# NI 43-101 Pre-Feasibility Technical Report Cerrado Verde Project, Minas Gerais, Brazil

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#### **Report Prepared for**

Verde Agritech Plc Salatin House 19 Cedar Road Sutton, Surrey, UK SM2 5DA

#### **Report Prepared by:**

BNA Consultoria e Sistemas Rua Desembargador Leão Starling, 200 31.310-370 Belo Horizonte, MG, Brazil

Andes Mining Services Ltd. Av. Diagonal 550, Int. 203, Miraflores, Lima, Peru

#### Signed by QPs:

Beck Nader, D.Sc., M.Sc., MAIG Bradley Ackroyd, B.Sc. (Geo), MAIG

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## 1. Summary

#### 1.1 Introduction

Verde Agritech PLC (VERDE or the Company) commissioned BNA Consultoria e Sistemas (BNA) to prepare a Technical Report compliant with Canadian National Instrument 43-101 (NI 43-101) for a Pre-Feasibility Study (PFS) of the Cerrado Verde Project (or the Project) located in Brazil.

The contract allows VERDE to file this report as a Technical Report with the Canadian Securities regulatory authorities pursuant to NI 43-101, Standards of Disclosure for Mineral Projects. Except for the purposes legislated under provincial securities law, any other uses of this report by any third party is done so at that party's sole risk. The responsibility for any disclosure remains with VERDE. The user of this document should ensure that this is the most recent Technical Report for the property, as it is not to be considered valid if a new Technical Report has been issued.

This report provides mineral resource and mineral reserve estimates, and a classification of resources and reserves in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum Standards on Mineral Resources and Reserves: Definitions and Guidelines, May 10, 2014 (CIM).

This PFS follows the PFS completed by Amec Americas Limited (AMEC), NCL Ingeniera y Construccion SpA (NCL) and Andes Mining Services Limited (AMS) (March 31, 2014), and contains changes to the Project's mineral classification (from glauconitic meta-argillite to glauconitic siltstone), without modifying the mineral resource classification. Moreover, the reserves and economic assessment were updated due to a change in the product to be produced (ThermoPotash to Super Greensand®).

Super Greensand® is a multi-nutrient fertilizer product that has been studied since 2009 by the Company in partnership with specialists in Brazil and abroad. Super Greensand® is an alternative to Potassium Chloride (KCI), which is a widely used fertilizer in Brazil. The country has only one KCI mine and therefore must import over 90% of what is used. Compared with KCI, which is not the most suitable product for tropical agriculture, Super Greensand® production has two great advantages: the rock has a high potassium grade (average of 10% K<sub>2</sub>O) and the Project is close to the largest agricultural region of the country, the Brazilian savannah (Cerrado). Super Greensand® is an alternative that may allow Brazil to decrease its dependence on potassium imports and is a more sustainable and appropriate fertilizer for tropical soils.

## 1.2 Property Description and Location

The Cerrado Verde Project is located in the Alto Paranaiba region of Minas Gerais State, Brazil, approximately 39 km to the east of the city of São Gotardo. São Gotardo is located approximately 320 km west of Belo Horizonte (the capital of the state of Minas Gerais) and is connected via a high-quality paved road (BR-262) (Figure 1.2-1). From São Gotardo, the Project area is accessed via secondary gravel roads which connect with the nearby farming region.

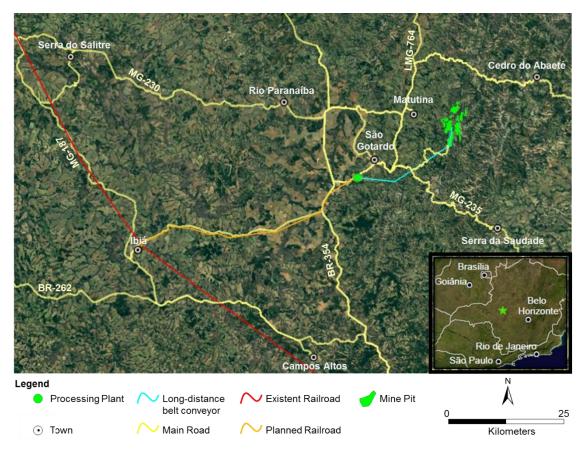


Figure 1.2-1: Map of the Cerrado Verde Project

The permit boundaries are defined by UTM coordinates with WGS84 datum (Zone 23S). The coordinates for a central point within the Cerrado Verde permits are: 7,856,500 N and 394,500 E.

The mineralized zones of the Cerrado Verde Project are composed of glauconitic siltstone units from the Serra da Saudade Formation, Bambuí Group. The known mineralization is located within the areas covered by the permits held by VERDE.

## 1.3 Permit Status and Ownership

The Cerrado Verde Project area comprises a total of 30 granted exploration permits covering an aggregate area of 52,274 ha and 3 additional areas covering 4,350 ha. An application has been submitted for a permit for these 3 additional areas.

VERDE owns 100% of the Project through its Brazilian subsidiary companies. There was no prior ownership of permits immediately prior to the submission of VERDE's applications. The Company has submitted the necessary applications to acquire the rights to explore the permits.

## 1.4 Geology and Mineralization

The Cerrado Verde Project region is mainly underlain by Neoproterozoic and Cretaceous rock units, which are partly covered by Cenozoic sandstones, lateritic sediments and soils.

The thickness of the glauconitic siltstone unit varies from 15 m to 80 m in the southernmost domain, to over 50 m in the northern half of the Serra da Saudade range.

VERDE's permits run for the entire 120 km strike length and reach a potential width of up to 500 m.

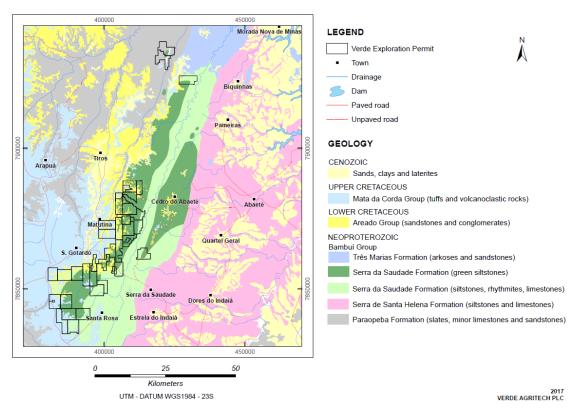


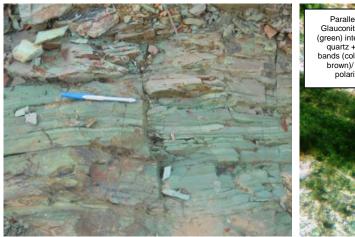
Figure 1.4-1 Cerrado Verde Regional Geological Setting (VERDE, March 31, 2014)

The previous Pre-Feasibility Study (March 2014) presented the Project's mineralization as a glauconitic meta-argillite. However, after performing detailed mineralogical studies using a combination of optical microscopy, X-ray diffraction, electron microprobe analysis and scanning electron microscopy, it was determined that the ore is a silty-clayed sedimentary rock. Despite the folds found in the outcrops, no minerals, metamorphic structures or evidence of deformation were identified in the thin sections. The natural fragmentation in the outcrops is due to the fractures and bedding surfaces. Therefore, the Project's mineralization is now referred to as a glauconitic siltstone. Despite this change in nomenclature, the Project's mineral resources were not affected, as the ore deposit is homogeneous in its glauconitic siltstone content.

The glauconitic siltstone unit shows millimeter- to centimeter-thick bands that are rich in glauconite, dark green in color and interbedded with quartz-rich layers.

Studies of thin cross sections conducted on fresh samples of glauconitic siltstone identified: glauconite (40%-80%), K-feldspar (10%-15%), quartz (10%-60%), muscovite-sericite (5%), biotite (2%), titanium oxide (<1%), manganese oxide (<1%), goethite (<1%), barium phosphate and rare-earth element phosphates (trace amounts).

Enriched levels of potassium with  $K_2O$  grades from 8% to 12% are associated with the glauconitic levels, which are dark-green in color.



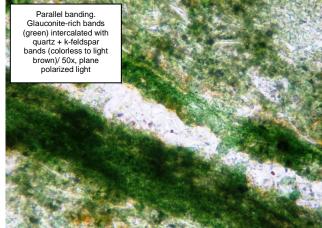


Figure 1.4-2 Siltstone Unit

Mineralized Glauconitic

Figure 1.4-3 Photomicrograph of sample CV DH 05 (32m - 34m)

## 1.5 Exploration and Drilling

Up until 2011, exploration work was focused on a number of glauconitic siltstone units across the Cerrado Verde permit areas, known as Target 1, Target 2, Target 3, Target 4, Target 5, Target 6, Target 7, Target 10, Target 11, Target 12, Target 13, Target 14, Target 16 and Target 17.

In 2012 exploration activities were concentrated on a select number of higher grade K<sub>2</sub>O targets. Four specific areas were chosen based on the preliminary K<sub>2</sub>O grades from exploration drilling: target areas 7, 10 and 12 were selected, in addition to a new area located within exploration permit number 830.383/2008, which was acquired by VERDE from a third party. Geological mapping suggests that these four target areas belong to a single glauconitic siltstone 'domain'. Subsequently, these 4 individual target areas were collectively grouped into a single target area known as Target 7.

A total of four drilling campaigns were completed across VERDE's exploration permits. VERDE drilled a total of 695 Reverse Circulation (RC) holes totaling 40,225 m and 25 diamond core (DC) holes totaling 1,717 m. Exploration drilling conducted throughout the 2012 field campaign focused entirely on testing K<sub>2</sub>O mineralization within the Target 7 mineralized domain.

#### 1.6 Mineral Resource Estimate

The Cerrado Verde Project mineral resource estimate is based on 435 drill holes (26,609 m) drilled at a nominal spacing of approximately 200 m by 200 m (Figure 1.6-1). A total of 420 reverse circulation drill holes (25,563 m) and 15 diamond drill holes (1,046 m) have been completed.

The mineral resource estimate has focused on a flat-lying, sub-horizontal mineralized domain which has been defined at the surface and drill tested to the depth of the mineralization using a nominal 6%  $K_2O$  grade cut-off to guide the wireframing process, as shown for Target 7 in Figure 1.6-1.

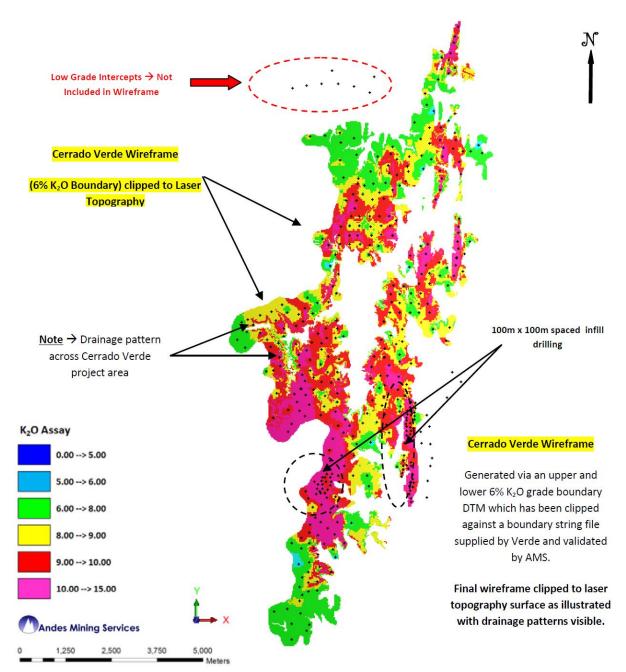


Figure 1.6-1: Cerrado Verde Block Model Target 7- Coded by K<sub>2</sub>O Grade (Estimate) (AMS, March 28, 2014)

A combined mineral resource statement that incorporates previously reported mineral resources completed by SRK Consulting (SRK) has been prepared for the Cerrado Verde Project. A combined measured and indicated mineral resource of 1,472 Mt at 9.28%  $K_2O$  (using a 7.5%  $K_2O$  cut-off) and an inferred mineral resource of 1,850 Mt at 8.60%  $K_2O$  (using a 7.5%  $K_2O$  cut-off grade) (Table 1.6-1) are reported for the Cerrado Verde Project.

The statement has been classified by Qualified Person Bradley Ackroyd (MAIG) in accordance with NI 43-101 and accompanying documents 43-101.F1 and 43-101.CP. It has an effective date of March 31, 2014.

Table 1.6-1 Cerrado Verde Project – Measured, Indicated and Inferred Mineral Resource Grade

**Tonnage Report (AMS & SRK Consulting)** 

Target	Cut-Off (% K₂O)	Tonnes (Mt)	Average Grade (% K <sub>2</sub> O)				
Measured Resource Category							
Target 7 7.5 83 10.1							
T	otal Measured	83	10.13				
	Indic	ated Resource Category	у				
Target 6	7.5	23	8.83				
Target 7	7.5	1,366	9.24				
7	otal Indicated	1,389	9.23				
Total M	easured & Indicated	1,472	9.28				
	Indic	ated Resource Category	У				
Target 1	7.5	236	8.72				
Target 2	7.5	12	8.54				
Target 3	7.5	126	8.72				
Target 4	7.5	147	9.03				
Target 5	7.5	27	8.31				
Target 6	7.5	48	8.84				
Target 7	7.5	305	8.89				
Target 11	7.5	47	8.27				
Target 13	7.5	168	8.50				
Target 14	7.5	325	8.65				
Target 16	7.5	257	8.15				
Target 17	7.5	151	8.19				
	Total Inferred	1,850	8.60				

Mineral resources are not mineral reserves and do not have demonstrated economic viability.

Effective Date of the mineral resource estimate is: March 31, 2014

#### 1.7 Mineral Reserve Estimate

BNA studied the Cerrado Verde Project as a conventional open pit operation, with the following characteristics:

- Both ore and waste mining will be performed using hydraulic excavators. As a precautionary measure, it has been assumed that 30% of the ore and 30% of the waste will be mined after a drilling and blasting operation;
- Loading and hauling operations, including equipment maintenance, will be conducted by a mining contractor.

A series of economic pit shells were calculated using the Lerchs-Grossman algorithm through the application of the Revenue Adjustment Factor (RAF). This factor is applied to the selling price(s) of the product(s), in such a manner that a mathematical pit is generated for each applied factor. The selection of a final pit shell for mine design was based on an NPV maximization strategy.

The Project was divided into three distinct phases, with their respective production rates and duration shown below:

- Phase 1: 600,000 t of final product per year, for the first 2 years;
- Phase 2: 5 Mt of final product per year, from year 3 to year 6;
- Phase 3: 25 Mt of final product per year for the remainder of the life of the mine.

The expected mass recovery is 100%.

The Mineral Resources are inclusive of the Mineral Reserves.

**Table 1.7-1 Mineable Reserve Results** 

	Proven Reserve	Probable Reserve	Total Reserve
Tonnes (Mt)	68.11	709.17	777.28
K₂O Grade (%)	10.34	9.72	9.78

<sup>(1)</sup> As of December 22, 2017.

- (2) A cutoff grade of 8.5% K<sub>2</sub>O was used to report reserves.
- (3) Overall strip ratio of 0.29 to 1.
- (4) Waste contains inferred resources, which have the potential to be upgraded to higher category resources, and possibly reserves, after sufficient definition work has been completed.
- (5) Based on 100% mining recovery.

## 1.8 Recovery Methods

The Project will consist of 3 phases with distinct processing rates: 600 Ktpy, 5 Mtpy and 25 Mtpy. The ore from the mine will have a top size of 500 mm.

The processing circuit consists of crushing, sifting and grinding stages, during all three phases, as depicted in Figure 1.8-1, Figure 1.8-2 and Figure 1.8-3, respectively.

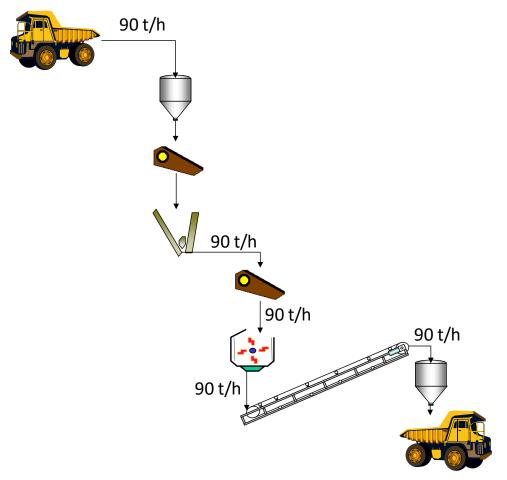


Figure 1.8-1 Simplified processing flowchart for Phase 1 (600 Ktpy)

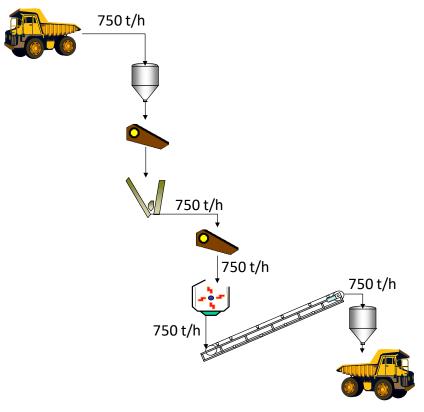


Figure 1.8-2 Simplified processing flowchart for Phase 2 (5 Mtpy)

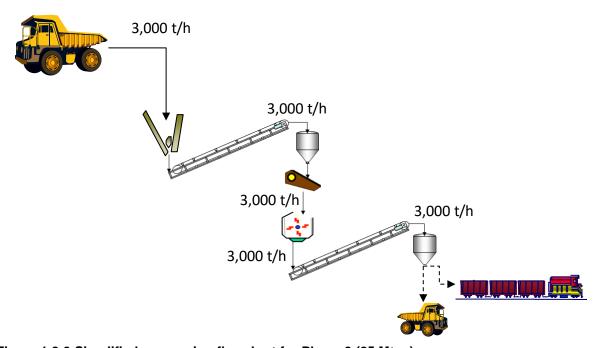


Figure 1.8-3 Simplified processing flowchart for Phase 3 (25 Mtpy)

## 1.9 Market Study

The Market Study evaluates the market in Brazil for Super Greensand<sup>®</sup>. Super Greensand is the commercial name given by the Company to the ore (glauconitic siltstone) mined at the Cerrado Verde project.

A conservative methodology was chosen when estimating the product price and market.

First, the Product was priced exclusively based on its potassium content. No additional value was given to the several other nutrients the product supplies.

Second, the Product's potassium content was valued based on the cost of potassium from the market's cheapest source of potassium, KCI. There are other sources of potassium such as Nitrate of Potash and Sulfate of Potash which are sold at a premium to KCI because they don't contain chloride. Super Greensand also doesn't contain chloride, but no additional value was charged for this benefit.

Third, the price for KCI, CFR Brazil port, adopted for the study was the lowest found among independent analysts - \$250. The average delivered cost for KCI from the port to the farmer was calculated at US\$346.00.

Fourth, US\$346.00 was divided by 6 in order to account for the fact that the concentration of potassium in Super Greensand 6 times lower. KCl is 60%  $K_2O$ , while Super Greensand is 10%  $K_2O$ . As a result, farmers will pay US\$57.67 per tonne of Super Greensand, meaning they will continue spending the same amount on potash as if they were buying KCl.

Targeted markets, planted area and the K<sub>2</sub>O demand per state in 2016 were the parameters selected to determine the FOB price for Super Greensand<sup>®</sup> during each phase of the Project. Assuming a given market share for each phase, it was possible to define the sales volumes in each mesoregion and, based on these, calculate the weighted average FOB price. The average FOB prices for each phase are:

- Phase 1: US\$38.15;
- Phase 2 US\$35.17;
- Phase 3 US\$25.10.

#### 1.10 Indicative Economics

As part of the verification process for the reserves presented in this report, BNA conducted an economic valuation of the Cerrado Verde Project for the material classified as reserves. This section outlines the capital and operating costs considered in this valuation. All costs are based on a conversion rate of US\$1.00 = R\$3.28.

The total capital cost for the Project (with a nominal accuracy of -25% to +25% and including a 15% contingency) is estimated at US\$369.59 million. Table 1.10-1 shows the CAPEX summary for all Project Phases.

Table 1 10-1	CAPEX	Summary for	all Project	Phases
I able 1.10-1	CALLY	Sullilliai v 101	all Fluicu	LFIIASES

December 1	In	Investment (US\$x1,000)					
Description	Phase 1	Phase 2	Phase 3				
Processing							
Plant	1,267	8,397	16,687				
Belt Conveyor	82	324	126,831				
Processing Total	1,349	8,721	143,518				
Road Improvement	884	5,258	-				
Railway Branch Line	-	-	145,427				
Owner's Cost	478	933	14,815				
Subtotal 1	2,710.45	14,911.29	303,759.71				

Description.		Investment (US\$x1,000)				
Description		Phase 1	Phase 2	Phase 3		
Contingency	15%	406.57	2,236.69	45,563.95		
TOTAL CAPEX		3,117.02	17,147.98	349,323.67		

Operating costs are estimated based on preliminary mine and process design criteria and engineering, as well as budgetary quotes. Operating costs are calculated to a PFS-level of accuracy and are expected to have an accuracy of  $\pm 25\%$ , including a 15% contingency. Table 1.10-2 summarizes the operating costs for the Project over the first 10 years.

**Table 1.10-2 Annual Operating Costs** 

Decerintian		Annual Operating Costs (US\$x1,000)								
Description	1	2	3	4	5	6	7	8	9	10
A – Mining Labor	543	543	777	777	777	777	1,495	1,495	1,495	1,495
B – Mining Operation	5,004	5,312	18,871	19,208	18,236	17,678	125,369	117,321	121,653	121,653
C – Environmental Recovery	97	97	800	796	800	797	3,978	3,974	4,084	4,084
D - Processing	1,769	1,775	7,247	7,211	7,250	7,215	27,697	27,669	28,437	28,437
E - G&A	323	324	2,667	2,654	2,668	2,655	13,261	13,247	13,615	13,615
F - Environmental Compensation	121	121	121	121	121	121	121	121	121	121
G - Support Facility Maintenance	150	150	1,246	1,246	1,246	1,246	6,256	6,256	6,256	6,256
Subtotal	7,857	8,172	30,483	30,768	29,852	29,243	171,922	163,827	169,405	169,405
. Contingency (15%)	1,179	1,226	4,572	4,615	4,478	4,386	25,788	24,574	25,411	25,411
TOTAL OPERATING COST	9,035	9,398	35,056	35,383	34,330	33,629	197,710	188,402	194,816	194,816
H- Unit Cost <sup>1</sup>		•	•		•	•	•	•	•	•
. ROM	14.00	14.52	6.57	6.67	6.43	6.33	7.45	7.11	7.15	7.15
. TOTAL (ore+waste)	13.31	11.68	5.66	5.81	5.95	6.03	4.89	5.25	5.92	5.92

<sup>1.</sup> The Unit Cost for the ROM is given by the total operating cost divided by the produced ROM tonnage, while the Total Unit cost is given by the total operating cost divided by the sum of both ROM and Waste produced tonnes. Since the operational cost for the waste is smaller than the operational cost for the ROM, the Total Unit cost is smaller than the ROM Unit cost.

An economic-financial analysis was conducted in order to evaluate the feasibility of the Project. The economic-financial analysis showed that the Project presents attractive results, with an average cashflow (EBTIDA) corresponding to approximately 71% of the Project's gross revenue during the first 10 years and an NPV, discounted to 8% per year, of 1.99 billion dollars.

The Project's IRR corresponds to 287% of the Project's total CAPEX.

#### 1.11 Conclusions and Recommendations

An update to the 2014 Pre-Feasibility evaluations has been completed for VERDE's Cerrado Verde Project in São Gotardo, Minas Gerais, Brazil. The results of the study indicate that the Super Greensand® can be produced in the desired purity and that there is demand in the market in its use as a fertilizer.

The financial results for the project justify advancing and refining the pre-feasibility engineering designs to the feasibility level within the next 12 to 18 months. BNA recommends that VERDE conduct the following activities:

- A geotechnical study to evaluate the stability of the final pit and waste piles;
- Evaluation of the impact of the waste piles, located inside the exhausted pits, on the remaining mineral resource;
- Trade-off studies focused on new relocations for the primary crusher and expansion of the belt conveyor aimed at reducing the hauling cost;
- Extension of the existing hydrogeological study to cover the entire Project area;
- A detailed study of the inclusion of the blasting operation for both ore and waste mining;
- Detailed study of the pit's external accesses, to minimize the hauling distances and the amount of cut and fill required for their construction, considering the rugged relief of the region;
- Detailed quotes for the execution of the mining activities in Phase 1;
- An evaluation of the use of road trucks with trailers for ore haulage in Phase 1 in order to reduce hauling costs

Additional elements of the recommended work program include environmental permit application support, marketing studies; more comprehensive metallurgical testing; and a more detailed evaluation of process equipment and infrastructure.

AMS recommends that VERDE re-assay the pulp residues from previous drilling in the glauconitic siltstone unit in order to roughly determine the overall quantity of exploitable Lithium.

The cost of the recommended work programs is estimated at US\$4.96 million, as shown in Table 1.11-1.

	Table 1.11-1	Definitive	Feasibility	<b>∕ Stud</b>	y Work Program
--	--------------	------------	-------------	---------------	----------------

Activity	Total (US\$ x 1,000)
Engineering Studies	3,125
Administration	375
Geotechnical Drilling	177
Environmental Studies	278
Exploration (Lithium)	1,000
Total	4,957

### 2. Introduction

### 2.1. Terms of Reference and Purpose of the Report

Verde Agritech PLC (VERDE or the Company) commissioned BNA Consultoria e Sistemas (BNA) to prepare a Technical Report compliant with Canadian National Instrument 43-101 (NI 43-101) for a Pre-Feasibility Study (PFS) of the Cerrado Verde Project (Cerrado Verde Project or the Project) located in Brazil. The quality of information, conclusions, and estimates contained herein are consistent with the level of effort involved in the Consultant's services, based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This report is intended for use by VERDE subject to the terms and conditions of its contract with the Consultant's and relevant securities legislation. The contract permits VERDE to file this report as a Technical Report with Canadian Securities regulatory authorities pursuant to NI 43-101, Standards of Disclosure for Mineral Projects. Except for the purposes legislated under provincial securities law, any other uses of this report by any third party is at that party's sole risk. The responsibility for this disclosure remains with VERDE. The user of this document should ensure that this is the most recent Technical Report for the property as it is not valid if a new Technical Report has been issued.

This report provides Mineral Resource and Mineral Reserve estimates, and a classification of resources and reserves in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum Standards on Mineral Resources and Reserves: Definitions and Guidelines, May 10, 2014 (CIM).

The Verde AgriTech PLC Group is an English company listed on the Canadian Stock Exchange, since 2007, and on the OTCQB Venture Market in the United States (U.S.) since 2017. The Group's corporate tree (Figure 2.1-1) comprises the companies Verde Fertilizantes and FVS Mineração Ltda, headquartered in Brazil, and Verde AgriTech PLC and GB01N Limited, headquartered in England.

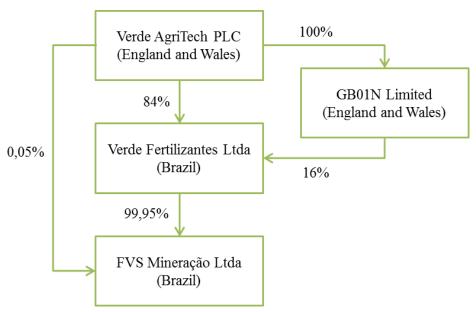


Figure 2.1-1: Verde AgriTech PLC Group's corporate tree (VERDE, October 2017)

This PFS follows the PFS completed by Amec Americas Limited (AMEC), NCL Ingeniera y Construccion SpA (NCL) and Andes Mining Services Limited (AMS) (March 31, 2014), and contains changes to the Project's mineral classification (from glauconitic meta-argillite to glauconitic siltstone), without modifying the mineral resource classification. Moreover, the reserves and economic

assessment were updated due to a change in the product to be produced (ThermoPotash to Super Greensand®).

Super Greensand® is a multi-nutrient fertilizer product that has been studied since 2009 by the Company in partnership with specialists in Brazil and abroad. Super Greensand® is an alternative to Potassium Chloride (KCl), which is a widely used input in agriculture in Brazil. The country has only one KCl mine and therefore must import over 90% of what is used. Compared with KCl, which is not the most suitable product for tropical agriculture, Super Greensand® production has two great advantages: the rock has a high potassium grade (average of 10% K<sub>2</sub>O) and the Project is close to the largest agricultural region of the country, the Brazilian savannah (Cerrado). Super Greensand® is an alternative that may allow Brazil to decrease its dependence on potassium imports and is a more sustainable and appropriate input for tropical soils.

#### 2.2. Qualifications of Consultants

The Consultants preparing this technical report are specialists in the fields of geology, exploration, mineral resource and mineral reserve estimation and classification, mining, geotechnical, environmental, permitting, metallurgical testing, mineral processing, processing design, capital and operating cost estimation, and mineral economics.

The following individuals, by virtue of their education, experience and professional association, are considered Qualified Person (QP) as defined in the NI 43-101 standard, for this report, and are members in good standing of appropriate professional institutions.

- Bradley Ackroyd. B.Sc., MAIG, principal consulting geologist for AMS, responsible for the resource estimates;
- Beck Nader. D.Sc., M.Sc., MAIG, Senior Advisor at BNA, responsible for the reserve estimates, processing and economical assessment.

The Certificate of Author forms are provided in Section 30.

The responsibilities of the QPs during the preparation of the different sections of this Technical Report are shown in Table 2.2-1.

**Table 2.2-1 Authors Responsibilities** 

Author	Responsible for Preparation of Section/s			
Beck Nader	1. Summary; 2. Introduction; 3. Reliance on Other Experts; 6. History; 13. Mineral Processing and Metallurgical Testing; 15. Mineral Reserve Estimates; 16. Mining Methods; 17. Recovery Methods; 18. Project Infrastructure; 19. Market Studies and Contracts; 20. Environmental Studies, Permitting and Social or Community Impact; 21. Capital and Operating Costs; 22. Economic Analysis; 23. Adjacent Properties; 24. Other Relevant Data and Information; 25. Interpretation and Conclusions; 26. Recommendations; 27. References			
Bradley Ackroyd	4. Property Description and Location; 5. Accessibility, Climate, Local Resources, Infrastructure and Physiography; ; 7. Geological Setting and Mineralization; 8. Deposit Types; 9. Exploration; 10. Drilling; 11. Sample Preparation, Analyses and Security; 12. Data Verification; 14. Mineral Resource Estimates; 26. Recommendations; 27. References			

Other consultants who contributed to this report, including review of the Cerrado Verde Project Pre-Feasibility Study included:

Hudson Burgarelli. M.Sc., Mining Engineer at BNA;

- Laís Nametala, M.Sc., Mining Engineer at BNA;
- Luis Antonio Camilotti, Engineer at MINALAC.

None of the Consultants or any associates employed in the preparation of this report has any beneficial interest in VERDE. The Consultants are not insiders, associates, or affiliates of VERDE. The results of this Technical Report are not dependent upon any prior agreements concerning the conclusions to be reached, nor are there any undisclosed understandings concerning any future business dealings between VERDE and the Consultants. The Consultants are being paid a fee for their work in accordance with normal professional consulting practice.

#### 2.3. Details of Inspection

Mr. Bradley Ackroyd visited the Project most recently between 7<sup>th</sup> and 10<sup>th</sup> of August 2012. There have been no material changes in site conditions since Mr. Ackroyd's most recent site visit.

Dr. Nader visited the site in November 10, 2017. During the site visit, Dr. Nader inspected the general location of the property, site conditions, the major infrastructure and current mining and processing operations.

#### 2.4. Sources of Information

Information used to support this Technical Report was derived from previous technical reports on the property, and from the reports and documents listed in the References section of this Technical Report.

BNA has used information primarily provided by VERDE or its consultants to prepare this prefeasibility study. VERDE provided market studies information. Capital and operating costs in the technical economic model are based on data provided by VERDE and/or their consultants, as well as all the processing information.

**Mineral Resources:** The mineral resource estimates included in this report were prepared by Mr. Bradley Ackroyd of Andes Mining Services (AMS), an independent consulting firm. Mr. Ackroyd is the principal consulting geologist for AMS with 11 years of experience in exploration and mining geology. Mr. Ackroyd is also a Member of the Australian Institute of Geosciences (MAIG). Mr. Ackroyd visited the site in 2012, between August 7 and August 10.

#### 2.5. Effective Date

The effective date of this report is December 22, 2017.

The effective date of the Cerrado Verde mineral resources is March 31, 2014.

There were no material changes to the information on the Project between the effective date and the signature date of the Technical Report.

#### 2.6. Units of Measure

The Metric System for weights and units has been used throughout this report, unless noted otherwise. All currency is in U.S. dollars (US\$) unless otherwise stated, and all geographical coordinates in UTM, WGS1984, zone 23S.

## 3. Reliance on Other Experts

The Consultants' opinion contained herein is based on information provided by VERDE throughout the course of the investigations. The sources of information include data and reports supplied by VERDE personnel as well as documents referenced in Section 27. The Consultants have relied upon the work of other consultants in the Project areas in support of this Technical Report.

VERDE has warranted to the authors that the information provided for preparation of this report correctly represents all material information relevant to the Cerrado Verde Project. VERDE has taken reasonable measures to ensure that permits to its properties are in good standing.

The Consultants used their experience to determine if the information from previous reports was suitable for inclusion in this Technical Report and adjusted information that required amending. The QP Beck Nader has examined the data for the Project provided by VERDE, and has relied upon that basic data to support the statements and opinions presented in this Technical Report. In the opinion of the QP, the data is present in sufficient detail, is credible and verifiable in the field, and is an accurate representation of the Project.

This report includes technical information that requires subsequent calculations to derive sub-totals, totals, and weighted averages. Such calculations inherently involve a degree of rounding and consequently can introduce a margin of error. Where these rounding errors occur, they are not considered to be material.

The authors have relied upon the work of others to describe the geology, exploration, mining operational expenditure (quotations from: U&M – U&M Mineração e Construção S/A and KS Terraplenagem e Serviços), hydrogeology (MDGEO Hidrogeologia e Meio Ambiente), geotechnical parameters to define the pit slopes (Consórcio Mineiro de Engenheiros Consultores Ltda) waste pile geometric parameters (Solosconsult Engineering) and all processing subjects (Luis Antonio Camilotti, from MINALAC). They also relied on a previously published PFS prepared by AMEC Americas Limited (AMEC), NCL Ingeniera y Construccion SpA (NCL) and Andes Mining Services Limited (AMS) in 2014 to validate the resources of the Project.

The QP for this Technical Report confirms that VERDE has completed a market study for its products which includes ongoing sales of Super Greensand<sup>®</sup>.

The QP also confirms that the process facility is capable of producing Super Greensand®.

## 4. Property Description and Location

### 4.1. Project Location

The Cerrado Verde Project is located in the Alto Paranaiba region of Minas Gerais State, Brazil, approximately 39 km to the east of the city of São Gotardo. São Gotardo is located approximately 320 km west of Belo Horizonte (the capital of the state of Minas Gerais) and is connected via a high-quality paved road (BR-262) (Figure 4.1-1). From São Gotardo, the Project area is accessed via secondary gravel roads which connect with the nearby farming region.

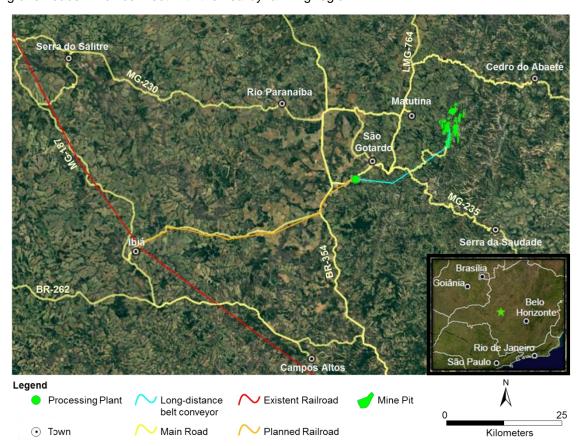


Figure 4.1-1: Location Map of the Cerrado Verde Project

The permit boundaries are defined by UTM coordinates with WGS84 datum (Zone 23S). The coordinates for a central point within the Cerrado Verde permits are: 7,856,500 N and 394,500 E.

The mineralized zones of the Cerrado Verde Project are composed of glauconitic siltstone units from the Serra da Saudade Formation, Bambuí Group. The known mineralization is located within the areas covered by the permits held by VERDE.

#### 4.2. Permit Status

The Cerrado Verde Project area comprises a total of 30 granted exploration permits covering an aggregate area of 52,274 ha and 3 additional areas covering 4,350 ha, as shown below in Figure 4.2-1 and Table 4.2-1.

The permits are owned by VERDE via their subsidiary companies Verde Fertilizantes Ltda and FVS Mineração Ltda.

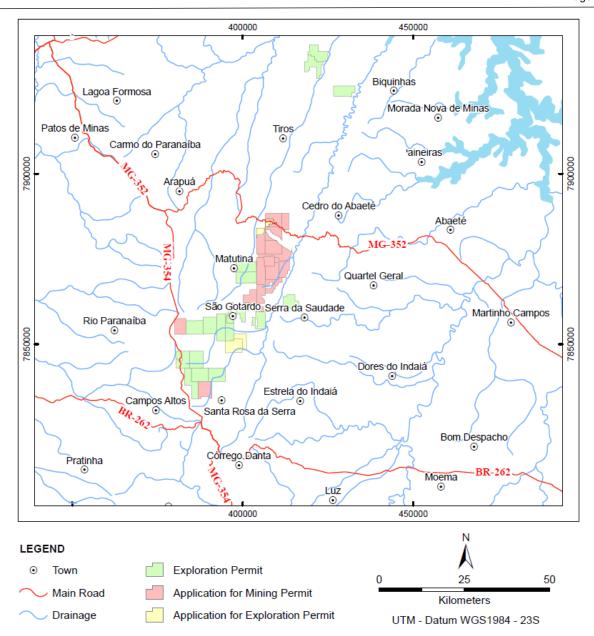


Figure 4.2-1: VERDE Permits - Cerrado Verde Project (VERDE, October 2017)

Table 4.2-1 Summary of VERDE Permits (VERDE, November 10, 2017)

Table 4.2-1 Summary of VERDE Permits (VERDE, November 10, 2017)						
Permit Number	Area (Ha)	Owner	Status of Mining Right			
			Application for mining permit filed on 06/07/2013			
830383/2008	900	VERDE	Mining permit for 20 Ktpy approved on 02/09/2017, valid			
			until 02/09/2021			
830402/2011	945.16	VERDE	Application for exploration permit filed on 02/11/2011			
830404/2011	1,856.44	VERDE	Application for exploration permit filed on 02/11/2011			
830406/2010	1,548.73	VERDE	Application for mining permit filed on 07/14/2017			
830794/2010	1,857.56	VERDE	Final exploration report filed on 04/02/2013			
830796/2010	1,923.57	VERDE	Final exploration report filed on 04/02/2013			
830947/2011	1,895.73	VERDE	Final exploration report filed on 09/24/2012			
831025/2010	1,853.68	VERDE	Application for mining permit filed on 07/14/2017			
831038/2013	1,274.5	VERDE	Application for exploration permit filed on 04/10/2013			
833257/2008	1,993.84	FVS	Final exploration report filed on 08/22/2012			
833259/2008	1,476.58	FVS	Final exploration report filed on 08/22/2012			

Permit Number	Area (Ha)	Owner	Status of Mining Right
833263/2008	1,844.23	FVS	Final exploration report approved on 04/16/2013
833264/2008	1,511.58	FVS	Final exploration report filed on 08/22/2012
833268/2008	966.82	FVS	Final exploration report approved on 04/16/2013
833270/2008	1,991.78	FVS	Application for mining permit filed on 06/07/2013
833272/2008	1,587.61	FVS	Final exploration report approved on 02/04/2013
833274/2008	1,994.84	FVS	Final exploration report filed on 08/22/2012
833276/2008	1,334.71	FVS	Final exploration report approved on 04/16/2013
833277/2008	1,992.24	FVS	Final exploration report filed on 08/22/2012
833280/2008	1,742.04	FVS	Final exploration report approved on 07/04/2013
	1,928.55	FVS	Application for mining permit filed on 06/07/2013
833289/2008			Economic Development Plan (PAE) approved on
			08/31/2015
			(DNPM requested the Environmental License)
833295/2008	1,571.46	FVS	Application for mining permit filed on 06/07/2013
833305/2008	1,555.92	FVS	Final exploration report filed on 08/22/2012
833306/2008	1,712.36	FVS	Application for mining permit filed on 06/07/2013
833311/2008	1,993.88	FVS	Final exploration report filed on 08/22/2012
833315/2008	1,992.07	FVS	Final exploration report filed on 08/22/2012
833316/2008	1,994.21	FVS	Final exploration report filed on 08/22/2012
833322/2008	1,992.7	FVS	Final exploration report filed on 08/22/2012
833323/2008	1,536.42	FVS	Application for mining permit filed on 06/07/2013
833324/2008	1,932.31	FVS	Application for mining permit filed on 07/14/2017
833326/2008	1,920.21	FVS	Application for mining permit filed on 07/14/2017
833648/2008	1,784.49	FVS	Final exploration report filed on 11/29/2012
833945/2013	743.54	VERDE	Application for exploration permit filed on 12/18/2011

The boundaries of the permits have not been surveyed because this is not a requirement of Brazil's mining code.

VERDE applied for the mineral permits directly to the National Department of Mineral Production (DNPM). There was no prior ownership of mineral rights immediately prior to VERDE's applications. The areas were available, and VERDE made the necessary applications. The only exception is for the exploration permit number 830.383/2008, which was acquired by VERDE from a prior ownership.

Permits are granted by the DNPM for a period of three years and are renewable for additional three years. Prior to the expiry date of the exploration permit, the holder must prepare and submit a final exploration report. DNPM has approved the technical report for mineral permits that include the entirety of the Cerrado Verde mine pit. The approval of the exploration report allows the Company to submit the Application for Mining Permit (Requerimento de Lavra) and the Economic Development Plan (Plano de Aproveitamento Econômico – (PAE)). VERDE has filed the Application for Mining Permit with the respective PAE for the entirety of the Cerrado Verde Project site (15 mineral permits), totaling an area of 24,371 ha. These permits encompass the entire Cerrado Verde Project pit area, which corresponds to 1,524 ha.

## 4.3. Agreements and Encumbrances

#### 4.3.1. Finder's Fee

VERDE entered into a discovery contract (Finder's Fee) dated September 29, 2008 (with a retroactive term beginning on July 26, 2008) with Ysao Munemassa (Ysao) pursuant to which Ysao performed, at VERDE's expense, preliminary geological surveys and research studies on the Cerrado Verde Project.

