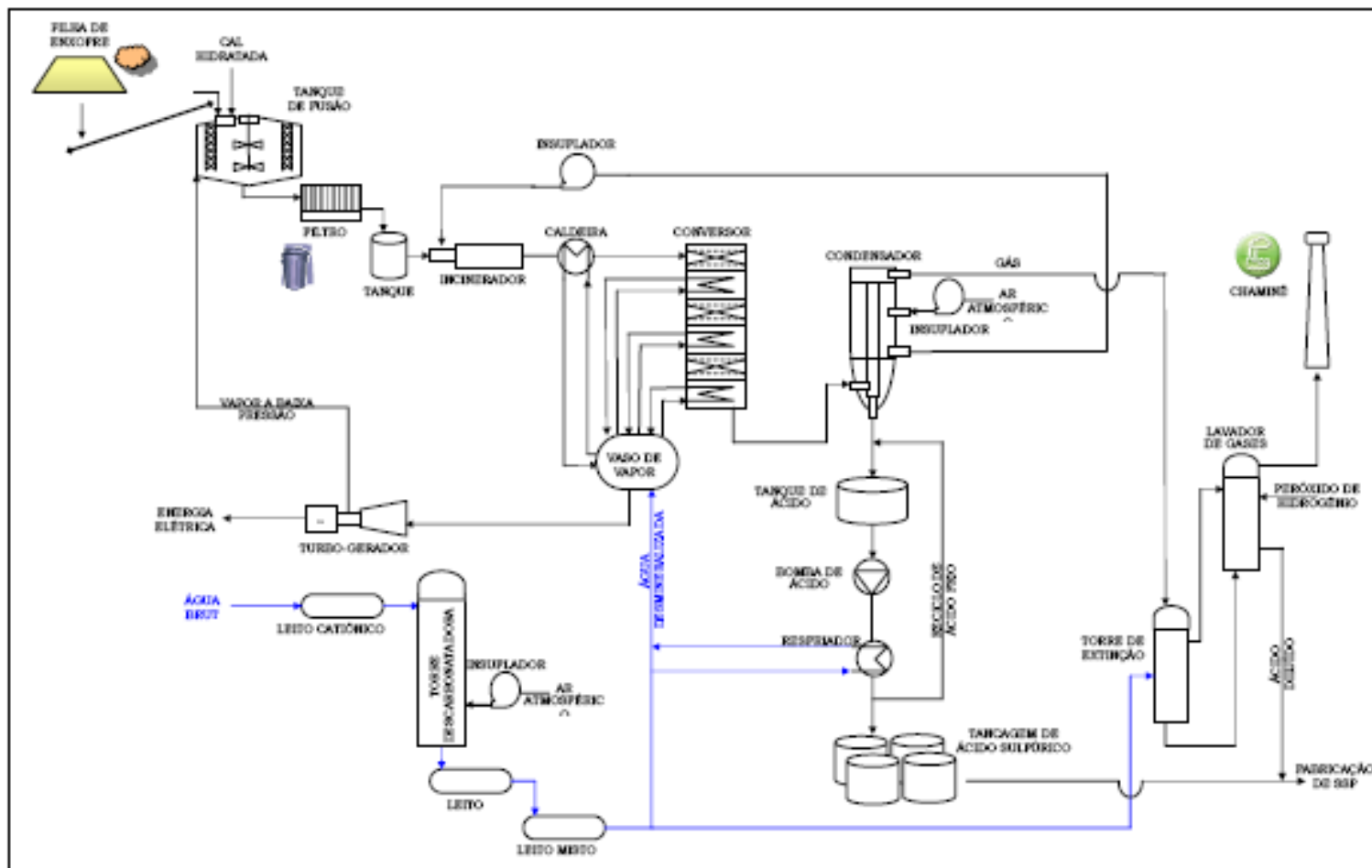
Wet Sulphuric Acid (WSA) Plant Technology is a wet catalytic process, which recovers SO₂ as concentrated sulphuric acid. Drying of the flue gas is not required in the wet gas process. The energy of the gas phase hydration of the SO₃ to H₂SO₄ gas and the energy of condensation of the H₂SO₄ are recovered in the form of hot air that is used for the combustion of sulphur and to preheat the boiler feed water, both leading to an increased rate of steam production compared to the dry gas process. In the dry process, this heat is traditionally lost in the cooling water.

Process phases are as follows (**Figure 2.2.2.b**):

- Sulphur melting and filter;
- Sulphur burning in reaction with air oxygen;
- SO₂ conversion into SO₃ in catalytic beds using Vanadium Pentoxid (P₂O₅);
- SO₃ gases scrubber and absorption in appropriate tower;
- Cooling and storage of acid product

In the sulphuric acid production process several chemical reactions occur: the sulphur combustion in a special Burner; SO₂ conversion into SO₃ (inside the converter), and SO₃ absorption (in the Acid Towers). These reactions are exothermic so it is possible to use this energy to produce electrical energy in a turbo generator. The designed Sulphuric Acid plant will be capable to produce 10 Megawatts which facilitates reusing the electrical power consumption in the whole plant.

Figure 2.2.2.b
Sulphuric Acid Manufacturing Process Flowchart



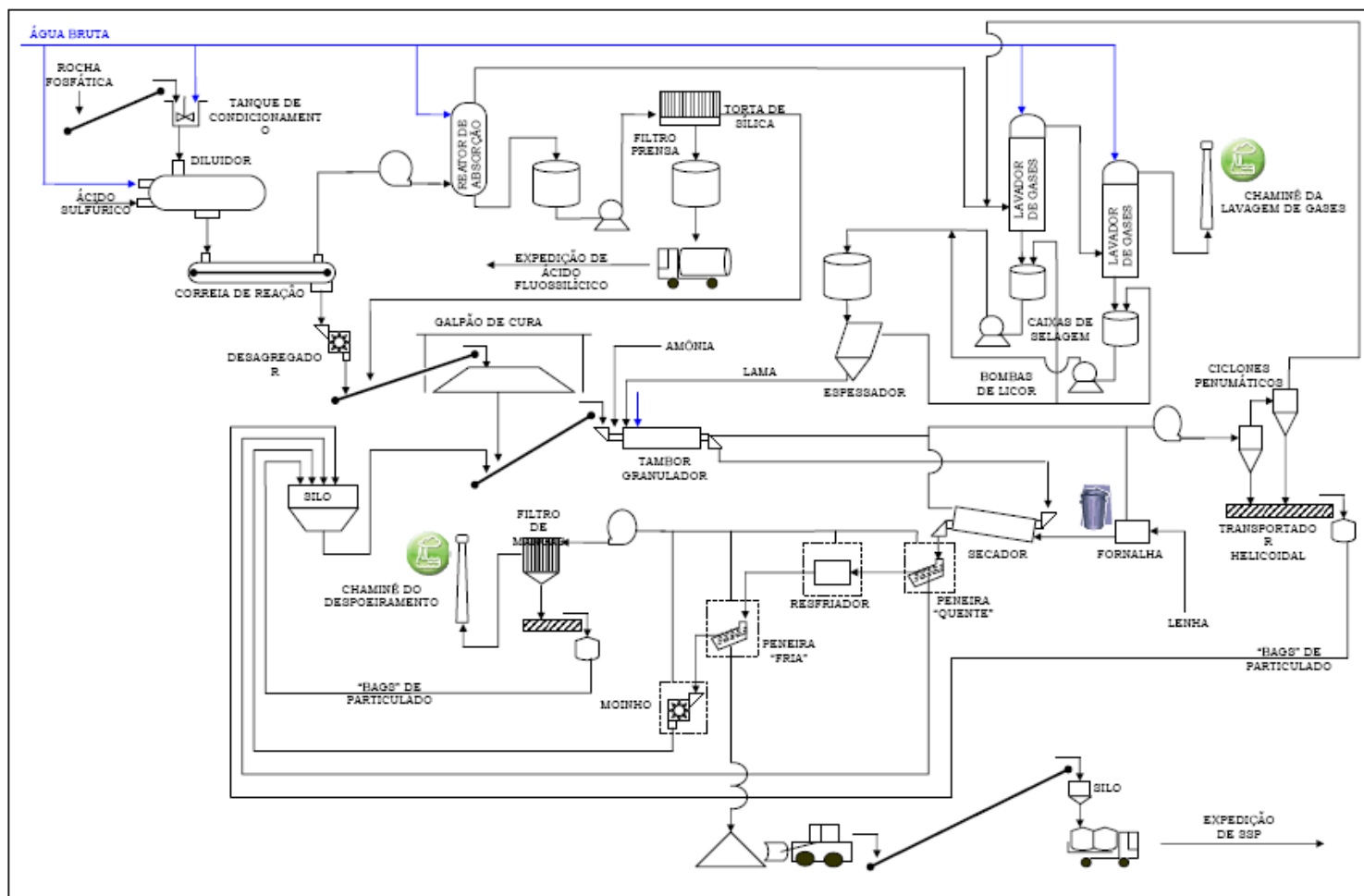


Single Superphosphate - SSP Production

SSP production is based on the reaction between phosphate rock and sulphuric acid, which are obtained from previous processes. SSP will be stored in a warehouse during its curing period, and then will be granulated by adding ammonia and dried in a rotary dryer fuelled by firewood.

The production of SSP includes two main processes: acidulation and granulation (**Figure 2.2.2.c**).