The Cerrado Verde Project Discovery Contract was subsequently amended on July 27, 2010 establishing that VERDE shall pay to Ysao:

- 100,000 Stock Options one year after the application for exploration permits for the Cerrado Verde Project area are filed with the DNPM; (PAID)
- US\$500,000.00 upon approval of a bankable feasibility study, and
- a 3% royalty on the net smelter return.

VERDE has the right to purchase the royalties due to Ysao at a cost of US\$1,000,000.00 for each 1% of the protected right of royalty owed to Ysao.

#### 4.3.2. 830.383/2008

On March 30, 2012, the Company prepared and signed a contract for the full transfer of the mining permits related to exploration permit number 830.383/2008 (830.383/2008). In addition to the transfer of mining permits, the contract established VERDE's right of first refusal to acquire the farm within 5 years after the signing of the contract. A payment was made in the amount of R\$50,000.00 (approximately US\$15,243.90) and a royalty of US\$0.03 per tonne of mined ore will be due if a mine is operated in this area.

#### 4.3.3. Fragata

On October 4, 2016, the Company prepared and signed a private agreement by means of a *Guia de Utilização* (a document that allows the extraction of mineral resources in a titled area, prior to the granting of the mining permit, based on technical, environmental and market criteria, with prior authorization from DNPM) related to DNPM permit number 830.383/2008, allowing the extraction of up to 100,000 t of ore.

A royalty of US\$0.06 per tonne of mined ore will be due for extraction of between 0 and 20,000 t in this area. If the extraction is between 20,000 t and 100,000 t, the royalty increases to US\$0.11 per tonne.

On April 19, 2017, the Company obtained an exploitation consent from DNPM through a *Guia de Utilização*, allowing VERDE to mine 20 Ktpy until February 9, 2021. An application to increase annual production to 50,000 t was submitted to DNPM for analysis on May 10, 2017.

#### 4.3.4. Selado

VERDE signed a lease for a property with a 51 Mt ore reserve (Fazenda Selado), on May 22, 2014. The payments resulting from this agreement are listed below:

- Construction of a house;
- US\$3,048.78 (R\$10,000.00) for renovation of the existing house;
- Monthly income for the occupants: four Brazilian minimum salaries (US\$1,142.68) (to begin following signature of the agreement);
- US\$4,573.17 (R\$15,000.00) per effectively impacted hectare, due when the impact effectively occurs. The maximum impacted area is 35 ha.

#### 4.3.5. Confusão

The Company has signed a private agreement by means of a *Guia de Utilização* related to DNPM permit number 833.264/2008. A royalty of US\$0.15 per tonne of mined ore will be due if there is any

extraction in this area. A mining permit application will be submitted to the DNPM for analysis in January of 2018.

#### 4.3.6. Londônia

The Company signed a private agreement through a *Guia de Utilização* related to DNPM permit number 833.263/2008. A royalty of US\$0.15 per tonne of mined ore will be due if there is any extraction in this area. A mining permit application will be submitted to the DNPM for analysis in January of 2018.

#### 4.4. Taxes and Royalties

In Brazil, the DNPM monitors exploration, mining, and mineral processing. This regulatory body also administers mineral exploration permits and mining concessions. Mineral exploration permits are issued by DNPM and mining concessions by the Ministry of Mines and Energy.

Exploration permits are granted for a maximum period of three years. As prerequisite, the applicant must provide all requirements and evidence that the area of interest does not overlap with an existing permit. The permit tax should be paid to the Brazilian government up to the delivery of the final exploration report or while the authorization is valid. Exploration permits can be extended for a second period no longer than three years. DNPM has discretion of whether to grant the requested renewal.

A mining concession carries a royalty payment obligation to the federal government, the Financial Compensation for the Exploitation of Mineral Resources (CFEM), which is established at 2% of the gross sales price of the mineral product, less taxes levied on its sale.

#### 4.5. Environmental Liabilities and Permitting

The authors are unaware of any environmental liabilities to which the Cerrado Verde Project is subject.

Environmental regulations and general environmental rules and obligations in Brazil are relatively similar to those applicable in Canada. The Brazilian environmental policy is the responsibility of the Ministry of the Environment and is executed at three levels: federal, state, and municipal. VERDE intends to file an Environmental Impact Assessment and associated documentation required to advance the whole Project from exploration to the exploitation phase.

## 4.6. Other Significant Factors and Risks

There are no other risks or significant factors known at this time that may affect access, title, or the right or ability to form work on the Project.

# 5. Accessibility, Climate, Local Resources, Infrastructure and Physiography

## 5.1. Topography, Elevation and Vegetation

The peneplain developed by the glauconitic siltstone unit, i.e., the ground over which the Areado Group was deposited, undulates between an altitude of 850 m and 1,000 m. Higher elevations of peneplain development are found in the more southern parts of the Serra da Saudade range. In the middle portion of the Serra da Saudade range (location of Cerrado Verde Project), the peneplain is placed between 880 m and 920 m. Therefore, it is reasonable to infer that all of the surface exposures of the glauconitic siltstone unit were the result of the Tertiary erosion cycles that stripped off the Mesozoic rocks (Mata da Corda and Areado groups) (Figure 5.1-1).

The local vegetation consists of primitive savannah (*cerrado*) relicts, still preserved between subsistence plantations and familiar livestock.



Figure 5.1-1 Panoramic View Looking across the Cerrado Verde Project Area

## 5.2. Climate and Length of Operating Season

The climate of the region is classified, according to the Brazilian Institute of Geography and Statistics (IBGE) annual report in 2002, as half-humid warm tropical, with average annual temperatures of 22 °C. Annual rainfall in the area averages between 1,300 mm and 1,800 mm, 84% of which falls during the rainy season between October and March, with the highest rainfall between December and January. Exploration and mining operations can be conducted year-round.

## 5.3. Physiography

Cerrado Verde Project is located within the hydrographic basin of Indaiá River, a tributary river on the left-hand margin of the São Francisco River. According to Secretaria do Estado de Ciência e Tecnologia de Minas Gerais (SECTES, 1938), the Indaiá River basin is part of the geomorphological unit known as São Francisco Plateau, where the edges of the hills and the crest points dip towards the NE with high structural controls (COSTA-FILHO et al, 2007).

The main drainages in the Cerrado Verde region are the rivers Indaiá, Abaeté, Borrachudo and its tributaries. These rivers have meandering channel style morphology with predominantly dendritic drainage patterns evident in areas where pelitic rocks dominate. To the north of the Project is the Três Marias Dam, which constitutes the main confluence point of the rivers in the region.

The main topographic feature across the Cerrado Verde region is the Serra da Saudade ridge. The landscape can be separated into three domains that may be correlated to typical South American surfaces as defined by King (1956):

- Upper Surface: Older stage of the group that has exposed the Areado Group Sandstones and Mata da Corda Group;
- Intermediate Surface: Refers to the second stage of the group after the dissection of the
  Upper Surface (triggered by the resumption of the erosive process). The average altitude of
  the intermediate surface is 750 m to 850 m ASL. The intermediate surface presents itself as
  an irregular surface which stretches along a N-S strike and is developed over the Serra da
  Saudade Formation, represented by psammitic lithotypes; and
- Basal Surface: the youngest, bordering the São Francisco River, with elevation ranging from 570 m to 630 m. Exposure occurs in pelites of the Serra de Santa Helena and Serra da Saudade formations.



Figure 5.3-1 Panoramic View Looking across the Cerrado Verde Project Area (August 2012)

## 5.4. Access to Property

The Project can be accessed by air from Rio de Janeiro, São Paulo, Brasilia and other cities to Patos de Minas, from there overland to São Gotardo (approximately 126 km) via good quality paved roads (BR-354 and BR-352). From Belo Horizonte, the Project site is accessed by 320 km through BR-352. From the town of Matutina the Project area is accessed by secondary gravel roads that traverse the farming region.

The unpaved roads are in reasonable conditions, although some sections require improvement.

## 5.5. Surface Rights

According to the Brazilian law, surface rights are separate from mining rights. Therefore, the landowner has no title to the minerals contained in the soil or in the sub-soil, which are deemed a

property of the federal government. The federal government can grant to private companies or individuals the right to exploration and mining of sub surface minerals.

Private companies or individual holders of an Exploration Permit are supposed to enter into an agreement with the landowner, allowing them access to the area, in order to conduct exploration activities. If an agreement is not reached, Brazilian Mining Code establishes a judicial procedure by means of which the mining company or individual secures access to the area by paying the landowner a compensation for damages to his or her property and loss of income due to exploration.

VERDE has agreements in place with relevant landowners, which allows them to undertake exploration in the permits.

Private companies or individuals holding a Mining Permit are entitled to access the area necessary for the mine infrastructure. Such surface rights are obtained by agreement with the landowner, providing compensation for the price of the land and additional losses caused by the occupation of such land. In case such agreement is not reached, surface rights are granted by the local Court based upon previous payments by the mining company or individual according to the amount judicially determined for such compensation.

In addition to compensation for damages, the landowner is entitled by law to a royalty equal to 50% of the Financial Compensation for the Exploitation of Mineral Resources (CFEM). However, there may be an agreement between the mining company and the landowner, establishing a compensation that is satisfactory for both (J. MENDO, 2009). The Company is considering the purchase of all properties within their permits, so this amount will not be due, since VERDE will be the owner.

VERDE has started to negotiate agreements with landowners to gain mining access and has already settled an agreement with the landowners of Fragata (Section 4.3.3) and Selado (Section 4.3.4).

#### 5.6. Local Resources and Infrastructure

São Gotardo is the closest town, located 39 km west from the Project site, with a significant population to provide manpower for a potential mining operation, having a population of around 34,000. São Gotardo also has good infrastructure, with domestic power and telephone service available. Also, the Project is very close to Patos de Minas (129 km away), the main city in the Alto Paranaiba area, which has a strong economic, cultural, educational and social environment.

Belo Horizonte, located about 320 km from the Project site, is the capital and the largest city in the state of Minas Gerais, with a population above 2 million people. It is the major center of Brazil's mining industry, with infrastructure for mining equipment and services available. There is a large commercial airport with domestic and international flights. Several state and federal government agencies are based there, in addition to private businesses that provide services to the mining industry. Skilled labor is readily available in Belo Horizonte, as well as at the towns near the Project.

# 6. History

Section 6 summarizes the prior history of the Project.

## 6.1. Exploration History

The glauconitic siltstone occurrence has been known as a potential potassium resource since the 1960's, although only regional mapping has been undertaken in the permits held by VERDE over the years.

VERDE does not have data with respect to past owners or any prior exploration work. VERDE is not aware of any historic resource estimation work on the property. There is no data or information available on prior exploration or development previous to the current owner.

## 6.2. Resource Estimation History

VERDE commenced drilling across the Cerrado Verde Project in late 2009.

#### 6.2.1. Coffey Mining (March 2010)

In March 2010, Coffey Mining Pty Ltd (Coffey Mining) was commissioned by VERDE to complete a mineral resource estimate.

The maiden mineral resource estimate was based upon 19 reverse circulation (RC) drill holes (997 m), which targeted only a select portion of the regional glauconitic siltstone within the VERDE permits. All holes were successful in intersecting the glauconitic siltstone.

Coffey Mining estimated a Mineral Resource for the Cerrado Verde Project with an effective date reported to February 27, 2010. All grade estimations were completed using Ordinary Kriging (OK) for  $K_2O$ . The estimation was constrained within the mineralization interpretations.

A total inferred resource of 161 Mt at 8.75% K<sub>2</sub>O was determined (no cut-off grade applied) as shown in Table 6.2.1-1 below.

Table 6.2.1-1 Cerrado Verde Project – February 27, 2010 - Inferred Grade Tonnage Report

Domain	Cut-Off Grade (% K <sub>2</sub> O)	Tonnes (Mt)	Average Grade (% K <sub>2</sub> O)
	0	67.82	6.22
	3	67.82	6.22
	4	67.45	6.23
Low Grade	5	55.85	6.41
Low Grade	6	33.19	7.27
	7	20.24	7.78
	8	6.49	8.52
	9	1.01	9.43
	0	92.74	10.61
	7	92.74	10.61
	8	92.20	10.63
High Grade	9	86.55	10.76
	10	64.39	11.17
	11	35.71	11.61
	12	8.24	12.33
Total (High + Low Grade)		160.56	8.75

Coffey Mining considered the permits to have the potential to host a very large tonnage potassium resource within the glauconitic siltstone unit. This was demonstrated by the preliminary resource numbers generated from an initial drilling program, as well as regional mapping and grab sampling across the permit package.

Coffey Mining recommended that a Preliminary Economic Assessment (PEA) was undertaken on the Cerrado Verde Project prior to undertaking any additional resource definition drilling.

#### 6.2.2. SRK Consulting (September 2011)

In September 16, 2011, SRK Consulting (U.S.), Inc. were mandated by VERDE, to prepare a National Instrument 43-101 (NI 43-101) PEA on the Cerrado Verde Project.

Volodymyr Myadzel made an update to the overall Project resources by including Targets 4, 6, 7, 10 and 11. Targets 4, 6, 7, 10 and 11 resources are reported in addition to the existing Funchal Norte Target resources.

A total indicated resource of 74.04 Mt at 9.22%  $K_2O$  was determined (7.5%  $K_2O$  cut-off grade applied) with an additional inferred resource totaling 1,135.55 Mt at 9.47%  $K_2O$  (7.5%  $K_2O$  cut-off grade applied, except for the Funchal Norte area with a 10%  $K_2O$  cut-off grade), as shown in Table 6.2.2-1 below.

Table 6.2.2-1 Cerrado Verde Project - September 16, 2011

Target	Cut-Off Grade (% K <sub>2</sub> O)	Tonnes (Mt)	Average Grade (% K <sub>2</sub> O)
	INDICATED	RESOURCE	
Target 6	7.5	23.25	8.83
Target 7	7.5	50.79	9.39
TOTAL INDICATED		74.04	9.22
	INFERRED	RESOURCE	
Target 4	7.5	74.43	9.20
Target 6	7.5	47.85	8.84
Target 7	7.5	873.59	9.45
Target 10	7.5	28.50	10.10
Target 11	7.5	46.79	8.27
Funchal Norte	10	64.39	11.17
TOTAL INFERRED		1,135.55	9.47

Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability.

Inverse Distance Weighting with power two (IDW2) estimate (Block Model – 50~mE~X~50~mN~X~10~mRL).

Effective date of Targets 4, 6, 7, 10 and 11 is August 3, 2011.

Effective date of Funchal Norte is March 1, 2010.

#### 6.2.3. SRK Consulting (February 2012)

In late February 10, 2012, SRK Consulting (SRK) was commissioned by VERDE to prepare an NI 43-101 PEA for the Cerrado Verde Project.

As part of the PEA, SRK reported an updated mineral resource estimate for the Cerrado Verde Project based on drilling completed throughout 2010 and 2011.

The resource update included: Target 1, Target 2, Target 3, Target 4, Target 5, Target 6, Target 7, Target 10, Target 11, Target 12, Target 13, Target 14, Target 16, Target 17. Funchal Norte is now referred to as Target 8 and is included in Target 7. Volodymyr Myadzel constructed the geologic and resource model for Targets 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 16 and 17. Dr. Myadzel was responsible for the resource estimation methodology and the resource statement.

A total indicated resource of 71 Mt at 9.22%  $K_2O$  was determined by SRK Consulting (7.5%  $K_2O$  cutoff grade applied) with an additional inferred resource totaling 2,764 Mt at 8.91%  $K_2O$  (7.5%  $K_2O$  cutoff grade applied) as shown in Table 6.2.3-1 below.

The resource estimate has been undertaken in compliance with accepted CIM definitions for indicated and inferred resources in accordance with NI 43-101 Standards of Disclosure for Mineral Projects.

Table 6.2.3-1 Cerrado Verde Project – December 17, 2011

Target	Cut-Off Grade (% K <sub>2</sub> O)		Average Grade (% K <sub>2</sub> O)
	INDICATED	RESOURCE	,
Target 6	7.5	23.25	8.83
Target 7	7.5	47.83	9.55
TOTAL INDICATED		71.08	9.22
	INFERRED	RESOURCE	
Target 1	7.5	235.86	8.72
Target 2	7.5	11.63	8.54
Target 3	7.5	126.52	8.72
Target 4	7.5	146.67	9.03
Target 5	7.5	27.27	8.31
Target 6	7.5	47.85	8.84
Target 7	7.5	955.20	9.50
Target 10	7.5	28.50	10.10
Target 11	7.5	46.79	8.27
Target 12	7.5	235.68	8.80
Target 13	7.5	168.25	8.50
Target 14	7.5	325.20	8.65
Target 16	7.5	257.49	8.15
Target 17	7.5	150.89	8.19
TOTAL INFERRED		2,763.80	8.91

Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Effective date of Targets 1, 2, 3, 4, 5, 12, 13, 14, 16, 17 is December 21, 2011.

Effective date of Targets 4, 6, 10 and 11 is August 3, 2011.

Effective date of Target 7 is February 10, 2012.

#### 6.2.4. AMS (March 2014)

In late March 2014, VERDE has retained AMEC, NCL and AMS to prepare a Pre-Feasibility Study (PFS) for the Cerrado Verde ThermoPotash (TK) Project.

A combined mineral resource statement that incorporates previously reported mineral resources completed by SRK Consulting has been prepared for the Cerrado Verde Project by AMS. A combined measured and indicated mineral resource of 1,472 Mt at 9.28% K<sub>2</sub>O (using a 7.5% K<sub>2</sub>O cut-off) and an inferred mineral resource of 1,850 Mt at 8.60% K<sub>2</sub>O (using a 7.5% K<sub>2</sub>O cut-off grade) (Table 6.2.4-1) are reported for the Cerrado Verde Project.

The statement has been classified by Qualified Person Bradley Ackroyd (MAIG) in accordance with NI 43-101, and accompanying documents 43-101.F1 and 43-101.CP. It has an effective date of March 31, 2014. As the latest and unmodified resource estimate, this work will be detailed in Item 14.

Table 6.2.4-1 Cerrado Verde Project – Measured, Indicated and Inferred Mineral Resource Grade Tonnage Report (AMS & SRK Consulting)

Target	Cut-Off (% K <sub>2</sub> O)	Tonnes (Mt)	Average Grade (% K <sub>2</sub> O)			
	Measured Resource Category					
Target 7	7.5	83	10.13			
	Total Measured	83	10.13			
	Indica	ted Resource Categor	у			
Target 6	7.5	23	8.83			
Target 7	7.5	1,366	9.24			
	Total Indicated	1,389	9.23			
Total I	Measured & Indicated	1,472	9.28			
	Inferr	ed Resource Category	1			
Target 1	7.5	236	8.72			
Target 2	7.5	12	8.54			
Target 3	7.5	126	8.72			

Target	Cut-Off (% K₂O)	Tonnes (Mt)	Average Grade (% K <sub>2</sub> O)
Target 4	7.5	147	9.03
Target 5	7.5	27	8.31
Target 6	7.5	48	8.84
Target 7	7.5	305	8.89
Target 11	7.5	47	8.27
Target 13	7.5	168	8.50
Target 14	7.5	325	8.65
Target 16	7.5	257	8.15
Target 17	7.5	151	8.19
	Total Inferred	1,850	8.60

Mineral resources are not mineral reserves and do not have demonstrated economic viability.

Effective Date of the mineral resource estimate is: March 31, 2014

#### 6.3. Reserve Estimation History

In late March 31, 2014, VERDE has retained AMEC, NCL and AMS to prepare a Pre-Feasibility Study (PFS) for the Cerrado Verde ThermoPotash (TK) Project, being NCL responsible for the reserve estimates.

NCL studied the Cerrado Verde Project as a conventional open pit operation. NCL has determined the following mining details for the project:

- Ore mining will be carried out by bulldozers while waste will be mined out directly by hydraulic excavators. There will be no use of explosives on the TK mine site.
- Load and haul equipment will be rented to the mining contractor and will be operated by Verde's personnel. Ancillary equipment will be operated by the contractor's personnel. All equipment will be maintained by the mining contractor.

A series of economic pit shells were calculated using the Lerchs-Grossman algorithm for different TK prices. The selection of a final pit shell for mine design was based on a NPV maximization strategy, taking into account factors such as external waste dump size and desired life of mine.

The LoM mining schedule feeds 233 Ktpy of fresh rock to the primary crusher. The expected mass recovery is 100%.

The Mineral Resources are inclusive of the Mineral Reserves.

Table 6.3-1 Cerrado Verde Project – Mineral Reserve Summary

Ore Reserves	Mass (Kt)	K₂O (%)
Proven Reserve	5,381	10.87
Probable Reserve	1,639	10.77
Total Reserve	7,020	10.85

- (1) As of March 31, 2014.
- (2) A variable cutoff grade was used to report reserves, between 10.2% and 10.6% K<sub>2</sub>O.
- (3) Numbers may not add up due to rounding.
- (4) Overall strip ratio of 0.34 to 1.
- (5) Waste contains inferred resources, which have potential for upgrading to higher category resources, and possibly reserves after sufficient definition work has been completed.
- (6) Based on 100% mining recovery.

# 6.4. Mining History

The mining works were initiated in May 15, 2017, by means of a *Guia de Utilização*, and 20,000 t of ore were mined so far. Mining is performed as an open pit operation without production of waste.

# 7. Geological Setting and Mineralization

#### 7.1. Regional Geology

The region is mainly underlain by Neoproterozoic and Cretaceous rock units, which are partly covered by Cenozoic sandstones, lateritic sediments and soils (Figure 7.1-1). The oldest rocks are represented by the Bambuí Group, which comprises the marine deposits of the Paraopeba Formation, the Serra de Santa Helena Formation and the Serra de Saudade Formation, including the glauconitic siltstone unit. Variegated siltstones and sandstones dominate all of these units. The Serra da Saudade Formation consists of carbonate and siliclastic sediments that were deposited in an epicontinental platform in the late Neoproterozoic (700 My - 600 My). The overlying Três Marias Formation is composed of arkosic sandstones.

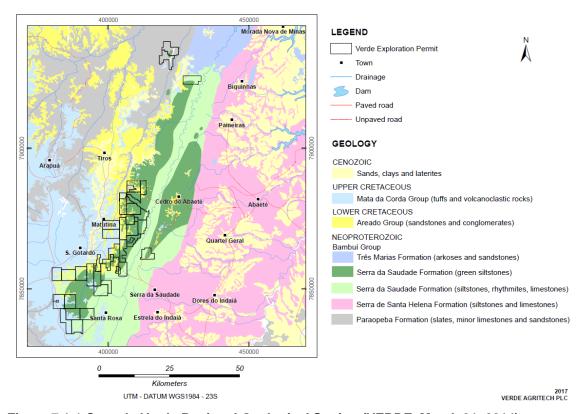


Figure 7.1-1 Cerrado Verde Regional Geological Setting (VERDE, March 31, 2014)

Following the deposition of the Bambuí Group and the Brasiliano Orogeny, the region was exposed to a long period of erosion during the Paleozoic, Triassic and Jurassic periods, giving rise to the development of a mature, deeply eroded peneplain. The terrigenous sediments of the Areado Group were deposited during the Lower Cretaceous on this extensive, flat peneplain. The next stratigraphic phase is recorded by the extensive and dominantly pyroclastic kamafugitic volcanism of the Mata da Corda Group of Upper Cretaceous age.

## 7.2. Local Geology

#### 7.2.1. The Glauconitic Siltstone Unit

The glauconitic siltstone unit occurs mainly at the top of the Serra da Saudade Formation and underlies the Areado Group sandstone (Figure 7.2.1-1). The glauconitic siltstone occurs in extensive

outcrops, along both banks of Indaiá River, in a trend of approximately 120 km x 20 km in area. It covers the regions and municipalities of Santa Rosa da Serra and São Gotardo (SW), Matutina, Quartel de São João and Cedro do Abaeté (center), Paineiras and Biquinhas (NE), in the State of Minas Gerais.

The thickness of the glauconitic siltstone unit varies from 15 m to 80 m in the southernmost domain, to over 50 m in the northern half of the Serra da Saudade range. The lower contact with the siltstone of the Serra da Saudade Formation is transitional (2 m to 3 m in width) and contains intercalations of limestone lenses and calciferous siltstone.

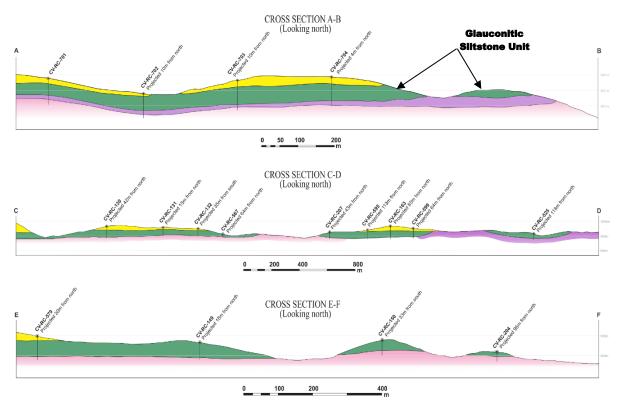


Figure 7.2.1-1 Cross Section through Target 7 - Cerrado Verde Project Area (VERDE, March 31, 2013)

The Serra da Saudade Formation was eroded during the Gondwana Cycle (KING, 1956) of probably Jurassic age, and it was over this extensive peneplain that the Cretaceous sandstone beds of the Areado Group were deposited.

The upper contact is transitional with rhythmic intercalations of glauconitic siltstone and siltstone with various colors (predominantly pink when weathered), defined informally as the transition zone. These intercalations vary from millimeters to meters in thickness.

#### 7.2.2. Structural Setting

The glauconitic siltstone unit and the transition zone have sub horizontal attitude, as shown in the cross sections presented in Figure 7.2.1-1. However, there were founded pervasive concentric and chevron folds in the outcrops, in which the axial planes dip NNW (Figure 7.2.2-1 and Figure 7.2.2-2). There were observed folds with nearly vertical axial planes and sub-horizontal folding axis.

Although the folds founded in the outcrops, no minerals or metamorphic structures and evidence of deformation were identified in thin sections. The natural fragmentation in outcrops is due to the bedding surfaces and verticalized fractures with several directions.

The largest extension of the glauconitic siltstone unit occurs where the erosion has been less intense, and is marked by the presence of remnants of the Areado Group sandstones. This occurs mainly in the central part of the outcropping glauconitic siltstone.

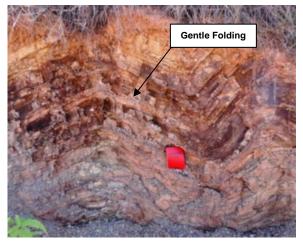


Figure 7.2.2-1 Folding throughout transition



Figure 7.2.2-2 Chevron Folding - Glauconitic Siltstone Unit

#### 7.2.3. Elevation and Erosion Level

The peneplain developed on the glauconitic siltstone unit, i.e., the ground over which the Areado Group was deposited, undulates between the elevation of 1,000 m and 850 m. Higher elevations of peneplain development are found in the southern portions of the Serra da Saudade Formation. In the middle portion of the ridge, the peneplain is placed between 880 m and 920 m. Therefore, it is fair to assume that all of the surface exposures of the glauconitic siltstone unit were the result of the Tertiary erosion cycles that stripped off the Mesozoic rocks (Mata da Corda and Areado groups).

#### 7.3. Mineralization

The previous Pre-Feasibility Study (March 2014) presented the Project's mineralization as a glauconitic meta-argillite. However, after performing detailed mineralogical studies using a combination of optical microscopy, X-ray diffraction, electron microprobe analysis and scanning electron microscopy, it was determined that the ore is a silty-clayed sedimentary rock. Despite the folds found in the outcrops, no minerals, metamorphic structures or evidence of deformation were identified in the thin sections. The natural fragmentation in the outcrops is due to the fractures and bedding surfaces. Therefore, the Project's mineralization is now referred to as a glauconitic siltstone. Despite this change in nomenclature, the Project's mineral resources were not affected, as the ore deposit is homogeneous in its glauconitic siltstone content.

The glauconitic siltstone unit is the target rock type across the VERDE group of permits as it contains a high content of K<sub>2</sub>O. It is a fine-grained siltstone, usually laminated, alternating with more massive levels and a few intercalations of dark-green argillite sheets (Figure 7.3-1).

The glauconitic siltstone unit shows millimeter- to centimeter-thick bands that are rich in glauconite, dark green in color and interbedded with quartz-rich layers (Figure 7.3-2).

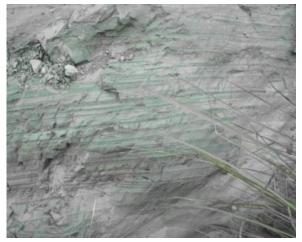
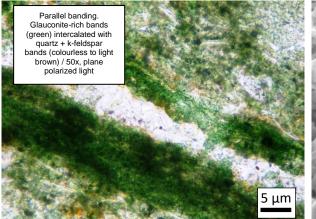


Figure 7.3-1 Layered Intercalations of Glauconitic Siltstone

Figure 7.3-2 Mineralized Glauconitic Siltstone Unit

A petrographic study using optical microscopy, X-ray diffraction, electron microprobe and scanning electron microscope was carried out upon fresh samples of glauconitic siltstone containing more than 10% of  $K_2O$ , collected from diamond drilling ½ core samples. Thin section studies detected significant quantities of K-bearing minerals and quartz (Figure 7.3-3 and Figure 7.3-4): glauconite (40%-80%), K-feldspar (10%-15%), quartz (10%-60%), muscovite-sericite (5%), biotite (2%), titanium oxide (<1%), manganese oxide (<1%), goethite (<1%), barium phosphate and rare-earth element phosphates (trace amounts).



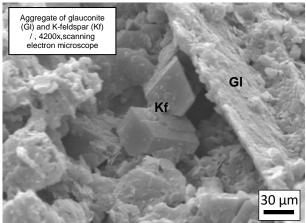


Figure 7.3-3 Photomicrograph of sample CV DH 05 (32 m - 34 m)

Figure 7.3-4 Photomicrograph of sample CV DH 04 (7 6m - 78 m)

#### 7.3.1. Mineralized Zones

As stated previously, potassium mineralization in the glauconitic siltstone unit occurs as mineral forming elements of glauconite, K-feldspar and muscovite-sericite.

The glauconitic siltstone held within VERDE's permits can be traced for the entire 120 km strike length with a potential width of up to 500 m. Enriched levels of potassium with K<sub>2</sub>O grades from 8% to 12% are associated to the glauconitic levels, dark-green in color. (Figure 7.3.1-1).



Figure 7.3.1-1 Outcrop of Glauconitic siltstone in the Cerrado Verde Project Area

#### 7.3.2. Surrounding Rock Types

The glauconitic siltstone unit is partially covered by a thin layer of sandstone of Cretaceous age in its central part. To the east it is intercalated with red to yellow pelites (argillites, rhythmites and siltstones), which forms the transition zone (Figure 7.3.2-1). The transition zone is the basal part of the glauconitic siltstone unit and outcrops by a combination of gentle folding and erosion. To the west, the glauconitic siltstone is eroded by a N-S running creek which exposes the underlying carbonaceous sandstone. To the north and to the south, the glauconitic siltstone unit is again intercalated with argillites, rhythmites and siltstones.



Figure 7.3.2-1 Transition zone with Intercalations of Glauconitic Siltstone and Reddish Siltstones

# 8. Deposit Types

Normally, glauconite is considered a diagnostic element indicative of continental shelf marine environments with slow rates of accumulation. It develops as a consequence of diagenetic alteration of sedimentary deposits, bio-chemical reduction and subsequent mineralogical changes affecting iron-bearing micas such as biotite, and is also influenced by the decaying process of organic matter degraded by bacteria in marine animal shells. Glauconite forms under reducing conditions in sediments (Figure 8-1).

A geological model has been proposed for the potassium-rich glauconitic siltstone (MOREIRA, 2015). It is a unique type of mineralization that is known only in the Serra da Saudade Formation, Bambuí Group, in the western part of the state of Minas Gerais. Glauconite is authigenic and highly mature. The high concentration of this mineral is related to a depositional environment with a low sedimentation rate. The glauconitic siltstone has resulted from a high-level flooding event in the Bambuí Basin. The sedimentary provenance is from supracrustal felsic elements on continental margin environment with acid magmatic arc (foreland basin).

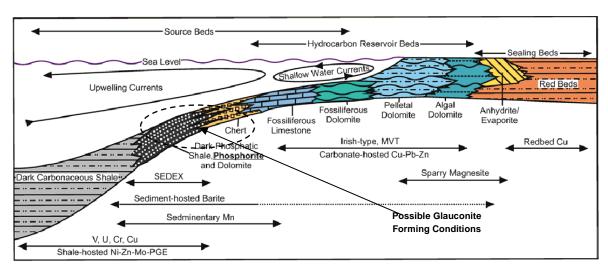


Figure 8-1 Potassium Deposits - Possible Genetic Setting for Cerrado Verde (SHELDON, 1963)

# 9. Exploration

## 9.1. Historical Exploration

Up until 2011, exploration work was focused upon a number of glauconitic siltstone units known as Target 1, Target 2, Target 3, Target 4, Target 5, Target 6, Target 7, Target 10, Target 11, Target 12, Target 13, Target 14, Target 16 and Target 17 (Figure 9.1-1 and Figure 9.1-2).

Exploration activities included field and laboratory studies; geological mapping; outcrop studies and their correlation; drilling across the glauconitic siltstone unit; systematic sampling; chemical and physical analysis of the rock samples/drill core samples; metallurgical characterization and processing test work.

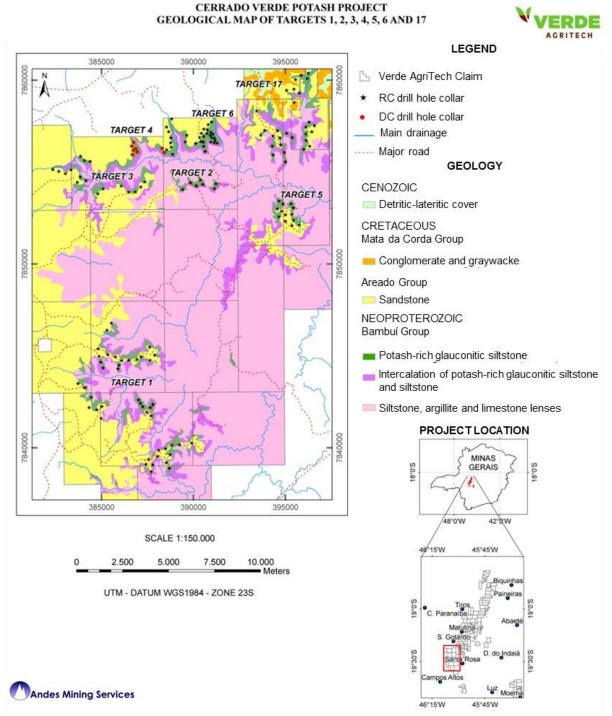


Figure 9.1-1 2010/2011 Historical Target Areas for Drilling - Southern Targets (VERDE, March 31, 2013)

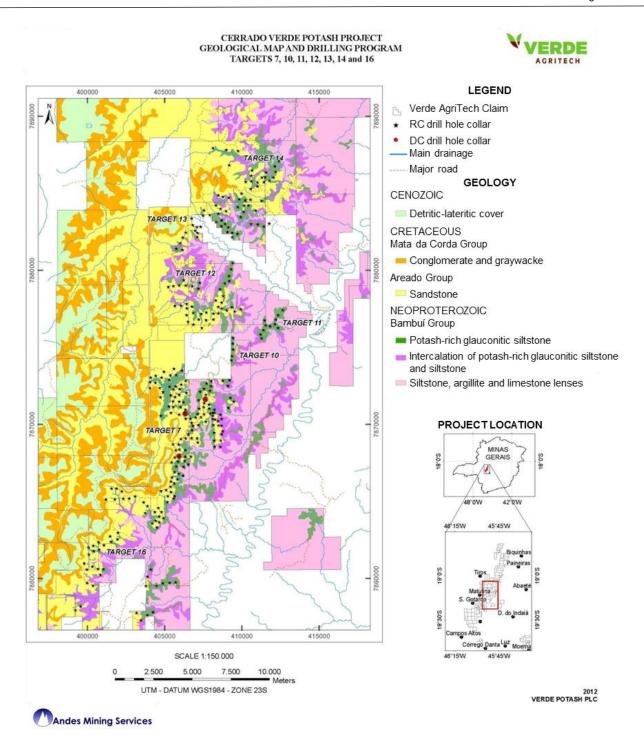


Figure 9.1-2 2010/2011 Historical Target Areas for Drilling - Central Targets (VERDE, March 31, 2013)

Initially, a literature review was performed upon all the material relating to the Project and surrounding areas, along with studies of economic exploitation of the potassium present in silicate rocks such as the glauconitic siltstone. This study also included technological and marketing aspects for producing and selling a potassium product.

Subsequently, the geological, geophysical and geochemical information was integrated on a regional scale, followed by the analysis and interpretation of digital satellite images for the visualization of the regional structures and occurrences of glauconitic siltstone across permits held by VERDE.

The outcrop of the glauconitic siltstone unit can be distinguished on satellite images by its characteristic bluish color.

In the preliminary survey, the targets were defined using Google Earth images and data from Shuttle Radar Topography Mission (SRTM). In the first program undertaken in 2008, mapping of the main rock types present in the region was performed, on a 1:25,000 scale, as well as a survey of the main access, drainage and farms within the areas of interest. For this survey GPS devices from Garmin<sup>®</sup>, model GPSMAP 76 CSX were used.

A preliminary evaluation of the potassium levels on outcrop samples were made through a portable X-ray fluorescence device, followed by chemical analysis at ALS Minerals, Bureau Veritas Brasil, FRX Service, SGS Geosol laboratories in Vespasiano and Belo Horizonte, Minas Gerais State, and at the São Paulo University.

Later stages of field involved the generation of geological cross sections (regional scale), especially in the areas of glauconitic siltstone exposure, and semi-detailed mapping campaigns for recognition of the main lithofacies and stratigraphic relationships and structural aspects. During the mapping, the samples collected were used to make thin sections and subjected to lithochemical/mineralogical analysis. Structural data and some stratigraphic section surveys were made throughout the area.

#### 9.1.1. 2012 Exploration Activities

In 2012 however, exploration activities were concentrated on a select number of higher grade  $K_2O$  targets. Target areas included 7, 10 and 12, and a new area located within exploration permit 830.383/2008 which was acquired by VERDE from a third party.

Geological mapping suggested these targets belonged to a single glauconitic siltstone body. Subsequently, these 4 individual target areas were collectively grouped into a single target area known as Target 7.

#### **Geological Mapping**

The glauconitic siltstone unit is the main rock-type of interest to be mapped across the VERDE permits, and has a marked bluish color which can be observed from Google Earth images (Figure 9.1.1-1). Zones of glauconitic siltstone outcrops were interpreted on Google Earth images, converted into shapefiles in ArcGIS and then inserted on PDAs (Trimble and GETAC personal digital assistant) with GPS and ArcPad programs installed. The topographic maps, the legal status and the existing geological maps were also inserted into the PDA units.

Geological mapping was carried out with the PDAs (Figure 9.1.1-2) into which the outcrops of glauconitic siltstone and other lithologies, float material, soil points, geological structures and lithological contacts were inserted and exported to ArcGIS software. Only once this was completed, was a final geological map was produced.

Glauconitic siltstone outcrops were routinely sampled, and the K<sub>2</sub>O values were assayed with Innov-X Delta portable X-ray fluorescence (XRF) spectrometer. Glauconitic siltstone zones which returned greater than 6% K<sub>2</sub>O were mapped in more detail in preparation for drill testing.



Figure 9.1.1-1 Google Earth Image - Glauconitic siltstone unit marked by a typical bluish color





Figure 9.1.1-2 Geological Mapping using GETAC PDA's with ArcPad Software (VERDE, March 31, 2013)

#### Airborne Surveys

VERDE contracted Geoid Laser Mapping Ltda to conduct an airborne laser scanning survey across an area measuring 116.72 km<sup>2</sup>. The main objective of the survey was to cover Target 7 and its immediate surroundings in which the company plans to develop an open pit mine, the concentration plant and the tailing disposal areas studies. A laser contour map was generated at 1 m intervals with a 1:1,000 scale

map produced and utilized to accurately plot the geology and the drill hole collar locations (Figure 9.1.1-3).

The drill holes collar coordinates were measured using a differential global positioning system (DGPS) instrument (Trimble® R4 with RTK radio system). A double frequency L1/L2 Global Navigation Satellite System of geodesic pair was utilized. The equipment collect data in real time with a horizontal accuracy of 3 mm + 0.1 mm and up to 3 times the horizontal accuracy for vertical measurements.

The grid system was based on Universal Transverse Mercator (UTM) coordinates, in World Geodetic System 1984 (WGS84) applied to Zone 23S.

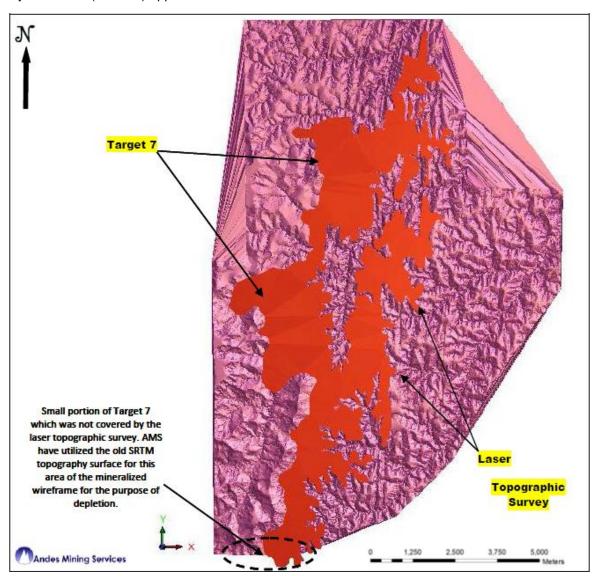


Figure 9.1.1-3 Detailed Airborne Topographic Laser Survey (AMS, March 31, 2013)

#### Reverse Circulation and Diamond Drilling

A total of four drilling campaigns were performed across the Cerrado Verde Project with the first campaign commencing in late 2009.

The principal drilling methods utilized, include rotary-percussion reverse circulation drilling (RC) and diamond core drilling (DC). Drilling was initially carried out at a nominal spacing of 100 m x 400 m grid

spacing across a number of specific target areas identified by VERDE (Figure 9.1.1-4 and Figure 9.1.1-5).

Details regarding individual RC and DC drilling programs have been covered in Section 10 of this report.