Figure 2.2.2.c
Single Superphosphate (SSP) Manufacturing Process Flowchart



Storage Units

PROJECT ARRAIAS has planned several storage units, including safe and controlled tanks, warehouses and yards for storing raw materials and inputs. These storage units area listed below:

Process Plant Storage Units

- Ore Stockpile Yard
- Crushed Ore Stockpile Yard
- Process Water Tank
- Caustic Soda Tank
- Soybean Oil Tank
- Reactant Preparation and Storage Warehouse
- Phosphate Rock Stockpile Yard

Sulphuric Acid Plant Storage Units

- Sulphur Stockpile Yard
- Hydrated Lime Storage Warehouse
- Sulphuric Acid Storage Tanks
- Hydrogen Peroxide Storage Tanks

SSP Production Storage Units

- Ammonia Tanks
- Firewood Stockpile Yard
- Granulated Materials Storage Warehouse
- Natural Fines Storage Warehouse

Support Storage Units

- Diesel Oil Tank
- Clarified Water Tank
- Fresh Water Tank
- Solid Waste Storage Area
- Disposable Materials Storage Area

Shipment Plant

Primarily, a front-end loader will transfer the granulate product from the stockpile into a hopper fitted with a belt conveyor to feed the big bags system located on the trucks. The trucks will be positioned in a weigh bridge to assure the correct weight is loaded. It is proposed that, in the future, a front-end loader reclaim the material from the granulate stockpile to double-deck vibrating screen. The oversize from the first deck will report to a chain mill and return as circulating load. The oversize from the second deck will direct to a

coating drum where coating additive will be introduced. The undersize from the second deck will flow by gravity to a hopper for further reprocessing.

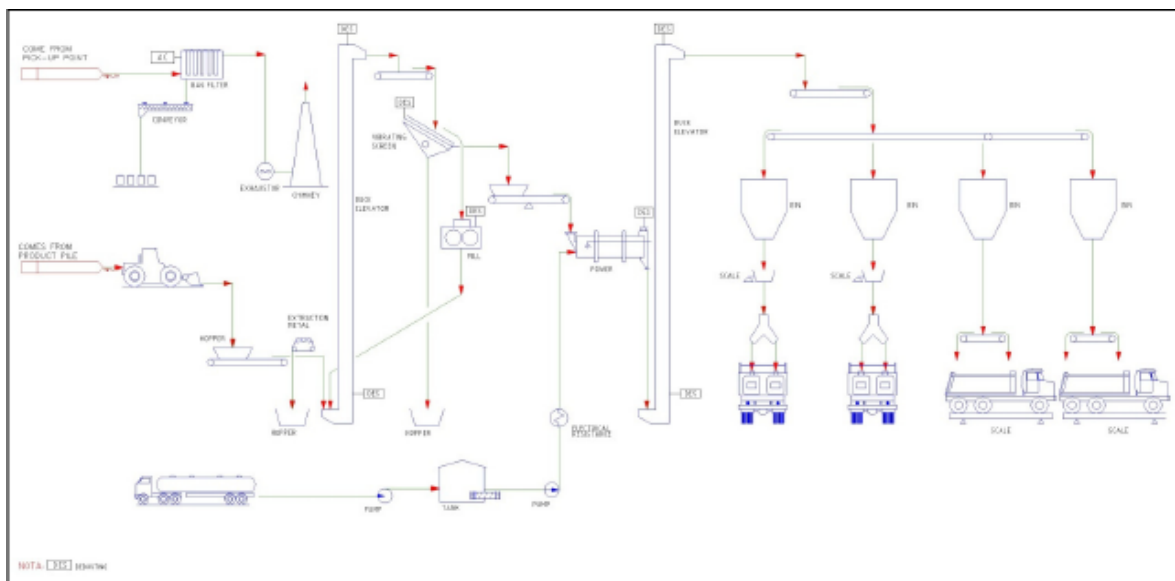
The coating agent will be transported by 30 t trucks and pumps will transfer it to the storage tank. Then, pumps will transfer the coating agent to the coating drum passing through a heat exchanger to reduce viscosity as required.

Later, this material will feed four bins and after being properly weighed, it will be directed by gravity to bags positioned in the trucks or directly to trucks.

All dust collecting points located along the shipment plant will report to the dedusting system comprised of a bag filter. The clean air will then be released to the environment after passing through an exhaust fan and chimney. Conveyors will transport the powder retained in the filtering process to bags to be re-processed.

Shipment flow-sheet is shown in **Figure 2.2.2.d**

Figure 2.2.2.d
Shipment flow-sheet



2.2.3

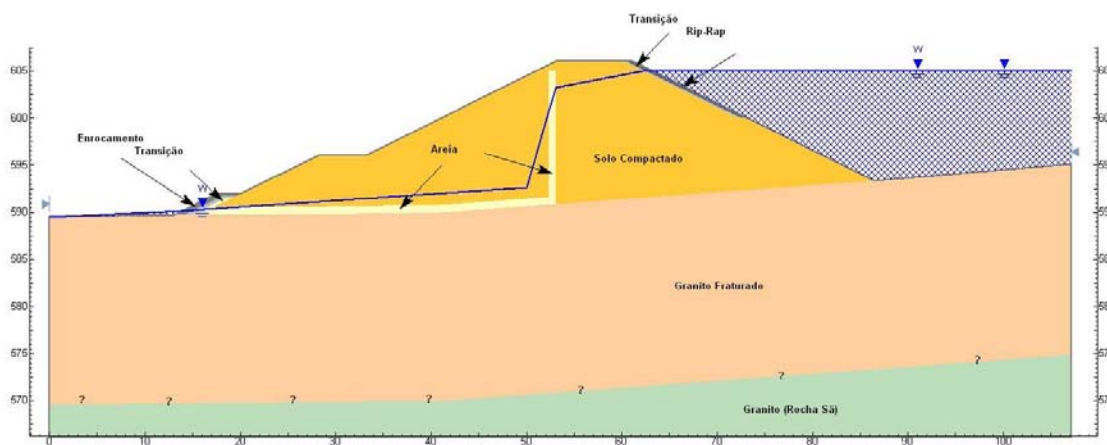
Water Catchment Dam

In the Arraias municipality region, water body flow varies sharply depending on the season, which would prevent the Project's water supply to be supplied by run-of-the-river catchment during dry periods. The alternative of capturing groundwater would not meet the high volume of water required for the processing. Thus, PROJECT ARRAIAS will rely on a dam on the Bezerra River.

Two dams are planned in the the Project: (i) a water catchment dam, and (ii) a tailings dam. The water catchment dam was designed for implementing in a configuration stage, whereas the tailings dam was designed in two configuration stages: the first configuration corresponding to the first three years of plant operation. The second configuration is the final dam corresponding to the 20 years of the Project's life-cycle. The plant's water demand lies at 700 m³/hr (0.194 m³/s), working during 7,776 hours/year.

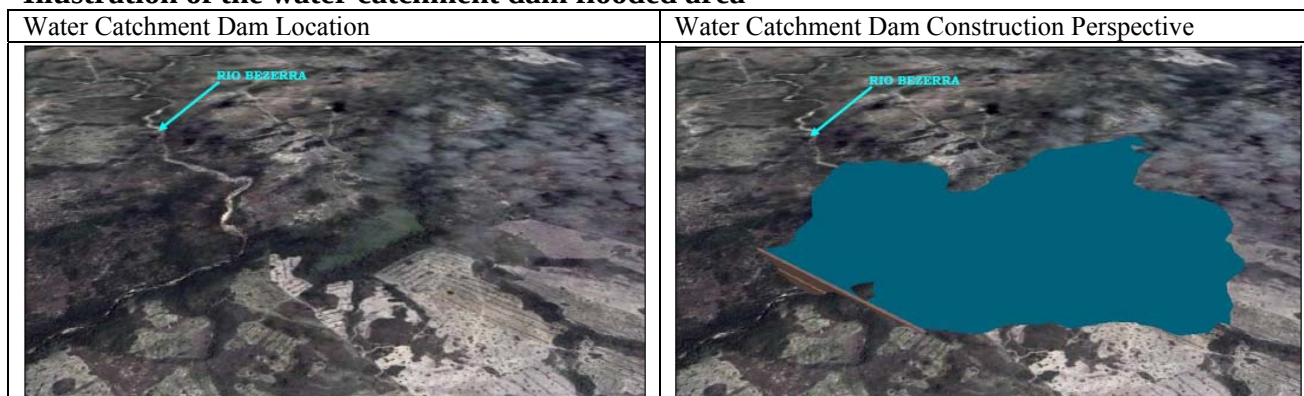
The axis defined as the best option for the phosphate project (axis C-02) is located at the drainage of the (stream) Bezerra River downstream from the confluence of the Poção Creek. The dam crest was projected at the elevation El. 607 m and 10.0 m wide. The upstream talus inclination is 1V:2H in all its extension and it is coated by rip-rap 1 m thick. The downstream talus has an inclination equal to 1V:2H between shoulders, located at every 10.0 m of difference of level and 5.0 meters wide. These shoulders are protected with a laterite layer 0.15 m thick and the talus between them must be protected by grass. Catchment dam section is shown in Figure 2.2.3.a.

Figure 2.2.3.a
Catchment dam section



The reservoir inundation area is approximately 97.2 hectares, considering up to the overflow sill elevation. The vegetation suppression area, comprising the massif and reservoir area and accesses make up, approximately, 127.4 ha. The foreseen axis of the dam is, in average, 7.8 km distant from the refining plant. The reservoir volume is $7.3 \times 10^6 \text{ m}^3$ and the compacted massif volume is $180,000 \text{ m}^3$. Figure 2.2.3.b presents an illustration of the water catchment dam flooded area.

Figure 2.2.3.b
Illustration of the water catchment dam flooded area



The Water Catchment Reservoir's residence time was calculated for two scenarios: long-term mean flow (38 days) and maximum monthly flow (6 days).

Water Catchment and Transportation System for the Industrial Units

Water will be transported through 24" - diameter pipes using 72,000 and 20,000m³ water tanks. Total pipe length is estimated at 5,000 m, and may be altered as it is still in the design phase. However, no earth movement is expected.

2.2.4

Tailings Dam

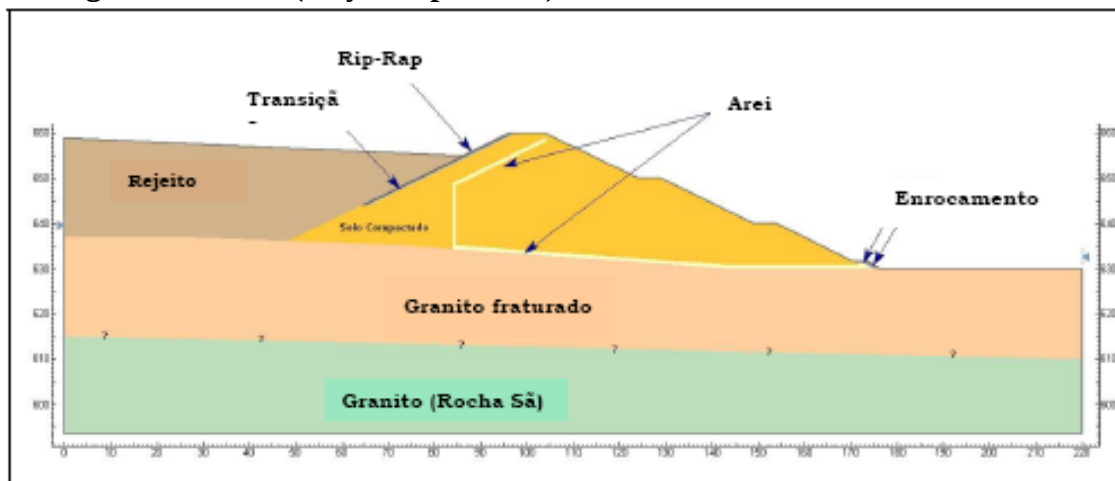
The tailings dam is located on the drainage of the Bezerra River upstream from the catchment dam and corresponds to the first three years of plant operation. As described in **Section 3.3**, the possibility of locating the Tailings Dam outside of a surface water course was analyzed and dismissed for technical reasons as indicated in **Section 3.3**.

The crest for the initial dam was projected at the elevation El. 650 m and 10.0 m wide. The upstream talus inclination is 1V:2H in all its extension and it is coated by rip-rap 1 m wide. The upstream talus inclination is 1V:2H between shoulders, located at every 10.0 m of difference of level and 5.0 meters wide. These shoulders are protected with a laterite layer 0.15 m thick and the talus between them must be protected by grass

The foreseen axis of the dam is, in average, 8.5 km distant from the refining plant. The reservoir volume is $7.5 \times 10^6 \text{ m}^3$ and the compacted massif volume is $465,000 \text{ m}^3$. The reservoir inundation area is approximately 270 hectares, considering up to the overflow sill elevation. The vegetation suppression area, comprising the massif and reservoir area and accesses make up, approximately, 277.4 ha.

The final tailings dam configuration consists in wall built downstream from the initial configuration axis. The final dam crest was projected at the elevation El. 660 m and 10.0 m wide. The upstream talus inclination is 1V:2H along the entire length and it is coated by rip-rap 1 m thick. The downstream talus has a slope equal to 1V:2H between shoulders located every 10.0 m of elevation. These shoulders are each 5.0 meters wide. They are protected with a laterite layer 0.15 m thick and the talus between them must be protected with grass. Figure 2.2.4.a presents the tailings dam section.

Figure 2.2.4.a
Tailings dam section (20-year operation).

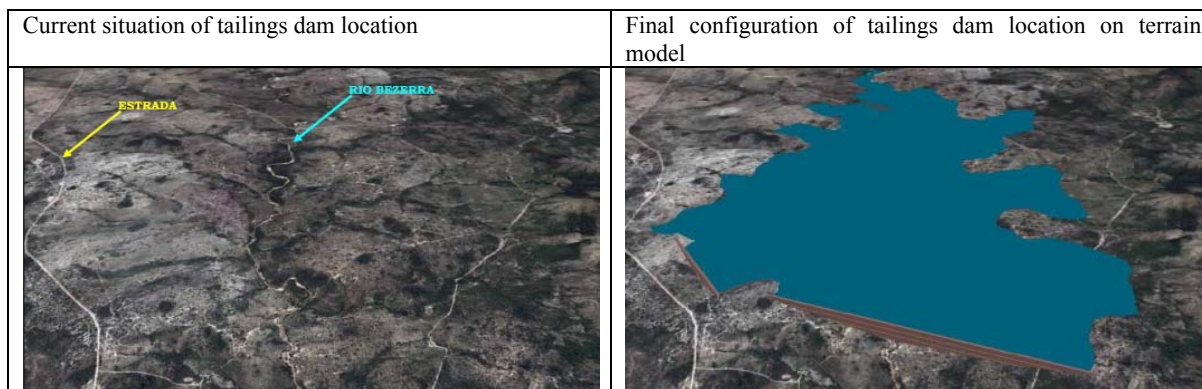


Fonte: FIMENTA DE AVILA, 2010.

The foreseen axis of the dam is, in average, 8.5 km distant from the refining plant. The reservoir volume is $53.1 \times 10^6 \text{ m}^3$ and the compacted massif volume to raise the dam is $1.34 \times 10^6 \text{ m}^3$. Four (4) raisings are foreseen for the Project in the years 2, 6, 11, 15 and 19.

The reservoir inundation area is approximately 433.2 hectares, considering up to the overflow sill elevation. The vegetation suppression area, comprising the massif and reservoir area and accesses make up, approximately, 737.1 ha. The Tailing reservoir's residence time was calculated for two scenarios: long-term mean discharge (193 days) and maximum monthly flow (29 days). **Figure 2.2.4.b** presents an illustration of the tailings dam flooded area.

Figure 2.2.4.b
Tailings dam inundation area



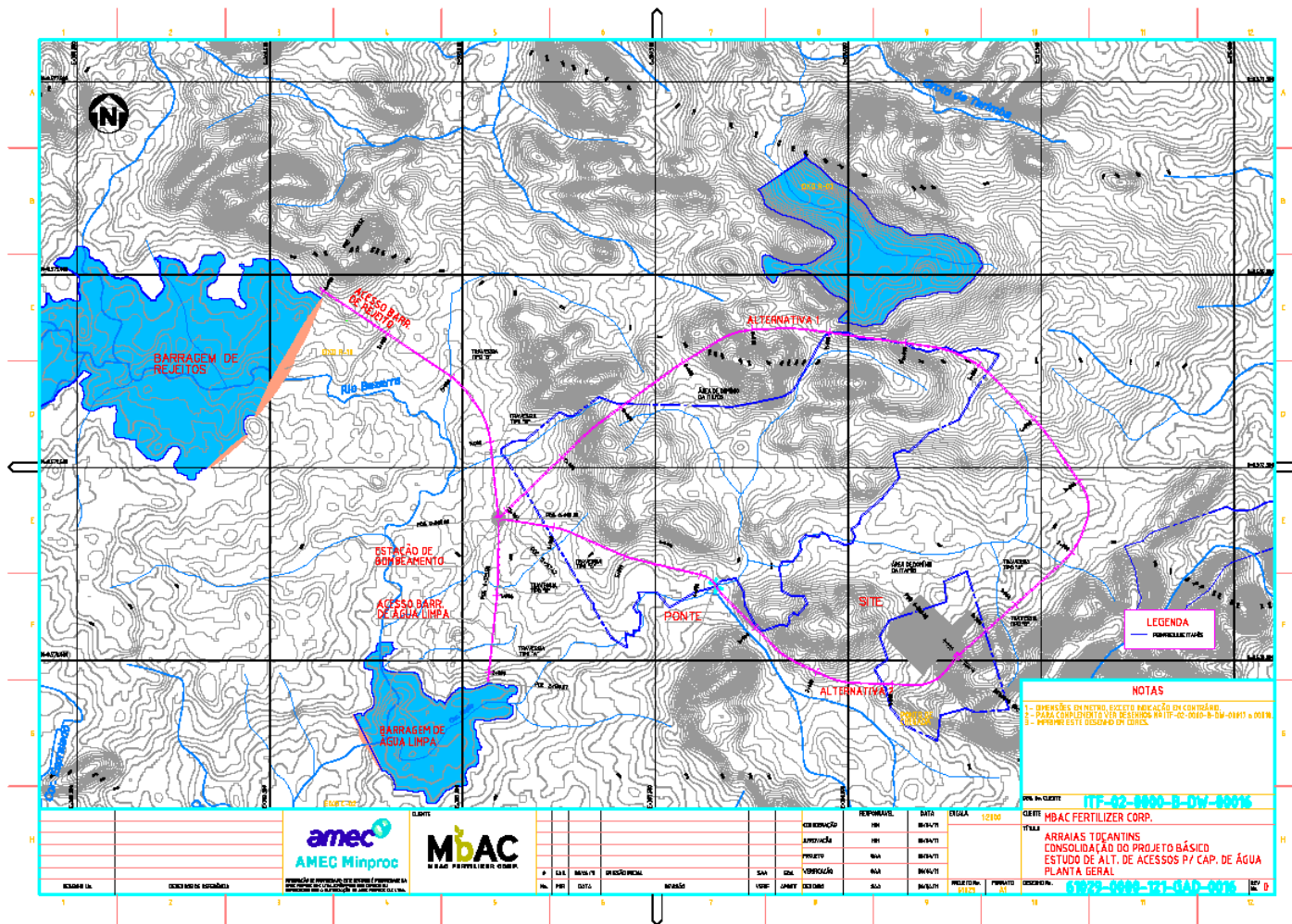
Tailings transport system from flotation process facilities to the tailings dam

Transportation in pipes of water effluents from the ore processing plant to the talings dam will use gravity. Afterwards, recycled water from this dam will be pumped to a specific watertank on the plant site, stored separately from the fresh water and used only for the operation of the Mill plant.