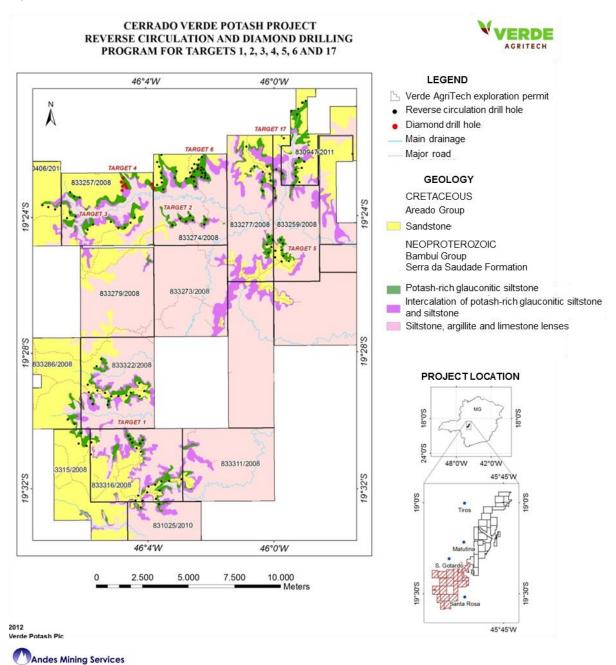


Figure 9.1.1-4 2010/2011 Geological Map and Drilling Program for Targets 1, 2, 3, 4, 5, 6 and 17 (VERDE, March 31, 2013)

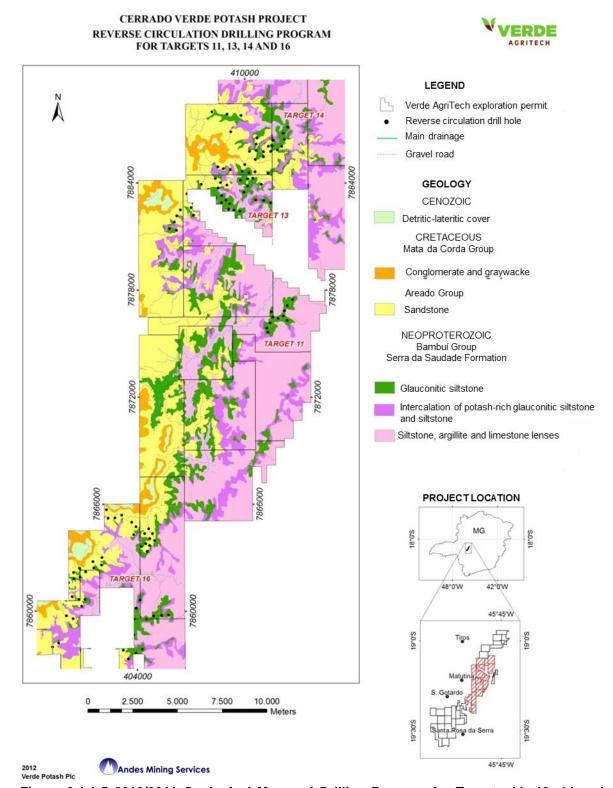


Figure 9.1.1-5 2010/2011 Geological Map and Drilling Program for Targets 11, 13, 14 and 16 (VERDE, March 31, 2013)

In 2012, infill drilling was completed across Target 7 down to a 100 m x 100 m grid spacing in some areas in order to increase the resource category confidence (Figure 9.1.1-6).

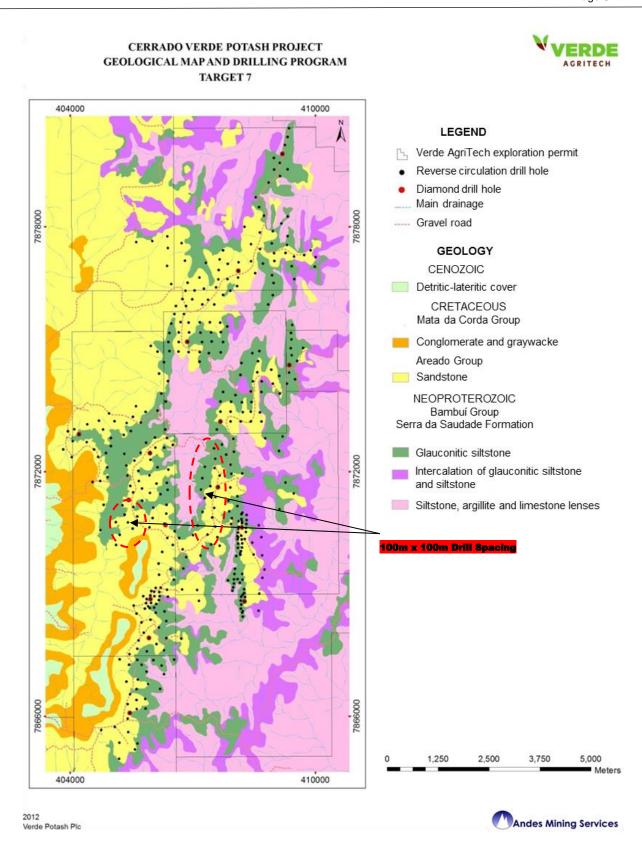


Figure 9.1.1-6 2012 Geological Map and Infill Drilling Program for Target 7 (VERDE, March 31, 2013)

## 9.2. Recent Exploration

In 2014 VERDE drilled four Reverse Circulation (RC) holes for a total of 378 m to install piezometers and water level indicators using an Atlas Copco rig belonging to *Geosedna Perfurações Especiais* S/A. RC samples of glauconitic siltstone were collected every 1 m and sampling for analysis at SGS Geosol laboratory in Vespasiano, Minas Gerais State, Brazil. A total of 246 samples were analyzed by XRF for Fe<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, CaO, MgO, MnO, TiO<sub>2</sub>, Na<sub>2</sub>O, K<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, and LOI. A total of 12 samples were analyzed by inductively coupled mass spectrometer with multi-acid digestion for 51 elements. In these samples a Lithium anomaly (higher than 60 ppm LiO<sub>2</sub>) was identified.

## 10. Drilling

A total of four drilling campaigns were performed across the Cerrado Verde Project.

The principal drilling methods utilized, include rotary-percussion reverse circulation drilling (RC) and diamond core drilling (DC). Initial drilling was carried out at a nominal grid spacing of 100 m x 400 m across the majority of individual target areas. In 2012, infill drilling was completed across Target 7 with certain higher-grade portions selected for infill 100 m x 100 m drilling in order to increase the resource category confidence.

Table 10-1 highlights the number of holes, the average depth reached, and the number of meters drilled across each target area.

Table 10-1 VERDE Drilling Summary Statistics - Cerrado Verde Project Area

Prospect	Number of	Average	Meters	Number of	Average	Meters
•	Holes	Depth (m)	Drilled	Holes	Depth (m)	Drilled
Target 1	44	54	2,352	0	0	0
Target 2	7	47	329	0	0	0
Target 3	17	69	1,172	0	0	0
Target 4	10	66	662	8	65	520
Target 5	13	57	738	0	0	0
Target 6	22	57	1,255	2	76	151
Target 7	375	61	22,805	15	70	1,046
Target 10	5	50	250	0	0	0
Target 11	11	50	542	0	0	0
Target 12	40	63	2,508	0	0	0
Target 13	45	49	2,181	0	0	0
Target 14	21	58	1,218	0	0	0
Target 16	54	50	2,691	0	0	0
Target 17	31	49	1,522	0	0	0
TOTAL	695	56	40,225	25	70	1,717

## 10.1. Campaign #1 (Late 2009)

In late 2009, a drilling program was undertaken across a select portion of Target-7. A Prominas R1-H drill rig (belonging to *Fuad Rassi Engenharia Indústria e Comércio Ltda*) drilled a total of 19 vertical RC holes for a total of 997 m with an average drillhole depth of 52 m.

## 10.2. Campaign #2 (January 2011 - June 2011)

Three RC drill rigs (belonging to *Geosedna Perfurações Especiais S/A*) were used in the second campaign which started in January 2011 and finished in June 2011. These three rigs (Foremost, Prominas and Explorac), drilled a total of 424 vertical RC holes for a total of 24,148 m of drilling (Figure 10.2-1 and Figure 10.2-2). The RC boreholes were drilled using  $4\frac{3}{4}$ " and 5" hammers to an average depth of 56 m across a 400 m x 400 m grid spacing (approximately). Of the 424 holes drilled, 104 holes did not intercept typical glauconitic siltstone mineralization. These holes intercepted the transition zone (lower grade material, below 7%  $K_2O$ ) which is the rhythmic intercalation of siltstones. These drill holes were used in the wireframe modelling to determine the mineralized area, however were not used for resources estimation purposes given their lower grade  $K_2O$  values.



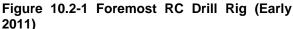




Figure 10.2-2 Explorac RC Drill Rig (Early 2011)

## 10.3. Campaign #3 (February 2011 - August 2011)

The third drilling campaign, carried out between February 2011 and April 2011, accounts for 5 twinned RC/DC holes totaling 412 m of drilling. All holes were drilled vertical, and drilled to an average depth of 82 m. The rig used was a Diakor II (belonging to *Isoágua Perfurações Especiais Ltda*,) with HQ and NQ diameter coring.

The purpose of the twinned holes was to confirm the geology and highlight, in detail, the lithological and mineralogical variations of the intercepted units, besides providing material for bulk density measurements. In August 2011, a total of 8 DC holes were drilled into Target 4, using a Mach 1200 rig (belonging to *Rede Engenharia e Sondagens S/A*). All holes were drilled vertically with a total of 520 m drilled giving an average depth of 65 m.

## 10.4. Campaign #4 (May 2012 - September 2012)

Three RC drill rigs (belonging to *Geosedna Perfurações Especiais S/A*) were used in the fourth drilling campaign, which started in May 2012 and finished in September 2012. These three rigs (Fordcarro and Explorac), drilled a total of 252 vertical RC holes for a total of 15,080 m of drilling (Figure 10.4-1 to Figure 10.4-4). The RC boreholes were drilled using 4¾" and 5" hammers to an average depth of 60 m in a 200 m x 200 m and 100 m x 100 m grid pattern.

Of the 252 drill holes, only 1 drill hole (CV-RC-609) did not intercept the typical glauconitic siltstone mineralization. This drill hole intercepted the transition zone, which is a rhythmic intercalation of siltstones. This drill hole was used to help guide the wireframe modelling to determine mineralized area. Drill hole assays from CV-RC-609 were used for estimation purposes to give a better estimate on the margins of the typical glauconitic siltstone mineralized unit.



Figure 10.4-1 Fordcarro RC Drill Rig (May 2012)



Figure 10.4-2 RC Drilling #1 - CV Target 7 (August 2012)



Figure 10.4-3 RC Drilling #2 - CV Target 7 (August 2012)



Figure 10.4-4 RC Drilling #3 - CV Target 7 (August 2012)

Between August 2012 and September 2012, 12 DC holes were drilled in Target 7, using a Mach 1200 rig (belonging to *Rede Engenharia e Sondagens S/A*). All holes were drilled vertically and twinned existing RC/DC holes, with an average depth of 65 m, totaling 785 m of drilling. Diamond drill core samples (HQ and NQ) provided suitable material for further bulk density measurements.

## 10.5. Surveying

All holes have been drilled vertically, and downhole deviation surveys are not required in view of the shallow depth to which the holes have been drilled.

The drilling was carried out perpendicular to the mineralization and reflects the true thickness.

AMS completed an inspection of the historical drilling completed during a site visit in August 2012. AMS noted an excellent correlation between historical drill collar coordinated in the field and those reported within the database.

AMS noted that reputable companies were involved in this drilling, and samples were analyzed at internationally recognized laboratories. AMS had no reason to doubt the integrity of all drilling to date, and for the purpose of the mineral resource estimate, both diamond and RC drilling have been included.



Figure 10.5-1 AMS Drill Collar Field Check



Figure 10.5-2 Yard Storage of RC Drill Chips



Figure 10.5-3 Warehouse Storage of RC Drill Chip Trays



Figure 10.5-4 Warehouse Storage of Diamond Drill Core

Drillhole collars were surveyed using a Trimble® Pathfinder Pro XR DGPS. The data had post-correction validated by the IBGE with reference to the *Santiago & Cintra* station in Belo Horizonte (vertex 93,621; East 608,308.23 m, North 7,799,827.00 m, 879.06 m altitude (HAE) – recording rate: 0.5s, C/A code + L1). All azimuth, distances, areas and perimeters were calculated following the UTM planar projection system, WGS84 datum, MC –45W and 23S zone. The accuracy of the measurements (borehole and surface) is within acceptable standards, considering the type of mineralization. The accuracy is approximately 1 cm after 45 minutes of satellites tracking and meets acceptable industry standards for the style of mineralization.

The drilling data was interpreted and compiled into a 3D geological model which is described and discussed in Section 14 of this Technical Report.

## 10.6. Logging

The RC chip samples were sieved at the Project site with small amounts of chip sample retained and stored in labelled chip trays (Figure 10.6-1). Chip samples were described by lithology, color and degree of weathering, and were analyzed by a portable X-ray fluorescence spectrometer.

Diamond drill core was placed in core boxes for storage and future reference (Figure 10.6-2). The weathering, regolith and lithology, including the petrographic features were logged by the geologists, as well as the recording of basic geotechnical observations (rock quality designation (RQD),

weathering degree and impact resistance degree). Information was entered into a digital database (Microsoft Excel). Logging was performed in the core shed where the drill core is stored. After the logging, the core boxes were photographed as a precaution against loss and/or deterioration.





Figure 10.6-1 Reverse Circulation Sample Logging Box

Figure 10.6-2 Glauconitic siltstone Diamond Core Storage

#### 10.7. Recovery Calculations

For the RC drilling, the recovery determinations were made by the relationship between the interval weight and the reference value, using the formula below:

$$\% \operatorname{Rec} = \frac{(x) \operatorname{kg} * 100}{C_{v}}$$

Where, the cylinder volume ( $C_v$ ) considers the average density of 2.30 g/cm<sup>3</sup>:

$$C_v = \pi^* R^{2*}h = \pi^* 6.35^{2*}100 = 3.1415^*40.32^*100 = 12,666.5 \text{ cm}^3 * 2.30 \text{ g/cm}^3 = 29.132 \text{ kg}$$

For DC, recovery determinations are made by the sum of length of core pieces compared with the total length of the core run.

AMS have reviewed recoveries for all diamond drilling completed across the Cerrado Verde Project area and note excellent core recoveries throughout, with no material issues noted.

## 10.8. Diamond Drilling (DDH) Sampling

After logging, the selected diamond drill core was cut lengthwise using a diamond core saw. One half of the core was sent for analysis and the other half was retained in the core box for future reference.

The samples, with a length of 2 m, were packed in a plastic bag, with the identification number written with a marker on the sample together with an identification tag. The bag was placed inside another, sealed with clamps and likewise identified. All data related to sampling was recorded into an excel database for subsequent correlation with analytical results once returned from the laboratory.

## 10.9. Reverse Circulation (RC) Sampling

As part of the first drilling campaign, samples were taken on 2 m intervals and riffle split down to an approximate 3 kg sample through a 3-tier riffle splitter (1:7 splitting ratio).

For the 2011 and 2012 drilling programs, RC samples were collected every 1 m to 3 m intervals, placed in a large plastic bag and weighed on a balance scale. A small sample was taken from the bag and placed into a chip tray for visual inspection and logging by the geologist. The main water intersections encountered by drilling were also noted and entered in spreadsheets by the supervisor on the Project site. The cyclone was cleaned by compressed air after every rod drilled.

Sampling intervals were selected after a preliminary analysis by the portable Innov-X Delta X-ray fluorescence equipment (XRF). Intervals which contained greater than 6% K<sub>2</sub>O were selected for analysis. A safety margin was given for these intervals. This margin ranged from 1 m to 5 m, taking as reference the content of 6% K<sub>2</sub>O and variations up to 2% below this level. The results obtained were integrated into an excel spreadsheet and passed via a personal digital assistant (PDA) to a responsible individual at the core shed.

At the Project site, the sample was split repeatedly in a riffle splitter until a representative sample of approximately 1.3 kg was obtained. This sample was destined for preparation and laboratory analyses. The riffle splitter was beaten with a rubber mallet and cleaned with compressed air after every sample, to avoid sample contamination. The wet and moist samples were split using a hollow plastic cylinder with a sharpened tip (approximately 5%-10% of samples from the 2011 program. No wet sampling completed as part of the 2012 field program). This cylinder was projected into the sample bag, in order to perforate it in several different places. The material from the bag that was returned within the cylinder was then sampled. Approximately six punches were sufficient to obtain a representative sample of the 1 m to 3 m sample interval drilled based upon observations made from the site visit while drilling was in progress. These samples were transported to the laboratory facilities for further processing.

## 10.10. Bulk Density

For the resource estimation, dry bulk densities values were calculated from select samples of diamond drill core. After the geological description, the drill core was sawn in half. The weathered and fresh lithological units were chosen for density measurements. Intervals of 10 cm to 15 cm were selected from the half core. The top and the base from each section of drill core were marked and the depth recorded on the density spreadsheets for each hole.

Each sample interval was wrapped in transparent film (vinyl polychloride resin) and weighed in air by an OHAUS Adventurer<sup>®</sup> digital balance, approved by INMETRO (the National Institute of Meteorology, Normalization and Industrial Quality), with a precision of at least 0.02 g (Figure 10.10-1). The sample was then completely immersed in water by way of a suspended steel hook attached to the central beam of the balance. The immersed sample weight was then recorded.

The transparent film was removed, and the sample was placed in a labelled aluminum tray and then dried in an electric oven at a temperature of approximately 95 °C for 24 hours. After cooling, the sample was wrapped again in transparent film and weighed in air on top of the digital balance. The sample was then completely immersed in water by way of a suspended steel hook attached to the central beam of the balance (Figure 10.10-2). The immersed weight was then recorded.





Figure 10.10-1 Wrapped Sample Weighed in Air

Figure 10.10-2 Wrapped Sampled Weighed in Water

Thereafter, the sample was returned to its respective place in the drill core box. The wet and dry densities calculations were made using the Archimedes Principle.

During the 2011 diamond drilling campaign, only the dry densities measurements of the glauconitic siltstone were performed on holes drilled into Targets 4, 6 and 7. As part of the 2012 drill program, wet and dry measurements of the glauconitic siltstone samples were completed on diamond drill cores for Target 7. Table 10.10-1 display the average values of the weathered and fresh glauconitic siltstone samples obtained for Targets 4, 6 and 7. Figure 10.10-3 and Figure 10.10-4 illustrate the bulk density distribution of samples taken from both fresh and weathered material across Target 7.

Table 10.10-1 Drill Core Density Measurements (Targets 4, 6 and 7)

Lithological Unit	Type of Density	Target 4	Target 6	Target 7
Weathered	Wet Density (g/cm³)	-	-	1.74 (14 samples)
Glauconitic siltstone	Dry Density (g/cm³)	1.52 (28 samples)	1.43 (4 samples)	1.64 (15 samples)
Fresh Glauconitic	Wet Density (g/cm³)	-	-	2.29 (123 samples)
siltstone	Dry Density (g/cm³)	2.14 (33 samples)	2.08 (10 samples)	2.18 (178 samples)

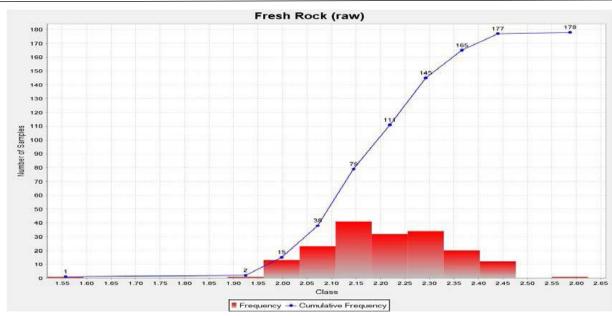


Figure 10.10-3 Density Measurement Histogram – Fresh Rock Material from Target 7 (average 2.18 g/cm³)

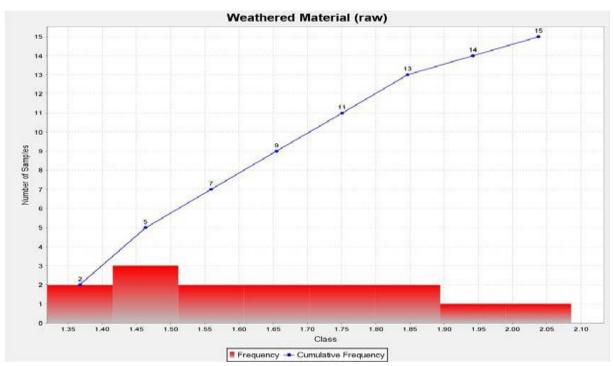


Figure 10.10-4 Density Measurement Histogram – Weathered Material from Target 7 (average 1.64 g/cm³)

Density determinations were made from a number of diamond drill core samples selected from Target 7. A total of 178 samples were collected from the "fresh" glauconitic siltstone material with an average bulk density value of 2.18 g/cm³ recorded. In addition, a further 15 samples were collected from the "weathered" glauconitic siltstone material with an average bulk density value of 1.64 g/cm³ recorded.

# 11. Sample Preparation, Analysis and Security

## 11.1. Sampling Method

Samples for laboratory analyses were prepared at the Project site by VERDE technicians and sent in a VERDE vehicle to the respective laboratories. A summary of the current drilling completed by VERDE, along with the laboratories utilized for each phase of drilling is shown in Table 11.1-1 below.

Table 11.1-1 Laboratories Used in Analyzing VERDE Drilling

Year	Company Name	Type of Drilling	Number of Holes	Meters Drilled	Lab Used
2009	VERDE	RC	19	997 m	Bureau Veritas (Brazil)
2011	VERDE	RC / DDH	452	26,609 m	SGS Geosol
2012	VERDE	RC / DDH	264	15,865 m	SGS Geosol

## 11.2. Sample Preparation and Assaying Methods

#### 11.2.1. 2009 Program

For the initial RC drilling program, samples were taken on 2 m intervals and then riffle split down to 3 kg samples for submission.

Samples were sent to Bureau Veritas laboratory in Vespasiano, Minas Gerais State, Brazil. This laboratory is part of the international chain of laboratories owned by Bureau Veritas which has ISO 14001 certification. The samples were received, dried, crushed to 2mm, riffle split and analyzed by XRF for Fe<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, CaO, MgO, MnO, TiO<sub>2</sub>, Na<sub>2</sub>O, K<sub>2</sub>O, BaO, P<sub>2</sub>O<sub>5</sub>, Cr<sub>2</sub>O<sub>3</sub>, SrO and LOI.

While no quality control was undertaken by VERDE for this initial drilling program, Bureau Veritas inserted duplicates, blanks and certified standards at a rate of 5% to maintain their own quality control.

#### 11.2.2. 2011 and 2012 Programs

RC samples were generally taken on 1 m to 3m intervals and then riffle split down to 1.3 kg samples for submission. DC samples were taken on 2 m intervals (half core samples collected) and submitted to the laboratory.

Approximately 96% of the total drill meters are accounted for by RC drilling, of which a total of 12% were drilled moist and further 4.7% were drilled wet (Table 11.2.2-1). AMS have reviewed the sampling procedure, quantity and spatial location of wet drill samples across the Cerrado Verde Project area, and believe there to be no significant bias within the database, which is material to the overall resource reported. In addition, AMS make note of a number of DDH twin holes to original RC drilling (include moist and wet sampling), and note no significant bias between DDH and RC sampling. A full discussion of the study completed for twin hole drilling is covered in Section 12.2.4 of this report.

Table 11.2.2-1 RC and DDH Sampling (2011 and 2012 Programs - Wet vs Dry Sampling)

Table T1.2.2-1 NC	and Den Gamping	(	- g. a	
		Drill	Туре	
	DDH	%	RC	%
Holes	15	3.55	408	96.45
Meters (m)	1,046.4	4.09	24,566	95.91
Drill Type	% of Database		Sample Quality	
Drill Type	% of Database	Dry (%)	Sample Quality Moist (%)	Wet (%)
Drill Type	% of Database	<b>Dry (%)</b> 83.35	· · · · · · · · · · · · · · · · · · ·	<b>Wet (%)</b> 4.69

#### **RC** Drilling

For the 2011 and 2012 drilling programs, RC samples were collected every 1 m to 3m intervals, placed in a large plastic bag and weighed on a balance scale. A small sample was taken from the bag and placed into a chip tray for visual inspection and logging by the geologist. The main water intersections encountered by drilling were also noted and entered into spreadsheets by the supervisor on the Project site. The cyclone was cleaned by compressed air after every rod drilled.

Sampling intervals were selected after a preliminary analysis by the portable Innov-X Delta X-ray fluorescence equipment (XRF) (Figure 11.2.2-1). Intervals which contained greater than 6% K<sub>2</sub>O were selected for analysis, with a safety margin in length surrounding these intervals. This margin ranged from 1 m to 5 m, taking as reference the content of 6% K<sub>2</sub>O and variations up to 2% below this level. The results obtained were integrated into an excel spreadsheet and passed via a personal digital assistant (PDA) to a responsible individual at the core shed.

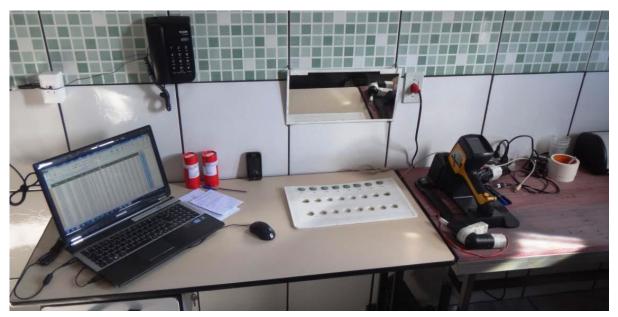


Figure 11.2.2-1 XRF Analysis of Powdered Dry RC Samples (August 2012)

At the Project site, the sample was split repeatedly in a riffle splitter until a representative sample of approximately 1.3 kg was obtained (Figure 11.2.2-2 to Figure 11.2.2-5). This sample was then destined for preparation and laboratory analyses. The riffle splitter was beaten with a rubber mallet and cleaned with compressed air after every sample, to avoid sample contamination.

The wet and moist samples were split using a hollow plastic cylinder with a sharpened tip. This cylinder was projected into the sample bag, in order to perforate it in several different places. The material from the bag that was returned within the cylinder was then sampled. Approximately six punches are sufficient to obtain a representative sample of the 1 m to 3 m sample interval drilled. These samples were transported to the laboratory facilities for further processing.



Figure 11.2.2-2 Cleaning Riffle Splitter



Figure 11.2.2-3 Preparing Samples for Submission



Figure 11.2.2-4 Preparing RC Samples for dispatch



Figure 11.2.2-5 Riffle Splitting RC Samples

### Diamond Drilling (DDH) Sampling

After logging, the selected diamond drill core was cut lengthwise using a diamond core saw. One half of the core was sent for analysis and the other half was retained in the core box for future reference.

The samples, with a length of 2 m, were packed in a plastic bag, with the identification number written with a marker on the sample together with an identification tag. The bag was placed inside another, sealed with clamps and likewise identified. All data related to sampling was recorded into an excel database for subsequent correlation with analytical results once returned from the laboratory.

### Sample Submission

Both RC and DC samples were sent to SGS Geosol Laboratórios Ltda (SGS) laboratory in Vespasiano, Minas Gerais State, Brazil. SGS maintains ISO 9001:2008 and ISO 14001:2004 certifications. The samples were received, dried, crushed to 2mm, riffle split and analyzed by XRF for Fe<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, CaO, MgO, MnO, TiO<sub>2</sub>, Na<sub>2</sub>O, K<sub>2</sub>O, BaO, P<sub>2</sub>O<sub>5</sub>, and LOI. AMS did not complete a laboratory site visit as part of the site visit completed in early August 2012.

Once received by the laboratory, samples were manually checked for sequential numbering before being logged into the laboratory system for tracking. Physical preparation quality controls were introduced by the laboratory, which include a preparation blank (quartz) and duplicate at every 20 samples. Samples were dried at 105 °C  $\pm$  5 °C and passed through a crusher with 95% of the sample passing at 2 mm. Once crushed, the fractionation of the sample was made to approximately 600 g. The pulverizing of the 600 g sample was made so that 95% passes through 150 mesh (110 micron)

screen, forming the laboratory aliquot (500 g) and the reserved pulp. At this stage, the laboratory quality control was obtained by the inclusion of a reagent blank, certified reference materials and a laboratory duplicate within each analytical run. The blank was inserted at the beginning, standards at every 20 samples and a duplicate was inserted at random intervals. All data gathered for quality control samples was automatically captured by the laboratory software, sorted and retained in the quality assurance/quality control (QA/QC) database. The SGS quality management system complies with the requirements of International Standards ISO 9001:2008.

After the loss on ignition (LOI) analysis, the analytical aliquot preparation was made by fusion with lithium tetraborate in the fusion machine with oxygen enriched flame – Phoenix® (XRF Scientific). In this method, a calcined sample (0.5 g) is added to the lithium borate fusion (50% Li<sub>2</sub>B<sub>4</sub>O<sub>7</sub> – 50% LiBO<sub>2</sub>), mixed and fused between 1,050 °C and 1,100 °C. The machine uses a mold which incorporates a crucible shape in which both mixing and mixing and molding is performed. When mixing was complete, the molten material was cooled in the moldable and the bead was removed using a suction cup. The analysis of the fused tablet was made by X-Ray Fluorescence Spectrometer – AxiosmAX-Minerals® (PANalytical). The samples were analyzed for Fe<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, CaO, MgO, MnO, TiO<sub>2</sub>, Na<sub>2</sub>O, K<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, and LOI. Detection limits for XRF analysis completed by SGS are highlighted in Table 11.2.2-2 below.

**Table 11.2.2-2 Detection Limits of XRF Analysis** 

Item	Al <sub>2</sub> O <sub>3</sub>	CaO	Fe <sub>2</sub> O <sub>3</sub>	K <sub>2</sub> O	MgO	MnO	Na₂O	P <sub>2</sub> O <sub>5</sub>	SiO <sub>2</sub>	TiO <sub>2</sub>
Limit of Detection	<0.10	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01

# 11.3. Quality Controls and Quality Assurance

Before May 2010, the company did not have appropriate internal QA/QC systems for the drilling campaign.

In May 2010, VERDE introduced a QA/QC program. For the internal control reference, at every 20 routine samples, a certified standard, a powder blank and a duplicate were inserted and sent to the laboratory. In this program, as the analytical results were received, they were immediately imported into the respective sampling spreadsheets, where any undesirable analytical deviations of standards, blanks, duplicates, or inconsistency between the sample result and its respective lithology could be easily compared. Simple inversions of sample results and typographical errors of the spreadsheets compiled after receiving the assay certificates were common. As a result, all the results of all samples from this program were checked one by one by VERDE personnel (database manager).







Figure 11.3-2 Blanks and Standards Included for Submission

Initially, duplicates were prepared from the splitting of the previous sample pulps. After analysis at the SGS laboratory, the pulps were returned and forwarded for analysis at the ALS Brasil Ltda laboratory, located at Vespasiano, Minas Gerais State. From there, the pulps were sent to the ALS laboratory located in Lima, Peru for analysis. The pulps were analyzed by XRF and LOI. The ALS quality management system complies with the requirements of the International Standards ISO 9001:2008 and ISO/IEC 17025:2005. Quality control samples were inserted within each analytical run. For XRF methods, the minimum number of QA/QC samples are 2 standards, 1 duplicate and 1 blank, introduced every 39 samples. The blank was inserted at the beginning, standards were inserted at random intervals, and duplicates were analyzed at end of the batch. Every batch of samples analyzed has a dual approval and review process. The individual analytical runs were monitored and approved by the analyst. The results were compared with the initial values of SGS in graphics for duplicate controls like Thompson and Howarth, QQ and Correlation plots. This procedure was adopted until sample CV-RCS-2151 (March 2011).

From March 2011 onwards, starting at the sample CV-RCS-2171, the duplicate was obtained by quartering the routine sample prepared by VERDE personnel in the field to assist in verifying the entire laboratory sample preparation process.

For the accuracy control, the Australian GeoStats Pty Ltd certified reference material and IPT - Brazilian *Instituto de Pesquisas Tecnológicas* reference material were used. These were submitted to SGS for conventional XRF analysis. The standards certificates are attached at the end of this report.

The blank material was prepared from pulverized quartz obtained from a Brazilian laboratory Sulfal Química Ltda. At the time, the company did not have appropriate internal contamination control. Gravel blanks composed of quartz was suggested as a suitable alternative to verify the contamination of the sample preparation stage of sample processing.

For the external control reference, after analysis at the SGS laboratory, pulps were selected each 20 routine samples, and sent for analysis at ALS Minerals laboratory or at Bureau Veritas Brazil.

Further details regarding QA/QC protocol is discussed in Section 12 of this report.

# 11.4. Adequacy of Procedures

Regular inspections of Geosol SGS laboratory are undertaken by VERDE personnel. This inspection included a check for sample preparation, assaying methods, equipment calibration and QA/QC analysis which proved to be satisfactory. The preparation rooms and equipment are kept clean, and upon the completion of each shift, these rooms are thoroughly cleaned. All laboratories and equipment are provided with a ventilation system and exhaust fans. All instruments are in serviceable condition.

The laboratory operates according to international standards and the risk of error in chemical analysis can be assessed as low.

The VERDE sampling methods, chain of custody procedures, and analytical techniques are all considered appropriate and are compatible with accepted industry standards.

### 11.5. Sample Security

VERDE diamond drill core and reverse circulation drill cuttings are currently stored in a Matutina town that VERDE has rented (Figure 11.5-1). After logging, core samples are marked for splitting and sampling by VERDE geologists. Each RC and diamond core sample is placed in a plastic bag which in turn is placed in a nylon bag for transporting via truck to the ALS or SGS Geosol sample preparation laboratories located in Belo Horizonte.

AMS considers the sampling security implemented by VERDE to meet current industry best practice.



Figure 11.5-1 VERDE Office and Sample Storage Yard/Preparation Area (Matutina) (August 2012)

# 12. Data Verification

Quality control and quality assurance programs (QA/QC) were limited during early exploration programs conducted across Cerrado Verde target areas. Quality control procedures implemented during the 2009 drilling campaign were essentially internal laboratory QA/QC procedures. Routine laboratory QA/QC procedures included the addition of certified analytical standards, duplicates and blanks in the sample sequence.

Bureau Veritas used the following certified reference standard materials:

- IPT 146 Iron Ore VALE (low FeO content);
- IPT 53 K-feldspar;
- Composite Standard: IPT 53 + IPT 146.

For every 20 samples submitted, 4 control samples were placed by the laboratory. This include, 1 certified reference material, 1 blank (quartz), 1 preparation blank (Li<sub>2</sub>B<sub>4</sub>O<sub>7</sub> chip) and one duplicate sample.

In May 2010 (following the completion of the first drilling program), VERDE introduced an internal QA/QC program. For internal control reference, at every 20 routine samples, a certified standard, a powder blank and a duplicate sample were inserted by VERDE into the sample sequence.

Current QA/QC practice implemented by VERDE includes the addition of duplicates, gravel blanks, certified reference materials and a program of umpire laboratory check samples. As part of the most recent drilling program(s) completed in 2012, as soon as analytical results were received they were immediately imported into the respective sampling spreadsheets, and any undesirable analytical deviation of standards, blanks, duplicates, or inconsistency between the sample result and respective lithology were easily compared. Simple inversion of sample results due to typing errors of the spreadsheets after receiving the certificates, are also common and, therefore, all the results of all samples were checked one by one and not only for the control samples introduced.

Further details regarding the integrity of the VERDE database are provided below in Sections 12.1 and 12.2.

# 12.1. Geological Database

The drill hole information was organized on the personal digital assistant (PDA) and the data were exported directly to the database in \*.xls format. The results of chemical analysis were received in \*.xls format and compiled for each drill hole with reference to the respective log sheet. It underwent a double check with the data compiled by the database manager (VERDE employee). The local data validation was performed by VERDE.

VERDE have provided AMS with an excel database, complete with collar, survey, geology and assay information. AMS have validated the database using the database audit tools, with no material inconsistencies noted. In addition, AMS have made a manual check of the database, and any minor inconsistencies noted were promptly rectified by VERDE personnel.

The following checks were performed:

- Holes that had no collar data;
- Overlaps in sample intervals;

- Gaps in sample intervals;
- Matching the geological logging length to the drill hole sample length;
- The first sample does not correspond to 0 m in the database analysis;
- The azimuth is not in the range from 0 to 360 degrees;
- The dip angle is not in the range from 0 to 90 degrees;
- · Azimuth or dip angle of the drill hole is missing; and
- The drill hole total depth is less than the depth of the last sample.

There were no material errors noted within the database. Only two overlapping samples were noted which were correctly by AMS before importing the database into Access.

The Excel database was converted into an Access format database which is compatible with most commercial geological modelling software, and allows key relationship based changes/modifications to be easily made (for example – application of average density grades across geological boundaries).

Hardcopy assay data from SGS and ALS was made available to AMS, and a comparison of these results with the data supplied in the VERDE database was completed as part of the validation checks. AMS checked a total of 10% of the VERDE drill holes for validation purposes. No material errors were identified with the original log and the digital database.

# 12.2. Quality Analysis/Quality Control (QA/QC)

VERDE has set in place a QA/QC program for reverse circulation and diamond drilling programs which includes the submission of blanks, duplicates (field and pulp), certified standards and umpire assays.

VERDE has undertaken quality control on approximately 5% of the total samples prepared. This includes the submission of approximately 5% duplicates (field and pulp), 5% certified standards and 5% blanks. Blanks and standards are inserted routinely into the prepared samples for dispatch to the laboratory. In addition, umpire assays have also been completed on approximately 10% of the total samples prepared and assayed.

All QA/QC results returned from the laboratory to-date have been made available to AMS for review. QA/QC results and graphs were compared with hardcopy original data from both the SGS and ALS laboratories.

### 12.2.1. 2009 Drilling Program

During the 2010 drilling campaign, VERDE did not carry out a proper QA/QC program. The QA/QC analysis was the internal Bureau Veritas Brazil program. To undertake an umpire sample analysis, 5% of samples sent to the Bureau Veritas Brazil and were then sent to SGS in Belo Horizonte. The accuracy, precision and contamination of the analysis was evaluated. VERDE personnel have reviewed the QA/QC results returned by Bureau Veritas Brazil as presented below in Table 12.2.1-1.

Table 12.2.1-1 Standards Utilized by Bureau Veritas Brazil

Standard	Expected Value (K <sub>2</sub> O %)	+/- 10% (EV)	Failed	N <sup>0</sup> of Analyzes	Minimum (%)	Maximum (%)	Mean (%)
IPT 146	0.04	0.034 and 0.042	5	6	0	0.07	0.05
IPT 53	12.10	10.89 and 13.31	0	6	11.95	12.61	12.18

Standard	Expected Value (K <sub>2</sub> O %)	+/- 10% (EV)	Failed	Nº of Analyzes	Minimum (%)	Maximum (%)	Mean (%)
IPT 53 + IPT 146	6.07	5.46 and 6.67	0	6	5.84	6.36	6.07
Pulp Blanks	0	<0.30	2	30	-	-	-

With the exclusion of IPT 146 (which is less than the quoted detection limit for K<sub>2</sub>O), all blanks and standards inserted by Bureau Veritas Brazil are within a 10% tolerance level.

#### **Sampling Precision**

Pulp duplicate samples were taken by Bureau Veritas Brazil every 20 samples. The results of these duplicates are shown below in Figure 12.2.1-1.

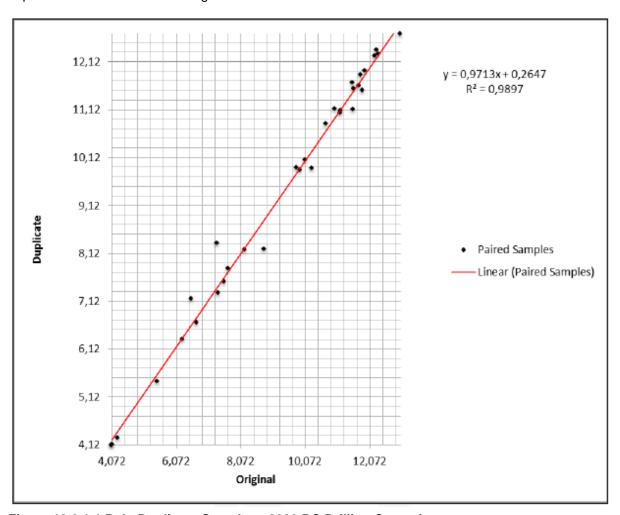


Figure 12.2.1-1 Pulp Duplicate Samples - 2009 RC Drilling Campaign

#### Inaccuracy

At the time of the 2009 drilling program, no QA/QC data was supplied by VERDE. It was recommended that VERDE adopt a QA/QC program which includes the use of certified standards, blanks and pulp duplicates. In addition, it was recommended that field duplicates be taken which would require the re-splitting of the RC field reject sample and submitted at a rate of approximately 5%.

#### Conclusions

The results show excellent precision for K<sub>2</sub>O with 97% of the data being within 10% HARD. The Bureau Veritas Brazil QA/QC data shows good precision and accuracy, despite the limited QA/QC completed for the field campaign.

### 12.2.2. 2011 Drilling Program

In May 2010, VERDE introduced an internal QA/QC program. For internal control reference, at every 20 routine samples, a CRM, a powder blank and a duplicate sample were inserted by VERDE.

#### Sampling Precision

SGS was used as the main laboratory by VERDE for the Cerrado Verde Project.

The sampling precision was evaluated using the method of repeated analysis of field duplicates for K<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, CaO, Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, MgO, TiO<sub>2</sub>, MnO, Na<sub>2</sub>O and LOI. From a total of 3,244 samples, 66 were re-examined, representing 2% of the total number of tests.

One of the parameters used in the analysis of the results was the precision. Precision is a measure of how well the Y value represents the X value. It is most commonly used in assay quality control, where X is the first assay value and Y is the matching repeat assay. A perfect result has a precision of zero. Values of greater than zero represent an increasing amount of deviation; for example, a precision of 10% indicates that the difference between X and Y varies by around 10% of X. The tests for K<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, MgO and TiO<sub>2</sub>, had a high quality and accuracy in the statistical analysis, with precision accuracy lower than 5%. For MnO and Na<sub>2</sub>O, the tests showed a precision accuracy lower than 15%, and for CaO, the tests showed a precision accuracy higher than 15%. The number of tests provided are considered sufficient to be statistically representative.

#### Precision of the Chemical Analysis

The sampling precision was evaluated using the method of repeated analysis for  $K_2O$ ,  $P_2O_5$ , CaO,  $Al_2O_3$ ,  $Fe_2O_3$ ,  $SiO_2$ , MgO,  $TiO_2$ , MnO,  $Na_2O$  and LOI. From a total of 3,244 samples, 108 were reexamined, representing 3.3% of the total number of tests.

Information on internal quality control was presented as a single data batch, without separation of the samples by grade ranges. Two evaluation methods were used, simple linear regression and QQ (Quantile Quantile) plot.

In general, the tests for  $K_2O$ ,  $Al_2O_3$ ,  $Fe_2O_3$ , MgO,  $TiO_2$  and  $SiO_2$ , had a high quality and accuracy in the statistical analysis, with accuracy higher than 5%. For  $P_2O_5$ , CaO, MnO and  $Na_2O$ , tests showed a precision up to 12%.