Figure 2.2.4.c map presents the chosen locations for the water catchment reservoir (*Barragem de Água Limpa*) and for the Tailings reservoir (*Barragem de Rejeitos*), both other alternative locations for the water catchment reservoir as blue outlines (*Alternativa 1* e *Alternativa 2*), possible transportation systems between the reservoirs and the industrial complex as pink lines (*Acesso à barr. de rejeitos*, *Acesso à barragem de água limpa*, *Ponte*) and also the pumping station (*Estação de Bombeamento*) and industrial complex (*Site*).

Figure 2.2.4.c

Alternative Alignment Guidelines for Water Catchment, Pumping and Transportation Systems between the Dams and the Industrial Complex



Construction materials for the dams

The typical sections of the dam are composed by compacted filling and internal drainage designed in carpet and vertical filter in sand.

The approximate volumes consumed during the dam construction and of sterile material to be excavated during the mine construction phase are:

- water catchment dam mass (landfill): 180,000 m³;
- first stage (3 years of disposal) of the tailings dam (fill): 465,000 m³;
- second stage (20 years of disposal) of the tailings dam (fill): 1,340,000 m³;
- Sterile material excavated during the construction phase of the mining areas (excavation): 11,690,000 m³.

Definition of borrow area locations and of their specific volumes should be reported along with the specific environmental plans. The sterile material disposal areas have already been proposed during the mine planning.

A specific study will present:

- Technical evidence and studies that confirm suitability of the sterile material for dam construction and suitability of the sand available along Bezerra River.
- Estimates of the sterile materials volume required for construction of dams
- Estimates of the sand volume needed for the installation of dam filters
- Legal requirements for use of sand in the construction of dam filters

2.2.5

Access and Road Re-routing

The Project area is located in the municipality of Arraias, in the southeast of Tocantins State. It lies approximately 400 km from Brasília and 450 km from Palmas. There are two routes to reach the Project area: via Arraias or via Campos Belos. Access to both cities from Brasília is via paved roads driving through BR-020 and GO-118 and then via unpaved but in fairly good conditions roads to reach the Project area. Campos Belos can also be reached by air. The local airstrip is paved, approximately 1400 m long and located some 6 km from Campos Belos.

The roads connecting the Project to the main cities and commercial centres in the region are paved and in good conditions. The field office and most exploration areas are easily accessible from Campos Belos all year round through a good network of gravel roads.

The internal roads from the mine pits to the plant are not yet defined as they will be defined when the detailed plan for the mines is done. These roads are not permanent and may be relocated several times along the Project lifetime.

2.3

Industrial Process Inputs

2.3.1

Raw Materials and Supply

Main characteristics and properties of each one of the raw materials and supplies are described as follows:

Phosphate Ore

The ore to feed the processing plant will be stored in an open yard. The apparent density obtained for phosphate ore material based on mineral research analysis is of 1.54 t / m³.

Water

Primary water demand will be from ore processing and steam generation in the sulphuric acid plant. Water supply will come from the dam to be built for this purpose, delivering 686 m³/h to the process, and from recycling, which will supply 1,887 m³/h.

Sulphur

Sulphur will be supplied in solid form in bulk and received by trucks that dump it on the storage yard. A shovel-loader will form a stockpile to feed the sulphuric acid plant.

Caustic Soda

Thirty ton trucks transport the caustic soda at 50% w/w in solution. A reagent transfer pump then transfers this caustic from the trucks to the caustic soda storage tank with a capacity of approximately seven days production. Part of the caustic soda stored in the tank is pumped to the soy oil emulsion preparation tank. Water may be introduced into the caustic soda circuit to clean the transfer piping and prevent from scaling with crystallized caustic soda. This water will be later reused in the industrial process, including for caustic soda dilution. The remaining caustic soda is pumped to a tank fitted with a mechanical agitator to prepare 10% w/w caustic soda by diluting with water. The 10% w/w caustic soda

solution is then pumped to a storage tank and to the first conditioning tank in each of the three flotation circuits for pH control.

Soybean oil

A product similar to that used for food, soybean oil will be used to prepare the ore slurry for the flotation process. Its density is approximately 900 kg/m³. Soybean oil will be received in 20,000-liter capacity tank trucks and will be stored.

Sodium silicate

This input will come in an aqueous solution of 50% mass concentration, in 20,000 liter capacity tank trucks. It is an inorganic salt solution that has a depressant action preventing the adsorption of soybean oil by mineral particles other than apatite.

Flocculant

Thickening operations include the use of flocculants for improved performance, resulting in higher recovery of clarified water, as well as a higher rate in water clarification. The flocculant to be used is Magnafloc 1011 or similar, which is a high molecular weight polymer to be received in granular form, packed in plastic bags.

Hydrated lime

Hydrated lime (Ca (OH) 2) is a stable solid bulk material (powder), which should be stored in a closed warehouse until it is utilized in the fusion of sulphur to produce sulphuric acid.

Hydrogen peroxide

Hydrogen peroxide (H₂O₂) will be consumed in the process of the gas washing plant to produce sulphuric acid and will be procured in a 50% concentration solution.

Ammonia

Ammonia is a liquefied toxic, corrosive, and flammable gas, to be received in tank trucks and stored in tanks with leakage-proof valve systems. Ammonia storage and handling will have adequate leakage-proof control and protection systems. The project's contingency plan (**Section 7.3**) presents emergency procedures and measures to be taken in case of leakage.

Firewood

Firewood will be used as furnace fuel in the drying processes. During the first years of production, firewood will come from land clearing of the dams and mining sites, in compliance with all legal procedures for removal of vegetation and use of wood. No existing wood suppliers from either forest exploitation areas with authorized management plans or eucalyptus plantations are known to exist in an area close enough to the project to justify logistic and economic viability of their use. Therefore, the obtainment of the necessary firewood supply once the supplies coming from land clearing are depleted will be based on the following processes: (i) an assessment of the existing forestry base, with a more comprehensive survey of existing firewood offer coming from forest exploitation areas with authorized management plans or certified eucalyptus plantations; and (ii) if such offer is not sufficient for the demands of the Project, development of a Program to promote the development of eucalyptus plantations by local farmers in order to supply the remaining demand.

All of ITAFÓS' firewood suppliers will be duly certified and properly registered with the Brazilian Institute of the Environment (IBAMA).

A record of firewood production areas will be established to provide information to meet the Project's total demand of approximately 117,200 m³ per year. The estimated area for firewood supply is of 3,200 to 5,400 hectares (as shown in the Table below), considering that, in the Cerrado region, eucalyptus production varies from 150 to 250 m³ / ha, with production cycles of approximately 7 years to form a mature tree.

Table 2.3.1.a

Planting Area to produce 117,200 m³/year of firewood

	Firewood Production	hectares	area (7 years/plantation)
maximum	250 m ³ /ha	469	3,282 ha
	200 m ³ /ha	586	4,102 ha
minimum	150m ³ /ha	781	5,469 ha

As expected, ITAFÓS will have to register with IBAMA as a consumer of forest raw materials. Firewood for the Project will be stored in a warehouse.

Annual quantities of raw materials and supplies are listed in the Table below.

Table 2.3.1.b
Raw materials and supplies for industrial activity

Description	Quantity (t/year)
Phosphate Ore 3,200,000	3,200,000
Water	4,527
Sulphur	50,000
Caustic Soda (liquid solution at 50%)	7,240
Soybean Oil	4,221
Sodium silicate (liquid solution at 50%)	1,529
Flocculant	28
Hydrated lime	4,967
Hydrogen peroxide (liquid solution at 50%)	350
Ammonia	8,100
Firewood	117,200 m ³ /year

2.3.2

Water Demand

PROJECT ARRAIAS total water consumption is estimated at approximately 2,474 m³/ h, of which about 72% (or 1,887 m³/h) will be recycled water and 28% (or 686 m³/h) will be water from the catchment dam as detailed in the Table below.

Table 2.3.2.a
Consolidation of Water Consumption

Water Consumption	Capture (m ³ /h)	Other sources (m ³ /h)
Ore Processing Plant	357.5	1,887.4
Chemical Facilities	127.9	
Other uses	201.0	
Total	686.4	1,887.4

The water catchment dam should provide regular water supply of up to 700 m³/h. Additional water supply of 1,607 m³/h will be obtained through water recirculation.