The correlation coefficient of the sample values of regular control is above 0.9, confirming that the tests for the most important elements for the mineralization were conducted with a satisfactory and acceptable accuracy.

#### Inaccuracy

The inaccuracy was determined as a difference in Fe<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, P<sub>2</sub>O<sub>5</sub>, MnO, TiO<sub>2</sub>, CaO, MgO, K<sub>2</sub>O, Na<sub>2</sub>O and LOI in samples, between the values determined by SGS and those determined by an independent laboratory ALS.

The external control was conducted for the purpose of determination of systematic inaccuracy in the results from the principal analytical laboratory. The value of the systematic inaccuracy was estimated by the same formula as used for the internal control.

The number of repeated tests is 119, which is 3.6% of the total number of tests 3,244. In summary, the analysis of data for each laboratory demonstrates good precision of data with a high coefficient of correlation R > 0.98.

The total number of external control tests is considered sufficient to be statistically representative. According to the analysis of external control data, the accuracy of principal laboratories is considered satisfactory.

#### **Standards**

For quality control 174 standard samples were used, which represent 5.3% of the total number of analyzed samples.

- Standard GPO-11 (53 analysis results / 9 samples outside tolerance limits);
- Standard GPO-12 (52 analysis results / 16 samples outside tolerance limits);
- Standard GPO-13 (87 analysis results / 0 samples outside tolerance limits);
- Standard GIOP-27 (29 analysis results / 1 samples outside tolerance limits);
- Standard IPT-18B (89 analysis results / 3 samples outside tolerance limits);
- Standard IPT-53 (84 analysis results / 0 samples outside tolerance limits); and
- Standard IPT-72 (43 analysis results / 43 samples outside tolerance limits).

Seven types of standards were analyzed, and the results were analyzed using the Shewhart Control Chart. Statistical analysis was performed for the following elements Fe<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, P<sub>2</sub>O<sub>5</sub>, MnO, TiO<sub>2</sub>, CaO, MgO, K<sub>2</sub>O and Na<sub>2</sub>O.

The analyzed results provided by SGS, present problems when compared with known results. It was reported by VERDE that inadequate results were occurring before March 2011 due to XRF equipment that was poorly calibrated during this period. In almost all cases, standard results were reporting lower than reference material results. An example from standard reference material GPO-12 is presented below in Figure 12.2.2-1.

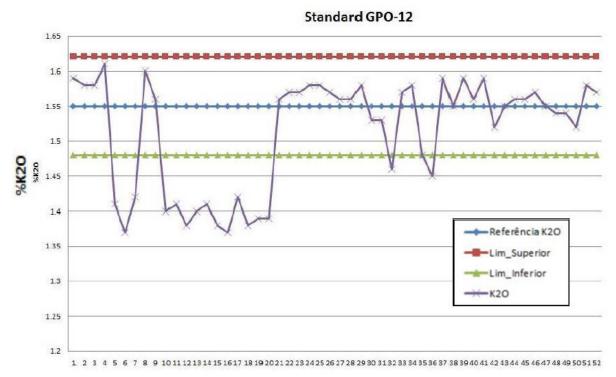


Figure 12.2.2-1 Standard GPO-12 Samples Results (Purple Line) - 2011 Drilling Campaign

#### **Blank Samples**

For quality control 174 blank samples were used, representing 5.3% of the total number of samples analyzed.

When discussing the methodologies of the blank samples with the VERDE team, it was certified that powder material was sent to the laboratory.

The purpose of using blank samples is to attempt to quantify the contamination of samples during the sample preparation process. This objective was not achieved whereas the blank samples were sent to a laboratory as powder, not subject to potential contamination involved in the preparation process and reduction of other samples. This makes it unnecessary to analyze the results obtained for the blank samples to quantify the possible errors in the preparation of other samples.

### Conclusions

It was certified that the tests relating to duplicate samples were conducted with an acceptable and satisfactory accuracy for the most important elements of the mineralization under study.

### 12.2.3. 2012 Drilling Program

### Summary

For the 2012 drilling campaign, all assays results are derived from analyses performed at SGS Geosol (Belo Horizonte) and ALS (Lima) laboratories. The control samples, inserted at every batch of 20 routine samples, were:

- 1 field duplicate;
- 1 pulp duplicate;
- 1 certified standard;
  - o GPO-11;

- ITAK-904;
- o ITAK-905;
- 1 blank (chipped quartz, crushed, homogenized and certified by Bureau Veritas, without K<sub>2</sub>O contents);
- 1 umpire (pulp sample re-analyzed at ALS).

The standards were submitted as 10 g sachets for conventional XFR analysis. The assay data for all standards show acceptable results within 3 standard deviations. Precision of the duplicates for XRF method is considered very good. The assay data for all duplicates show acceptable results within 10% accuracy.

#### Methodology

QA/QC for standard samples was made considering the 3 standard deviation limits. Shewhart control charts were used to evaluate the accuracy and dispersion. The analysis for duplicates and umpires was made according to the orientation given by the SGS Geosol. The maximum acceptable value for the difference between the result of the routine sample (V1) and its duplicate (V2) is given by the following equations;

$$Precision = \frac{100*LDE}{Mean (V1:V2)} + LR$$

Where LDE is the Statistic Detection Limit (0.025% for  $K_2O$ ) and LR is the repeatability limit (7% for  $K_2O$ ). The relative percentage difference between V1 and V2 is given by the equation;

% Diff 
$$v_{I,V2} = Abs \frac{V_1 - V_2}{Mean (V_1:V_2)} * 100$$

If %Diff<sub>V18V2</sub> is bigger than the maximum acceptable value (given by "Precision" on the equation above), the duplicate result is an "inadequate" result. This relative difference was also analyzed considering 5% or 10% tolerance and by linear regression plots.

#### DDH

A total of 12 DDH for 785.40 m were drilled as part of the 2012 drilling program. A total of 257 drill core samples were submitted to SGS for analysis, with the inclusion of an additional 12 CRMs, 12 field duplicates, 12 pulp duplicates, 12 blanks and a further 12 umpire assays as part of standard QA/QC implemented by VERDE.

Results for CRMs submitted to the laboratory for analysis are presented below in Table 12.2.3-1 and Figure 12.2.3-1 to Figure 12.2.3-3.

Table 12.2.3-1 CRMs Submitted by VERDE to SGS Laboratories (Diamond Drilling)

CRM Id	Supplier	K₂O (Max)	K <sub>2</sub> O (Min)	K₂O (Mean)	Number	Outside +/- 3 x SD Limits
GPO-11	Geostats	3.06	3.01	3.03	4	0
ITAK-904	ITAK	7.47	7.43	7.45	4	0
ITAK-905	ITAK	10.30	10.10	10.18	4	0

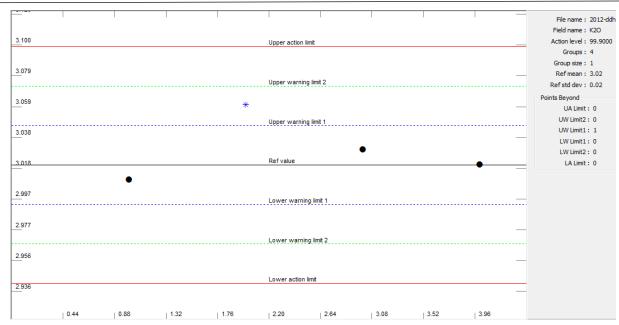


Figure 12.2.3-1 Shewhart Control Chart for Standard GPO-11

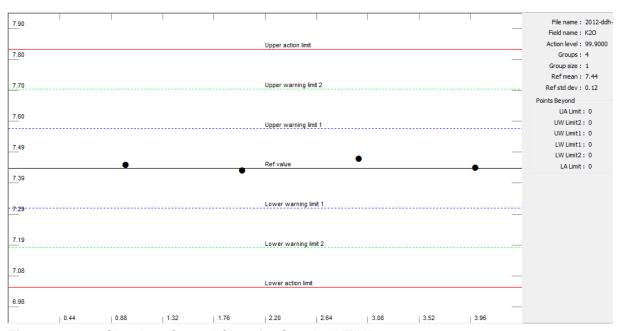


Figure 12.2.3-2 Shewhart Control Chart for Standard ITAK-904

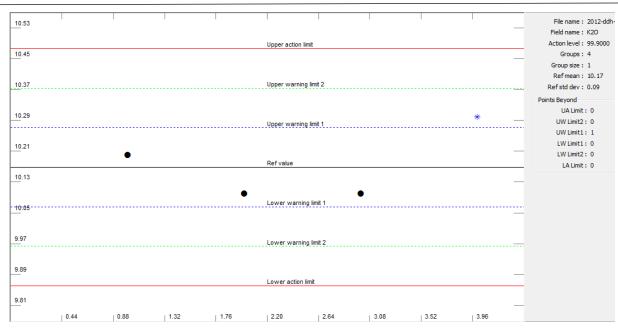


Figure 12.2.3-3 Shewhart Control Chart for Standard ITAK-905

On the whole, CRMs submitted by VERDE display excellent accuracy, with no outstanding issues which require attention. AMS is satisfied with the current procedure in place for submission of certified standards.

A total of 12 field duplicates were submitted by VERDE based on the recent diamond drilling program. The objective of this was to determine relative precision levels between various sets of assay pairs and the quantum of relative error. This directly reflects on the precision of the sampling technique utilized.

Based on the analysis, AMS concludes that the precision of field duplicates is acceptable as shown in Table 12.2.3-2 and Figure 12.2.3-4 below.

Table 12.2.3-2 Field Duplicates Submitted by VERDE to SGS Laboratory (Diamond Drilling)

Population	12	y (Diamona Diming)
Correlation Coefficient	0.997417255	
Covariance	2.155931818	
Precision	1.26%	
	Original (X)	Duplicate (Y)
Mean	9.73	9.76
Variance	2.07	2.25
Standard Deviation	1.44	1.50
Max	11.30	11.60
Min	7.18	7.09

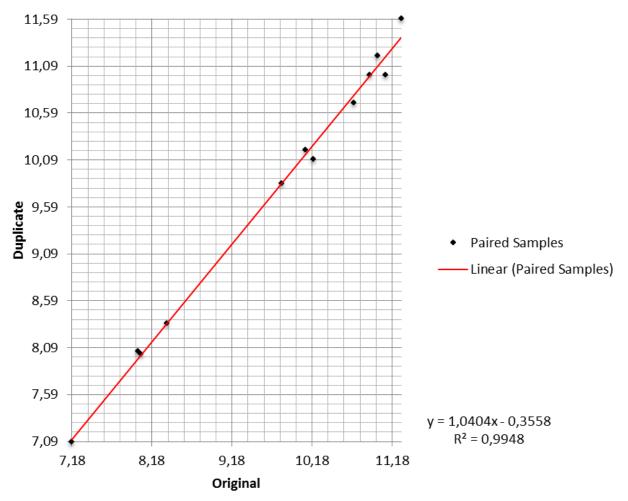


Figure 12.2.3-4 Linear Regression for Field Duplicates (Diamond Drilling)

All blank samples returned K<sub>2</sub>O values consistent with certificate provided by Bureau Veritas.

### <u>RC</u>

A total of 252 RC drillholes for 15,080 m were drilled as part of the 2012 drilling program. A total of 4,733 RC samples were submitted to SGS for analysis, with the inclusion of additional 250 standards, 250 field duplicates, 242 pulp duplicates, 250 blanks and further 254 umpire assays as part of standard QA/QC implemented by VERDE.

Results for standards submitted to the laboratory for analysis are presented below in Table 12.2.3-3 and Figure 12.2.3-5 to Figure 12.2.3-7.

Table 12.2.3-3 Standards Submitted by VERDE to SGS Laboratories (Reverse Circulation Drilling)

Standard Name	Supplier	K <sub>2</sub> O (Max)	K <sub>2</sub> O (Min)	K <sub>2</sub> O (Mean)	Number	Outside +/- 3 x SD Limits
GPO-11	Geostats	3.08	2.96	3.02	74	0
ITAK-904	ITAK	7.56	7.28	7.42	89	0
ITAK-905	ITAK	10.30	9.95	10.15	87	0

#### Standard GPO 11 (K2O)

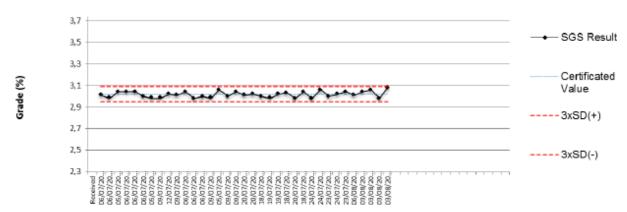


Figure 12.2.3-5 Shewhart Control Chart for Standard GPO-11

#### Standard ITAK-904 (K2O)

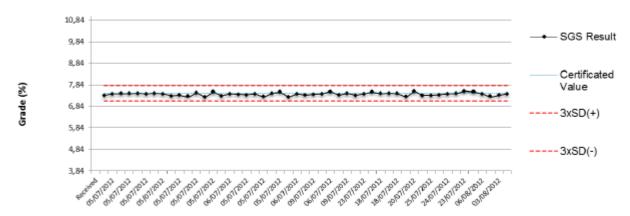


Figure 12.2.3-6 Shewhart Control Chart for Standard ITAK-904

#### Standard ITAK-905 (K2O)

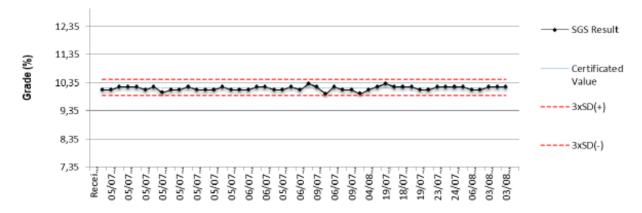


Figure 12.2.3-7 Shewhart Control Chart for Standard ITAK-905

A total of 250 field duplicates were submitted by VERDE based on the recent reverse circulation drilling program.

Based on the analysis, AMS concluded that the precision of field duplicates is acceptable as shown in Table 12.2.3-4 and Figure 12.2.3-8 below.

Table 12.2.3-4 Field Duplicates Submitted by VERDE to SGS Laboratory (Reverse Circulation Drilling)

Drilling)		
Population	250	
Correlation Coefficient	0.994492172	
Covariance	2.257993116	
Precision	1.64%	
	Original (X)	Duplicate (Y)
Mean	9.69	9.68
Variance	2.29	2.25
Standard Deviation	1.51	1.50
Max	12.00	11.90
IVIAX	12.00	11.00

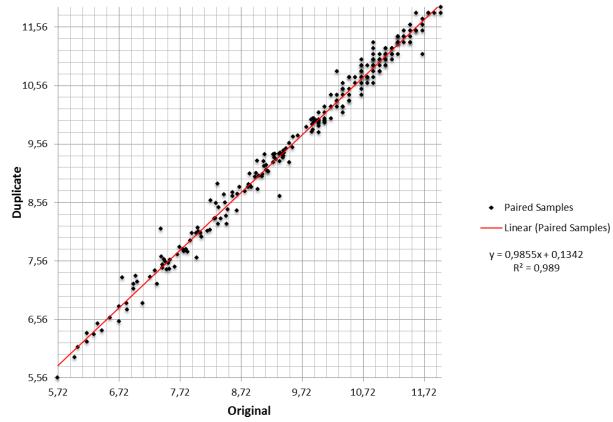


Figure 12.2.3-8 Linear Regression for Field Duplicates (Reverse Circulation Drilling)

All field duplicates are inside the 10% tolerance level.

A total of 242 pulp duplicates were submitted by VERDE based on the recent reverse circulation drilling program.

Based on the analysis, AMS concludes that the precision of pulp duplicates is acceptable as shown in Table 12.2.3-5 and Figure 12.2.3-9.

Table 12.2.3-5 Pulp Duplicates Submitted by VERDE to SGS Laboratory (Reverse Circulation Drilling)

Population	242	
Correlation Coefficient	0.996531627	
Covariance	2.290954549	
Precision	1.31%	

	Original (X)	Duplicate (Y)
Mean	9.68	9.81
Variance	2.29	2.31
Standard Deviation	1.51	1.52
Max	12.00	12.10
Min	5.72	5.84

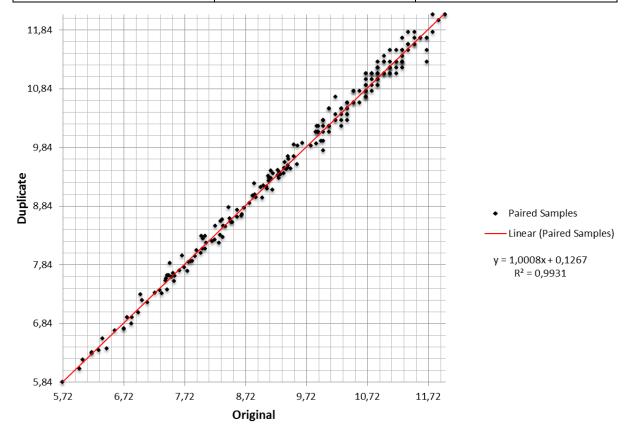


Figure 12.2.3-9 Linear Regression for Pulp Duplicates (Reverse Circulation Drilling)

All pulp duplicates are inside the 10% tolerance level.

A total of 242 umpire assay samples were submitted by VERDE based on the recent reverse circulation drilling program.

Based on the analysis, AMS concludes that the precision of assay results between laboratories is acceptable as shown in Table 12.2.3-6 and Figure 12.2.3-10 below.

Table 12.2.3-6 Umpire Samples Submitted by VERDE to ALS Laboratory (Reverse Circulation Drilling)

Population	242	
Correlation Coefficient	0.996077628	
Covariance	2.557619772	
Precision	1.49%	
	Original (X)	Duplicate (Y)
Mean	9.57	9.62
Variance	2.53	2.59
Standard Deviation	1.59	1.61
Max	12.16	12.10
Min	5.42	5.29

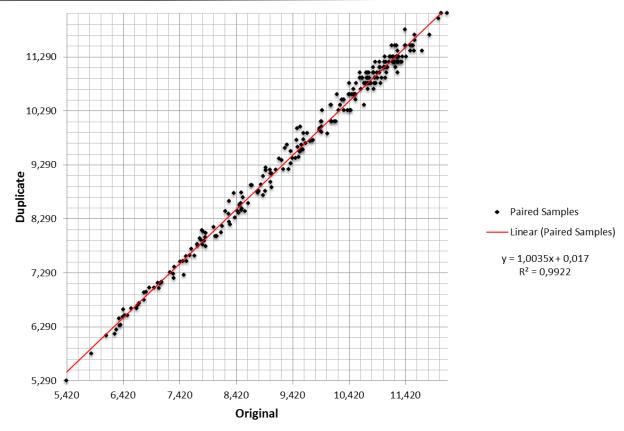


Figure 12.2.3-10 Linear Regression for Umpire Samples (Reverse Circulation Drilling)

All umpire assay results are inside a 5% tolerance limit.

All blank samples returned  $K_2O$  values consistent with certificate provided by Bureau Veritas (Figure 12.2.3-11). Minor variation was noted with 7 samples reporting slightly anomalous results of 0.02%  $K_2O$ , however this in the opinion of AMS this is not material to the overall resource estimate.

VERDE should ensure that SGS maintain best practice sample preparation techniques going forward to minimize the effects of any sample preparation contamination.

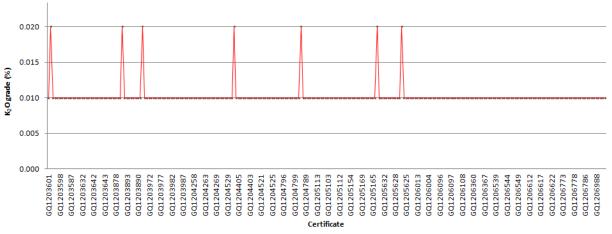


Figure 12.2.3-11 Blank Samples Submitted (Reverse Circulation Drilling)

### 12.2.4. Twin Hole Comparisons

Twelve reverse circulation (RC) and diamond drill holes (DH) were drilled at between 1 m and 3.5 m intervals. The objective was to compare the lithological descriptions and the analytical results of both

drilling techniques, given that a number of RC holes were drilled either moist or wet. A total of 785 m drilled into Target 7 between August and September 2012 were sampled at intervals of 2 m and sent for assays at SGS Geosol lab. Due to the low  $K_2O$  results obtained in the CV-RC-575C and CV-DH-34 pair (average grade of 5%  $K_2O$ ) those holes are not used in the comparison. The lithologies logged are equivalent on both core samples. The difference is  $K_2O$  grades between both drilling techniques are shown in Table 12.2.4-1.

Table 12.2.4-1 Twin Hole Comparisons (DDH vs RC Drilling)

	UTM WGS84 23S		Distance	Elevation	,	%	
Holes	Holes X Y		Between (m)		% K₂O (Ore)	Difference	
CV-RC-535	404219.48	7872932.95	10 m	936.73	6 m-32 m @ 9.65% K <sub>2</sub> O	0.2%	
CV-DH-28	404219.60	7872933.91	1.0 m	936.83	6 m-32 m @ 9.63% K₂O	-0.2%	
CV-RC-553	405958.82	7872458.65	2.1 m	941.19	30 m-88 m @ 10.08% K <sub>2</sub> O	-0.7%	
CV-DH-29	405958.46	7872458.37	2.1 m	941.39	30 m-88 m @ 10.15% K <sub>2</sub> O	+0.7%	
CV-RC-563	405434.59	7871312.26	2.9 m	964.40	30 m-70 m @ 10.69%	-1.2%	
CV-DH-30	405433.44	7871309.65	2.9 111	964.26	30 m-70 m @ 10.82%	+1.2%	
CV-RC-607	409368.90	7874619.64	2.2 m	909.32	0 m-46 m @ 10.86%	+1.8%	
CV-DH-26	409368.77	7874621.81	2.2 111	909.08	0 m-46 m @ 10.66%	-1.8%	
CV-RC-621	408211.46	7870647.59	0.9 m	952.03	15 m-85 m @ 10.20%	-0.8%	
CV-DH-31	408211.26	7870648.42	0.9 111	952.35	15 m-85 m @ 10.28%	+0.8%	
CV-RC-648	408271.18	7868815.12	2.5 m	927.48	9 m-51 m @ 9.57%	-2%	
CV-DH-33	408268.83	7868815.89	2.5 111	927.22	9 m-51 m @ 9.76 %	+2%	
CV-RC-669	405967.04	7868889.22	1.1 m	968.81	18 m-68 m @ 10.20%	-1.2%	
CV-DH-32	405967.35	7868890.26	1.1 111	968.78	18 m-68 m @ 10.32%	+1.2%	
CV-RC-680	409216.66	7879790.43	3.5 m	894.71	0 m-30 m @ 10.57%	-1.2%	
CV-DH-23	409219.95	7879789.17	3.3 111	895.49	0 m-30 m @ 10.70%	+1.2%	
CV-RC-711	406866.85	7875195.04	2.4 m	921.24	12 m-56 m @ 10.13%	-2.3%	
CV-DH-25	406866.85	7875192.62	2.4 111	921.50	12 m-56 m @ 10.36%	+2.3%	
CV-RC-721	407679.56	7873233.78	2.0 m	943.10	16 m-42 m @ 8.71%	-2.3%	
CV-DH-27	407677.64	7873234.57	2.0 m	942.87	18 m-40 m @ 8.91%	+2.3%	
CV-RC-789	408118.71	7876931.67	2.2 m	923.86	13 m-37 m @ 8.73%	-3.6%	
CV-DH-24	408120.77	7876932.62	Z.Z III	924.13	13 m-37 m @ 9.04%	+3.6%	

The results show a good comparison of grades between moist/wet RC samples and dry diamond drilling. Results strongly suggest that reverse circulation drilling is suitable for inclusion in the resources estimate for the Cerrado Verde Project.

## 12.2.5. Data Quality Summary

As part of the 2011/2012 work program undertaken across the Cerrado Verde Project area, VERDE has implemented an internal QA/QC protocol which includes the insertion of reference materials in the

sample series (certified analytical standards and blanks). The QA/QC program also included analysis of field and pulp duplicates on a systematic basis, and the re-analysis of selected sample pulp duplicates in a second analytical laboratory for verification (umpire assays).

Reported results for the 2011 program highlight several issues with respect to submitted standards and blanks. Upwards of 10% - 20% of standards plot outside tolerance levels set by VERDE, and this has been attributed to poor calibration of XRF equipment by the laboratory (SGS). AMS made note of the fact that in almost all cases, the laboratory standard results returned were reporting lower than the standard reference material certified values. In addition to this, it was noted that powdered blank material was submitted throughout the 2011 drilling campaign. AMS considers this material as being ineffective in testing for sample preparation contamination issues as part of the sample submission process implemented by VERDE.

Significant QA/QC improvements were noted during the 2012 drilling campaign, with reported results for the certified analytical standards showing a very good correlation for all three utilized standards. There were no reported issues with any of the standard results returned from the laboratory.

Additionally, all blank samples returned  $K_2O$  values <0.02%  $K_2O$ , with previous issues regarding the submission of powdered blank samples rectified during the 2012 drilling campaigns through the use of a quartz gravel blank.

The results of duplicate test work completed (both field and pulp duplicates) show a good correlation with the original analytical values and provide acceptable data variance.

The re-analysis of pulp duplicate from selected mineralized samples (umpire assays) showed an excellent correlation which indicates very little laboratory bias between both ALS and SGS laboratories.

It is the author's opinion that despite some QA/QC concerns for the 2011 drilling campaign, VERDE is now operating according to industry standard with respect to QA/QC protocol for the insertion of controlled reference material into the stream of samples submitted for the Cerrado Verde Project.

The overall data package is considered of sufficient quality to be used for mineral resource estimation.

# 13. Mineral Processing and Metallurgical Testing

All required metallurgical tests to produce Super Greensand® were performed with the glauconitic siltstone.

FLSmidth performed a crushability test on September 9, 2011, using their certified method. The results are presented in Table 13-1 to Table 13-3.

Table 13-1 UCS Compressive Test (ASTM D 2838)

Comple #	(in inch	nes)	(in pounds)	nci	
Sample #	Diameter Height Compressive Loa		<b>Compressive Load</b>	psi	
1	1.98	4.55	10,150	3,307	
2	1.99	3.94	5,590	1,799	
3	1.98	4.21	12,280	4,005	
4	-	-	-	-	
5	-	-	-	-	
Ave	1.98	4.23	9,340	-	

Compressive Strength 3,032 psi

r = 0.990

**Table 13-2 Bond Crushability** 

Sample	Thickness (inches)	M/C Scale ft-lb (M/C Scale) Inch Thickness		CWI kW-h/mt	CWI hp-h/s t	
1	1.89	11.25	5+95	10.06	12.24	
2	<b>2</b> 1.97		5+71	9.65	11.74	
3	2.05	7.50	3.66	6.18	7.52	
4	1.95	7.50	3.85	6.50	7.91	
5	1.90	7.50	3.95	6.67	8.11	
6	2.06	7.50	3.64	6.15	7.48	
7	1.89 7.50		3.98	6.72	8.18	
8	1.90	7.50	3.94	6.66	8.10	
9	1.82	7.50	4.13	6.98	8.49	
10	1.63	7.50	4.62	7.80	9.49	
Average Macl	Average Machine Scale Impact Strength =			7.34	8.93	

Specific Gravity =

2.52 g/cm<sup>3</sup>

Average Impact Value 8.68

Crushability Index 8.93 hp-h/short ton 7.34 kW-h/m.t

**Table 13-3 PAC Abrasion Test** 

Paddle Wt.	930.303	grams	
After	930.300	"	
Wt. Loss	0.0003	"	

(Chrome Moly Steel Paddle)

Abrasion Index =
0.0003 grams

PAC Product PSD						
Mesh Size	Cum %passing	microns				
1/2"	100,0	12,700				
3/8"	98,0	9,525				
1/4"	64.9	6,350				
4 Mesh	52.8	4,750				
6 Mesh	46.5	3,350				
8 Mesh	40.7	2,360				
12 Mesh	36.1	1,700				
40 Mesh	21.2	425				
70 Mesh	15.2	212				
100 Mesh	8.1	150				
200 Mesh	4.3	75				
325 Mesh	2.5	45				

Product Size Passing 80% (P80)	
7798 μm	

Product:					
Sieve 1	9,528 micron				
%Passing	98%				
Sieve 2	6,350 micron				
%Passing	64.8%				
80% Passing	7,798 micron				

Other tests were performed for products other than the Super Greensand® (such as KCI and ThermoPotash); and will not be detailed here, for those are not the subject of this study.

# 14. Mineral Resource Estimate

### 14.1.Introduction

AMS has estimated the Mineral Resource for Target 7 for the Cerrado Verde Project using drilling data completed by VERDE during the 2011 and 2012 field campaigns. In addition, a small number of drill holes have been included from a drill program undertaken in late 2009. The final database used to produce the mineral resource estimate totals 435 drill holes which comprise 420 reverse circulation drill holes and a further 15 diamond drill holes.

The mineral resource estimate is derived from a computerized resource block model. The construction of the block model starts with the modelling of 3D wireframe envelopes or solids of the mineralization using drill hole K<sub>2</sub>O analytical data and lithological information. Once the modelling has been completed, the analytical data contained within the wireframe solids is normalized to generate fixed length composites. The composite data is used to interpolate the grade of blocks regularly spaced on a defined grid that fills the 3D wireframe solids. The interpolated blocks located above the bedrock interface and outside the default waste solid comprise the mineral resources. The blocks are then classified based on confidence level using proximity to composites, composite grade variance and mineralized solids geometry. The 3D wireframe modelling was initially interpreted by VERDE, and then modified by the author based on final assay results. The block model and mineral resource estimation were conducted by AMS based on information provided by VERDE.

All grade estimation was completed using Ordinary Kriging (OK) for K<sub>2</sub>O as well as Al<sub>2</sub>O<sub>3</sub>, CaO, Fe<sub>2</sub>O<sub>3</sub>, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub>, TiO<sub>2</sub> and LOI. This estimation approach was considered appropriate based on a review of a number of factors, including the quantity and spacing of available data, the interpreted controls on mineralization, as well as the style of mineralization under consideration.

The estimation was constrained entirely within both the fresh rock and weathered domains. Weathered regolith is generally well developed across the Cerrado Verde Project area (typically 5 m-20 m in depth), with all 435 drill holes noted to intersect significant K<sub>2</sub>O mineralization within fresh rock and to a lesser extent weathered material across the Project area. Drilling into the fresh rock across the Cerrado Verde Project area almost always results in a sharp increase in the K<sub>2</sub>O grades across the regolith boundary (weathered to fresh rock).

The Cerrado Verde Project mineral resource estimate is based on 435 drill holes (26,609 m) drilled at a nominal spacing of approximately 200 m by 200 m. A total of 420 reverse circulation drill holes (25,563 m) and 15 diamond drill holes (1,046 m) have been completed across the resource area. DDH have been completed as twin holes to pre-existing reverse circulation drilling to provide suitable QA/QC comparison test work. Infill drilling to a 100 m by 100 m spacing has been completed in two separate areas of the resource in an effort to increase the resource category confidence, and provide suitable vectors from variographic studies.

Drilling included within the Cerrado Verde Project is listed below in Table 14.1-1 and illustrated in Figure 14.1-1.

Table 14.1-1 Cerrado Verde Resource - Drilling Summary Statistics

Table 1411 1 Collade Volue 100		
Year	Drilling Technique	Summary
2009	-	-
2009	RC	19 Holes (997 m Total)
2010*	-	-
2010	-	-

Year	Drilling Technique	Summary	
2011	DHH	3 Holes (261 m Total)	
2011	RC	149 Holes (9,486 m Total)	
2012	DHH	12 Holes (785.4 m Total)	
2012	RC	252 Holes (15,080 m Total)	

<sup>\*</sup>No drilling was completed by VERDE during 2010.

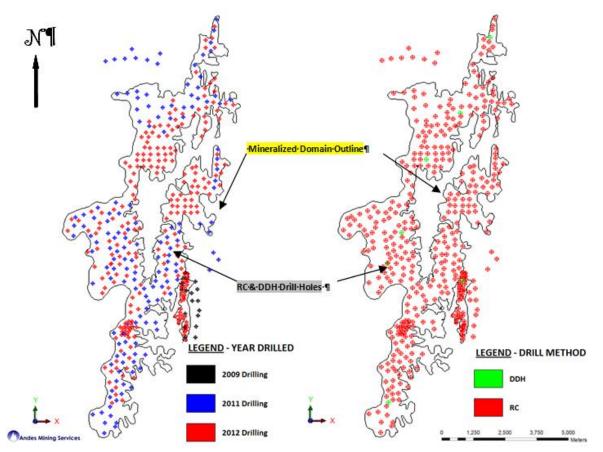


Figure 14.1-1 Plan View of Mineralized Domain Outline (Target 7) with Drillholes (AMS, March 31, 2013)

# 14.2. Geological Modelling

Given the extensive number of drill holes across the Cerrado Verde Project, a detailed geological model has been developed by VERDE personnel as a basis for resource estimation work completed by AMS.

AMS note the majority of drilling completed by VERDE has been within the fresh rock profile of the glauconitic siltstone unit where the  $K_2O$  is enriched, and subsequent geological modelling has focused on mineralized intervals within this fresh rock unit.

AMS have generated a mineralized domain for the Cerrado Verde Project area based upon an interpretation of drill hole data as well as geological mapping data supplied by VERDE personnel. AMS and VERDE have interpreted a mineralized K<sub>2</sub>O domain (which has been used for the estimation of Al<sub>2</sub>O<sub>3</sub>, CaO, Fe<sub>2</sub>O<sub>3</sub>, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub>, TiO<sub>2</sub> and LOI also) using a 6% K<sub>2</sub>O lower grade limit to guide the interpretation (Figure 14.2-1 to Figure 14.2-4).

An upper and lower digital terrain model (DTM) surface was generated for the 6% K<sub>2</sub>O grade boundary based on the 435 drill holes included in the database. Some lower grades were selectively

included within the mineralized boundary, where the grade data was logically interpreted to form part of the mineralized shape.

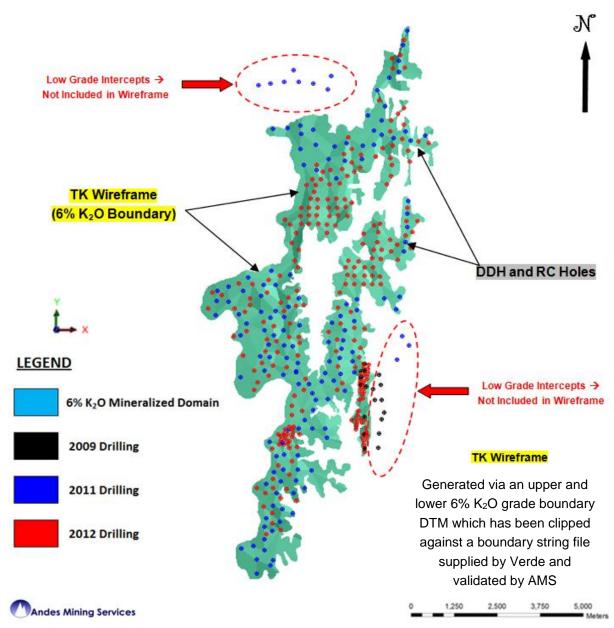


Figure 14.2-1 Plan View of Cerrado Verde Wireframe (AMS, March 31, 2013)

Upper and lower DTM surfaces representing a 6% K<sub>2</sub>O mineralized package were then clipped to a mineralized boundary surface supplied by VERDE which has been generated from a ground based survey of outcropping glauconitic siltstone in conjunction with satellite imagery.

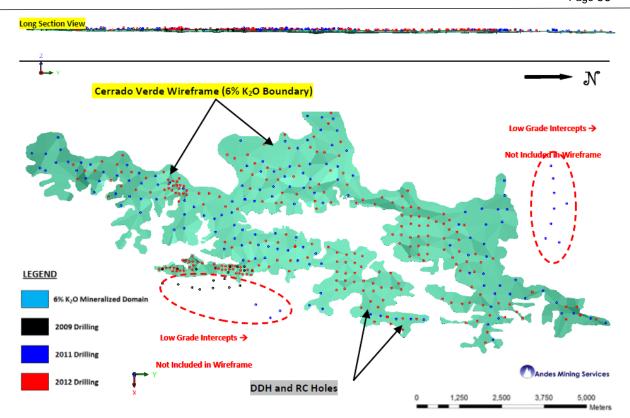


Figure 14.2-2 Long Section and Plan View of the Cerrado Verde Wireframe (AMS, March 31, 2013)

In addition to a 6% K<sub>2</sub>O mineralized domain, AMS have generated a DTM surface between weathered material and the underlying fresh rock material to take into consideration differences in bulk density (Figure 14.2-3 and Figure 14.2-4). As well as a significant density difference between weathered and fresh rock material, there is a sharp increase in K<sub>2</sub>O grades across this boundary.

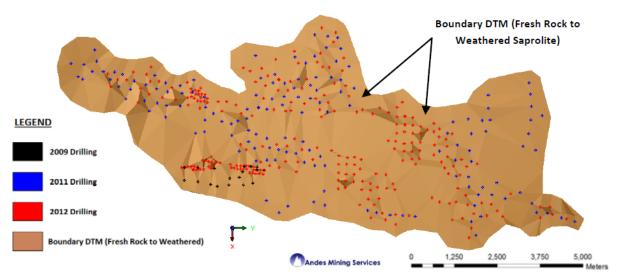


Figure 14.2-3 Bounding DTM Surface between Fresh Rock and Weathered Material (AMS, March 31, 2013)

AMS have utilized a recent detailed airborne laser scanning topographical survey across the Cerrado Verde Project area as an upper boundary surface for the Cerrado Verde wireframe (Figure 14.2-4). Drill holes were adjusted to the topographic surface before wireframing commenced.

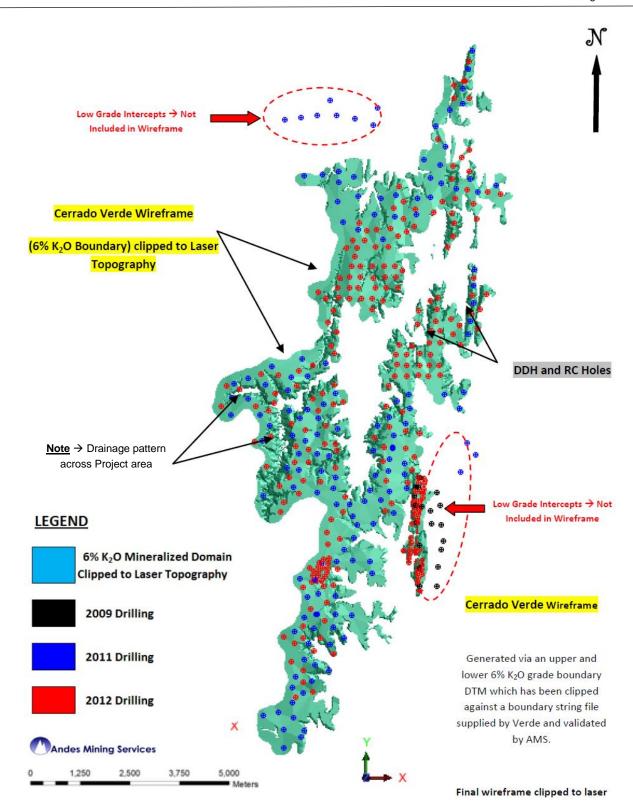


Figure 14.2-4 Plan View of Cerrado Verde Wireframe and Drilling clipped to Topography (AMS, March 31, 2013)

Density values were assigned appropriately downhole with an average value of 2.18 g/cm³ assigned to the fresh rock material, while all other weathered material (saprolite and colluvium) was assigned a density value of 1.64 g/cm³ as per discussions in Section 10.10.

It is quite clear that K<sub>2</sub>O values are more elevated within the fresh rock glauconitic siltstone material as shown in the section below (Figure 14.2-5).

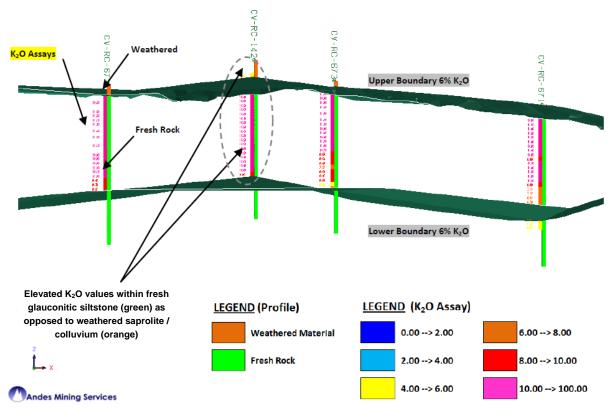


Figure 14.2-5 Cross Section View of Wireframe & Drill Holes at 7,868,700 N (+/-50 m) (AMS, March 31, 2013)

# 14.3. Sample Selection and Sample Compositing

Samples were selected for the mineral resource estimate from within the mineralized wireframe generated from the geological and grade based domain. Samples intervals were assigned a nominal 'intersection code' which reflected the mineralized domain from which those intervals were derived. The average sample length utilized for Cerrado Verde is 2 m (Figure 14.3-1).

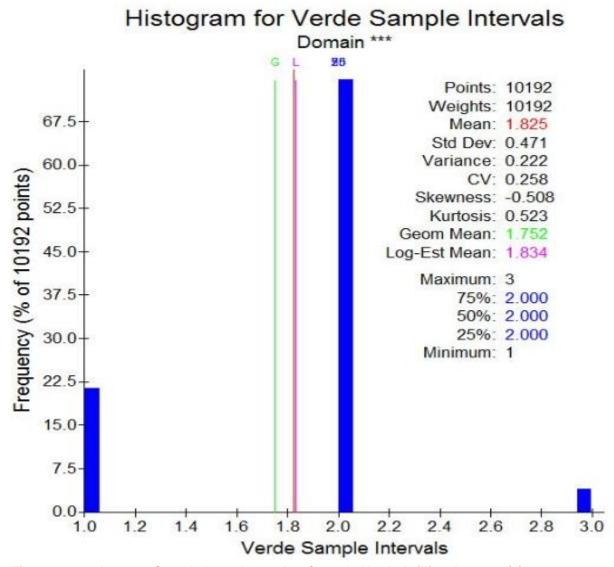


Figure 14.3-1 Average Sample Length Graph - Cerrado Verde Drilling Program(s)

Selected samples were visually compared back to the interpretation to ensure that the flagging was correct and appropriate.

Block model grade interpolation is conducted on composited analytical data. Selected sample intervals were composited downhole to 5m intervals which AMS considers is the likely mining bench height for a large scale open pit mining operation of this geometry and grade variability.

Composites were generated to 5 m intervals based on a "best fit" approach and hence no residual samples were discarded. Given the bulk mining approach that will be adopted, this method of generating composites was considered appropriate.

No capping was applied to the assays before compositing.

The composite file was used as the basis for geostatistics and 3D modelling and estimation.

# 14.4. Statistical Analysis

The drillhole database was composited to a 5 m down-hole composite interval, with the 5 m composite used for all statistical, geostatistical and grade estimation studies. Statistical analysis of 5 m composites from the mineralized domain is presented below in Table 14.4-1.

Table 14.4-1 Summary Statistics – 5m Composites within Cerrado Verde Mineralized Domain

	Element	Count	Minimum	Maximum	Mean	Std. Dev.	CV
	Al <sub>2</sub> O <sub>3</sub>	3256	5.05	19.31	15.56	1.36	0.09
	CaO	3256	0.01	21.84	0.50	1.19	2.38
	Fe <sub>2</sub> O <sub>3</sub>	3256	2.53	10.60	6.86	0.62	0.09
N. 41 11 1	K <sub>2</sub> O	3387	2.50	12.89	9.27	1.71	0.18
Mineralized	LOI	3150	1.28	29.93	3.50	1.26	0.36
Domain	MgO	3256	1.40	13.03	2.90	0.46	0.16
"TARGET 7"	MnO	3150	0.02	1.45	0.13	0.06	0.46
	Na <sub>2</sub> O	3150	0.05	1.99	0.19	0.25	1.33
	P <sub>2</sub> O <sub>5</sub>	3150	0.01	3.44	0.14	0.10	0.70
	SiO <sub>2</sub>	3256	23.15	77.10	59.79	3.01	0.05
	TiO <sub>2</sub>	3150	0.30	2.93	0.82	0.10	0.12

No top cut has been applied to  $K_2O$  and  $Al_2O_3$  composite data based on a review of histogram and log probability curves show below (Figure 14.4-1 and Figure 14.4-2 respectively). Top cuts have been applied to all other elements which include CaO,  $Fe_2O_3$ , LOI, MgO, MnO,  $Na_2O$ ,  $P_2O_5$ ,  $SiO_2$  and  $TiO_2$  based on a review of histogram and log probability curves show below (Figure 14.4-3 to Figure 14.4-11).

Individual top cuts applied to each element are presented below in Table 14.4-2.

Table 14.4-2 Top Cuts Applied to 5m Composite Data for Cerrado Verde

Table 14.4-2 Top Cuts Applied to 5in Composite Data for Cerrado Verde						
	Element	Count	Minimum	Maximum	Mean	Top Cut Applied (%)
	Al <sub>2</sub> O <sub>3</sub>	3256	5.05	19.31	15.56	No Top Cut Applied
	CaO	3256	0.01	21.84	0.50	8.0
	Fe <sub>2</sub> O <sub>3</sub>	3256	2.53	10.60	6.86	9.0
	K <sub>2</sub> O	3387	2.50	12.89	9.27	No Top Cut Applied
Mineralized	LOI	3150	1.28	29.93	3.50	10.5
Domain	MgO	3256	1.40	13.03	2.90	3.8
"TARGET 7"	MnO	3150	0.02	1.45	0.13	0.58
	Na <sub>2</sub> O	3150	0.05	1.99	0.19	1.6
	P <sub>2</sub> O <sub>5</sub>	3150	0.01	3.44	0.14	0.8
	SiO <sub>2</sub>	3256	23.15	77.10	59.79	73.0
	TiO <sub>2</sub>	3150	0.30	2.93	0.82	1.3

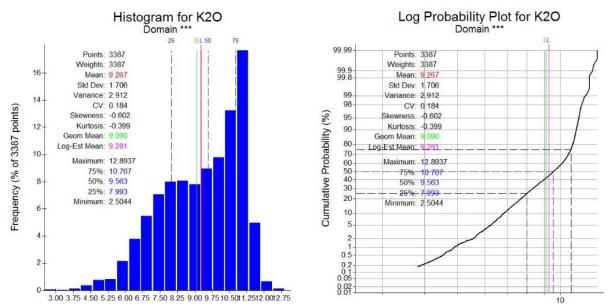


Figure 14.4-1 Histogram and Log Probability Plot - K₂O Composite Data (5 m)

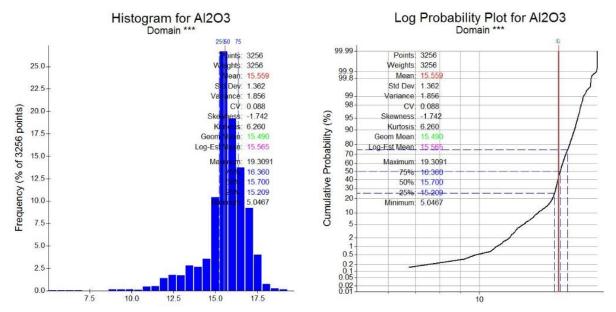


Figure 14.4-2 Histogram and Log Probability Plot - Al<sub>2</sub>O<sub>3</sub> Composite Data (5 m)

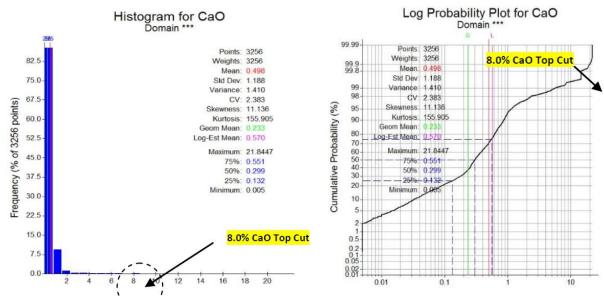


Figure 14.4-3 Histogram and Log Probability Plot - CaO Composite Data (5 m)

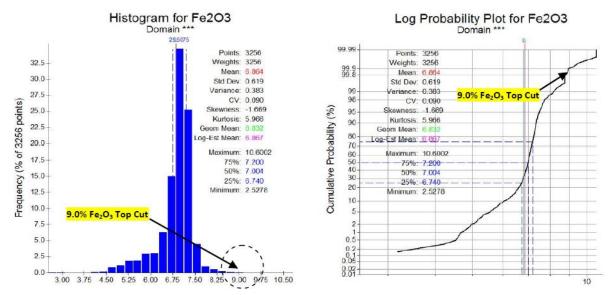


Figure 14.4-4 Histogram and Log Probability Plot - Fe<sub>2</sub>O<sub>3</sub> Composite Data (5 m)

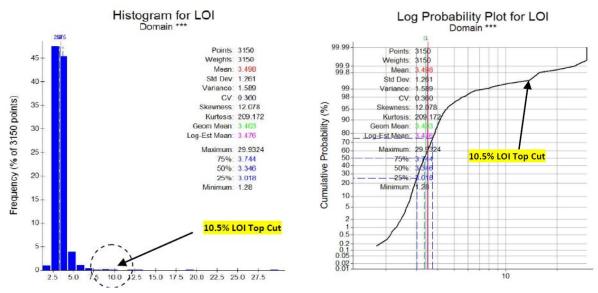


Figure 14.4-5 Histogram and Log Probability Plot - LOI Composite Data (5m)

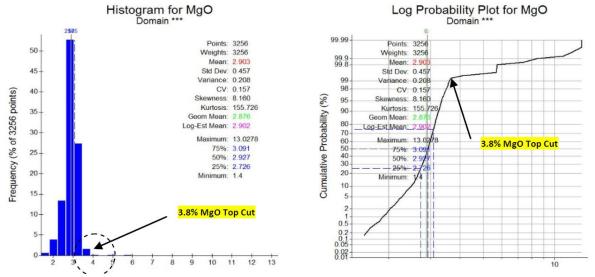


Figure 14.4-6 Histogram and Log Probability Plot - MgO Composite Data (5 m)

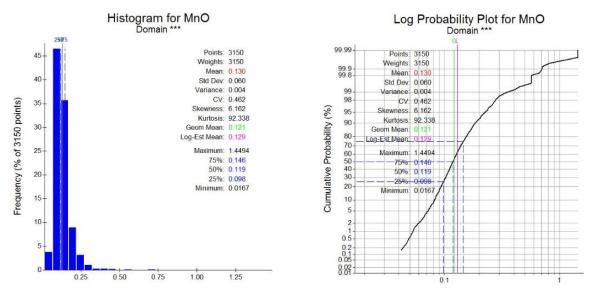


Figure 14.4-7 Histogram and Log Probability Plot - MnO Composite Data (5 m)

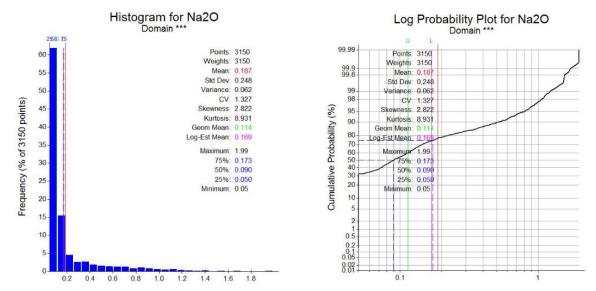


Figure 14.4-8 Histogram and Log Probability Plot - Na<sub>2</sub>O Composite Data (5 m)

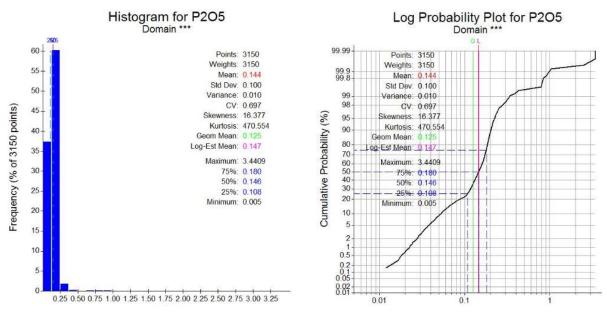


Figure 14.4-9 Histogram and Log Probability Plot - P<sub>2</sub>O<sub>5</sub> Composite Data (5 m)

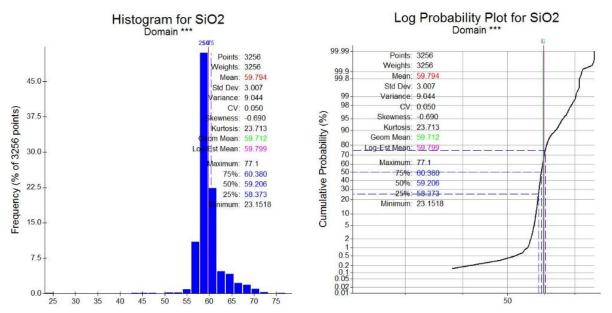


Figure 14.4-10 Histogram and Log Probability Plot - SiO<sub>2</sub> Composite Data (5 m)

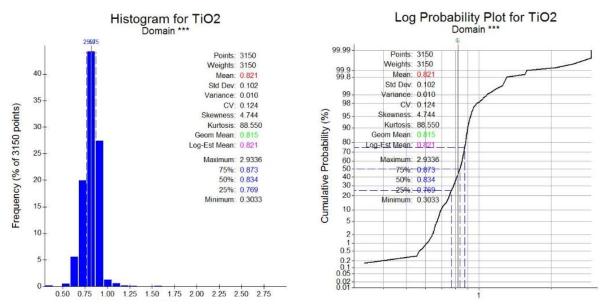


Figure 14.4-11 Histogram and Log Probability Plot - TiO<sub>2</sub> Composite Data (5 m)

### 14.5. Variography

The spatial continuity of composite grades for K<sub>2</sub>O as well as Al<sub>2</sub>O<sub>3</sub>, CaO, Fe<sub>2</sub>O<sub>3</sub>, LOI, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub> and TiO<sub>2</sub> were assessed by means of a variety of types of variograms.

Normal variograms were not stable. Therefore, pairwise relative variograms were computed and modelled for the 5 m composites. Variogram fans were analyzed for  $K_2O$  in order to identify potential anisotropies in the grade continuity within the modelled mineralized envelope. The variogram parameters determined for  $K_2O$  were applied to all other elements.

Table 14.5-1 below presents the variogram model of K<sub>2</sub>O and Figure 14.5-1 shows the pairwise relative variogram graph for K<sub>2</sub>O.

Table 14.5-1 Variogram Model of K<sub>2</sub>O Grade for 5m Composites

		First	Spherica	l Variog	ıram Comp	onent	•	S	econd s	Spherical	Variogr	am Cor	nponen	t
Nugget Effect	Sill			Orientation (in degrees)		Sill	Ranges (in meters)		Orientation (in degrees)					
	(C)	Max	Interm	Min	Azi	Dip	Spin	(C)	Max	Interm	Min	Azi	Dip	Spin
				Gla	uconitic sil	Itstone	Ore Dom	nain (Tar	get 7)					
0.21	0.48	000	000	70.5				0.31	000	000	455			
21%	48%	290	290	72.5	0	0	0	31%	620	620	155	0	0	0

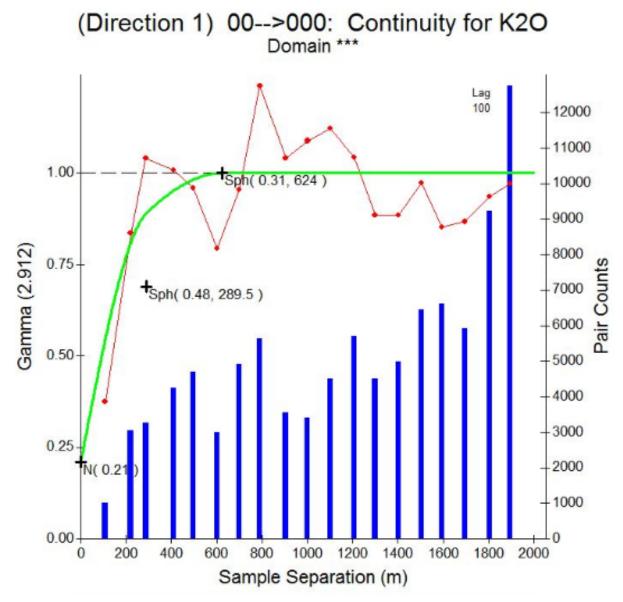


Figure 14.5-1 Pairwise Relative Variogram Graph for K<sub>2</sub>O

Generally, the variography is suggesting some anisotropy at relatively short distances (less than 300 m) but is isotropic at longer distances (upwards to 600 m - 650 m) (Figure 14.5-2). The best continuity in the analytical data, was observed on a horizontal plane (azimuth 0° and dip at 0°) while the direction of least continuity was perpendicular to the plane of best continuity (azimuth 90° and dipping towards 90°). The nugget effect is low (21%) which is normal for deposits of this style and nature.

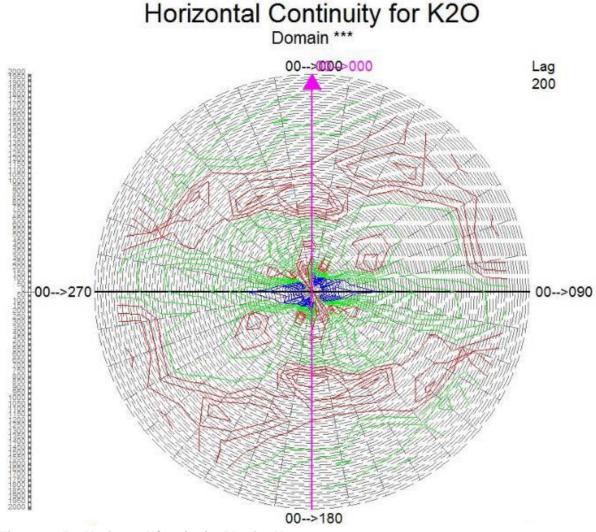


Figure 14.5-2 Horizontal Continuity Plot for K₂O

## 14.6. Block Model Development

A three-dimensional block model was defined for the Cerrado Verde Project, covering the interpreted  $K_2O$  mineralized domain. A parent block size of 50 mE x 50 mN x 5 mRL has been used with variable sub-blocking utilized in order to capture the relatively thin nature of the interpreted sub-horizontal mineralized glauconitic siltstone. A sub-block size of 6.25 mN x 6.25 mE x 1.25 mRL has been utilized. Estimation was only carried out into parent blocks, with sub-blocks assigned the parent cell grade estimates.

Table 14.6-1 below shows the summary of the 3D block model created for the Cerrado Verde Project.

Table 14.6-1 Block Model Summary - Cerrado Verde Project

Table 14.6-1 Block Wood	Table 14.6-1 Block Model Summary - Cerrado Verde Project											
	Y	x	Z									
Minimum Coordinates	7864000	403000	600									
Maximum Coordinates	7881000	410700	1100									
User Block Size	50	50	5									
Sub-Block Size	6.25	6.25	1.25									

	Y	х	Z
Rotation	0	0	0

A visual review of the wireframe solids and the block model indicates robust flagging of the block model (Figure 14.6-1).



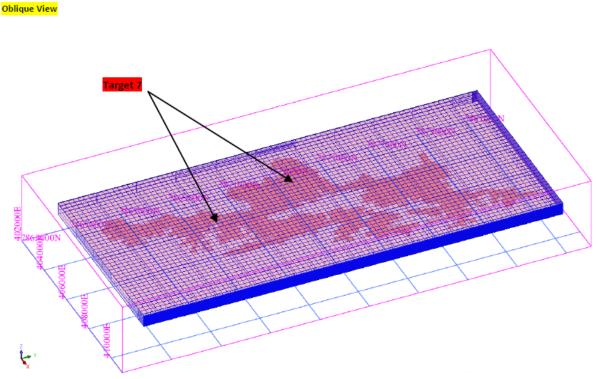


Figure 14.6-1 Block Model for the Cerrado Verde Project

AMS have also completed basic volume checks upon the mineralized wireframe domain and the block model reported volume, with results presented below in Table 14.6-2.

Table 14.6-2 Volume Check - Mineralized Wireframe vs Block Model Ore Domain

		Reported Volume (bcm)								
	Ore Wireframe	Ore Wireframe Block Model Domain % Difference								
Cerrado Verde Ore Zone	1,127,912,679	1,127,806,006	0.01							

The attributes coded into the block models include all elements (K<sub>2</sub>O, Al<sub>2</sub>O<sub>3</sub>, CaO, Fe<sub>2</sub>O<sub>3</sub>, LOI, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub> and TiO<sub>2</sub>), density, topography, weathering, resource category, domain code, as well as a number of kriging attributes and sample variance data.

A full list of attributes coded to the model is listed below in Table 14.6-3.

				de Project (AMS, March 31, 2013)
Attribute Name	Туре	Decimal	Background	Description
al2o3	Real	6	0	Aluminium (Oxide)
avg_dist_k2o	Real	1	-99	Average Distance to Find Samples
cao	Real	6	0	Calcium (Oxide)
density	Real	6	0	Density Value (Assigned)
domain	Character	-	waste	Ore Domain Assigned
fe2o3	Real	6	0	Iron (Oxide)
K <sub>2</sub> O	Real	6	0	Potassium (Oxide)
loi	Real	6	0	Loss On Ignition (LOI)
mgo	Real	6	0	Magnesium (Oxide)
min_dist_K2O	Real	1	-99	Minimum Distance to Find Samples
mno	Real	6	0	Manganese (Oxide)
na2o	Real	6	0	Sodium (Oxide)
num_samp_K2O	Integer	-	-99	Number of Samples for Estimate
p2o5	Real	6	0	Phosphorous (Oxide)
pass_no	Integer	-	0	Pass Number (1, 2 or 3)
pass_no_K2O	Integer	-	0	Pass Number for K2O Estimate
pod	Character	-	999	Pod Number
rescat	Character	-	none	Measured, Indicated, or Inferred
sio2	Real	6	0	Silica (Oxide)
permit_status	Character	-	outside	Either Inside or Outside
tio2	Real	6	0	Titanium (Oxide)
topo	Integer	-	0	Assign 1 if Underneath Laser Topo
weathering	Character	-	none	Either Fresh or Weathered

#### 14.7. Grade Estimation

The grade interpolation for all elements for the Cerrado Verde Project was estimated using Ordinary Kriging (OK). Anisotropic search ellipsoids were selected for the grade interpolation process based on the analysis of the spatial continuity of K<sub>2</sub>O, Al<sub>2</sub>O<sub>3</sub>, CaO, Fe<sub>2</sub>O<sub>3</sub>, LOI, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub> and TiO<sub>2</sub> grades using variography and on the general geometry of the modelled mineralized saprolite envelope. Limits are set for the minimum and maximum number of composites used per interpolation pass, and restriction are applied on the maximum number of composites used from each hole.

The interpolation process was conducted using 3 successive passes with relaxed search conditions from one pass to the next until all blocks were interpolated. The orientation of the search ellipsoids, which is identical for each interpolation pass, is 0° azimuth, 0° dip and 0° plunge consistent with a relatively uniform, sub-horizontal (flat lying) mineralized domain (Table 14.7-1).

In the first pass, the search ellipsoid distance was 200 m (long axis) by 200 m (intermediate axis) by 20 m (short axis). Search conditions were defined with a minimum of 8 composites and a maximum of 16 composites with a maximum of 2 composites selected from each hole. For the second pass, the search distance was increased to 400 m (long axis) by 400 m (intermediate axis) by 20 m (short axis) and composites selection criteria were kept the same as the first pass, however with a lowering of the minimum number of samples required to make an estimate set at 6. Finally, the search distance of the third pass was increased to 1500 m (long axis) by 1500 m (intermediate axis) by 60 m (short axis) and again the same composites selection criteria were applied with a lowering of the minimum number of samples to 4.

All blocks within the Cerrado Verde mineralized domain were estimated as part of the three-pass estimate.

Table 14.7-1 outlines the search direction and parameters used for the 3-pass interpolation, while Table 14.7-2 highlights the percentage of blocks estimated within each of the estimation passes completed.

Table 14.7-1 Summary of Search Direction and Parameters for 3-Pass Interpolation

	Search Directions									
Zone		Dip / Dip Direction (degrees)								
K₂O Ore Domain		000		0 / 000						
	1 Pass	1 Pass 2 Pass 3 Pass								
Х	200m	400m	1500m	4						
Υ	200m	400m	1500m	4						
Z	20m	20m 20m 60m								
MIN SAMPLE	8	8 6 4								
MAX SAMPLE	16	16	16	-						

Table 14.7-2 Percentage of Blocks Estimated for 3-Pass Interpolation

Pass #	Percentage of Blocks Estimated
1 Pass	19.9%
2 Pass	74.5%
3 Pass	5.6%

The search ellipse was configured to match the main mineralization direction, which is sub-horizontal given the geological understanding at the time of this mineralization. Figure 14.7-1 shows the interpolation results visually for the three respective passes across the Cerrado Verde Project area.

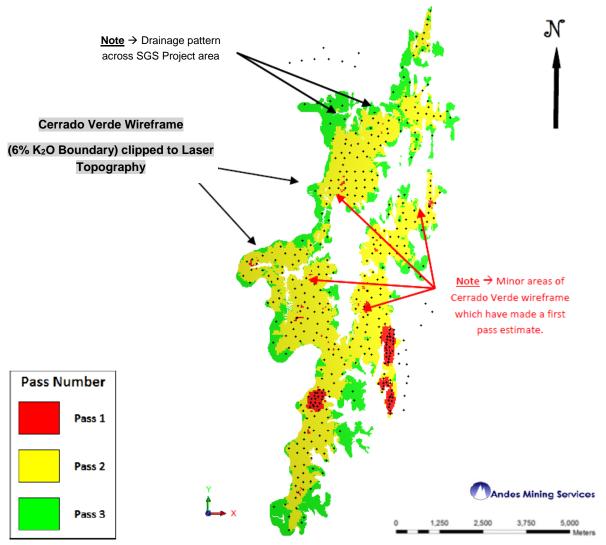


Figure 14.7-1 Cerrado Verde Block Model – Coded by Pass Number with Drill Holes (AMS, March 31, 2013)

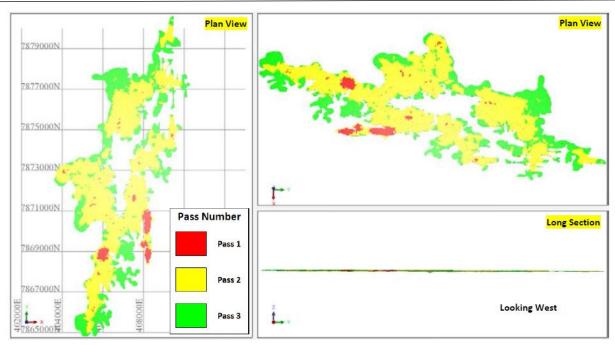


Figure 14.7-2 Cerrado Verde Block Model Composite - Coded by Pass Number (Estimate) (AMS, March 31, 2013)

Figure 14.7-3 and Figure 14.7-4 below illustrate grade variations across the block model (mineralized domain) for  $K_2O$ .

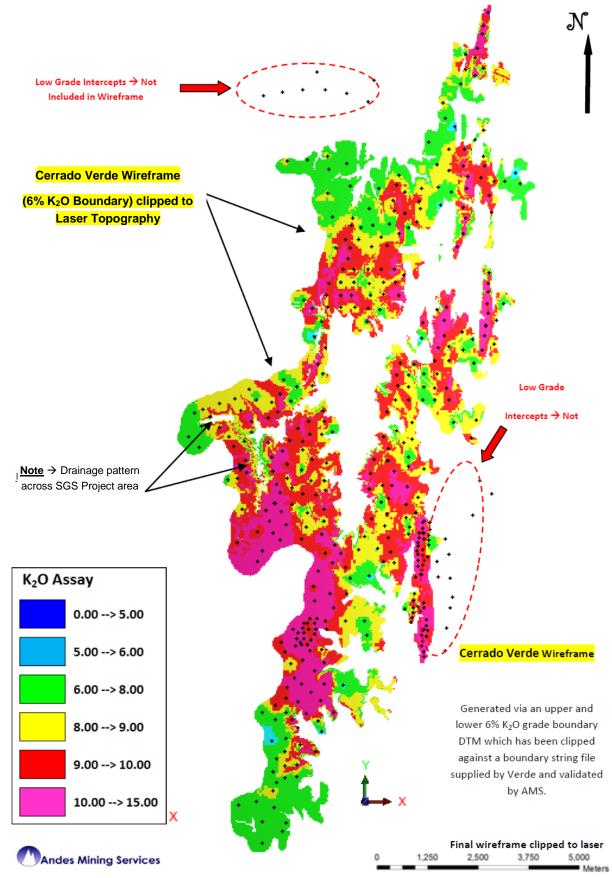


Figure 14.7-3 Cerrado Verde Block Model – Coded by K₂O Grades (Estimate) (AMS, March 31, 2013)

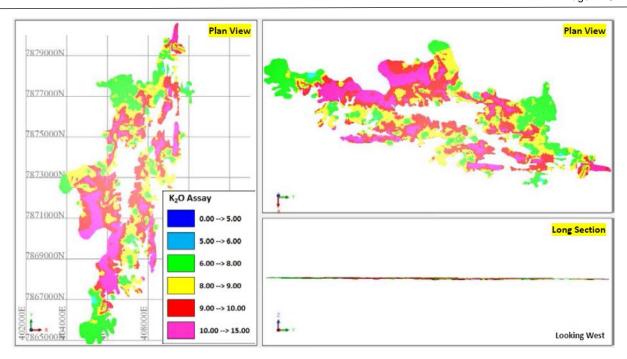


Figure 14.7-4 Cerrado Verde Block Model – Coded by K₂O Grades (Estimate) (AMS, March 31, 2013)

#### 14.8. Model Validation

A validation of the mineral resource K<sub>2</sub>O grade as well as all other elements (Al<sub>2</sub>O<sub>3</sub>, CaO, Fe<sub>2</sub>O<sub>3</sub>, LOI, MgO, MnO, Na<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SiO<sub>2</sub> and TiO<sub>2</sub>) was conducted as part of the verification process. The validation includes: 1) a visual comparison of the color-coded block values versus the composites data in the vicinity of the interpolated blocks, and; 2) a comparison of the grade average parameters for the composite data and the block model data.

Table 14.8-1 summarizes the comparative statistics of the composite and block model datasets without any cut-off grades.

Table 14.8-1 Comparative Statistics of the Composite and Block Model Datasets

_		Average Grade (%) - Composites vs Block Model Comparison										
Dataset	Count	Al <sub>2</sub> O <sub>3</sub>	CaO	Fe <sub>2</sub> O <sub>3</sub>	K <sub>2</sub> O	LOI	MgO	MnO	Na₂O	P <sub>2</sub> O <sub>5</sub>	SiO <sub>2</sub>	TiO <sub>2</sub>
Composites	3387*	15.56	0.50	6.86	9.27	3.50	2.90	0.13	0.19	0.14	59.79	0.82
Block Model	2958191	15.52	0.54	6.80	8.95	3.51	2.86	0.13	0.21	0.15	60.06	0.81

<sup>\*</sup> Various number of composites available for each element. See Table 14.4-1 for details.

The variation in grade from the average composite value of 9.27% K<sub>2</sub>O to the block model grade of 8.95% K<sub>2</sub>O, is reflected in the tendency for drilling to be more tightly spaced across the highest-grade portions of the mineral resource. The effect of this is to give an overall average composite grade that is biased higher due to the uneven spread of assay data. A slightly lower block model grade is to be expected, given that a tightly controlled search ellipse acts to limit the spread of higher grade samples concentrated in a number of small areas and the OK interpolation process in effect declusters the data.

In order to check that the estimation has worked correctly, the model has been validated through a visual comparison of down hole drilling grades (assays) and estimated blocks in close proximity to those drill holes. A total of 20 east-west vertical sections have been generated and used to validate the block model.

An example of the visual validation is shown below with a cross section of the block model (7,875,400 N) compared against the drill hole results. There is an excellent correlation in block grades with down hole drilling assays for  $K_2O$ , with grade spreading both laterally and vertically found to be consistent with the input parameters for the block modelling.

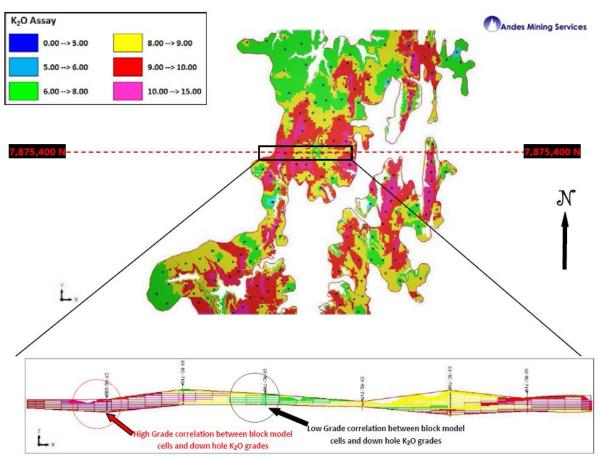


Figure 14.8-1 Block Model Validation against Drilling – Section at 7,875,400 N (AMS, March 31, 2013)

#### 14.9. Mineral Resource Classification

The mineral resources at the Cerrado Verde Project have been classified as measured, indicated and inferred. The parameters used to determine the mineral resource classification include, but are not limited to; drilling density, estimation pass number, number of samples used to make a block estimate as well as the average distance to find samples to make a block estimate.

Table 14.9-1 below highlights some of the specific factors considered in the classification of the Cerrado Verde Project resource.

Figure 14.9-1 and Figure 14.9-2 show the resource classification across the Cerrado Verde Project area.

Table 14.9-1 Resource Classification Considerations - Cerrado Verde Project

Resource	Considerations	% Estimated
Measured	Block MUST estimate in 1 Pass and have minimum 8 composites to be considered applicable. In addition, drill density in immediate vicinity of applicable blocks must be in order of 100 m x 100 m spacing in order for blocks to classify as "MEASURED"	4.29
Indicated	Block must estimate within either the 1 or 2 Pass to be considered "INDICATED". Blocks already classified as MEASURED resources were excluded.	75.82
Inferred	Any block that made an estimate in the three passes, but has not already been assigned Measured or Indicated Status has been assigned "INFERRED"	19.89
Unclassified	Any block that did not make an estimate in the 3 Passes has been assigned "UNCLASSIFED"	0.00

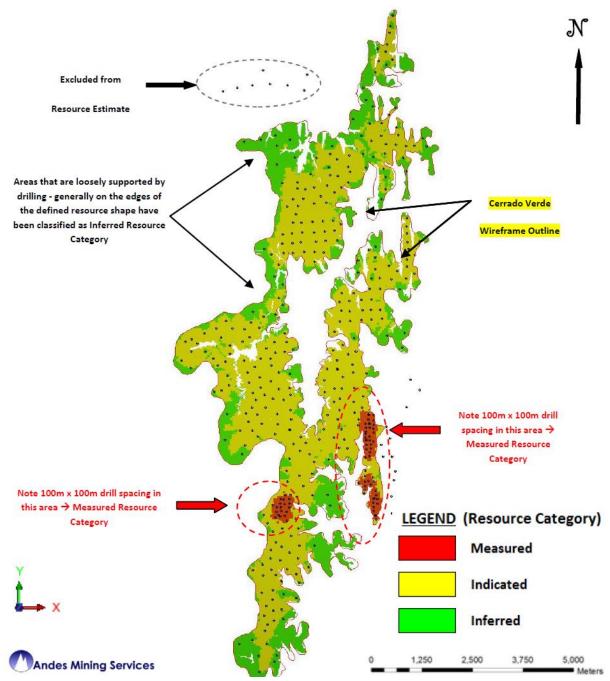


Figure 14.9-1 Cerrado Verde Block Model – Resource Classification (AMS, March 31, 2013)

The lateral extent of both measured and indicated resources for the Cerrado Verde Project are highlighted below in Figure 14.9-2 and Figure 14.9-3. With both the indicated and inferred resource category removed, Figure 14.9-3 shows the true extent of measured resource categories and highlights the close spaced  $100 \text{ m} \times 100 \text{ m}$  drilling pattern in these areas.

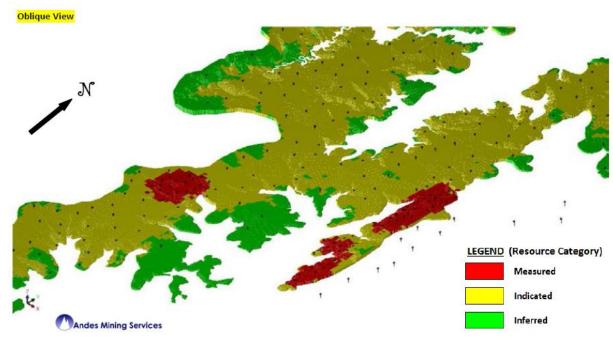


Figure 14.9-2 Measured, Indicated and Inferred Resource Classification – Cerrado Verde (AMS, March 31, 2013)

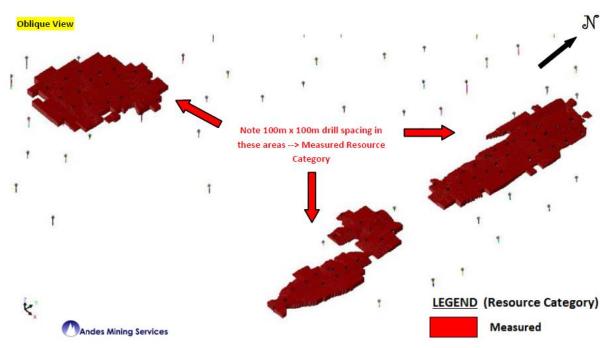


Figure 14.9-3 Cerrado Verde Block Model – Measured Resource Classification (AMS, March 31, 2013)

# 14.10. Mineral Resource Reporting

The grade estimates for the Cerrado Verde Project has been classified as a measured, indicated and inferred mineral resource in accordance with NI 43-101 guidelines based on the confidence levels of the key criteria that were considered during the mineral resource estimation. Key criteria are tabulated below in Table 14.10-1.

Table 14.10-1 Confidence Levels of Key Categorization Criteria – Cerrado Verde Project

Items	Discussion	Confidence			
Drilling Techniques	Diamond drilling is industry standard with good recoveries exhibited throughout.	High			
Logging	Standard nomenclature used. Minor overlaps noted within database.	High			
Drill Sample Recovery	Excellent recoveries recorded for new drilling. Moderate recovery levels noted for RC drilling programs completed in 2009.	High			
Sub-sampling Techniques & Sample Preparation	DC sampling completed on 2 m intervals or to geological boundaries where they exist. Majority of RC sampling completed on 2 m sample intervals, however early programs (2009 and portions of 2011) completed on both 1m and 3m sample intervals. Sample preparation has been completed to industry standards.	High			
Quality of Assay Data	Excellent for standards, blanks and duplicates (2012 Program). Umpire assay test work is excellent with no bias observed between laboratories.	Moderate / High			
Verification of Sampling and Assaying	Duplicate sample data shows excellent correlation (coarse reject duplicates).  DDH twin hole drilling with pre-existing RC holes shows excellent correlation for grade with no grade bias observed.	High			
Location of Sampling Points					
Data Density and Distribution	Drill spacing of approximately 200 m by 200 m. Within three areas of the resource, drill spacing has been reduced to 100 m by 100 m in an effort to increase the resource category confidence in these areas.	Moderate / High			
Audits or Reviews	AMS completed a site visit and resource update for the Cerrado Verde Project between 7 and 10 of August 2012. No further reviews / audits have been completed since this time.	N/A			
Database Integrity	Only DDH and RC holes are considered for the resource. VERDE completed initial handheld XRF assay test work on samples. Samples which assayed >6% K <sub>2</sub> O via handheld were sent to laboratory for complete XRF analysis. AMS have included a small number of drill holes in the resource which are ONLY supported by handheld XRF results. This was necessary in order to give a representative estimate for the entire mineralized domain (glauconitic siltstone).	Moderate / High			
Geological Interpretation	Entirely within saprolite and fresh rock. Strong geological understanding with much of the mineralized domain outcropping at surface. Orebody is visual (green appearance on satellite photos).	High			
Estimation and Modelling Techniques	Ordinary Kriging (OK) utilized which is appropriate given the distributions observed in the data.	High			
Cut-Off Grades	A 7.5% K <sub>2</sub> O cut-off grade has been applied to the final reported resource numbers. This is consistent with the 7.5% cut-off grade used by SRK consulting for the February 2012 resource estimate which formed part of a Preliminary Economic Assessment (PEA). Recent metallurgical test work has proven this cut-off grade to be economic.				
Mining Factors or Assumptions	50 mE by 50 mN by 5 mRL SMU.	High			

A detailed summary (various cut-off grades) of the estimated measured, indicated and inferred mineral resources for the Cerrado Verde Project is provided below in Table 14.10-2.

The statement has been classified by Qualified Person Bradley Ackroyd (MAIG) in accordance with the guidelines of NI 43-101. Mineral resources that are not mineral reserves do not have demonstrated economic viability.

Table 14.10-2 Confidence Levels of Key Categorization Criteria - Cerrado Verde Project

Table 14.	10-2 Con	nuence	Level	3 01 N	ey Cale	gurizati	OII CITLE	:11a - Ce	FITAUU V	elue Fi	Ojeci	
Cut-Off (% K₂O)	Tonnes (Mt)	K₂O	P <sub>2</sub> O <sub>5</sub>	CaO	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	MgO	TiO <sub>2</sub>	MnO	Na₂O	LOI
	Measured Resource Category											
7.5	83	10.13	0.13	0.33	15.73	6.99	58.93	2.90	0.83	0.13	0.10	3.31
				I	ndicated F	Resource (	Category					
7.5	1,365	9.24	0.14	0.49	15.61	6.85	59.83	2.90	0.81	0.13	0.17	3.47
		М	easured	and Inc	licated Mir	neral Reso	ource (7.5%	% Cut-Off	K <sub>2</sub> O) *			
7.5	1,448	9.30	0.14	0.48	15.61	6.86	59.78	2.90	0.81	0.13	0.16	3.46
					Inferred R	esource C	ategory					
7.5	305	8.89	0.14	0.59	15.61	6.84	59.86	2.87	0.81	0.13	0.23	3.56
	Inferred Mineral Resource (7.5% Cut-Off K <sub>2</sub> O) *											
7.5	305	8.89	0.14	0.59	15.61	6.84	59.86	2.87	0.81	0.13	0.23	3.56

<sup>\*</sup>Mineral resources are not mineral reserves and do not have demonstrated economic viability.

The mineral resource estimate has focused on a flat-lying, sub horizontal mineralized domain which has been defined at surface and drill tested to depth of mineralization using a nominal 6% K<sub>2</sub>O grade cut-off to guide the wireframing process.

An independent mineral resource has been estimated for the Cerrado Verde Project comprising a combined measured and indicated mineral resource of 1,448 Mt at 9.30% K<sub>2</sub>O (using a 7.5% K<sub>2</sub>O cutoff), and an inferred mineral resource of 305 Mt at 8.89% K<sub>2</sub>O (using a 7.5% K<sub>2</sub>O cut-off grade).

Grade tonnage curves for the measured, indicated and inferred portions of the Cerrado Verde Project are shown below in Figure 14.10-1 to Figure 14.10-3 respectively.

Appropriate rounding has been applied to Table 14.10-2.

It has an effective date of March 31, 2014.

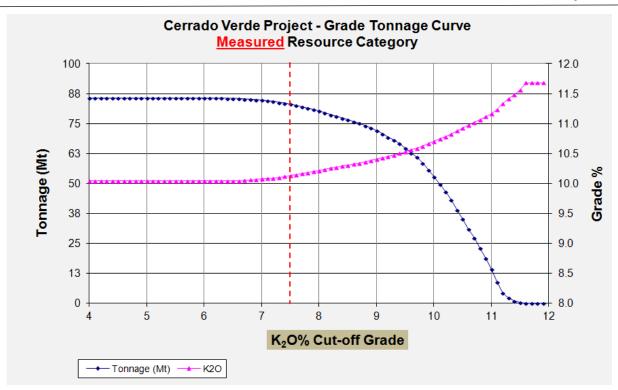


Figure 14.10-1 Grade Tonnage Curve – Measured Resource Category (AMS, March 31, 2013)

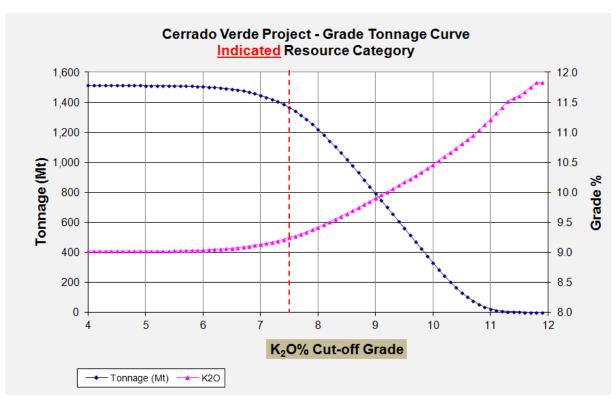


Figure 14.10-2 Grade Tonnage Curve – Indicated Resource Category (AMS, March 31, 2013)

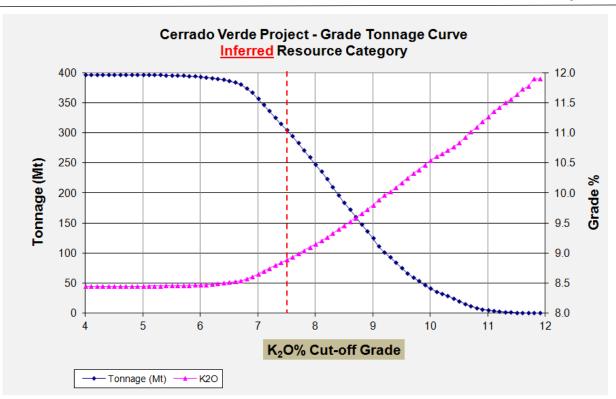


Figure 14.10-3 Grade Tonnage Curve – Inferred Resource Category (AMS, March 31, 2013)

Additional grade tonnage curves for combined Measured and Indicated as well as the total combined resource are presented in Figure 14.10-4 and Figure 14.10-5.