Water demand estimated for human consumption for the operation phase is of 10,000 l/day, which will be supplied by one or two wells. Sand filters will remove turbidity and decontamination tanks will allow flocculation, coagulation and precipitation, as well as other processes that may be necessary to comply with the drinking-water standards in CONAMA (Brazilian National Environmental Council, acronym in Portuguese) Resolution 357 of March 17th, 1995 and WHO Guidelines for Drinking Water (WHO, 2008). The treated water shall be stored in a fresh water tank to supply the industrial complex.

Water Resources Demand

The National Water Agency (Agência Nacional de Águas - ANA) requires that after the dam construction the Bezerra River water flow be at least 30% of its previous flow.

According to the regulatory procedures in force, the standard reference flow is based on 95% of flow duration (Q95), obtained using the permanence curve, and 30% of Q95 should be guaranteed downstream of each intervention (PIMENTA DE ÁVILA, 2010).

The study was based on flow data from the Ponte Paraná fluviometric station, which has a total drainage area of 29,818 km². Ponte Paraná fluviometric station has a long-term average specific yield of 10.8 L/s.km² (long-term average flow divided by drainage area of the station) and Q95 equal to 68.982 m³ / s (PIMENTA DE ÁVILA, 2010).

Q95 values for the waste and water containment dams are calculated proportionately to their respective drainage areas and the Q95 as well as the Ponte Paraná rainfall station drainage area. **Table 2.3.2.b** presents the results and the minimum residual flows for the two dams.

Table 2.3.2.b
Minimum Waste Flows to be Kept

Dam	Drainage Area (km ²)	Q ₉₅ (m ³ /s)	Minimum Residual Flow– 30% OF Q ₉₅ (m ³ /s)
Tailings Dam	56.32	0.132	0.040
Water Catchment Dam	128.19	0.301	0.090

Source: PIMENTA DE AVILA, 2010.

2.3.3 Energy demand

The forecast peak demand for the Project, out of the peak, is about 10,600 kW (see **Table 2.3.3.a**). As shown in **Figure 3.2.4**, relevant portion of electric power shall be supplied by own generation to be obtained through sulfuric acid manufacturing.

Table 2.3.3.a
Electric Power Demand

Productive Unit	Demand (Free Generation) (kW)
Processing Unit	12,900
Acid Sulphate Plant	(7,500)
Chemical Plant (SSP)	5,200
TOTAL	10,600 kW

In peak time, power demand should be reduced to 7,200 kW through the interruption of some sectors such as crushing, regrinding and water catchment. The Project's power supply will come a new transmission line to be built by Celtins, which will be a facility of the State of Tocantins serving the Southeast of the State (and therefore not dedicated to the project), until the main substation, in 69 kV voltage. The remaining substations should be fed from the main substation in 13,8 kV voltage.

The following **Table 2.3.3.b** presents details of the Project's installed energy capacity and consumption.

Table 2.3.3.b
Capacity and energy consumption

Total installed capacity	18,100 kW
Off-peak consumption	10,600 kW
Peak hours consumption (17:30 to 21:00)	7,200 kW
Free generation in sulphuric plant	500 kW
Estimated monthly consumption	7,275,000 kW.h/month

2.4 Industrial Process Effluents and Wastes

2.4.1 Tailings

The principal effluents from the phosphate mineral beneficiation process will be the tailings, which will be generated in pulp form (water with mineral particles in suspension). This effluent will be disposed of in the tailings dam. According to Itafós, the tailings are inert and as such no further treatment is required before disposal on the tailings dam. Once released into the tailings dam reservoir, the solid particles will precipitate and deposit at the bottom, leaving the water supernatant, which will be retrieved through pumps mounted on ferries. After pumping from the tailings dam, it will proceed to the water tank to be reused in mineral processing.

2.4.2

Other Solid Wastes

Solid wastes resulting from 750 t/day production processes are the following:

Sulfuric Acid Plant

- A mixture of sulfur + diatom (liquid sulfur precoat filter) - Destination: Sold to fertilizer blenders, and of great commercial acceptance;
- Catalyst Powder (removed from Plant every 1.5 years, during scheduled maintenance shutdowns) - Destination: Landfills;
- Sulfur slurry with 60% content of S, from the Sulfur Filter: 5 tons p/ day;
- Ferrous Sulfate: 300 kg p/ year (removed from equipment, during annual scheduled maintenance shutdowns and utilized in SSP plants);
- Vn₂O₅ Vanadium Pentoxide: 12, 000 liters p/ year. Material is obtained after screening catalyst particles and is sent to companies specialized in recycling and elimination of toxic waste (for example, Suzanquim in Suzano, State of São Paulo).

Single Superphosphate SSP Production

- Silica - Destination: Material is incorporated into the SSP;
- Despite generating large quantities of dirt in the production area, this material yields no solid effluent. Everything that is produced, even sometimes off-specification, returns to the production process at some point.

2.4.3

Liquid Effluents

Liquid wastes resulting from 750 t/day production processes are the following:

Sulfuric Acid Plant

- Leakages and rain water contaminated with sulfuric acid - Destination: Project's Industrial Treatment Plant.
- Water from purges of the Plant's steam system: 0.5 m³ / h or 12 m³ per day. Water with pH 11 goes to Project's Sewage Treatment Plant.

Single Superphosphate SSP Production

- Fluosilic acid (20%) - Destination: Part of this by-product will be sold for water fluoridation in the region's water treatment systems. However, most of this material should be neutralized at Project's Sewage Treatment Plant, and the neutralization process results in solid waste).
- Acid that may leak in the area is sent to the Sump and reprocessed or neutralized with alkalis such as NaOH or Ca (OH) 2, and the neutralized product is utilized in the Granulation unit.

2.4.4

Point Source Atmospheric Emissions

Sulfuric Acid Plant

Main effluents in the sulfuric acid production are the following:

Table 2.4.4.a
SSP Production Unit Gas Emissions

Gas	Emission rate
SO ₂	Values less than 400 ppm or 2 Kg / t H ₂ SO ₄
SO ₃	Values less than 0.075 mg Nm ³ p/ hour

Single Superphosphate SSP Production

The table below shows gas effluents from the SSP production process

Table 2.4.4.b
SSP Production Unit Gas Effluent Emissions

	Gas	Emission rate
Gas effluents produced in the acidulate process	Total fluorides	0.10 Kg/t P ₂ O ₅ (input)
	Particulate matter	75 mg/Nm ³
Furnace and drier gases	Total fluorides	0.10 kg/t P ₂ O ₅ (input)
	Ammonia	0.02 kg/t product
Gas scrubber at grinder and dryer	Particulate matter	75 mg/Nm ³
Dust control at cooling system	Particulate matter	75 mg/Nm ³
Dry superphosphate sieving and grinding	These are considered fugitive rather than point-source emissions.	

2.4.5 Noise Emissions

Forecast emissions in industrial units are the following:

	Noise Level	
	Internal	External (50 m)
<i>Ore Processing Unit</i>	85	70
<i>Sulfuric Acid Plant</i>	85	70
<i>SSP Production</i>	85	70

2.5 Environment Control Systems

Ore Processing Unit

Projects and equipments related to ore processing units, sulfuric acid production and single supersulphate production come from their suppliers with effluent treatment systems as required to control and meet environmental standards of emissions. The detailing of these effluent treatment systems, as such, depends on the specific equipments to be used, which will be specified later by Itafös.

2.5.1 Gas Treatment

Gases from granulator and dryer will feed the gas treatment system. Gases from the granulator will report to the gas scrubber to absorb ammonia and fluorine as well as particulate material removal in a venturi scrubber.

Gases from the dryer will report to pneumatic cyclones to remove the particulate material. A conveyor will withdraw the underflow material from the cyclone to the recycle bin. The overflow will report to the gas scrubber to absorb fluorine and remove the remaining particulate material in a venturi scrubber.

The scrubbers will be fitted with sealing tank and liquor circulation pumps. Reposition water of the system will be fed into the dryer scrubber sealing tank. The granulator and the dryer scrubbers sealing tanks will be purged and the resulting slurry will report to a specific liquid effluent treatment station located at the granulation plant battery limits.

The purged slurry will report to a thickener. The overflow will be recirculated in the sealing tanks while the underflow (slurry) will be pumped to the granulator.

For the treatment of SO₂ and SO₃ gas emissions, a gas washing system with a treatment tower and scrubber with the application of hydrogen peroxide solution will be implemented.

The gas effluents generated during acidulation will be treated in the gas washing system described above that will recover fluorine compounds in the form of fluosilicic acid. Fluosilicic acid will be marketed as input for water treatment plants as a fluoride source. Gas from the furnace and drying machine will be treated through pneumatic cyclones to remove particulate material.

2.5.2

Fugitive Dust System

All dust collecting points located along the shipment plant will be sent to the de-dusting system comprised of a bag filter. Then the clean air will be released to the environment through chimney. The material collected in the bag house will be transported through conveyors to bags to be re-processed.

2.5.3

Waste Water Treatment

The sulfuric acid unit will have a water drainage containment basin to avoid the release of liquid effluents into the environment. In addition the plant's floor has an anticorrosion coating and containment basins to collect occasional leakages and prevent contamination.

The SSP production unit will have a settling and residues containment basin for drainage waters in addition to containment basins for its tanks.

The detailing of treatment procedures for domestic sewage (including sizing and location) is yet to be defined during the engineering detailing phase that is now underway. Itafós is planning 3 small treatment plants for microbiologic elimination and further disposal that will ensure compliance with the Brazilian and IFC requirements.