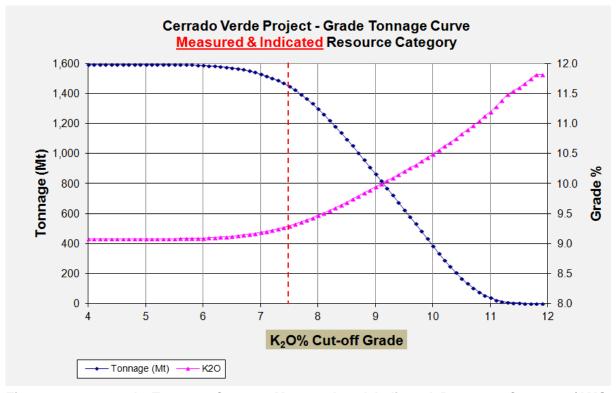


Figure 14.10-4 Grade Tonnage Curve – Measured and Indicated Resource Category (AMS, March 31, 2013)

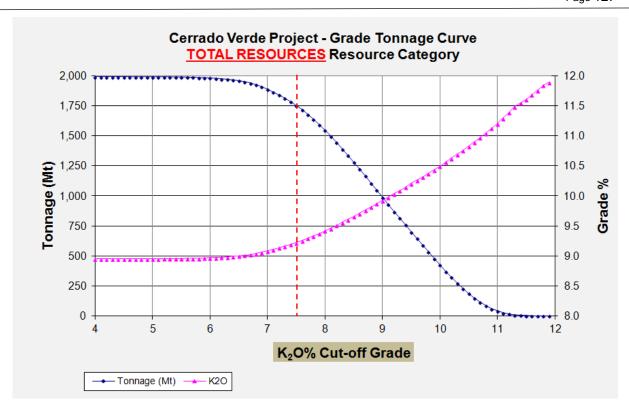


Figure 14.10-5 Grade Tonnage Curve - Total Resource Category (AMS, March 31, 2013)

A combined mineral resource statement which incorporates previously reported resources completed by SRK has been prepared for the Cerrado Verde Project. A combined measured and indicated mineral resource of 1,472 Mt at 9.28%  $K_2O$  (using a 7.5%  $K_2O$  cut-off), and an inferred mineral resource of 1,850 Mt at 8.60%  $K_2O$  (using a 7.5%  $K_2O$  cut-off grade) (Table 14.10-3) is reported for the Cerrado Verde Project.

Table 14.10-3 Measured, Indicated and Inferred Mineral Resource Grade Tonnage Report (AMS & SRK Consulting) – Ordinary Kriging (OK) & Inverse Distance Weighting with Power Two (IDW2)\* – (Block Model – 50mE X 50mN X 5mRL / 10mRL)\*

Target	Cut-Off (% K <sub>2</sub> O)	Tonnes (Mt)	Average Grade (% K <sub>2</sub> O)									
	Measured Resource Category											
Target 7	7.5	83	10.13									
Total M	easured	83	10.13									
	Indicated Resource Category											
Target 6	7.5	23	8.83									
Target 7	7.5	1,365	9.24									
Total In	dicated	1,388	9.23									
Total Measure	ed & Indicated	1,472	9.28									
	Inferred Reso	urce Category										
Target 1	7.5	236	8.72									
Target 2	7.5	12	8.54									

Target	Cut-Off (% K <sub>2</sub> O)	Tonnes (Mt)	Average Grade (% K <sub>2</sub> O)	
Target 3	7.5	126	8.72	
Target 4	7.5	146	9.03	
Target 5	7.5	27	8.31	
Target 6	7.5	48	8.84	
Target 7	7.5	305	8.89	
Target 11	7.5	47	8.27	
Target 13	7.5	168	8.50	
Target 14	7.5	325	8.65	
Target 16	7.5	257	8.15	
Target 17	7.5	151	8.19	
Total I	nferred	1,850	8.60	

Mineral resources are not mineral reserves and do not have demonstrated economic viability.

Appropriate rounding has been applied to Table 14.10-3

AMS and VERDE are not aware of any factors (environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other relevant factors) that may have materially affected the viability of the mineral resource estimate. The Cerrado Verde Project is a greenfield site and therefore is not affected by any mining, metallurgical or infrastructure factors.

<sup>\*</sup> IDW2 Estimate (Block Model – 50 mE x 50 mN x 10 mRL) --> Targets 1,2,3,4,5,6,11,13,14,16 and 17

<sup>\*</sup> OK Estimate (Block Model – 50 mE x 50 mN x 5 mRL) --> Target 7

## 15. Mineral Reserve Estimate

Mineral reserves were classified in accordance with the CIM Definition Standards for Mineral Resources and Mineral Reserves (May 10, 2014). Only mineral resources that were classified as measured and indicated were taken into account for the mineral reserve estimate used to demonstrate economic viability. Mineral reserves for the Cerrado Verde deposit incorporate appropriate mining recovery estimates for the open pit mining method selected.

Mineral reserves are an estimate of the tonnage and grade of ore that can be economically mined and processed. To be considered mineral reserves the estimated sale price of the material must cover all the costs incurred during mining, processing and selling.

The Mineral reserve estimate for the Cerrado Verde deposit is based on the resource block model provided by AMS, as well as on information provided by VERDE.

#### 15.1. Block Model

The Cerrado Verde mineral resource estimate was prepared by AMS based on drilling data compiled by VERDE during the 2011 and 2012 field campaigns and a small number of drill holes from a drilling program undertaken in late 2009.

The mineral resource is represented as a three-dimensional block model for Target 7. In the original AMS model a parent block size of 50 mE x 50 mN x 5 mRL was used, with variable sub-blocking utilized in order to capture the relatively thin nature of the interpreted sub-horizontal mineralized glauconitic siltstone. A sub-block size of 6.25 mN x 6.25 mE x 1.25 mRL was utilized. Estimates were only prepared for parent blocks, with sub-blocks assigned the parent cell grade estimates. Table 15.1-1 shows the geometry of the block model.

Table 15.1-1 Block Model Geometry.

	Υ	х	z	
Minimum Coordinates	7864000	403000	600	
Maximum Coordinates	7881000	410700	1100	
User Block Size	50	50	5	
Sub-Block Size	6.25	6.25	1.25	
Rotation	0	0	0	
No. of Blocks	340	154	100	

The model was delivered as a Surpac-compatible text file, which was imported into the Micromine software.

## 15.2. Topography

Verde supplied BNA with sufficient topography for the Cerrado Verde infrastructure. This was obtained from an airborne laser scanning survey, which produced a contour map with 1 m intervals.

The following section outlines the procedures used to estimate the mineral reserves. The mine plan is based on the detailed mine design derived from the optimal pit shell produced by applying the Lerchs-Grossman (LG) algorithm.

## 15.3. Basic Parameters and Project Criteria

The technical and economic parameters listed in Table 15.3-1 were used for the generation of the optimal mathematical pit, which consists of the pit that maximizes the value of the enterprise and was obtained through the application of the Lerchs-Grossman algorithm. The tools available in the Micromine 2014 software were used to generate this mathematical pit.

The classical methodology for selecting the optimal mathematical pit consists of the generation of a set of mathematical pit shells generated through the application of the Revenue Adjustment Factor (RAF). This factor is applied to the selling price(s) of the product(s), resulting in the generation of a mathematical pit for each applied factor. The results of this set of mathematical pits are analyzed in order to define the ultimate mathematical pit for the Project.

A summary of the technical and economic conditions and parameters used in the Project is presented in Table 15.3-1:

-		•
Parameter	Value	Unit
Super Greensand® selling price	25.10	US\$/t product
CutOff K₂O	8.50	%
Processing Cost	2.18	US\$/t ROM
Ore Mining Cost	4.16	US\$/t mined
Waste Rock Mining Cost	3.56	US\$/t mined
Dilution	0.00	%
Mining Recovery	100.00	%
Waste Rock Density (Sandstone)	1.77	g/cm <sup>3</sup>
Ore Density (Weathered Rock)	1.64	g/cm <sup>3</sup>
Ore Density (Fresh Rock)	2.18	g/cm <sup>3</sup>
Overall Slope Angle	37.00	0
Discount rate	8.00	% per year

The values for the selling price, processing cost and mining costs were taken from Phase 3. Due to the shape and geometry of the ore body, a decision was made to use a 100% mining recovery rate and to not apply a dilution factor to the mined material.

To obtain a product with a minimum 9.5% and maximum 10.5% K₂O grade, with an average grade of 10.0%, a grade-tonnage curve for the resource was generated in order to evaluate the cutoff grade to be used in the Project.

The resources located within a 1 km radius restriction limit of the Vila Funchal District were excluded from this analysis. Though this area is legally mineable, VERDE chose not to operate within this limit to avoid disturbing the local population.

The results of the resource grade-tonnage curve, excluding the Vila Funchal District area, are shown in Table 15.3-2 and Figure 15.3-1:

Table 15.3-2 Grade-tonnage curve for the resources, excluding the Vila Funchal District area.

CutOff K <sub>2</sub> O (%)	TONNES x 10 <sup>6</sup>	K <sub>2</sub> O (%)								
7.50	1,414.51	9.31								
8.00	1,275.11	9.48								
8.30	1,162.41	9.61								

CutOff K₂O (%)	TONNES x 10 <sup>6</sup>	K <sub>2</sub> O (%)
8.50	1,081.00	9.70
8.70	992.81	9.80
8.90	899.72	9.90
9.10	808.35	10.00
9.30	716.82	10.10
9.50	621.06	10.21
9.70	527.99	10.32



Figure 15.3-1 Resource grade-tonnage curve, excluding the Vila Funchal District area

A decision was thus made to apply a cutoff grade of 8.5% K<sub>2</sub>O in order to **obtain a product with a** minimum of 9.5% and a maximum of 10.5% of K<sub>2</sub>O, with an average grade of 10.0%,

The cutoff grade of 8.3% K<sub>2</sub>O would also maintain the overall content within the desired range, due to the low ore mass increment when applying this value, and in an effort to have greater flexibility with respect to the mining sequence plan, a cutoff of 8.5% of K<sub>2</sub>O was chosen instead.

A management decision was made in order to divide this Project into three distinct phases, with their respective production rates and duration shown below:

- Phase 1: 600 Kt of final product per year, for the first 2 years;
- Phase 2: 5 Mt of final product per year, from year 3 to year 6;
- Phase 3: 25 Mt of final product per year for the remainder of the life of the mine.

## 15.4. Optimal Pit Definition

When defining the final pit, the following restrictions were applied:

- Pit limited to the areas of mineral permits belonging to VERDE;
- Pit not to lie within a 1-kilometer radius of the Vila Funchal Village.

Only the material classified as measured and indicated and that was above the cutoff grade was considered as ore in the final pit optimization study.

Based on the defined technical and economic parameters, a set of mathematical pits was generated, with the Revenue Adjustment Factor (RAF) varying from 0.12 to 1.20. The results of these pits are shown in Table 15.4-1 and Figure 15.4-1:

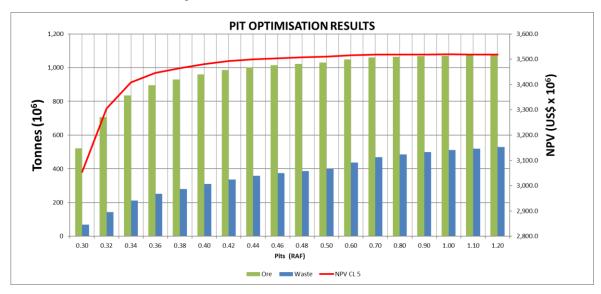


Figure 15.4-1 Results of the set of generated mathematical pits

Table 15.4-1 Results of the mathematical pit set

Table 15.	Table 15.4-1 Results of the mathematical pit set											
				Tonne		Percentage		Million US\$				
RAF	Ore	Waste Rock	Ore between 7.5 and 8.5% K <sub>2</sub> O	Ore below 7.5% K₂O	Inferred Resources (CutOff 8.5%)	Inferred Resources between 7.5% and 8.5% K <sub>2</sub> O	Inferred Resources below 7.5% K <sub>2</sub> O	Total Waste	K₂O	Stripping Ratio	NPV BEST	NPV CL 5
0.30	520.67	62.79	4.18	0.05	1.34	0.06	0.00	68.42	9.84	0.13	3,116.9	3,055.0
0.32	707.22	130.11	10.30	0.20	1.97	0.29	0.00	142.87	9.82	0.20	3,437.8	3,305.6
0.34	834.22	189.16	17.88	0.64	2.59	0.51	0.00	210.78	9.79	0.25	3,568.1	3,408.3
0.36	895.77	222.73	24.53	1.00	3.47	0.81	0.00	252.53	9.77	0.28	3,613.9	3,446.4
0.38	930.33	246.42	27.99	1.37	4.17	0.89	0.00	280.84	9.76	0.30	3,635.1	3,465.1
0.40	959.81	265.37	36.45	1.77	4.72	1.01	0.00	309.31	9.75	0.32	3,651.1	3,480.5
0.42	985.29	286.61	42.38	1.96	5.27	1.09	0.00	337.31	9.74	0.34	3,663.4	3,492.3
0.44	1,001.66	302.39	45.99	2.39	5.67	1.13	0.00	357.57	9.73	0.36	3,670.6	3,499.3
0.46	1,013.89	312.10	50.94	4.19	6.06	1.15	0.00	374.44	9.73	0.37	3,675.5	3,504.1
0.48	1,021.92	321.02	53.86	4.37	6.29	1.15	0.00	386.69	9.73	0.38	3,678.6	3,507.1
0.50	1,029.65	329.64	56.56	4.71	6.84	1.23	0.00	398.97	9.72	0.39	3,681.3	3,509.8
0.60	1,048.58	354.57	66.03	6.54	8.71	1.30	0.01	437.18	9.72	0.42	3,687.2	3,515.5
0.70	1,059.76	373.37	75.60	7.82	10.13	1.38	0.02	468.32	9.71	0.44	3,689.6	3,517.8
0.80	1,064.76	385.19	79.36	8.38	10.73	1.52	0.06	485.23	9.71	0.46	3,690.5	3,518.6
0.90	1,067.99	394.24	82.57	8.81	11.39	1.54	0.06	498.61	9.71	0.47	3,690.8	3,518.9
1.00	1,070.53	401.09	86.42	9.95	11.98	1.57	0.06	511.07	9.70	0.48	3,690.9	3,519.0
1.10	1,071.83	405.63	88.70	10.47	12.01	1.57	0.06	518.43	9.70	0.48	3,690.8	3,518.9
1.20	1,073.43	411.98	91.28	11.42	12.14	1.57	0.06	528.45	9.70	0.49	3,690.7	3,518.8

The following methodologies were used to calculate the NPV for the mathematical pits:

#### **Best Case (NPV Best)**

With this methodology it is assumed that the mathematical pits will be drawn in the sequence in which they were generated. This method favors the NPV for the pit, but the results obtained are often not operational.

#### Constant Lag (NPV CL 3)

With this methodology it is assumed that the mathematical pits will be drawn in the sequence in which they were generated, but will respect a maximum number of benches that can be mined in the same pit. For example, for a value of 5, after 5 benches are drawn from the same pit, the system will automatically advance to the next one, so that the difference between the benches drawn between two consecutive pits will never be greater than 5. Two scenarios were generated using this methodology, with a maximum value of 5 benches (NPV CL 5).

The application of different methods of calculating the NPV for the pits allows for a better evaluation when defining the optimum pit for the Project. It should be noted that the calculated NPV does not consider capital costs or any other costs not listed in Table 15.3-1, and therefore cannot be considered the NPV for the enterprise. It is to be used solely as an aid in the selection of the optimal pit of the Project.

The results show an approximate stabilization of the NPV for the pits from the 0.34 RAF. The efforts to maximize the NPV for the Project while minimizing the stripping ratio in the pit led to the selection of the pit illustrated in Figure 15.4-2 as the optimal pit for the Project.

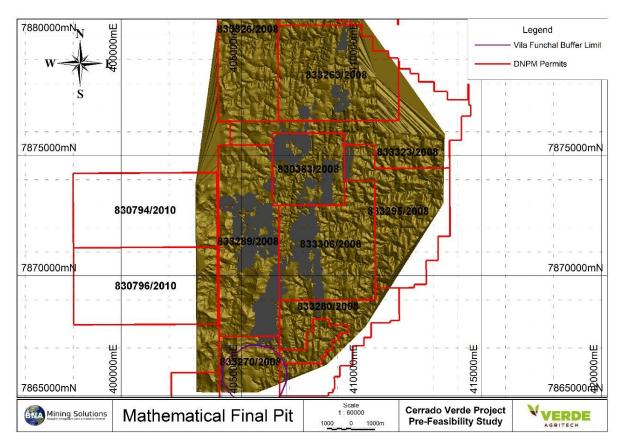


Figure 15.4-2 Selected Mathematical Pit

### 15.5. Pit Slopes

The pit slopes were based on the geotechnical study completed by *Consórcio Mineiro de Engenheiros Consultores Ltda* (CMEC) in September 2012. The angles recommended in the report for the operational mine design are shown in Table 15.5-1

**Table 15.5-1 Geotechnical recommendations** 

Slope Height (m)	Slope Inclination (°)			
30	80			
50	60			
70	54			
100	50			
150	40			
190	37			

As recommended by CMEC, an overall slope angle of 37° was selected for the mine design.

### 15.6. Final Pit Operationalization

The contours of the optimal mathematical pit were subsequently designed following the classic procedure that consists of the tracing of the toes and crests of the benches, access ramps and safety berms, thus allowing for the safe and efficient conduction of mining operations.

An operational mine design was not prepared for the two pits located to the north (Figure 15.6-1) due to the great distance and the small amount of material. This decision was made based on the size of the equipment that will be used in Phase 3, which makes the transportation of the material technically unfeasible over these great distances. Consequently, it will be necessary to adopt other strategies for the production of this material. Due to the low quantity and quality of the material contained in these pits, and to the adoption of a more conservative scenario, it was decided to not consider them in the Project reserve estimate. Table 15.6-1 shows the amount of material located in these pits:

Table 15.6-1 Results of Discarded Mathematical Pits

		Percentage					
Ore	Waste Rock	Ore Below 8.5% K₂O	Inferred Resources Above 8.5% K₂O	Inferred Resources Below 8.5% K₂O	Total Waste	K₂O Ore	Strip Ratio
30.41	4.70	0.51	0.15	0.01	5.38	9.48	0.38

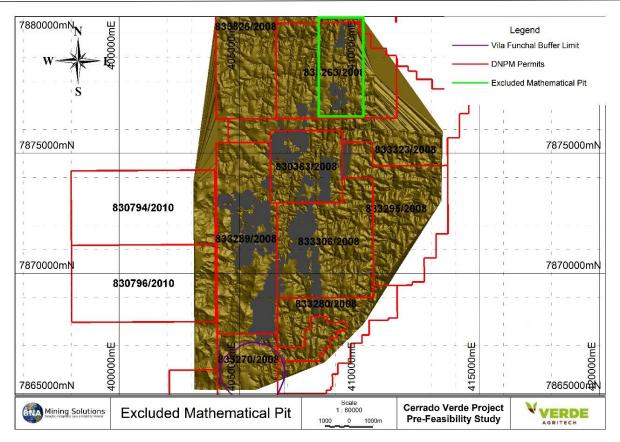


Figure 15.6-1 Location of the Discarded Mathematical Pits

The technical mining parameters used for the operational mine design can be found in Table 15.6-2:

**Table 15.6-2 Parameters for the Operational Mine Design** 

Parameters	Value	Unit
Bench height	10.0	meters
Minimum Berm Width	4.9	meters
Wall Slope Angle	50.0	0
Overall Slope Angle	37.0	0
Access road width	30.0	meters
Access road angle	8.0	%
Minimal Pit Bottom	50.0	meters

Due to the rugged relief of the region, a decision was made to prioritize the access routes inside the pits. Table 15.6-3 and Figure 15.6-2 show the result for the final operational pit that resulted from the mine design activities.

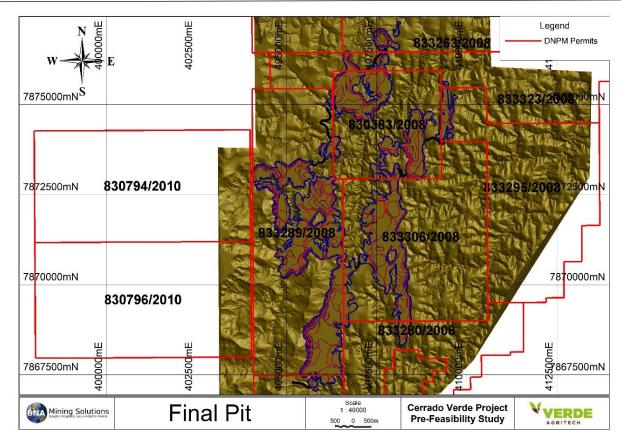


Figure 15.6-2 Results - Final Operational Pit

Table 15.6-3 Results - Final Operational Pit

	Tonnes (Mt)						Percei	ntage			Years	
Oi	re	Ore below 8.5% K <sub>2</sub> O	Total Ore	Waste Rock	Inferred Resources above 8.5% K <sub>2</sub> O	Inferred Resources below 8.5% K <sub>2</sub> O	Total Waste	K₂O Ore	K₂O Ore below 8.5% K₂O	K₂O Total Ore	Stripping Ratio	LOM
745	5.11	32.16	777.28	212.84	7.89	1.11	221.83	9.85	8.15	9.78	0.29	35.0

The "Ore below 8.5%  $K_2O$ " column is composed of material classified as measured or indicated resources that are below the applied cutoff grade. This material can be blended with ore that is above the cutoff grade, without the resulting overall average content dipping below the defined limit of 9.5%  $K_2O$ . Table 15.6-3 shows the total values for the adoption of this blending method. This premise was validated during the definition of the mining sequence (which will be shown in Section 16.2), which evaluated whether this blending will maintain the grades within acceptable limits or not.

Thus, the operationalized pit contains 777.28 Mt of ore and 221.83 Mt of waste, leading to a stripping ratio of 0.29, which results in the depletion of reserves in approximately 36 years.

Inferred Resources cannot be converted to reserves. Therefore, these have been listed as part of the total waste.

#### 15.7. Conversion Factors

Mineral Reserve figures have been determined based on the mineral resource estimate by taking into account geological, mining, processing, legal and environmental considerations and are therefore

classified in accordance with the CIM Definition Standards for Mineral Resources and Mineral Reserves.

For the definition of the mineable reserve, all measured and indicated ore located inside the final Project pit was considered. The measured ore was converted into a proven reserve and the indicated ore converted into a probable reserve.

Measured and indicated resources lying outside the final pit design have not been converted into reserves.

Inferred resources have not been converted into reserves and have instead been treated as waste for mine planning purposes.

#### 15.8. Relevant Factors

There are no known legal, political, environmental or other risks that could materially affect the potential development of the mineral resources.

#### 15.9. Mineral Reserve Statement

The Qualified Person for the Mineral Reserve estimate is Dr. Beck Nader, D.Sc., M.Sc., MAIG, Senior Advisor at BNA.

The results of the mineable reserve study for the Project are shown in Table 15.9-1:

**Table 15.9-1 Mineable Reserve Results** 

	Proven Reserves	Probable Reserves	Total Reserves
Tonnes (Mt)	68.11	709.17	777.28
K₂O Grade (%)	10.34	9.72	9.78

<sup>(1)</sup> As of December 22, 2017.

<sup>(2)</sup> A cutoff grade of 8.5% K<sub>2</sub>O was used to report reserves.

<sup>(3)</sup> Overall strip ratio of 0.29 to 1.

<sup>(4)</sup> Waste contains inferred resources, which have the potential to be upgraded to higher category resources, and possibly reserves, after sufficient definition work has been completed.

<sup>(5)</sup> Based on 100% mining recovery.

# 16. Mining Methods

The Cerrado Verde deposit is located in close proximity to the surface. Therefore, the mining method to be adopted for the Project is a traditional open pit shovel/truck operation.

### 16.1. Mine Preparation

Before production start-up, there will be a mine preparation or development stage. During this stage the mine will be prepared to ensure a continuity of ore production that is both necessary and sufficient to feed the crusher. This step should precede the effective initiation of the crushing operation.

Mine preparation will begin with land clearance if necessary over the entire area for the planned development phase. The organic soil will then be removed and stored in a previously prepared place for future use in the recovery of degraded areas. Track tractors, hydraulic excavators, wheel loaders and trucks equipped with dump buckets may be used in this removal operation.

Initially, the track tractor will scrape the layer of organic soil, forming hills at locations accessible to trucks. Then, a loader or a bulldozer will load the material into the trucks, which will haul it to the storage locations where it will be unloaded.

Once the organic soil is removed, the overburden will be stripped. This removal is planned in advance so that it results in a sufficient volume of exposed ore to feed the crusher for a period of roughly 6 months.

The land clearance, organic soil removal and overburden stripping operations will be repeated throughout the mining operation as the pit is enlarged.

During the mine preparation phase, some ore is usually produced and stored separately to be used later. This ore will be stocked in an area close to the crusher and will serve as a buffer stock to supply the crusher in the event of any interruption in the supply of ore directly from the mine.

The next step is to prepare the mining fronts by opening the benches to form an initial stock of ore sufficient for the first few months of operation, as well as to ensure the continuity of the production required to feed the crusher.

# 16.2. Sequential Mining Plan

The mine sequencing study was performed by using the Micromine 2014 software. This study consisted of the establishment of annual production schedules, the definition of the ore and waste block mining sequence and the evolution of the geometries throughout the life of the mine (LoM).

For the development of the production program, the areas to be mined annually were established, thus generating operational plans for years 1, 2 (Phase 1), 3, 4, 5, 6 (Phase 2), 7 and 8 (Phase 3). An effort was made to minimize the haulage distances and the amount of waste mined during the first few years, maintaining an average K<sub>2</sub>O grade that is above the minimum value allowed and as close as possible to the desired value.

In order to minimize the environmental impact of the Project, a strategy of reclaiming the exhausted pits with the waste from other pits will be adopted. This is feasible due to the fact there will be several pits arranged along project area. A 40,365 m<sup>2</sup> pile of waste material will be built up by the end of year 3, when the first pit is scheduled to reach the final pit configuration.

The strategy used in the sequencing will see the mining performed in a northerly direction, starting in the region to the south of the operational pit. When this region is exhausted, it will become available for the dumping of waste. The material in this area contains a small amount of waste compared to the other areas and is close to the Processing Plant.

The results of the operational sequencing can be found in Table 16.2-1 and in Figure 16.2-1 through Figure 16.2-9:

Table 16.2-1 Results Operational Mining sequencing

	Tonnes (Mt)								Percentage											
Period	Ore	Ore below 8.5% K <sub>2</sub> O	Total Ore	Waste Rock	Inferred Resources above 8.5% K <sub>2</sub> O	Inferred Resources below 8.5% K <sub>2</sub> O	Total Waste	K₂O	P <sub>2</sub> O <sub>5</sub>	CaO	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	MgO	TiO <sub>2</sub>	MnO	Na <sub>2</sub> O	LOI	Stripping Ratio	
Year 1	0.60	0.01	0.61	0.03			0.03	9.88	0.15	0.24	15.93	6.81	59.14	2.71	0.80	0.16	0.11	3.37	0.05	
Year 2	0.53	0.08	0.61	0.15			0.15	9.61	0.16	0.30	16.00	6.90	59.01	2.77	0.79	0.17	0.06	3.27	0.24	
Year 3	4.56	0.47	5.03	0.81			0.81	9.87	0.15	0.37	16.14	7.01	58.78	2.79	0.80	0.16	0.09	3.39	0.16	
Year 4	4.95	0.05	5.01	0.74			0.74	9.98	0.15	0.28	16.05	7.02	59.36	2.70	0.81	0.16	0.09	3.28	0.15	
Year 5	4.97	0.06	5.03	0.40	0.01		0.41	9.95	0.17	0.36	16.13	6.99	59.08	2.77	0.81	0.16	0.14	3.38	0.08	
Year 6	4.97	0.04	5.01	0.14	0.12		0.26	9.86	0.15	0.42	16.39	7.11	58.99	2.87	0.80	0.16	0.14	3.28	0.05	
Year 7	24.47	0.56	25.02	13.07	0.04	0.01	13.11	10.17	0.16	0.55	15.86	6.92	59.22	2.78	0.80	0.16	0.09	3.25	0.52	
Year 8	23.99	1.01	24.99	8.73	0.16	0.00	8.89	10.00	0.15	0.46	16.19	7.04	58.83	2.77	0.81	0.14	0.08	3.35	0.36	
Year 9-11	75.97	1.10	77.07	15.71	0.34	0.00	16.06	10.01	0.13	0.42	16.29	6.94	58.91	2.73	0.76	0.15	0.08	3.32	0.21	
Year 12-18	157.45	4.96	162.41	43.28	2.41	0.05	45.74	9.86	0.14	0.49	15.83	6.93	58.71	3.02	0.80	0.13	0.13	3.47	0.28	
Year 19-25	171.92	9.33	181.25	45.22	0.88	0.00	46.11	9.72	0.14	0.35	15.55	6.90	59.72	2.91	0.83	0.13	0.15	3.32	0.25	
Year 26-28	72.34	4.22	76.55	21.24	1.51	0.77	23.52	9.47	0.12	0.33	15.64	6.83	60.17	2.81	0.79	0.14	0.14	3.29	0.31	
Year 29-31	84.11	2.34	86.45	20.18	1.34	0.24	21.76	9.79	0.13	0.24	15.41	6.92	59.80	2.90	0.87	0.12	0.10	3.35	0.25	
Year 32-36	114.29	7.95	122.24	43.14	1.08	0.03	44.26	9.65	0.13	0.35	15.32	6.90	59.60	2.95	0.84	0.11	0.10	3.50	0.36	
Total	745.11	32.16	777.28	212.84	7.89	1.11	221.83	9.78	0.14	0.38	15.69	6.91	59.40	2.90	0.82	0.13	0.12	3.38	0.29	

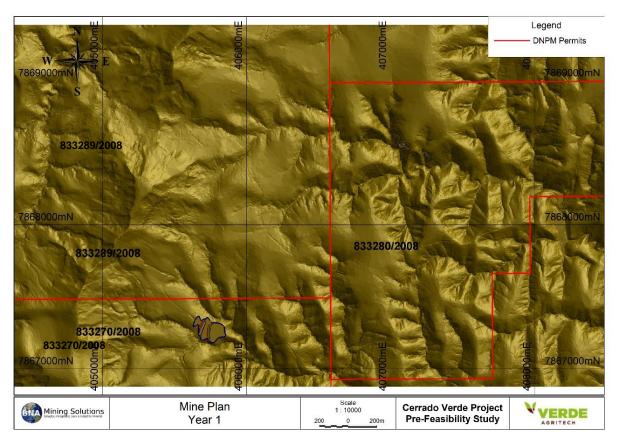


Figure 16.2-1 Mining sequencing Year 1

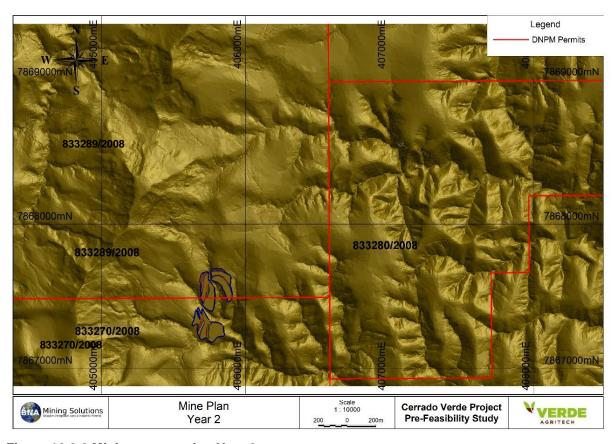


Figure 16.2-2 Mining sequencing Year 2

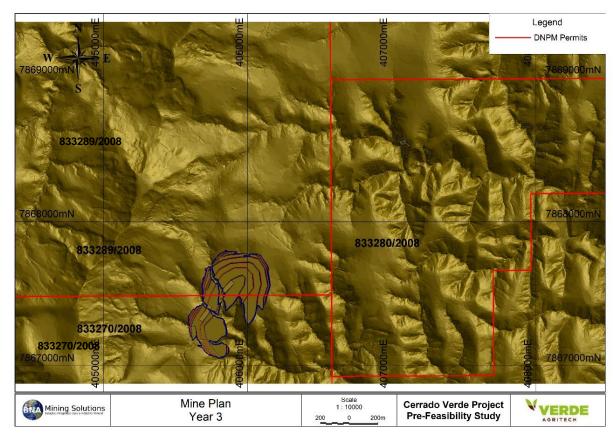


Figure 16.2-3 Mining sequencing Year 3

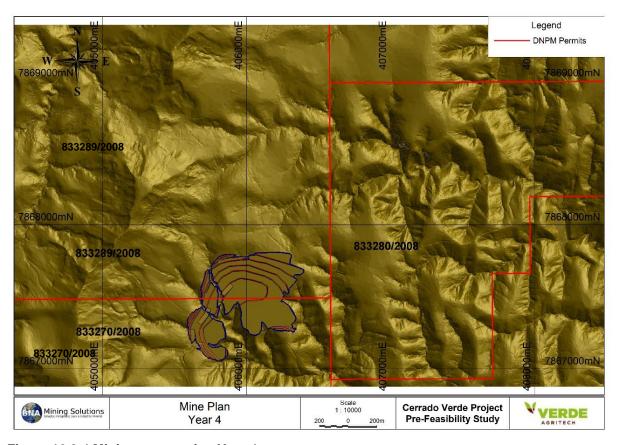


Figure 16.2-4 Mining sequencing Year 4

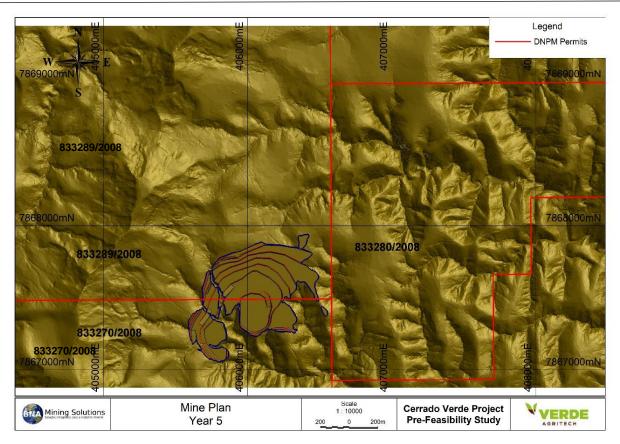


Figure 16.2-5 Mining sequencing Year 5

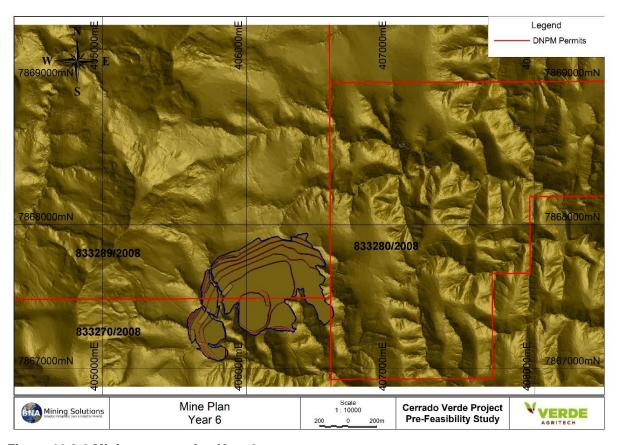


Figure 16.2-6 Mining sequencing Year 6

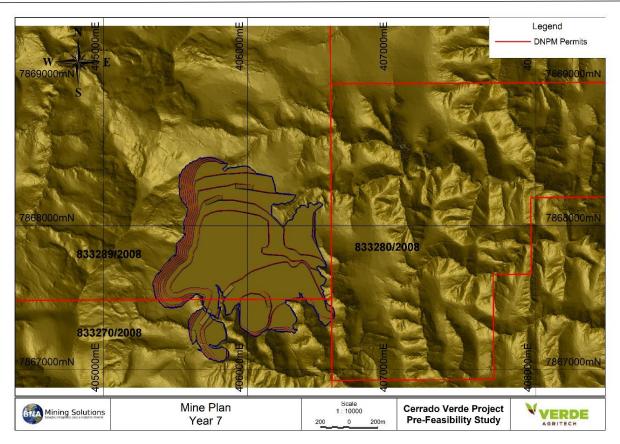


Figure 16.2-7 Mining sequencing Year 7

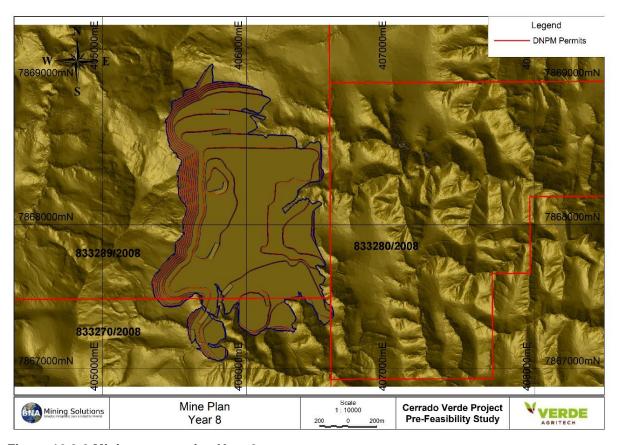


Figure 16.2-8 Mining sequencing Year 8

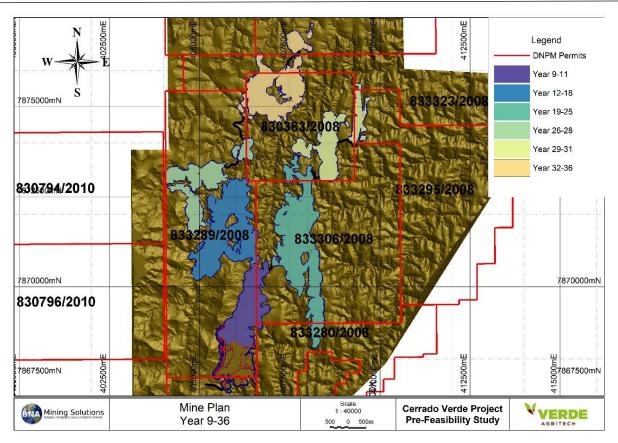


Figure 16.2-9 Mining sequencing After Year 8

# 16.3. Waste Disposal

In order to minimize the environmental impact of the Project, a strategy of reclaiming the exhausted pits with the waste from other pits will be adopted. Only a 40,365 m² pile of waste will be built up. This will be sufficient for the dumping of the removed waste until the first pit reaches the final pit configuration, which will occur at the end of year 3.

## 16.3.1. Pile Geometry Definition

The study of the geometric parameters of the waste pile that supported this Project is detailed in the report dated January 2013 and was carried out by *Solosconsult Engineering*.

According to the probable granulometric characteristics of the waste to be produced, the pile will have a geometry with the following characteristics:

- final external slope between berms (toe to slope crest): 1V: 2H (27°)
- overall pit slope: 23.2°
- maximum height between berms: 10.0 m
- minimum berm width: 6.0 m

The inclination was defined based on a retro analysis that took into consideration the estimated geotechnical parameters of the waste and the foundation. The results of this analysis were considered conservative.

A berm width of 6.0 m is considered the minimum for the installation of drainage ditches and protection lines, as well as for the passage of medium-sized vehicle traffic for repairs, monitoring and maintenance.

The preliminary design of the waste piles was done by BNA Mining Solutions. The waste pile, sufficient for dumping of the waste material during the first 3 years of operation, was designed in the immediate vicinity of the working fronts during the first years of operation. This pile has the following characteristics:

#### Waste Pile

Maximum height: 30 m
 Volume: 1.5 Mm<sup>3</sup>
 Affected area: 40,365 m<sup>2</sup>

This volume is sufficient to store the waste generated during the first 3 years of mine operation. At the end of Year 3, the southern part of the pit will already be in its final configuration and it will thus be possible to reclaim it using this waste. Table 16.3.1-1 and Figure 16.3.1-1 to Figure 16.3.1-7 illustrate the progress of the waste dumping through to year 8, as well as the configuration at the end of the life of the mine.