2.5.4

Solid Waste Handling Facilities

A temporary area for the storage of inert solid tailings until they are sent to their final destination is planned, as well as an area with sheds for the temporary storage of materials until their final destination.

2.6 Project Footprint

Construction Phase

Jobsite

The Project's construction plan includes 4 distinct areas to be occupied by the temporary facilities required during construction, which will total approximately 34,300 square meters (see **Table 2.6.a**).

Table 2.6.a
Temporary Facility Areas during Construction Phase

Facility	Área (m ²)
A Main entrance, truck service centre, and medical assistance centre	4,376
B Restaurant, social centre and bathrooms	4,489
C Jobsite	13,335
D Warehouse	12,123
TOTAL AREA	34,322 m²

Source: DESENHO Amec Minproc 60230-0000-05-121-002 (Rev 1).

2.6.1 Land Take

Total Area

Total land take by the project (mining areas, power plant, manufacturing unit, facilities, water catchment and tailings reservoirs) includes 1,492.56 ha, as detailed in **Table 2.6.1.a**, below.

Table 2.6.1.a - Project land take by current land use and Project structure.

Structure Land use	Mining pits	Industrial Unit	Tailings Reservoir	Water Reservoir	Total area
Typical cerrado	25,71 ha	6,04 ha	506,54 ha	52,01 ha	675,52 ha
Dense cerrado	67,83 ha	6,18 ha	-	-	74,02 ha
Cerradão	18,84 ha	1,93 ha	-	-	20,77 ha
Riparian Vegetation	33,43 ha	--	157,93 ha	51,60 ha	264,90 ha
Degraded land	72,73 ha	11,22 ha	11,97 ha	47,67 ha	154,60 ha
Pastures	271,13 ha	19,30 ha	64,70 ha	65,49 ha	431,38 ha
Built area	0,18 ha	-	0,12 ha	-	0,30 ha
APP*	44,97 ha	-	159,90 ha	49,02 ha	276,71 ha
Total Area	489,85 ha	44,67 ha	741,26 ha	216,77 ha	1.621,49 ha

***APP:** This refers to previously existing Permanent Protection Areas (e.g. along river margins, etc) that will be affected by the Project's construction.

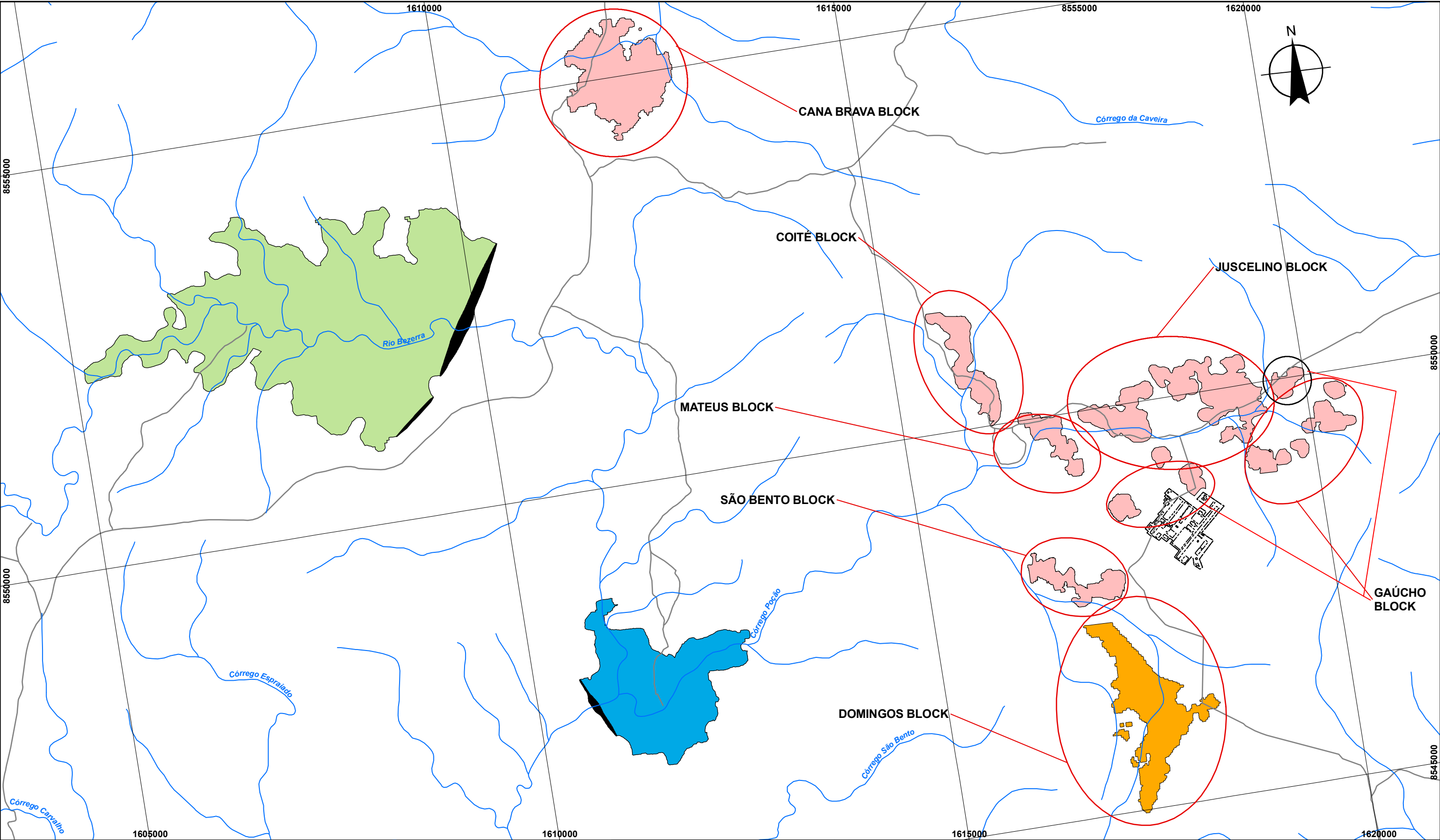
The Permanent Protection Areas (APPs) around the reservoirs (water and tailings), which consist in a 100m buffer that must be preserved with riparian vegetation, is not included in the table above. Itafós will preferably buy the Buffer Area as part of the land acquisition to build the dams. Notwithstanding, in the event that this 100m strip is not purchased, it will be compensated with ITAFOS paying land owners for the use of that right-of-way and establishing mechanisms to ensure land owners do protect that area for which ITAFOS is paying usage. Compensation will follow IFC Performance Standard 5 and ITAFOS' Resettlement Policy Framework (Appendix 2). Any costs incurred in revegetation of the buffer strip will be borne by ITAFOS.

Of the total area above, only 1113.52 ha will be occupied by the Project's footprint during the first five years, as the mining areas of Domingos (109.82 ha) would be exploited during that period, the tailings dam would be initially built with lower height, the Water Catchment dam would be built to supply water for the Project's use and the industrial areas and sanitary landfills would also be implemented. **Figure 2.6.1.a** shows the limits of the Project's five year footprint and final footprint.

The total land take of the Project will affect forty nine (49) properties mostly dedicated to cattle/pasture. **Table 2.6.1.b** below illustrates the Project's land take according to property size and current use. It is important to note that land acquisition has already begun and three (3) properties have been purchased on the basis of willing seller / willing buyer agreements, while three (4) others are currently undergoing negotiations for acquisition (2 registered and two non-registered properties). It is also important to observe that a total of 36 (registered) families live within areas to be purchased, and will need to be relocated. Seventeen (17) of these families are affected by the five-year footprint, and the remaining nineteen (19) will need to relocate after the initial five years of mine operation. However, all resettlement will be conducted during the Project's construction period, which is estimated to last 18 months. The Company will proceed with this relocation according to a Resettlement Policy Framework to be established in compliance IFC Performance Standard 5 and included in **Appendix 2**.

It must also be noted that additional land take may be triggered by the widening of existing roads which may be used to access the project areas or by the construction of additional temporary internal roads from the mining pits to the plant.

Detailing of existing vegetation and human land uses in areas to be acquired are presented in Environmental and Social Conditions (**Sections 5.2.2 and 5.2.3**) and Associated Impacts in **Section 6.2**.



LEGEND: - Hydrography - Roadways - Industrial Plant - Dams - Water- Catchment Dam - Tailings Dam (3-20 anos) - Mining Areas (0-5 anos) - Mining Areas (>5 anos)	LOCATION ON THE SHEET	INFORMATION Source: Information obtained from environmental Impact Assessment - July 2010 Scale: 1:45.000 0 0,225 0,45 0,9 1,35 1,8 2,25 2,7 km Projection - Universal Transverse Mercator - UTM Geodesic Reference System: South American Datum - SAD 69 Date: 01/04/2011 Fig. JGP: Figure Project Footprint.mxd	CLIENT:
	PROJECT: PROJECT ARRAIAS		
	FIGURE 2.6.1.a: PROJECT FOOTPRINT		
	Consultoria e Participações Ltda.		

Table 2.6.1.b

Properties affected by the Project's land take, including owners, property areas, affected areas and project uses.