Table 16.3.1-1 Waste Pile Volume

Piles	Volume (m³x10 <sup>6</sup> )
Year 3	0.6
Year 4	0.4
Year 5	0.2
Year 6	0.2
Year 7	8.1
Year 8	5.9
Year 8 to 36	111.1
Total	126.6

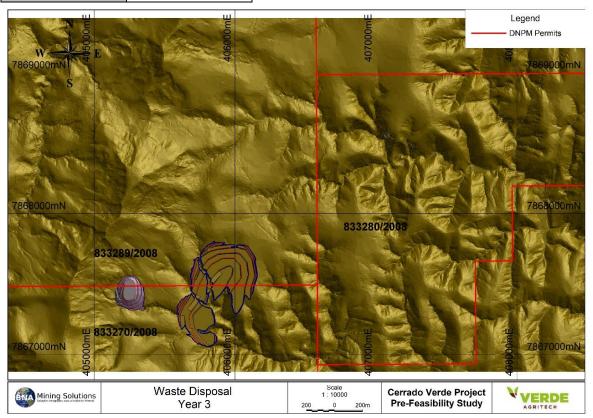


Figure 16.3.1-1 Waste disposal Year 3

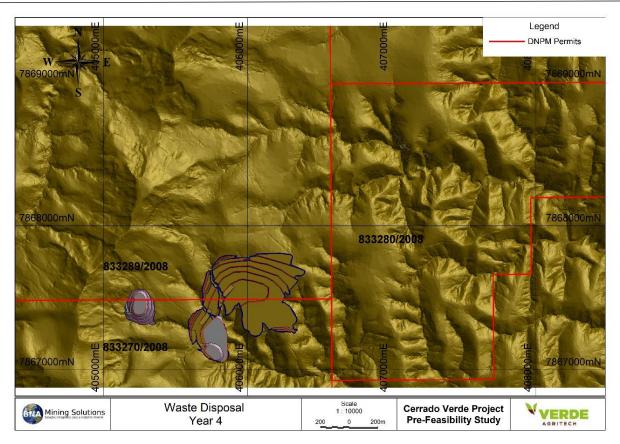


Figure 16.3.1-2 Waste disposal Year 4

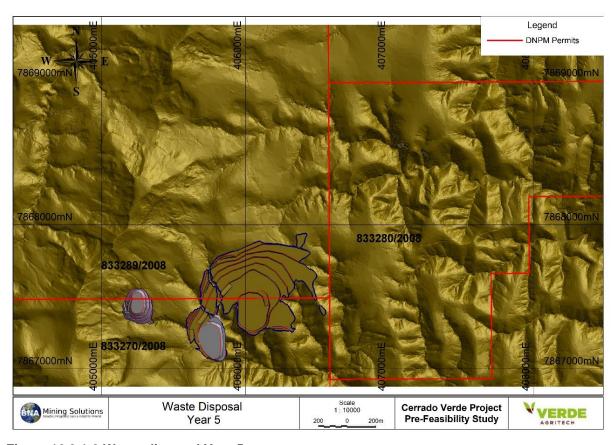


Figure 16.3.1-3 Waste disposal Year 5

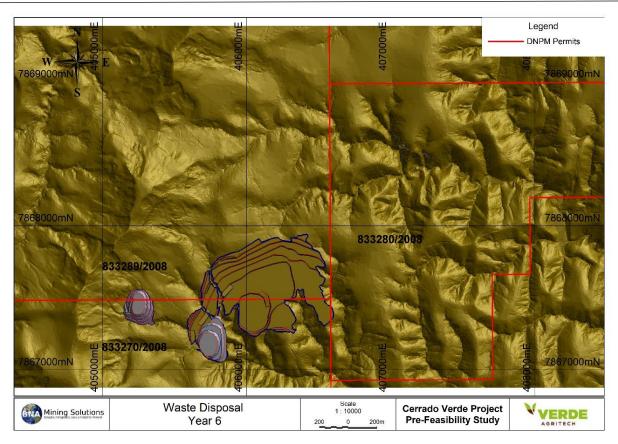


Figure 16.3.1-4 Waste disposal Year 6

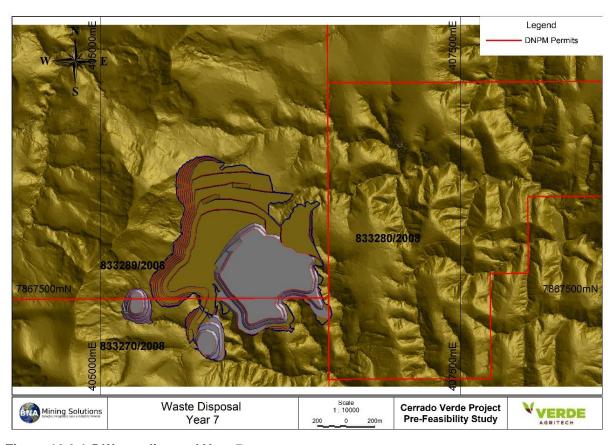


Figure 16.3.1-5 Waste disposal Year 7

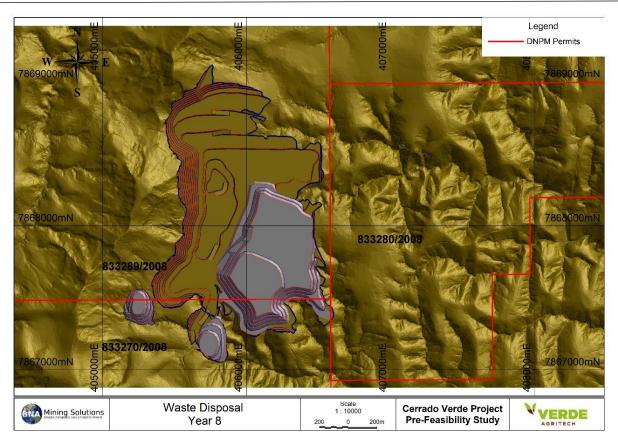


Figure 16.3.1-6 Waste disposal Year 8

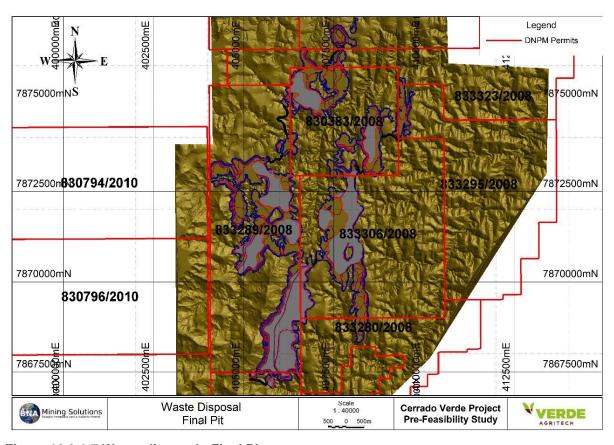


Figure 16.3.1-7 Waste disposal - Final Pit

BNA recommends additional studies be conducted to evaluate the location and stability of the projected waste piles, based on the current technical and economic parameters.

# 16.4. Hydrogeology

A hydrogeological study of part of the Project area was carried out by *MDGEO Hidrogeologia e Meio Ambiente*. As this study does not encompass the entire affected area of the Project, BNA recommends that this study be redone and that this new study cover the entire Project area and analyze the new final pit design.

# 16.5. General Project Layout

The processing plant for Phase 1 is located approximately 30 km from the Project area and is accessed along approximately 22 km of dirt roads and 8 km of asphalt road. The 22 km of dirt roads will be reworked to facilitate the material haulage, which will be done using road trucks. Figure 16.5-1 shows the access roads leading to the processing plant in Phase 1.

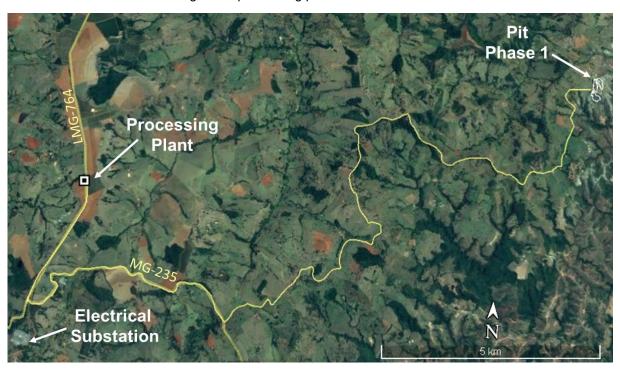


Figure 16.5-1 Access Roads to Phase 1 Processing Plant

For Phase 2, the processing plant will be located near the areas to be mined during the initial period, as shown in Figure 16.5-2. Ore haulage will be done using road trucks.

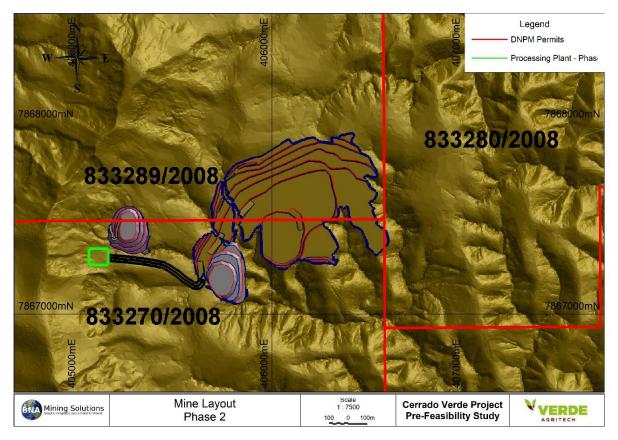


Figure 16.5-2 General Project layout – Phase 2

For Phase 3, it is expected that the product output will be transported via railroad. To this end, a new railway branch line will be built in São Gotardo and will connect to an existing branch line in the city of Ibiá (65 km from São Gotardo). The processing plant for Phase 3 will be built next to this railway branch line. The primary crusher will be located in the same area as the processing plant for Phase 2 and the crushed material will be transported to the processing plant in Phase 3 using long-distance belt conveyors. The installation of approximately 21.5 km of belt conveyors is planned for this phase. Off-road trucks will feed the primary crusher, which will feed the belt conveyor that will take the material to the processing plant in Phase 3.

Due to increased ore haulage distances, an expansion of the belt conveyor and the relocation of the primary crusher are planned for Year 11 in order to reduce the haulage distances for the remainder of the life of mine (LoM). Figure 16.5-3 shows the location of the primary crusher both at the beginning of Phase 3 and after its relocation and Figure 16.5-4 shows the location of the long-distance belt conveyor.

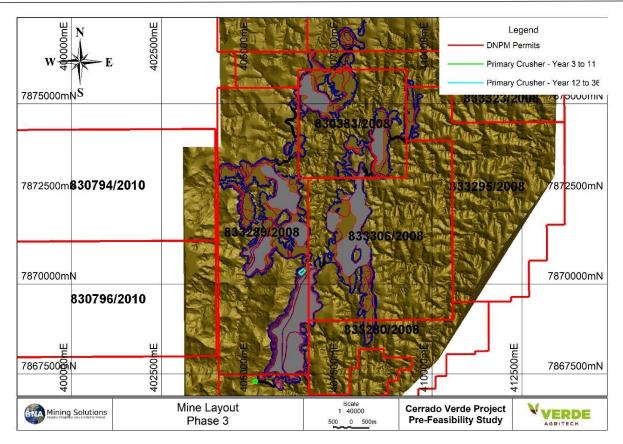


Figure 16.5-3 General Project layout - Phase 3

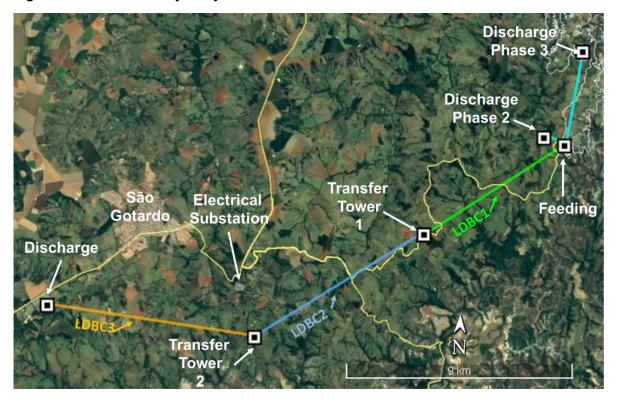


Figure 16.5-4 Long-distance belt conveyor (LDBC) layout

# 16.6. Haulage Distances

The average haulage distance of the Project was estimated, as in Table 16.6-1 using the following premises:

- For Phase 1, the processing plant is located approximately 26 km from the pit area;
- For Phase 2, the processing plant is located near the pit area during the first few years, as shown in Figure 16.5-2;
- For the beginning of Phase 3 (Year 7 to Year 11), the ore will be sent to the primary crusher, which will feed the material to the belt conveyors. This crusher is located at the same location where the Phase 2 processing plant is planned;
- From year 11, the relocation of the primary crusher, as shown in Figure 16.5-3, as well as the
  expansion of the belt conveyor to this same location, is planned. The grinding facility will be
  located near the wagon loading system;
- The destination of the waste from the first 3 years will be the waste pile located near the Phase 2 processing plant;
- From year 3, the destination of the waste will be the piles created inside the already exhausted pits.

The relocation of the primary crusher, as well as the expansion of the belt conveyor, are planned for year 11. The hauling distances were estimated considering this relocation.

**Table 16.6-1 Average Haulage Distances** 

		Me	eters
Phase	Period	Average Ore Haulage Distance	Average Waste Haulage Distance
Phase 1	Year 1	26,000	670
Pilase 1	Year 2	26,000	938
	Year 3	1,088	1,270
Dhaca 2	Year 4	1,506	1,347
Phase 2	Year 5	1,596	1,370
	Year 6	1,758	1,437
	Year 7	1,680	1,760
	Year 8	2,070	2,030
	Year 9-11	3,550	2,750
Dhasa 2	Year 12-18	2,250	3,400
Phase 3	Year 19-25	2,625	3,275
	Year 26-28	4,600	1,750
	Year 29-31	6,050	1,950
	Year 32-36	8,000	2,150

# 16.7. Mine Drainage

Draining operations will be carried out throughout the life of mine, for both side hill and open pit mining operations.

Generally speaking, with side hill mining operations, the water, whether of insurgency or rainfall in origin, will either be sent through the berms to areas outside the pits via their benches, or will be sent to sumps from where it will be pumped.

Once mining operations begin to produce pits, rainwater will be carried through ditches to collection boxes, installed at strategic locations, from where it will be continuously pumped. The water will also be dispersed by percolation and evaporation. Solids carried to the pit by rainwater will be removed during the dry season.

With regard to groundwater, hydrogeological surveys will be carried out and the best alternatives, either lowering the water table or directing the groundwater to collection boxes via ditches from where it is pumped out, will be studied.

# 16.7.1. Pit Drainage

Due to operational or blending needs and the deepening of the orebody, some sites will be mined to lower levels in the pit. As a result, the water that accumulates inside those pits must be drained.

In such cases, the water to be drained from the pits can originate from two main sources:

- Rainfall;
- The water table.

The first step in reducing the volume of rainwater is to ensure that runoff from rainfall outside the boundaries of the pits does not enter the pits. Therefore, drainage ditches and/or protection lines will be opened and these will divert these waters to the natural drainage system.

The rainwater within the boundaries of the pits will be led through ditches to strategically located sumps from where they will be pumped out of the pits and into the natural drainage system. Particulate retention dikes will be installed in these drains. Berms will be topographically controlled in a manner that creates a slight slope, on the order of 1% to 3%, towards the crests in order to avoid the formation of puddles on the surface of the benches.

If groundwater reaches the pits, it will also be led through ditches to the same sumps to be pumped out. Once there is a better understanding of the behavior of the groundwater, a study of the available solutions, including water table drawdown through wells, will be conducted.

## 16.7.2. Waste Pile Drainage

Before the beginning of waste disposal in the selected area, geotechnical and hydrogeological studies will be carried out to evaluate the need to construct drains at the base of the pile. If necessary, ditches with dimensions defined by geotechnical and hydrogeological studies will be opened. The ditches will then be filled with rocky material of different particle sizes, in descending scale from bottom to top, with the last layer consisting of pebbles up to 20 mm in diameter. Finally, a geotextile blanket will be placed over this material. This fabric should cover a safety strip on the edges, beyond the width of the ditches. The first layer of waste must be placed carefully to avoid shifting the blanket.

Upstream of the waste pile, ditches and/or protection lines will be constructed to divert runoff. In the lower parts of the pile, along the toes of the lower benches, ditches associated with protection lines will be built (the material dug to form the ditches will be arranged by their sides) to protect against possible landslides.

The berms will have a trim, in the transversal direction, on the order of 1% to 3% towards the toe, to prevent erosion of their faces. In the longitudinal direction, the benches will have a small slope, on the order of 1.5%, in opposing directions every 25 m. At the lower ends of these slopes, concrete

rainwater collection boxes fitted with pipes will be built. These pipes will have diameters dimensioned in accordance with the maximum volumes for each location, perpendicular to the face of the bench, with a slope on the order of 10%. Concrete stairs will be constructed from the ends of these pipes to allow the water to flow down. These stairs connect to the lower bench boxes, through to the last bench at the bottom of the pile. From these points the water will be led through ditches to particulate sedimentation ponds. From these ponds the water will be released into the natural drainage system. Dikes will be built at strategic points in these drains to ensure particulate retention.

## 16.7.3. Roads and Access Route Drainage

Roads and access routes will feature a narrow shoulder. Ditches will be opened along the sides of the roads for water collection and drainage. At specified distances, where possible, exits will be opened to allow the water to flow into the natural landscape. Depending on the region through which the road is passing, it may be necessary to build collection boxes and culverts to allow the water to flow to the other side of the road. When crossing valleys, culverts, dimensioned to handle the maximum expected flow in the area, will be installed.

# 16.8. Mining Operation

The main mining operations are:

- Excavation and loading;
- Ore haulage to the primary crusher and waste haulage to the waste pile;
- · Ancillary support services.

Excavating and truck loading operations will be performed using hydraulic crawler excavators for both ore and waste. As it was assumed for this Project that most of the material will be mined mechanically, it has been estimated that 30% of the ore and 30% of the waste will be mined using explosives, given that most of the material excavated will be friable. Trucks will haul the ore to the primary crusher and the waste to the waste piles.

In order to ensure a proper and adequate performance of the main mining operations, they will be supported by ancillary services, such as the maintenance of roads and access routes, dust control, drainage, lubrication, etc. These activities will be performed by a fleet of auxiliary equipment consisting of motor graders, irrigation tank trucks, road trains, track tractors, loaders and utility vehicles.

# 16.9. Mine Equipment

#### 16.9.1. Equipment Selection

As the ore is in close proximity to the surface and the material is highly fractured, it can be mined mechanically. As a precautionary measure, it has been assumed that 30% of the ore and 30% of the waste will be mined after a drilling and blasting operation. As a result, approximately 233.2 Mt of ore and 66.6 Mt of waste may be mined using explosives.

It is expected that all mining activities will be carried out by outsourced companies. As a result, quotations were requested from companies with extensive experience in this type of activity. The entire selection and sizing process for the mining equipment was carried out by these companies, with the support of professionals from VERDE and BNA.

The following are the production equipment and selected support activities defined for the 3 phases:

- Phase 1 Production Equipment
  - CAT 365 Hydraulic Excavator;

- o 8x4 Dump Truck;
- D6T Track Tractor;
- Atlas Copco D65 Drill;
- o 25,000-liter Water Truck;
- 16H Motor Grader;
- CAT 323 Hydraulic Excavator.
- Phase 2 Production Equipment
  - o HITACHI EX1200 Excavator;
  - o 777F Off- Highway Truck;
  - o D9T Track Tractor;
  - Atlas Copco D65 drill;
  - 25,000-liter water truck;
  - 16H motor grader;
  - CAT 323 Hydraulic Excavator.
- Phase 3 Production Equipment
  - o HITACHI EX2500 Excavator;
  - o 730E Off- Highway Truck;
  - D9T Track Tractor;
  - Atlas Copco D65 drill;
  - 25,000-liter Water Truck;
  - 16H Motor Grader;
  - CAT 323 Hydraulic Excavator.
- Support Equipment
  - Road Train;
  - Tanker Truck;
  - Workshop Truck;
  - Forklift;
  - Tire Handler Forklift;
  - Munck Truck;
  - o Bus;
  - o Van (internal transport).

# 16.9.2. Fleet Scaling

Table 16.9.2-1 shows the mining fleet scaled for the life of mine.

Table 16.9.2-1 Mining Fleet

DESCRIPTION	V 4	PERIOD												
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9 to 11	Year 12 to 18	Year 19 to 25	Year 26 to 28	Year 29 to 31	Year 32 to 36
Production Equipment														
CAT 365 Hydraulic Excavator	1	1									/			
8x4 Dump Truck	4	4												
D6T Track Tractor	2	2								/	/			
Atlas Copco D65 Drill	1	1	1	1	1	1	3	3	3	3 /	3	3	3	3
HITACHI EX1200 Excavator			2	2	2	2								
777F Off- Highway Truck			7	7	7	7								
D9T Track Tractor			2	2	2	2	6	6	6	6	6	6	6	6
HITACHI EX2500 Excavator							4	4	4	4	4	4	4	4
730E Off- Highway Truck							17	17	17	17	17	21	26	28
25,000-Liter Water Truck	1	1	2	2	2	2	4	4 /	4	4	4	5	5	5
16H Motor Grader	1	1	1	1	1	1	3	3	3	3	3	4	4	4
CAT 323 Hydraulic Excavator	1	1	1	1	1	1	2	2	2	2	2	2	2	2
Total Production Equipment	11	11	16	16	16	16	39	39	39	39	39	45	50	52
Support Equipment/Vehicles														
Bus	1	1	2	2	2	2	4	4	4	4	4	4	4	4
Van (internal transport)	1	1	2	2	2 /	2	4	4	4	4	4	4	4	4
L200 Pickup Truck	2	2	4	4	4	4	12	12	12	12	12	12	12	12
Road Train	1	1	1	1	1	1	2	2	2	2	2	2	2	2
Tanker Truck							3	3	3	3	3	3	3	3
Workshop Truck			1	<u>/</u> 1	1	1	2	2	2	2	2	2	2	2
Forklift	1	1	1/	1	1	1	2	2	2	2	2	2	2	2
Tire Handler Forklift			/ 1	1	1	1	2	2	2	2	2	2	2	2
Munck Truck			1	1	1	1	2	2	2	2	2	2	2	2
Total Support Equipment/Vehicles TOTAL	6 17	6	13 29	13 29	13 29	13 29	33 72	33 72	33 72	33 72	33 72	33 78	33 83	33 85

# 17. Recovery Methods

This section summarizes the processing operation settings.

The Project will consist of 3 phases with distinct processing rates: 600 Ktpy, 5 Mtpy and 25 Mtpy. The following items will describe the circuits adopted for each phase. The ore from the mine will have a top size of 500 mm.

# 17.1. Phase 1 (600 Ktpy)

In Phase 1, the run-of-mine (ROM) will be delivered to the processing facility by trucks. The ore delivered by trucks will be fed to the primary crusher via a 90 t dump hopper and an apron feeder. The crusher product (100% < 4") is then conveyed to a bin. The crushing plant is based on a 20 h/day effective crushing and 350 days/year operation. The ore from the crushing system will be taken to a 90 t bin through a transport belt conveyor with a design capacity of 90 t/h. The ore is reclaimed to 2 vibrating feeders of 60 m³/h each. Then the material is fed to two hammer mills with a 40 t/h capacity, each, and they are expected to generate a product with 100% below 2 mm. The ore from the grinding system will be taken to a 20 m³ loading bin through a transport belt conveyor with a design capacity of 90 t/h. The material from the bin will load trucks for transportation of the final product. Figure 17.1-1 shows a simplified flowchart of the process in Phase 1 with the overall processing rate in their respective flows.

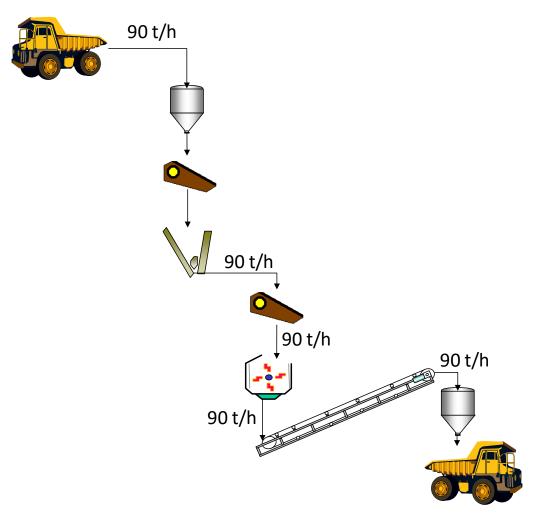


Figure 17.1-1 Processing flowchart for phase 1 (600 Ktpy)

# 17.2. Phase 2 (5 Mtpy)

In Phase 2, the run-of-mine (ROM) will be delivered to the processing facility by a conveyor belt with capacity of 750t/h. The ore will be fed to the primary crushers via two 100 m³ dump hopper and a vibratory feeder. The crushers product (100% < 4") is then conveyed to a bin. The crushing plant is based on 20 h/day effective crushing and 350 days/year operation, with capacities of 330 t/h each (2 crushers). The ore from the crushing system will be taken to two 100 m³ bin through a transport belt conveyor with a design capacity of 750 t/h. The ore is reclaimed to 2 vibrating feeders of 800 m³/h. Then the material is fed to four hammer mills with a 160 t/h capacity, each and they are expected to generate a product with 100% below 2 mm. The ore from the grinding system will be taken to three 20 m³ loading bins through a transport belt conveyor with a design capacity of 750 t/h. The material from the bins will load three pivoting conveyors for loading and transportation of the final product. Figure 17.2-1 shows a simplified flowchart of the process in Phase 2 with the overall processing rate in their respective flows.

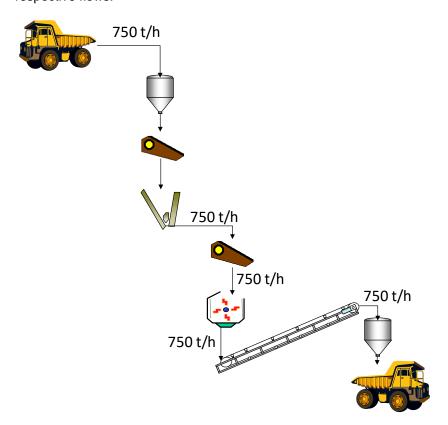


Figure 17.2-1 Processing flowchart for phase 2 (5 Mtpy)

# 17.3. Phase 3 (25Mtpy)

In Phase 3 (Year 11), the crushing facility will be relocated, as previously shown in Figure 16.5-3.

The run-of-mine (ROM) will be delivered to the primary crushing by trucks. The crushed material (100% < 4") will be delivered to the processing facility by a long-distance belt conveyor. The ore will be fed to the plant via eight 100 m³ dump hoppers and 3 vibratory feeders. The material is then conveyed to three 100 m³ bins through two transport belt conveyors with a design capacity of 950 t/h each. The ore is reclaimed to 6 vibrating feeders of 650 m³/h. Then the material is fed to 6 hammer mills with a 500 t/h capacity, each, and they are expected to generate a product with 100% below 2 mm. The ore from the grinding system will be taken to three 20 m³ loading bins through a transport belt conveyor with a design capacity of 950 t/h. The material from the bins will load three pivoting conveyors for

loading and transportation of the final product. Figure 17.3-1 shows a simplified flowchart of the process in Phase 3 with the overall processing rate in their respective flows.

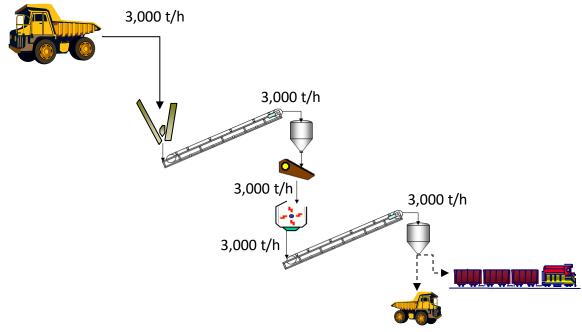


Figure 17.3-1 Processing flowchart for phase 3 (25 Mtpy)

# 18. Project Infrastructure

## 18.1.Introduction

The selected site for the Cerrado Verde Project is a greenfield site with limited infrastructure including existing gravel access roads.

The proposed site is located approximately 320 km from Belo Horizonte. The closest town to the Project site is São Gotardo with a population of approximately 32,000. São Gotardo has good infrastructure, with domestic power and telephone service available. The Project site is also only 130 km from Patos de Minas, the main city in the Alto Paranaiba region. These three areas should have significant population to provide the majority of the construction labor resources for the Project.

The proposed infrastructures will support the mining, plant and construction operations.

# 18.2. Mining Facilities

Ore mining operations are envisaged to be operated by third party contractors in the ore handling and transportation, but with supervision of VERDE. Therefore, all required facilities will be set up by VERDE.

#### 18.3. Access Roads

The existing gravel road leading to the plant from São Gotardo will be the main access to the plant. Due to an increase in traffic, an upgrade is anticipated on the current roads to support the plant operation.

# 18.4. HV Power Supply

The Cerrado Verde Project plant will be powered by the CEMIG 13.8 kV national grid system, connected through an exclusive transmission line 30 km long, from an existing grid substation close to the town of São Gotardo. The new HV transmission line will be installed adjacent to the existing access road leading to the plant. According to CEMIG regulations harmonic compensation and power factor systems shall be forecasted so that the operational performance of large equipment/heavy loads do not affect the basic system network and other consumers.

The Project's energetic demand, for each Phase, is presented in Table 18.4-1:

Table 18.4-1 Estimated energy consumption for each Project phase

Phase	Energy Consumption (kWh)
1	757
2	3,204
3	21,141

# 18.5. Water Supply

The Super Greensand® is produced through a dry processing method. Therefore, the water in the Cerrado Verde site will only be required for dust control and domestic purposes.

#### 18.6. Process Plant Facilities

The main infrastructures required for the process plant operation are the following:

- Plant roads:
- Administration building;
- Maintenance workshop and warehouse building;
- Power distribution;
- Main entrance and security;
- Communications;
- Refueling facility.

#### 18.6.1. Plant Roads

Plant roads will be stripped of organic material and compacted, allowing access to the required plant areas. Drainage ditches and culverts will be placed in accordance with the site drainage requirements.

## 18.6.2. Administration Building

The administration building will be of a single-story prefabricated panel construction. The building will include general areas for engineering, administration personnel, and a medical facility. The equipped medical facility will allow for the treatment of any injuries.

## 18.6.3. Maintenance Workshop and Warehouse Building

This building will have a suitable workshop to enable repair of plant equipment as well as fabrication of some parts. The workshop will be a steel frame building. Offices for warehouse, maintenance and planning personnel will be provided in the form of a prefabricated building housed within the steel framed building. Wash rooms and change rooms will also be provided.

#### 18.6.4. Power Distribution

Power distribution consists of a main substation receiving the 13.8 kV power feed with outdoor oil filled transformer, MCCs (Motor Control Centers), main distribution boards, local circuitry at 440 V, distribution panels and local control devices. All electrical distribution will be in cable trays using steel wired armored PVC sheet cables.

MCC's will be complete with motor management system, motor starters, contactors, transformers, panels and circuit breakers.

#### 18.6.5. Main Entrance and Security

The entire process plant site will be encompassed with fence. There will only be one main entrance gate where a weighbridge is provided for weighing incoming and outgoing delivery trucks.

#### 18.6.6. Communications

A radio communication system will be provided for the initial phases of the Project, following which VERDE will install a system according to its needs.

#### 18.6.7. Refueling Facility

A refueling facility will be installed in the plant that is to be supplied and operated by an external contractor.

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# 19. Market Studies and Contracts

#### 19.1. Presentation

This Market study evaluates Super Greensand®, a new product from Verde AgriTech. Super Greensand is the commercial name given by the Company to the ore (glauconitic siltstone) mined at the Cerrado Verde project.

Super Greensand® is a multi-nutrient fertilizer that has been studied since 2009 by independent agronomic experts.

In 2010, the independent research institute *Empresa de Pesquisa Agropecuária de Minas Gerais* (EPAMIG) conducted pioneering research, concluded in 2013, into the use of Super Greensand<sup>®</sup> in coffee production over the course of three years. The research revealed that Super Greensand<sup>®</sup> is an efficient source of potassium and, as such, an alternative to Potassium Chloride (KCI), which is a widely used input in agriculture in Brazil. The country has only one KCI mine and therefore must import more than 90% of what is used, even though this fertilizer is not the most suitable for tropical agriculture.

Though the Company currently exports Super Greensand to the United States, the only market for the product evaluated in this study was Brazil.

# 19.2. Super Greensand®: multi-nutrient fertilizer

Potassium is an essential element for plant development. Together with nitrogen and phosphorus, it forms the trio of the most widely used primary macronutrients in agriculture and the main source of potassium for this purpose is KCI.

Although this market study focuses on potassium, it is known that other nutrients have a major impact on the development and maintenance of crops. Thus, it is important to note that Super Greensand® is more than a source of potassium: it is a multi-nutrient product that aggregates elements found in various fertilizers.

Taking as an example the fertilization of a coffee tree with 400 kg of  $K_2O$  per hectare, one can calculate the amount of nutrients that Super Greensand® provides the crop. Super Greensand® provides more nutrients than KCl and, when taking into account the dosage in comparison with  $K_2O$ , the product may even meet the micronutrient needs of a crop as well as the macronutrient needs, as shown in Table 19.2-1.

Table 19.2-1 Nutrient intake for Super Greensand® x KCI

Nutrient	% in Super Greensand®*	Amount of nutrients supplied to the coffee plant via Super Greensand® (kg)**	Amount of nutrients supplied to the coffee plant via KCl (kg)**	Main sources of the nutrients
N	0.14	5.6	0	Urea
P <sub>2</sub> O <sub>5</sub>	0.18	7.2	0	MAP, SSP
K <sub>2</sub> O***	10	400	400	KCI
s	0.03	1.2	0	Sulfates and elemental sulfur
Ca	0.34	13.4	0	Calcitic Limestone, Magnesian Limestone, Dolomitic Limestone
Mg	1.74	69.7	0	Calcitic Limestone, Magnesian Limestone, Dolomitic Limestone
SiO <sub>2</sub>	58.97	2358.8	0	Calcium silicate

Nutrient	% in Super Greensand®*	Amount of nutrients supplied to the coffee plant via Super Greensand® (kg)**	Amount of nutrients supplied to the coffee plant via KCI (kg)**	Main sources of the nutrients
Fe	5.33	213.2	0	Iron sulfate
Mn	0.05	2.0	0	Manganese sulfate
CI	0.06	2.6	305.33	KCI
Zn	0.01	0.5	0	Zinc sulfate
В	0.01	0.4	0	Boric acid
Cu	0.002	0.08	0	Copper Sulfate
Co	0.0004	0.01	0	Cobalt Sulfate
Мо	0,00003	0,001	0	Sodium Molybdate

<sup>\*</sup> Analyses carried out by the following laboratories: SGS, Thornton Laboratories, IBRA, Bureau Veritas.

# 19.3. Agronomic results

This section presents the agronomic results from independent trials carried out by a governmentowned research institute, EPAMIG; the private research companies Victor Vieira Consultoria Agronômica and Integrar Gestão e Inovação Agropecuária, as well as an international agricultural corporation, Alliance One.

Several crops were tested between 2010 and 2017. Results for the following crops are presented below: coffee, beans, soybeans, maize and tobacco. Together these crops account for over 60% of all fertilizers consumed in Brazil.

## 19.3.1. Crop nutrition

#### Coffee

An independent trial conducted by EPAMIG in Patrocínio, Minas Gerais evaluated the efficiency of Super Greensand® as a source of potassium. The results demonstrate that treatment with Super Greensand® was more productive in comparison with the control group, which did not receive any potassium.

Table 19.3.1-1 Results from EPAMIG's experiment

Treatment	Pro	ductivity r	luctivity measured in bags of processed coffee treated per hectard (bags/ha)**				
	Floor	Plant	Total				
Control	4.9	17.8	22.7				
Super Greensand®	5.8	25.2	31.0				
Increase in Productivity (%)	23%	41.57%	36.56%				

<sup>\*</sup>Statistical difference defined using the Scott-Knott test

#### Tobacco

An independent trial conducted by Alliance One International Inc. in two southern Brazilian cities – Chuvisca (RS) and Passo do Sobrado (RS) – evaluated the productivity and quality of tobacco crops using Super Greensand® in comparison with Potassium Sulfate (SOP). The results showed that the use of both potassium products resulted in statistically equivalent production and quality.

Table 19.3.1-2 Results of the experiment conducted by Alliance One International Inc.

Treatments	Chuvisca (RS)	Passo do Sobrado (RS)				
Productivity (Kg/ha*)						
Potassium sulfate (75 kg/ha of K <sub>2</sub> O)	3,551 a	2,824 a				

<sup>\*\*</sup> Considering the application of 400 kg of K<sub>2</sub>O/ha

<sup>\*\*\*</sup> The application of K<sub>2</sub>O was leveled for both treatments

Treatments	Chuvisca (RS)	Passo do Sobrado (RS)				
Super Greensand <sup>®</sup> (75 kg/ha of K₂O)	3,583 a	2,716 a				
Quality Analysis – IQG*						
Potassium sulfate (75 kg/ha of K₂O) 83.4 a 77.1 a						
Super Greensand <sup>®</sup> (75 kg/ha of K₂O)	80.1 a	78.7 a				

<sup>\*</sup> Means followed by the same letter do not differ from each other - produced using the t test.

Tobacco growers opt for chlorine-free sources of potassium, such as Potassium Sulfate (SOP) or Potassium Nitrate over Potassium Chloride (KCI), which is composed of 47% chloride. Chlorine can have harmful effects on tobacco quality. The leaves of the plant gradually acquire some undesirable characteristics when burning and the storage life can be reduced, negatively impacting their market value. Super Greensand® has virtually no chlorine or salt, thus protecting cultures from chloride toxicity. The product can be adopted by all market niches that apply premium sources of potassium and offers other benefits, such as eliminating the need for multiple applications per crop.

#### Beans and Maize

An independent trial conducted by *Victor Vieira Consultoria Agronômica* in Quirinópolis (GO) evaluated the yield of a bean (first crop) and maize (second crop) intercropping system using Super Greensand® in comparison with KCl. Different doses of Super Greensand® were used. The results show that treatment with Super Greensand® was more productive than with both KCl and the control group, at all doses, for the bean crop.

With the maize crop, treatment with Super Greensand® was more productive than the control crop at all doses and produced more than treatment with KCl at larger doses, thus proving the residual effect of the product.

Table 19.3.1-3 Results of the experiment conducted by Victor Vieira Consultoria Agronômica

Treatment	Bean Productivity (Kg/ha)*	Maize Productivity (Kg/ha)*
Control	2,824.5 c	6, 994b
KCI (142 kg/ha K <sub>2</sub> O)¹	2,983.0 bc	7,286b
Super Greensand® (142 kg/ha K <sub>2</sub> O)	3,035.2 bc	7,192b
Super Greensand® (284 kg/ha K <sub>2</sub> O)	3,017.3 bc	7,488ab
Super Greensand® (568 kg/ha K <sub>2</sub> O)	3,573.0 a	7,439ab
Super Greensand® (1,136 kg/ha K <sub>2</sub> O)	3,233.2 b	7,854a
CV (%) <sup>2</sup>	6.6	36.62

<sup>&</sup>lt;sup>1</sup> Application in increments

#### Soybeans

An independent trial conducted by *Integrar Gestão e Inovação Agropecuária* in Triunfo (RS) evaluated productivity in soybean cultivation using Super Greensand<sup>®</sup> in comparison with KCl. The results show that treatment with Super Greensand<sup>®</sup> was more productive than both treatment with KCl and the control group.

Table 19.3.1-4 Results of the experiment conducted by Integrar Gestão e Inovação Agropecuária

Treatment	Grain yield (t/ha)*
Control	3.52b
KCI (120 kg/ha K₂O)	4.09ab
Super Greensand® (120 kg/ha K <sub>2</sub> O)	4.15a

<sup>\*</sup> Means followed by the same letter do not differ from each other - produced using the t test.

<sup>&</sup>lt;sup>2</sup> Coefficient of variation

 $<sup>^{\</sup>star}$  Means followed by the same letter do not differ from each other - produced using the t test.

## 19.3.2. Soil quality and sustainability

#### Increase in macro and micronutrient concentration

EPAMIG's independent trial in Patrocínio (MG) evaluated macro and micronutrient contents in the soil after coffee cultivation. The results showed that treatment with Super Greensand® resulted in a higher concentration of the macronutrients phosphorus (total and in solution), potassium, sulfur and calcium and the micronutrients zinc, copper, iron and manganese.

Table 19.3.2-1 Macronutrient evaluation from EPAMIG's experiment

Macronutrient contents							
Treatment	P-rem <sup>1*</sup>	Р	K	S	Ca	Mg	
	g L-1	mg	dm³	Cı	molc dm-	3	
Control	9.7	10.6	44.66	166.51	1.8	1.48	
Super Greensand®	10.9	18.6	70.33	181.96	2.4	1.29	
Increased nutrient concentration (%)	12.37	75.47	57.48	9.28	33.33	-	

<sup>&</sup>lt;sup>1</sup> The remaining phosphorus (P-rem) indicates the amount of P remaining in equilibrium solution in the soil.

Table 19.3.2-2 Micronutrient evaluation from EPAMIG's experiment

Micronutrient contents									
Treatment	Zn	Cu	Fe	Mn	В				
	mg dm-3								
Control	5.10	11.66	34.53	12.84	1.15				
Super Greensand®	6.44	14.49	37.58	15.44	1.11				
Increased nutrient concentration (%)	26.27	24.27	8.83	20.25	-				

# 19.4. Demand Projection

According to the International Fertilizer Industry Association (IFA)<sup>1</sup>, there was a decline in global fertilizer consumption in 2015/16 to 181 Mt. The outlook for 2016/17 is more optimistic due to improved market conditions, weather and political and economic situations in some countries. The expected demand for 2016/17 is 186 Mt with balanced growth among nutrients: nitrogen (+3.0% per year); phosphate (+3.0% per year) and potassium (+2.3% per year).

In Brazil, the fertilizer market is largely supplied by international producers. Roughly 75% of the inputs are imported. According to the *Associação Nacional para Difusão de Adubos* (ANDA), the country imports more than 90% of all the K<sub>2</sub>O consumed.

Brazil is the largest importer of potassium fertilizers in Latin America and will continue to dominate the demand for this nutrient in the coming years. By 2025 it is expected that 80% of Latin American imports of K<sub>2</sub>O will be destined for Brazil<sup>2</sup>.

In 2016, 5.7 Mt of K<sub>2</sub>O were consumed in Brazil (equivalent to 9.5 Mt of KCl or 57 Mt of Super Greensand®)<sup>2</sup>. The Brazilian Ministry of Mines and Energy, together with the International Bank for Reconstruction and Development (IBRD)<sup>3</sup> conducted a study in which the demand K<sub>2</sub>O in Brazil was projected through to 2030. For the projection, three macroeconomic evolution scenarios were considered (Fragile Scenario - 1 with annual GDP growth of 2.3%; Vigorous Scenario - 2, with 4.6% annual GDP growth and Innovative Scenario - 3, with annual growth of 6.9%).

<sup>\*</sup> Statistical difference defined using the Scott-Knott test

<sup>&</sup>lt;sup>1</sup> 84 IFA Annual Conference. Fertilizer Outlook 2016-2020.

http://www.fertilizer.org/imis20/images/Library\_Downloads/2016\_IFa\_Moscow\_Summary.pdf?WebsiteKey=411e9724-4bda-422f-abfc-8152ed74f306&=404%3bhttp%3a%2f%2fwww.fertilizer.org%3a80%2fen%2fimages%2fLibrary\_Downloads%2f2016\_IFa\_Moscow\_Summary.pdf

ANDA, Anuário estatístico 2016.
 MINISTÉRIO DE MINAS E ENERGIA E BANCO INTERNACIONAL PARA A RECONSTRUÇÃO E DESENVOLVIMENTO - BIRD. Relatório Técnico 52 - Perfil do Potássio, http://www.mme.gov.br/documents/1138775/1256650/P29\_RT52\_Perfil\_do\_Potássio.pdf/4971d20d-6612-4882-b131-450e15524ff8

Potassium fertilizers are widely used with crops such as wheat, rice, maize, oilseeds and sugarcane. Fruits and vegetables are also great consumers of this nutrient. The global demand for food has been growing exponentially. It is estimated that by 2050 the world's population will reach nine billion. This will represent a threat to food security, as fewer and fewer areas worldwide are available for cultivation.