Mining Areas					
#	Properties	Affected area (ha)	Property area (ha)	Project Uses	OBS
1	ITAFÓS MINERAÇÃO LTDA	0.49	155.09	Gaúcho Block	
2	ITAFÓS MINERAÇÃO LTDA	4.03	57.24	Gaúcho Block	
3	Jonas D'arc de Araújo	14.37	144.45	Gaúcho Block/ Juscelino Block	
4	José Ferreira Filho (Pinhão)	44.11	295.92	Gaúcho Block/ Juscelino Block	
5	Jonas Tadeu Marques	31.20	175.70	Gaúcho Block	
6	Mateus Martins dos Santos	27.64	91.58	Gaúcho Block	
7	Péricles José de Oliveira	0.10	31.29	Mateus Block	
8	Maria Alves de Araújo (João)	9.90	63.29	Mateus Block	
9	Manoel Divino José dos Santos	0.01	6.48	Juscelino Block	
10	ITAFÓS MINERAÇÃO LTDA	57.02	1555.50	Mateus Block/Coité Block	
11	Maria Emilia Ayres França	32.72	754.51	Cana Brava Block	
12	Otávio Costa Madureira	9.92	18.53	São Bento Block	
13	Osálvio Ferreira	0.79	3.66	São Bento Block	
14	Evan Francisco da cunha	0.86	3.90	São Bento Block	
15	Maria Soares de Jesus	1.29	5.82	São Bento Block	
16	Manoel Ferreira da Cruz (manelão)	3.42	11.01	São Bento Block	
17	Joaquim Ferreira	4.71	10.75	São Bento Block	Property occupied by squatter
18	Dalberto	0.34	0.76	São Bento Block	
19	Valdimiro Gomes	1.80	4.29	São Bento Block	
20	Joana Alves de Oliveira	0.19	6.89	São Bento Block	
21	Luzimar	0.38	5.58	São Bento Block	
22	Tarciso Dias	3.52	3.76	São Bento Block	
23	Juscelino Ferreira Furtado Neto	44.03	138.21	Juscelino Block	
24	Sergio Miosh Kita	62.29	128.02	Cana Brava Block	
25	José Alberto Alves	2.49	327.03	Domingos Block	
26	Domingos José Santos Junior	80.83	884.84	Domingos Block	
27	José Maria Gonçalves Bragança	28.06	107.20	Domingos Block	
28	João Alves Bueno (Pombo)	5.22	91.02	Cana Brava Block	

Industrial unit					
#	Properties	Affected área (ha)	Properties (ha)	Project Uses	OBS
1	ITAFÓS MINERAÇÃO LTDA	37.41	155.09	Industrial	
2	ITAFÓS MINERAÇÃO LTDA	5.64	57.24	Industrial	
6	Mateus Martins dos Santos	1.57	91.58	Industrial	
Reservoirs					
#	Properties	Affected área (ha)	Properties (ha)	Project Uses	OBS
29	Thiago Peruch Lemos dos Santos	126.93	2359.71	Water Catchment Reservoir	
30	Alfredo Martinele	122.36	415.45	Water Catchment Reservoir	
31	Antonio Aires França	53.37	1477.40	Water Catchment Reservoir	
32	Lindomar Braz de Oliveira	6.26	51.78	Tailings Reservoir	
33	Manoel Jackson Bueno Ramalho	78.34	90.40	Tailings Reservoir	
34	Arlindo Bueno Guimarães Filho	13.67	146.97	Tailings Reservoir	
35	João Carlos Pereira Santana	17.84	103.83	Tailings Reservoir	
36	Ascilon Pinto de Almeida	128.41	758.09	Tailings Reservoir	
37	Marcio Araujo Oliveira	2.64	119.99	Tailings Reservoir	
38	Vanderley dos Santos Menezes	10.54	10.54	Tailings Reservoir	
39	João Batista Rodrigues dos Santos	20.07	20.07	Tailings Reservoir	
40	Pedro Manuel da Cruz	13.77	13.77	Tailings Reservoir	
41	Edson José dos Santos	111.48	166.78	Tailings Reservoir	
42	Joaquim Ramalho e Herdeira (Francisco dos Santos)	325.39	431.04	Tailings Reservoir	Property occupied by squatter
43	Valduino Ramalho dos Santos	86.13	189.57	Tailings Reservoir	
44	Davi e Orizon Gentil dos Santos	20.53	36.43	Tailings Reservoir	
45	Francisco Carlos Santos	95.99	272.39	Tailings Reservoir	
46	Antonio Ribeiro Machado	1.37	1.37	Tailings Reservoir	
47	Domingos Lopes de Sousa	7.67	96.80	Tailings Reservoir	

Mining Pits:

The total area disturbed by the pits is about **673** hectares. The current Phasing Plan is presented below.

Table 2.6.1.c

Phasing plan for the exploitation of Mining Areas during the first 5 years of the Project.

Year	Block	Area (ha)
Year 0	Domingos	37
Year 1	Cana Brava	12
Year 2	Domingos	2
	Cana Brava	4
Year 3	Domingos	15
	Cana Brava	16,26
Year 4	Domingos	11
	Cana Brava	18
Year 5	Cana Brava	11,4

Industrial areas:

The industrial facilities will include a total of approximately 44.67 ha of operational areas, listed according to the following **Table 2.6.1.d**:

Table 2.6.1.d

PROJECT ARRAIAS Industrial Areas

Description	Area (m ²)
Plateau for water treatment plant (eta)	2,400
Plateau for clarified water tanks and drinking water	3,740
Plateau for raw water and reclaimed water basins	9,700
Plateau for solid tailings area	4,026
Plateau for water pumping	214
Plateau for crushing	4,710
Plateau for homogenization piles	39,250
Plateau for the sulphuric acid plant	32,600
Plateau for the beneficiation plant	26,350
Plateau for warehouse and laboratory	4,700
Plateau for fine ROM containment basin	2,660
Plateau for disposable materials centre	14,500
Plateau for flotation and phosphate rock fines containment basins	6,023
Plateau for main substation	2,600
Plateau for chemical plant (acidulation, granulation, drying and warehouses)	127,020
Plateau for support facilities (main entrance, restaurant, medical assistance centre, etc.)	21,190
Other areas (accesses, cut and fill slopes)	145,017
TOTAL	446,700 m²

Source: DESENHO 021-CD-010-0004 (Revisão 1).

2.6.2

Land Use Change

Rugged terrain and steep slopes in the Project region makes intensive farming practices difficult. Main altered habitats to be affected include pasture areas as shown in **Table 2.6.2.a** below.

Table 2.6.2.a

Type of soil cover areas to be suppressed with PROJECT ARRAIAS implementation

Soil Cover	Mining Areas	Industrial Complex	Tailings Dam	Water Catchment Dam	Sanitary Landfill	Total Area
Typical Cerrado	25.71 ha	6.04 ha	506.54 ha	52.01 ha	-	590.30 ha
Dense Cerrado	67.83 ha	6.18 ha	-	-	-	74.02 ha
Cerradão	18.84 ha	1.93 ha	-	-	-	20.77 ha
Riparian Vegetation	33.43 ha	--	157.93 ha	51.60 ha	-	242.96 ha
Exposed Soil	72.73 ha	11.22 ha	11.97 ha	47.67 ha	-	143.60 ha
Pasture Areas	270.13 ha	19.30 ha	64.70 ha	65.49 ha	1.00 ha	420.61 ha
Built Areas	0.18 ha	-	0.12 ha	-	-	0.30 ha
PPA						
Intervention Areas	44.97 ha	-	159.90 ha	49.02 ha	-	253.89 ha
TOTAL AREA	488.85 ha	44.67 ha	741.26 ha	216.77 ha	1.00 ha	1,492.56 ha

2.7

Construction

2.7.1

Workforce

During the PROJECT ARRAIAS construction phase, which is scheduled for a period of 20 months, a gradual increase in the number of employees is expected in the civil construction area. At construction peak, 1,500 workers are estimated.

Employee hiring procedures will comply with the CLT regulations (Consolidação das Leis de Trabalho, Brazilian worker's legislation). Workers will be hired for work in so-called "indefinite period contracts", that is, jobs not defined as temporary or defined by contracts ending at a defined date, as defined by CLT regulations. Itafós and the Constructor company's employment contracts will also comply with collective negotiation agreements established between the Project Company and the respective workers' unions as per the requirements in IFC Performance Standard 2.

During the construction phase, lodging will be implanted at the construction site, with the following facilities: 1 canteen, 1 living area, 1 dormitory and a sufficient number of bathrooms to comply with the Brazilian NR 24 (Regulating directive from the Brazilian Work Ministry), among other structures. These structures will be built in conformity to the Brazilian Worker's legislation (CLT) and the Brazilian Regulation Standards (NBR, acronym in Portuguese).

It is expected that about 60 % of the workforce will be comprised of local workers. During project construction, the expected to peak at 1500 workers, including individuals with the following qualifications:

Civil Engineering

- Carpenter;
- Finishing Mason;
- Foreman;
- Mason;
- Mason Assistant;
- Rigger

Mechanics/ Piping

- Adjustor;
- Blowtorch operator;
- Boiler operator;
- Erector;
- Industrial painter;
- Industrial plumber;
- Mechanical assembly assistant;
- Mechanical assembly foreman;
- Piping assembly assistant;
- Piping assembly foreman;
- Rigger;
- Welder

Electrical Instrumentation

- Electrical Instrumentation assistant;
- Electrician;
- Electrician foreman;
- Instrument operator;
- Instrumentation foreman

Operational Support

- Heavy Vehicle Driver;
- Operator

A Worker Capacitation Plan is included within the Environmental and Social Management System (**Section 7.3**). In order to absorb local manpower, the Capacitation Plan will aim to establish partnerships with local educational entities to offer courses and professional qualification training to local workers.

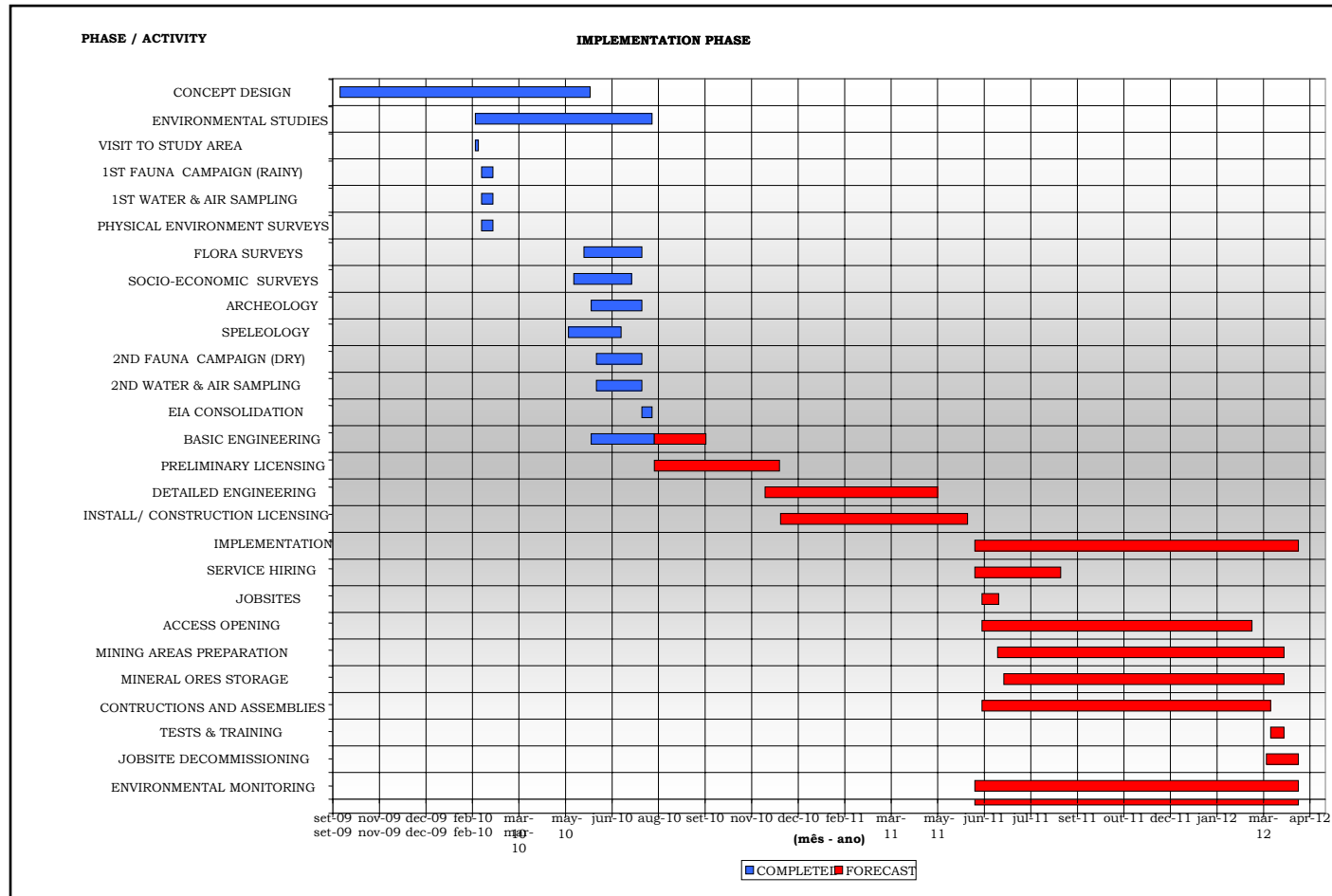
During project construction, approximately 300 indirect jobs are expected to be created, related to transportation, food preparation and distribution, energy generation and distribution and support-related business activities.

Itafós will require that Outsourced companies follow the guidelines of its own Conduct Code and its Environment, Health and Security standards. Outsourced companies' agreement to these guidelines will be registered in a document to be annexed to the Service Contract. Auditing that these are followed by outsourced companies will be done by Itafós.

2.7.2**Schedule**

The Project's detailed schedule for design and construction phases is shown in **Figure 2.7.2.a**. The estimated construction period is 20 months.

Figure 2.7.2.a
Detailed Schedule of Project Phases



2.7.3

Investment Costs

The Capital Cost Expenditure (CAPEX) estimates for PROJECT ARRAIAS development have been estimated to March/2010 rates base. The accuracy assumed to prepare the CAPEX is $\pm 15\%$. The exchange rate applied to the CAPEX calculation was US\$ 1.00 = R\$ 2.00.

Table 2.7.3.a
Capital Cost

Description	US\$ 000
Mine Development	6,884
Mine	13,216
Subtotal	20,100
Plant & Infrastructure	150,304
Taxes	25,002
Subtotal	175,306
Total	195,406

2.8

Operation and Maintenance

2.8.1

Workforce

After completion of the PROJECT ARRAIAS construction phase, the Project's operation will generate 389 direct jobs, among which 115 will be destined to mining activities and 274 to industrial activities. The Project will operate 24 hours a day in 3 shifts of 8 hours both for mining and industrial activities. During Operation, it is expected that 70% of the workforce will be comprised of local workers.

During the project's operation phase, approximately 300 indirect jobs will be created, related to the following activities: transportation, food preparation and distribution, energy generation and distribution and support-related business.

The required number of hourly labor personnel is 56 for the period preceding the beginning of production (preproduction). The maximum number of persons during commercial production is 158 in Year 11. Year 14 personnel requirements are significantly smaller due to reduction of pit operations.

Tables 2.8.1.a and **2.8.1.b** below show the Mine Personnel Deployment Schedule and Industrial Operations Personnel Deployment Schedule, respectively, for a 15-year operation period.

Table 2.8.1.a

Mine Personnel Deployment Schedule

Year	p	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total	72	119	113	128	151	176	171	167	185	171	150	190	170	144	113	75

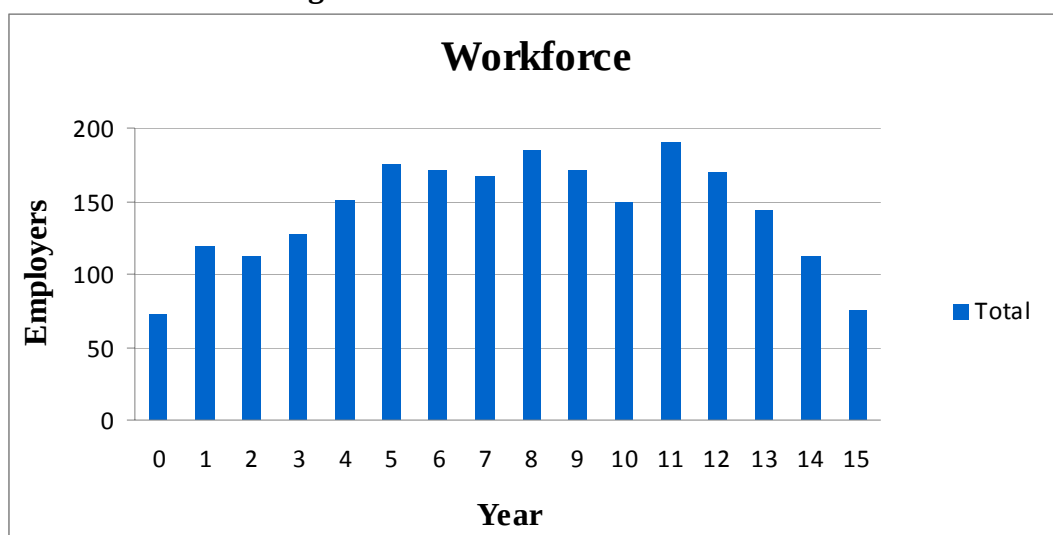
Table 2.8.1.a

Industrial Operations Personnel Deployment Schedule

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350

Figure 2.8.1a

Mine Workforce Histogram.



Employee hiring procedures will comply with Brazilian worker's legislation regulations (CLT). Workers will be hired for "indefinite period contracts" (as defined in **Section 2.7.1**, above), as defined in the CLT. Itafós work contracts will also comply with collective negotiation agreements established between the Project Company and the respective workers' union as per the requirements of IFC Performance Standard 2.

Itafós will require Outsourced companies to follow the guidelines in its Conduct Code and its Environment, Health and Safety standards. Outsourced companies' agreement to these guidelines will be registered in a document to be annexed to the Service Contract. Auditing that these are followed by outsourced companies will be done by Itafós.

2.9

Transmission Line

CELTINS (Centrais Elétricas de Tocantins) will install a new high voltage transmission line which will supply the Project's energy requirements. This transmission line is not a dedicated facility to the project, and its implantation is planned to improve the Power availability for all the Southeast Tocantins state..

The referred high voltage transmission line will supply power to the industrial facilities to the main substation at 69 kV. From the main substation, more substations will be supplied at 13.8 kV.

ITAFÓS will request electricity grid connection to Celtins, the energy distribution utility company in the state of Tocantins.

As the Project is located in the municipality of Arraias, it will be part of the Dianópolis Regional Service Centre (Centro Regional de Serviço - CRS). The transmission line design and its licensing and construction procedures shall be fully developed by Celtins.