Brazil is one of the world's largest food producers and the second largest importer of KCI. KCI is not the most suitable fertilizer for tropical agriculture, as it causes acidification and salinization of the soil. In addition, because it is highly soluble in water, it easily leaches into the deeper layers of the soil, which reduces the availability of potassium for the plants.

## 19.4.1. Supply characterization

Only 12 countries in the world produce a significant amount of potassium, with Canada and Russia being the world leaders. The potassium market is controlled by a few companies such as the North American group Canpotex (comprised of the PotashCorp, Mosaic and Agrium companies), Belaruskali of Belarus and Uralkali of Russia. Projections by Scotiabank Global Banking and Markets (2016) indicate that there will soon be an excess of potassium in the world market, peaking at 5.7 Mt in 2021.

The Brazilian production of KCl is limited to Vale S.A. At its Taquari-Vassouras mine, located in the state of Sergipe, the company produced KCl. Such production supplied only 5% of the national demand for potassium in 2016<sup>4</sup>. In 2017, Vale announced the sale of its fertilizer assets to the US firm The Mosaic Company. The rest of the demand is met by imports, mainly from Canadian and Russian companies.

## 19.4.2. KCI Pricing

The potassium industry has been dominated by the Russian-Canadian duopoly for many years. The Canadian side is represented by North American Canpotex - comprised of PotashCorp, Mosaic and Agrium - and the Russian side is represented by Belarusian Potash Company (BPC) - comprised of the Uralkáli and Belaruskáli companies.

In 2013, BPC collapsed when Uralkáli decided to leave the partnership to serve new markets. With the end of BPC, pressure from China and India, large fertilizer consumers, has led to a drop in the KCl price in the world market, triggering a price war. Since then, the price of potassium has been falling due to an increase in supply. BMO Capital Markets surveyed the global supply of NPK fertilizers and found that the potassium supply has exceeded/will exceed demand by 20%-25% in the period between 2013 and 2020. It is the worst supply/demand ratio among the three nutrients.

<sup>&</sup>lt;sup>4</sup>Anuário estatístico ANDA, 2016.

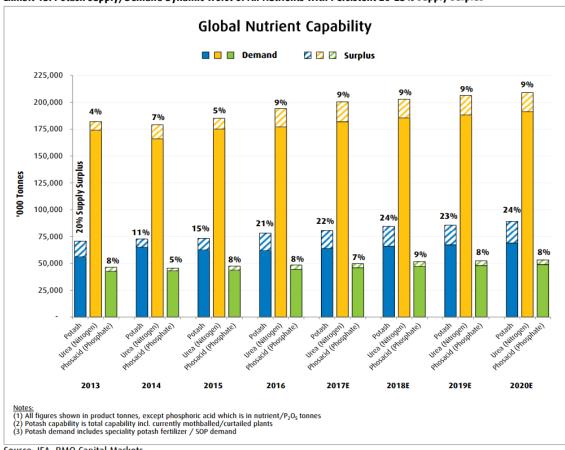


Exhibit 15: Potash Supply/Demand Dynamic Worst of All Nutrients With Persistent 20-25% Supply Surplus

Source: IFA, BMO Capital Markets

Figure 19.4.2-1 Global Nutrient Supply

Data from the World Bank Group show that, in 2009, a tonne of potassium was worth around US\$900.00. In 2013, the price dropped to about US\$390.00 and, in 2017, KCl is being sold at less than US\$250.00 per tonne, as shown below.

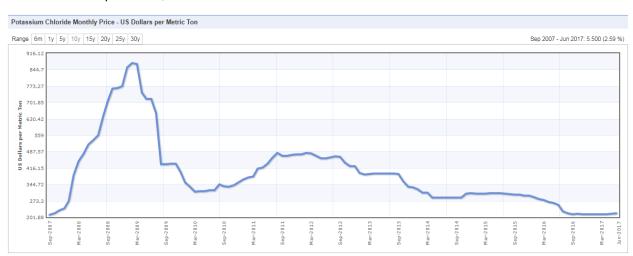


Figure 19.4.2-2 Change in the price of KCI over 10 years - 2007 to 2017<sup>5</sup> Source: The World Bank Group/Indexmundi

<sup>5</sup> The World Bank Group <a href="http://www.indexmundi.com/commodities/?commodity=potassium-chloride&months=120">http://www.indexmundi.com/commodities/?commodity=potassium-chloride&months=120</a>

For the purpose of this market study, the Company conducted a survey of long-term price estimates for KCI. The data are from Scotiabank Global Banking and Markets (2016) and BMO Capital Markets (2017). The Company chose to consider the lowest of all the prices in the analysis, i.e. US\$250.00 (Long Term Price estimated by Scotiabank Global Banking and Markets – 2016).

Table 19.4.2-1 Potassium Chloride price change and Long Term Price (LTP) estimate (US\$/t)

Source		2011	2012	2013	2014	2015	2016	2017	2018*	LTP
Scotiabank	Brazil	529	514	405	349	324	228	215	240	250
вмо	(CFR, \$/Mt)	515	520	410	358	325	232	243	238	260

\*Estimate

Source: Scotiabank Global Banking and Markets (2016) and BMO Capital Markets (2017)

#### 19.4.3. Potential markets for Super Greensand®

Brazilian agribusiness has a leading position in the global market. According to the Companhia Nacional de Abastecimento (CONAB), based on the figures for the 2014/2015 harvest, the Center-West is the main agricultural region of Brazil (agricultural production reached 88 Mt), followed by the South (77.4 Mt), Southeast (19.1 Mt), Northeast (16.8 Mt) and North (8 Mt)<sup>6</sup>.

#### 19.4.4. K<sub>2</sub>O consumption in target markets

The following Brazilian states are considered target markets in this study: Bahia, Espírito Santo, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, São Paulo and Tocantins. Together, they accounted for 92% of all K2O consumed in Brazil in 2016.

An analysis of Brazilian consumption over the last two years reveals that there was an increase of 11% between 2015 and 2016. In 2016, the state of Mato Grosso consumed about 1.2 Mt of K<sub>2</sub>O. São Paulo and Minas Gerais also recorded significant consumption rates, at 606 Kt and 599 Kt, respectively. Other large consumer states are located in areas where the Cerrado predominates, mainly in the Center-West region. Mato Grosso do Sul and Goiás consumed 364 Kt and 540 Kt, respectively. In other regions, the consumption rates were: Paraná (720 Kt), Rio Grande do Sul (718 Kt), Bahia (311 Kt), Tocantins (110 Kt), Santa Catarina (116 Kt) and Espírito Santo (60 Kt)<sup>7</sup>.

Table 19.4.4-1 K<sub>2</sub>O consumption, planted area and main crops of target markets <sup>8</sup>

State	K₂O consumption in 2015 (t)	K₂O consumption in 2016 (t)	Cultivated Hectares (2016 crop)	Main crops
Bahia	298,145	311,561	4,555,050	Grains, cotton, beans, coffee
Espírito Santo	53,605	60,619	696,342	Coffee, papaya, banana
Goiás	507,711	540,522	6,433,972	Beans, sorghum
Mato Grosso	1,112,774	1,211,482	14,526,203	Grains, corn, soybeans
Mato Grosso do Sul	320,594	364,456	5,034,351	Grains, soybeans, corn, sugarcane
Minas Gerais	520,548	599,251	5,869,779	Coffee, beans, corn, sorghum
Paraná	651,866	720,617	10,676,579	Grains, oats, barley, wheat, beans, corn, soybeans
Rio de Janeiro	5,019	6,681	119,361	Flowers, fruits, vegetables
Rio Grande do Sul	640,521	718,854	8,841,862	Grains, tobacco, fruits
Santa Catarina	83,798	116,038	1,557,496	Grains, tobacco
São Paulo	530,478	606,839	8,341,130	Sugarcane, orange, peanut, vegetables, coffee
Tocantins	104,480	110,497	1,248,034	Grains
TOTAL	4,829,539	5,367,417	67,900,159	

Source: IBGE, ANDA

<sup>&</sup>lt;sup>6</sup> Ministério da Agricultura http://www.brasil.gov.br/economia-e-emprego/2015/10/centro-oeste-produz-42-da-safra-de-graos-e-e-o-principal-polo-agricola-dopais

<sup>7</sup> Anuário estatístico ANDA, 2015 e 2016.

<sup>&</sup>lt;sup>8</sup> IBGE - Levantamento Sistemático da Produção Agrícola <a href="https://sidra.ibge.gov.br/tabela/1613/">https://sidra.ibge.gov.br/tabela/1613/</a> ftp://ftp.ibge.gov.br/Producao Agricola/Levantamento Sistematico da Producao Agricola [mensal]/Fasciculo/lspa 201703.pdf / e Secretaria de Agricultura dos Estados.

## 19.4.5. Target Markets

The Cerrado Verde Project is located near the main potassium-consuming states and the country's largest agricultural region, the Brazilian Cerrado.

In Phase 1, up to 600 Ktpy of Super Greensand® are expected to be distributed, serving the Minas Gerais market. In Phase 2, the estimated distribution will reach 5 Mtpy and will serve the main consumer regions closest to the location of the Project: Minas Gerais, Goiás and São Paulo. In these two Phases, the production will be transported by road from São Gotardo (MG) to the final destinations.

In Phase 3, the estimated distribution will reach 25 Mtpy and will serve the markets of Minas Gerais, Goiás, São Paulo and see expansion of the supply to Rio de Janeiro, Espírito Santo, Bahia, Tocantins, Paraná, Mato Grosso, Mato Grosso do Sul, Santa Catarina and Rio Grande do Sul. Production will be transported by road and rail. For Phase 3, the Company has entered into a Memorandum of Understanding with VLI Multimodal S.A. for the purpose of establishing cooperation between the parties for the development of a rail network that will connect the proposed production site to an existing rail line (see Section 16.5).

Table 19.4.5-1 Project phases, annual Super Greensand® production and target distribution market

Phase	Production (Mt)	Target Markets
Phase 1	0.6	Minas Gerais
Phase 2	5	Minas Gerais, Goiás, São Paulo
Phase 3	25	Minas Gerais, Goiás, São Paulo, Rio de Janeiro, Espírito Santo, Bahia, Tocantins, Paraná, Mato Grosso, Mato Grosso do Sul, Santa Catarina, Rio Grande do Sul

# 19.4.6. Definition of average freight

The following item will describe the methodology for calculating freight costs. When selecting the destinations, the *Instituto Brasileiro de Geografia e Estatística* (IBGE) methodology was adopted. This methodology divides the Brazilian states into mesoregions, meaning that states are subdivided into regional groups of municipalities. The mesoregions selected for this study are:

Table 19.4.6-1 Mesoregions selected for this study

STATE	ME	MESOREGIONS					
	Extremo Oeste Baiano	Nordeste Baiano	Sul Baiano				
Bahia	Vale São-Franciscano da Bahia	Metropolitana de Salvador					
	Centro Norte Baiano	Centro Sul Baiano					
Distrito Federal	Distrito Federal						
Espírito Santo	Litoral Norte Espírito-santense	Central Espírito- santense					
	Noroeste Espírito-santense	Sul Espírito-santense					
Caiáa	Noroeste Goiano	Centro Goiano	Sul Goiano				
Goiás	Norte Goiano	Leste Goiano					
	Noroeste de Minas	Campo das Vertentes	Oeste de Minas				
	Norte de Minas	<b>Central Mineira</b>	Vale do Mucuri				
Minas Gerais	Sul/Sudoeste de Minas	Jequitinhonha	Vale do Rio Doce				
	Triângulo Mineiro/Alto Paranaíba	Metropolitana de Belo Horizonte	Zona da Mata				

STATE	MESOREGIONS							
Mato Grosso do	Centro Norte de Mato Grosso do Sul	Pantanais Sul Mato- grossense						
Sul	Sudoeste de Mato Grosso do Sul	Leste de Mato Grosso do Sul						
	Nordeste Mato-grossense	Sudoeste Mato- grossense						
Mato Grosso	Norte Mato-grossense	Centro-Sul Mato- grossense						
	Sudeste Mato-grossense							
	Centro Oriental Paranaense	Centro Ocidental Paranaense						
	Oeste Paranaense	Sudoeste Paranaense						
Paraná	Noroeste Paranaense	Centro-Sul Paranaense						
	Norte Central Paranaense	Sudeste Paranaense						
	Norte Pioneiro Paranaense	Metropolitana de Curitiba						
	Noroeste Fluminense	Baixadas						
Rio de Janeiro	Norte Fluminense	Sul Fluminense						
	Centro Fluminense	Metropolitana do Rio de Janeiro						
Dia Cranda da	Centro Ocidental Rio-grandense	Noroeste Rio-grandense	Sudeste Rio- grandense					
Rio Grande do Sul	Centro Oriental Rio-grandense	Nordeste Rio-grandense						
	Sudoeste Rio-grandense	Metropolitana de Porto Alegre						
	Norte Catarinense	Vale do Itajaí						
Santa Catarina	Oeste Catarinense	Grande Florianópolis						
	Serrana	Sul Catarinense						
	São José do Rio Preto	Piracicaba	Itapetininga					
	Ribeirão Preto	Campinas	Macro Metropolitana Paulista					
São Paulo	Araçatuba	Presidente Prudente	Vale do Paraíba Paulista					
	Bauru	Marília	Litoral Sul Paulista					
	Araraquara	Assis	Metropolitana de São Paulo					
Tocantins	Ocidental do Tocantins							
Source: IBGE	Oriental do Tocantins							

Source: IBGE

Based on this definition of mesoregions, quotations were requested from several carriers in Brazil for selected municipalities within each mesoregion.

# 19.4.7. Super Greensand® CFR Price Composition

The logistical costs associated with KCI from its arrival at a Brazilian port through to the final customer were taken into account when formulating the price for Super Greensand<sup>®</sup>. For these calculations, the CFR<sup>9</sup> Brazil Port price was considered to be US\$ 250 per tonne, which corresponds to the long-term

<sup>&</sup>lt;sup>9</sup> The acronym CFR stands for 'Cost and Freight'. In this type of freight, expenses arising from placing of the goods on board the ship, freight to the designated port of destination and export formalities are borne by the seller; the risks and damage to the goods from the moment they are placed on board the ship at the port of embarkation are the responsibility of the buyer, who shall hire and pay for the insurance and the landing costs.

price for KCl<sup>10</sup>, as estimated by analysts at Scotiabank Global Banking and Markets (mentioned earlier in this report). As a result, the cost of KCl delivered in Brazil can be determined:

Table 19.4.7-1 Breakdown of KCI cost per tonne (delivered in Brazil)

Description	Amount in US\$	Amount in R\$ <sup>11</sup>
CFR Brazil Port Price	250.00	820.00
Brazil Port costs	17.00	55.76
Demurrage	3.00	9.84
AFRMM <sup>12</sup> Tax	5.00	16.40
Cost of transportation Port Brazil - distributor	29.00	95.12
Average margin added by dealer	30.00	98.40
Average distributor - producer transportation cost	12.00	39.36
Total	US\$ 346.00	R\$1,134.88

Thus, the total cost of KCI delivered to Brazilian producers is US\$346.00 per tonne, considering the lowest long-term price for the commodity.

KCI is 60%  $K_2O$  while Super Greensand® is 10%  $K_2O$ . The total cost of super greensand delivered to farmers should be one sixth of the price for KCI delivered to farmers, meaning that they will pay for Super Greensand® the same price they currently pay for KCI, adjusted based on the lower concentration of  $K_2O$ .

As previously mentioned, Super Greensand® is a multi-nutrient product. The calculation of the price per tonne of product will be based solely on the amount of potassium (10% of total K<sub>2</sub>O). Thus, the customer will pay for potassium, but will receive the other nutrients and benefits that the product provides at no additional cost.

Table 19.4.7-2 Cost (delivered to the farm) of each nutrient in Super Greensand®

Potassium 10%*	\$57.67
Magnesium 3%	NO ADDITIONAL COST
Silicon 59%	NO ADDITIONAL COST
Manganese 0,05%	NO ADDITIONAL COST
Traces of other 60 minerals	NO ADDITIONAL COST
Retains ammonia	NO ADDITIONAL COST
Increases soil's ability to retain water and other nutrients	NO ADDITIONAL COST
Does not saline or acidify soil	NO ADDITIONAL COST
Organic Matter Maximizer	NO ADDITIONAL COST
Approved for organic farming	NO ADDITIONAL COST

Despite having the advantages of a premium product, Super Greensand® will not be priced as such. The definition of the FOB price <sup>13</sup> is described below

11 US\$ = 3.28, long-term Projection for the dollar according to Focus Report, Banco Central do Brasil, June 16, 2017.

<sup>&</sup>lt;sup>10</sup> Current KCl price: US\$265.00 CFR Brazil (September 28, 2017)

<sup>&</sup>lt;sup>12</sup> Additional Freight for the Renewal of the Merchant Marine. This is an additional charge on freight levied by Brazilian and foreign shipping companies operating in Brazilian ports based on the bill of lading and the cargo manifest. It concerns long-haul navigation, cabotage, river and lake navigation and deals exclusively with the transportation of bulk cargoes in the North and Northeast regions.

<sup>&</sup>lt;sup>13</sup> The acronym FOB stands for 'Free on Board'. In this type of freight, the buyer assumes all risks and costs with the transportation of the merchandise, once it is placed on board the ship. The supplier must place the goods on board at the port of shipment designated by the importer.

# 19.5. FOB Price Definition for Super Greensand

# 19.5.1. Average FOB price for Phase 1

In order to calculate the average FOB price for Phase 1 it is necessary to 1) estimate the average transportation cost to each mesoregion in the target market and 2) calculate the potential market in each mesoregion.

In order to obtain the average transportation cost, local transportation companies were contacted and quotes were requested.

In order to calculate the potential market, each mesoregion's planted area was considered and its potash consumption estimated.

With all the different transportation costs and market sizes having been estimated, it was possible to calculate an FOB price per mesoregion by deducting the transportation cost from the CFR price of \$57.67 (see 19.4.7 Super Greensand® CFR price formation).

Finally, a market share was estimated for the target market and the same market share was applied across all mesoregions in order to calculate an average FOB price. For Phase 1, the state of Minas Gerais has a total market for potash of 554,130 tonnes of K<sub>2</sub>O, which is equivalent to 5,541,296 tonnes of Super Greensand<sup>®</sup>. Considering a market share of 10% in each mesoregion, it was possible to determine the sales volumes in each mesoregion and, based on these figures, the weighted average FOB price was calculated. The average FOB price in Phase 1 is US\$38.15.

Table 19.5.1-1 Average FOB Price for Phase 1

State	Mesoregion	Planted Hectares	Size of the K <sub>2</sub> O market in 2016 (t)	Size of the SGS potential market (t)	Freight from mine to producer (US\$)	FOB Price (US\$)	SGS Sales volume (t)
MG	Oeste de Minas	238,644	24,364	243,642	\$13.72	\$43.95	24,364
MG	Triângulo Mineiro/Alto Paranaíba	2,212,964	225,931	2,259,311	\$14.23	\$43.44	225,931
MG	Metropolitana de Belo Horizonte	78,197	7,983	79,835	\$16.77	\$40.90	7,983
MG	Campo das Vertentes	146,411	14,948	149,477	\$19.82	\$37.85	14,948
MG	Jequitinhonha	74,357	7,591	75,914	\$21.34	\$36.33	7,591
MG	Noroeste de Minas	934,084	95,365	953,647	\$24.39	\$33.28	95,365
MG	Sul/Sudoeste de Minas	850,221	86,803	868,028	\$24.39	\$33.28	86,803
MG	Norte de Minas	287,654	29,368	293,679	\$24.39	\$33.28	29,368
MG	Central Mineira	89,986	9,187	91,871	\$24.39	\$33.28	9,187
MG	Vale do Rio Doce	157,346	16,064	160,641	\$24.39	\$33.28	16,064
MG	Zona da Mata	324,981	33,179	331,787	\$24.39	\$33.28	33,179
MG	Vale do Mucuri	32,777	3,346	33,463	\$27.44	\$30.23	3,346
	TOTAL	5,427,622	554,130	5,541,300	\$21.63*	\$38.15*	554,130

#### 19.5.2. Average FOB Price for Phase 2

In Phase 2 (market of 5 Mtpy), the Project will serve the states of Minas Gerais, Goiás and São Paulo. The mesoregions, planted area and the 2016 demand for K<sub>2</sub>O per state were selected.

Considering the states of Minas Gerais, São Paulo and Goiás, the potential market for Super Greensand $^{\circ}$  is equal to 1,684,011 t of  $K_2O$ , equivalent to 16,840,112 t of product. Assuming a market

share of 14%, it was possible to define sales volumes in each mesoregion and, based on these figures, the weighted average FOB price was calculated. The average FOB price in Phase 2 is US\$35.17.

Table 19.5.2-1 Average FOB Price for Phase 2

State	Mesoregion	Planted Hectares	Size of the K <sub>2</sub> O market in 2016 (t)	Size of the SGS potential market (t)	Freight from mine to producer (US\$)	FOB Price (US\$)	SGS Sales volume (t)
MG	Oeste de Minas	238,644	24,364	243,642	\$13.72	\$43.95	34,110
MG	Triângulo Mineiro/Alto Paranaíba	2,212,964	225,931	2,259,311	\$14.23	\$43.44	316,304
MG	Metropolitana de Belo Horizonte	78,197	7,983	79,835	\$16.77	\$40.90	11,177
MG	Campo das Vertentes	146,411	14,948	149,477	\$19.82	\$37.85	20,927
SP	São José do Rio Preto	74,357	7,591	75,914	\$21.34	\$36.33	10,628
SP	Araraquara	1,248,347	90,821	908,205	\$19.82	\$37.85	127,149
MG	Jequitinhonha	490,458	35,682	356,821	\$19.82	\$37.85	49,955
SP	Campinas	934,084	95,365	953,647	\$24.39	\$33.28	133,511
SP	Bauru	850,221	86,803	868,028	\$24.39	\$33.28	121,524
SP	Piracicaba	287,654	29,368	293,679	\$24.39	\$33.28	41,115
SP	Marília	89,986	9,187	91,871	\$24.39	\$33.28	12,862
SP	Macro Metropolitana Paulista	157,346	16,064	160,641	\$24.39	\$33.28	22,490
SP	Araçatuba	324,981	33,179	331,787	\$24.39	\$33.28	46,450
MG	Noroeste de Minas	523,404	38,079	380,790	\$21.34	\$36.33	53,311
MG	Sul/Sudoeste de Minas	882,033	64,170	641,702	\$21.34	\$36.33	89,838
MG	Norte de Minas	377,059	27,432	274,320	\$21.34	\$36.33	38,405
MG	Central Mineira	175,675	12,781	127,808	\$21.34	\$36.33	17,893
MG	Vale do Rio Doce	111,067	8,080	80,804	\$21.34	\$36.33	11,313
MG	Zona da Mata	606,034	44,091	440,906	\$22.87	\$34.80	61,727
GO	Centro Goiano	357,922	30,066	300,660	\$24.39	\$33.28	42,092
G	Leste Goiano	903,473	75,893	758,930	\$24.39	\$33.28	106,250
GO	Sul Goiano	4,485,922	376,824	3,768,239	\$24.39	\$33.28	527,553
GO	Norte Goiano	215,735	18,122	181,220	\$24.39	\$33.28	25,371
SP	Ribeirão Preto	1,760,008	128,045	1,280,452	\$24.39	\$33.28	179,263
SP	Presidente Prudente	687,769	50,037	500,370	\$24.39	\$33.28	70,052
SP	Assis	898,476	65,366	653,665	\$24.39	\$33.28	91,513
SP	Vale do Paraíba Paulista	20,625	1,501	15,005	\$24.39	\$33.28	2,101
SP	Litoral Sul Paulista	45,525	3,312	33,121	\$24.39	\$33.28	4,637
SP	Metropolitana de São Paulo	3,448	251	2,509	\$24.39	\$33.28	351
MG	Vale do Mucuri	32,777	3,346	33,463	\$27.44	\$30.23	4,685
GO	Noroeste Goiano	144,107	12,105	121,052	\$27.44	\$30.23	16,947
SP	Itapetininga	649,101	47,224	472,238	\$36.43	\$21.23	66,113
	TOTAL	20,013,810	1,684,011	16,840,110	\$23.02*	\$35.17*	2,357,616

## 19.5.3. Average FOB Price for Phase 3

In Phase 3, the Project will serve the states of Minas Gerais, Goiás, São Paulo, Rio de Janeiro, Espírito Santo, Bahia, Tocantins, Paraná, Mato Grosso, Mato Grosso do Sul, Santa Catarina and Rio Grande do Sul. Again, the mesoregions, planted area and K<sub>2</sub>O demand per state in 2016 were selected.

In order to estimate the Brazilian demand for  $K_2O$  in Year 7 when the project is expected to achieve 25Mt one of the scenarios proposed in the report<sup>14</sup> prepared by the Ministry of Mines and Energy and the International Bank for Reconstruction and Development (IBRD) was used. In the intermediate scenario, proposed in the report, growth in the consumption of  $K_2O$  in Brazil between 2016-2031 is projected at 25%.

Freight costs were optimized in Phase 3, since the product will be transported via railroad from São Gotardo to the distribution centers, from where it will travel via highway to the final destination. For the expansion phase, VLI Multimodal S.A. estimated the costs of railway transportation from São Gotardo to the distribution centers and freight rates from there to final destinations were quoted by several carriers in Brazil.

For this Phase, a market share of 50% was assumed. The sales volumes in each mesoregion were defined and, based on these figures, the weighted average for the FOB price was calculated. The average FOB price in Phase 3 is US\$25.10.

Table 19.5.3-1 Average FOB Price for Phase 3

State	Mesoregion	Planted Hectares	Size of the K <sub>2</sub> O market in 2016 (t)	Size of the SGS potential market (t)	Freight from mine to producer (US\$)	FOB Price (US\$)	SGS Sales volume (t)
MG	Triângulo Mineiro/Alto Paranaíba	2,212,964	282,414	2,824,139	\$10.70	\$46.97	1,412,070
MG	Oeste de Minas	238,644	30,455	304,553	\$13.72	\$43.95	152,276
GO	Centro Goiano	357,922	37,582	375,825	\$14.07	\$43.60	187,912
MG	Metropolitana de Belo Horizonte	78,197	9,979	99,793	\$16.77	\$40.90	49,897
SP	Ribeirão Preto	146,411	18,685	186,847	\$19.82	\$37.85	93,423
MG	Campo das Vertentes	1,760,008	160,056	1,600,565	\$17.84	\$39.83	800,282
SP	São José do Rio Preto (SP)	74,357	9,489	94,893	\$21.34	\$36.33	47,446
SP	Araraquara (SP)	1,248,347	113,526	1,135,256	\$19.82	\$37.85	567,628
MG	Jequitinhonha	490,458	44,603	446,026	\$19.82	\$37.85	223,013
SP	Bauru (SP)	850,221	108,503	1,085,035	\$23.78	\$33.89	542,517
SP	Piracicaba (SP)	4,485,922	471,030	4,710,298	\$22.21	\$35.46	2,355,149
SP	Marília (SP)	934,084	119,206	1,192,059	\$24.39	\$33.28	596,029
SP	Macro Metropolitana Paulista (SP)	89,986	11,484	114,838	\$24.39	\$33.28	57,419
GO	Sul Goiano	157,346	20,080	200,802	\$24.39	\$33.28	100,401
SP	Araçatuba (SP)	324,981	41,473	414,734	\$24.39	\$33.28	207,367
GO	Noroeste Goiano (GO)	882,033	80,213	802,128	\$21.34	\$36.33	401,064
MG	Sul/Sudoeste de Minas	377,059	34,290	342,900	\$21.34	\$36.33	171,450
MG	Noroeste de Minas	175,675	15,976	159,760	\$21.34	\$36.33	79,880
MG	Central Mineira	111,067	10,101	101,005	\$21.34	\$36.33	50,503
MG	Vale do Rio Doce	144,107	15,131	151,315	\$23.13	\$34.54	75,657
MG	Zona da Mata	606,034	55,113	551,132	\$22.87	\$34.80	275,566
SP	Presidente Prudente (SP)	687,769	62,546	625,462	\$24.39	\$33.28	312,731
SP	Assis (SP)	898,476	81,708	817,081	\$24.39	\$33.28	408,540
SP	Vale do Paraíba Paulista				\$24.39	\$33.28	

<sup>&</sup>lt;sup>14</sup> MINISTÉRIO DE MINAS E ENERGIA E BANCO INTERNACIONAL PARA A RECONSTRUÇÃO E DESENVOLVIMENTO - BIRD. Relatório Técnico 52 - Perfil do Potássio <a href="http://www.mme.gov.br/documents/1138775/1256650/P29">http://www.mme.gov.br/documents/1138775/1256650/P29</a> RT52 Perfil do Potássio.pdf/4971d20d-6612-4882-b131-450e15524ff8

State	Mesoregion	Planted Hectares	Size of the K <sub>2</sub> O market in 2016 (t)	Size of the SGS potential market (t)	Freight from mine to producer (US\$)	FOB Price (US\$)	SGS Sales volume (t)
	(SP)	20,625	1,876	18,757	` '/		9,378
SP	Litoral Sul Paulista (SP)	45,525	4,140	41,401	\$24.39	\$33.28	20,700
SP	Metropolitana de São Paulo (SP)	3,448	314	3,136	\$24.39	\$33.28	1,568
GO	Norte Goiano (GO)	32,777	4,183	41,829	\$27.44	\$30.23	20,915
GO	Leste Goiano	215,735	22,653	226,526	\$25.91	\$31.75	113,263
DF	Distrito Federal	903.473	94,866	948,663	\$26.02	\$31.65	474,331
MG	Vale do Mucuri	161,011	8,379	83,794	\$27.43	\$30.24	41,897
ES	Sul Espírito-santense	152,217	16,564	165,638	\$30.49	\$27.18	82,819
MS	Leste de Mato Grosso do Sul	593,440	52,501	525,009	\$32.01	\$25.65	262,505
ES	Central Espírito- santense	129,913	14,137	141,367	\$33.54	\$24.13	70,684
PR	Norte Pioneiro Paranaense	1,122,476	94,998	949,984	\$33.54	\$24.13	474,992
sc	Vale do Itajaí	143,258	13,341	133,414	\$33.54	\$24.13	66,707
sc	Grande Florianópolis	30,259	2,818	28,180	\$33.54	\$24.13	14,090
sc	Sul Catarinense	165,636	15,425	154,255	\$33.54	\$24.13	77,127
МТ	Sudeste Mato-grossense	2,309,169	241,601	2,416,012	\$35.63	\$22.04	1,208,006
SP	Itapetininga	39,937	3,533	35,332	\$35.65	\$21.08	17,666
SP	Campinas	,	59,030	•	\$35.90	\$21.77	·
MS	Pantanais Sul Mato-	649,101		590,297	·	·	295,149
PR	grossense Norte Central	523,404	47,599	475,988	\$36.07	\$21.60	237,994
PR	Paranaense Metropolitana de	1,907,761	161,459	1,614,593	\$38.11	\$19.56	807,297
PR	Curitiba Centro Oriental	340,039	28,778	287,785	\$38.11	\$19.56	143,892
ES	Paranaense Noroeste Espírito-	287,654	36,710	367,098	\$40.15	\$17.51	183,549
MG	santense Norte de Minas	146,005	15,888	158,878	\$39.63	\$18.03	79,439
RJ	Norte Fluminense	874,930	74,048	740,479	\$39.18	\$18.49	370,239
МТ	Norte Mato-grossense	9,075,064	949,496	9,494,957	\$41.16	\$16.51	4,747,478
MT	Sudoeste Mato-	384,898	40,271	402,707	\$41.16	\$16.51	201,353
MT	grossense Nordeste Mato-	2,175,032	227,567	2,275,668	\$41.16	\$16.51	1,137,834
MT	grossense Centro-Sul Mato-	84,743	5,929	59,292	\$40.65	\$17.02	29,646
PR	grossense  Noroeste Paranaense	215,724	22,571	225,705	\$41.46	\$16.20	112,853
PR	Centro Ocidental	563,109	48,145	481,451	\$42.27	\$15.40	240,726
	Paranaense Sudeste Paranaense	794,934	67,278	672,776	\$42.07	\$15.59	336,388
PR		1,178,315	99,724	997,242	\$42.07	\$15.59	498,621
RJ	Centro Fluminense	681,915	57,712	577,124	\$42.07	\$15.59	288,562
RJ	Baixadas	7,461	522	5,220	\$42.07	\$15.59	2,610
RJ	Sul Fluminense	12,083	845	8,454	\$42.07	\$15.59	4,227
BA	Centro Norte Baiano  Vale São-Franciscano	4,671	327	3,268	\$42.07	\$15.59	1,634
ВА	da Bahia	196,837	16,829	168,293	\$42.68	\$14.98	84,147
PR	Oeste Paranaense Centro Norte de Mato	2,037,750	172,461	1,724,607	\$43.80	\$13.86	862,303
MS	Grosso do Sul Sudoeste de Mato	900,239	79,643	796,431	\$44.94	\$12.73	398,215
MS	Grosso do Sul	3,216,259	284,539	2,845,386	\$44.94	\$12.73	1,422,693

State	Mesoregion	Planted	Size of the K <sub>2</sub> O market in 2016 (t)	Size of the SGS potential market (t)	Freight from mine to producer (US\$)	FOB Price (US\$)	SGS Sales volume (t)
PR	Centro-Sul Paranaense	884,610	74,867	748,671	\$45.12	\$12.54	374,336
RJ	Metropolitana do Rio de Janeiro	23,293	1,630	16,297	\$45.12	\$12.54	8,149
	TOTAL	50,566,798	4,998,841	49,988,410	\$31.16	\$25.10	24,994,204

# 20. Environmental Studies, Permitting and Social or Community Impact

# 20.1. Background on Brazilian Environmental Regulations

The Ministry of Environment for Brazil is responsible for establishing the Brazilian regulations. The State Council (CONAMA) is responsible for administering the Minas Gerais Environmental Policy. CONAMA is composed of separate departments called: Superintendência Regional de Meio Ambiente (SUPRAM), Secretaria de Estado de Meio-Ambiente e Desenvolvimento Sustentável (SEMAD), Fundação Estadual do Meio Ambiente (FEAM), Instituto Mineiro de Gestão das Águas (IGAM) and Instituto Estadual de Florestas (IEF).

The following documents and processes are required under Brazilian law:

- Project Characterization Form (Formulário de Caracterização do Empreendimento FCE);
- Basic Orientation Form (Formulário de Orientação Básica Integrado FOB);
- Environmental Impact Study (Estudo de Impacto Ambiental EIA);
- Environmental Impact Report (Relatório de Impacto Ambiental RIMA);
- Public Hearing (Audiência Pública);
- Preliminary Permit (*Licença Prévia* LP);
- Construction Permit (Licença de Instalação LI);
- Operational Permit (Licença de Operação LO);
- Plan for Recovery of Degraded Areas (Plano de Recuperação de Áreas Degradadas PRAD);
- Mine Closure Plan (Plano de Fechamento de Mina).

The FCE is the first step in the environmental permitting process. Based on this filing, SEMAD issues the FOB which provides guidance for completing the EIA.

The initial stages of the environmental licensing aim at obtaining a LP, issued during the planning and designing phase of a project, after the presentation and analysis of its EIA.

The LP is followed by the LI, issued after a revision of the specifications of the project and the presentation of the plans, programs and projects which will be offered to meet the constraints eventually required in the LP. This can be added by detailed information of the project, processes and technologies that will be adopted to neutralize, mitigate or compensate for environmental impacts, as well as the procedures of the environmental monitoring. Finally, once the plant is installed and in accordance with relevant requirements, the company must obtain the LO, which authorizes the commencement of the activities.

An EIA in a detailed project is required by the Brazilian Government before any construction and mine operations. The RIMA consists of a document that lists all content of the EIA, summarized and written with a language to be more easily understood by the community.

A Public Hearing in accordance with federal law CONAMA 009/1987 is required to present the direct and indirect influence of the project to the people living in the region. After presentations addressed by

the company, there will be an opportunity for all participants to answer questions, collect comments and suggestions about the project. The public hearing shall occur according to the criteria of the SUPRAM and the Company has the responsibility to facilitate the location and transportation of the population to the event.

## 20.1.1. Environmental Compensations

Specific laws in Brazil consider aspects e.g. about forest, water resources, Conservation Units, and special areas, such as: State law No. 20.922/2013, Federal law No. 12.651/2012, CONAMA Resolution 369/2006, Federal law No. 11.428/06, Decree No. 6.660/08, IEF Ordinance 30/2015, Decree No. 45.629/2011 Federal law No. 9.985/2000, Federal Decree No. 6.848/2009, Federal Decree No. 4.340/2002, IEF Ordinance 55/2012, Law No. 20.922/13 and IEF Ordinance 27/ 2017.

Federal Law No. 12.651/2012 is the standard to protection and sustainable use of forests and other forms of native vegetation. This law comprises definition to aspects related to Permanent Preservation Area (APP), Legal Reserve (LR), need for intervention, forms of vegetation and economic instruments. The Legal Reserve and Permanent Preservation Area can be characterized as restrictions on property rights, grounded in social function provided for in the Federal Constitution. According to Law No. 9.985/2000 on the Sistema Nacional de Unidades Conservação (SNUC), the enterprises that cause significant environmental impact must commit financial resources to the implementation and maintenance of Conservation Units, specially protected areas in accordance with Article 225, §10, III Federal Constitution, 1998. The quantum of environmental compensation, to be held by the environmental agency, should be based on the degree of environmental impact, calculated at the stage of Preliminary License (LP).

# 20.2. Status of Permit Application

#### **20.2.1.** Fragata

VERDE has an environmental mining permit covering the Fragata area (Section 4.3.3). On February 9, 2017, the Company obtained an Environmental Authorization for Operation ("Autorização Ambiental de Funcionamento" — AAF) from SUPRAM. This document allows VERDE to mine 20 Ktpy until February 9, 2021. An application to increase annual production to 50,000 t was submitted to SUPRAM for analysis on May 5, 2017.

#### 20.2.2. Processing Plant

On August 3, 2016 Verde acquired a property covering 8.78 ha, located along highway LMG-764 in the municipality de São Gotardo, Minas Gerais. A payment was made in the amount of R\$ 345,000.00 (approximately US\$105,182.93).

On September 21, 2017, VERDE obtained an AAF for the Super Greensand® Processing Plant, allowing VERDE to install a processing plant on this property with an annual capacity of 199,500 t of Super Greensand®. VERDE is preparing the environmental studies for an expansion to the 600 Ktpy capacity planned for Phase 1.

#### 20.2.3. Selado

VERDE has applied for an environmental license for the production of 233 Ktpy in the *Fazenda Selado* area (Section 4.3.4). This production can be increased at a later date. The Selado site has a 51 Mt (10.23%  $K_2O$ ) mineral reserve.

#### 20.2.4. Confusão

On November 9, 2017, the Company obtained an AAF from SUPRAM for this area (Section 4.3.5). This document allows VERDE to mine 49,800 t per year until November 9, 2021.

#### 20.2.5. Londônia

The environmental license application for the Fazenda Londônia area (Section 4.3.6) will be filed with SUPRAM and the DNPM for analysis in January of 2018.

# 20.3. Waste Disposal

The waste will return to the open pits from the Year 4 on. Therefore, in the first three years of operation, there will be a 40,365 m<sup>2</sup> pile to stock the material, as previously detailed in Section 16.3.

# 20.4. Site Monitoring

The monitoring programs are presented in the Environmental Control Plan (Plano de Controle Ambiental – PCA) which addresses, among other things, the following items:

- Preservation of air and water quality;
- · Control the generation of solid waste and its treatment;
- Control of noise levels;
- The importance of upholding life quality;
- Transmission of knowledge through environmental education programs;
- Proper care of emergency situations.

Once the monitoring programs are commenced, VERDE will establish the environmental performance index, which will be based on the results of the main environmental monitoring programs that will be developed for the certification of the mitigation procedures effectiveness. Associated with the performance of the monitoring programs, the index should satisfy legal requirements.

## 20.4.1. Air Quality and Dust Control Plan

A monitoring air quality study was presented in the preliminary PCA for the production of 233 Ktpy (20.2.3 Selado). The main operations at mine include: mining, crushing, grinding and transporting of the ore. Emissions sources include:

- Mine stockpiles wind action over mine and other surfaces:
- Crushers;
- Access roads;
- Movement of machinery and equipment over unpaved roads.

The Project will require controls to manage dust, with application of a chemical bonding or recycled water to powder suppression. Recycled water will be placed on the unpaved roads to reduce dust issues.

## 20.4.2. Water Management

The groundwater protection predicts the analysis of mining waste by a monitoring program in accordance with the IGAM requirements. The quality of surface water and groundwater will be monitored by the conditions established by the environmental authorities.

The effluent discharge cannot degrade the water where there is unloading. The monitoring system will be installed as required by LO, in accordance with the PCA, bellow the ground levels to characterize the quality level.

The collection of water samples for quality analysis was performed and analyzed on the EIA. Apparent and true color, fluoride, total hardness, manganese, total iron, ammonia, nitrate, nitrite, total nitrogen, total phosphorus, phosphate, chlorine demand, alkalinity, biological oxygen demand, chemical oxygen demand, dissolved oxygen, total solids, suspend solids, total dissolved solids, coliforms, sulfides and other parameters were tested. Turbidity, dissolved oxygen, conductivity, pH, TDS and temperature were collected directly at the surface sampling points and transferred to the laboratory.

# 20.5. Social and Community

The main town in the vicinity of the Project site is São Gotardo, approximately 39 km west. The urban sprawl of São Gotardo is approximately 6km². The remaining areas of this municipality, in general, are divided into areas of livestock, crops and villages. At the projected mine and plant area, the main activity is livestock.

The municipality of São Gotardo has 34,425 inhabitants with 94.5% of the population in urban areas.

A comprehensive evaluation of the archaeological sites was made through a systematical study of historical data, followed by a field reconnaissance, comprising surface prospection. To minimize the possible impacts, VERDE will develop detailed archaeological research campaigns and education programs.

### 20.5.1. Potential Social or Community Related Requirements

The development of the Project will have positive and negative economic impact in the area of influence. Studies on the socioeconomic impacts at the region were performed for the production of 233 Ktpy (20.2.3 Selado). Additional studies must be made for the whole Project area.

## 20.5.2. Community Relations Plans

Programs for the development of the community around the project have already been made for the production of 233 Ktpy (20.2.3 Selado) as an integral part of the environmental licensing process, in order to minimize negative impacts on the region. These programs will be expanded to the whole Project area.

VERDE is developing a plan to promote social and economic development in a sustainable framework, by programs aimed to generate positive impacts and minimizing negative impacts on these communities.

### 20.5.3. Negotiations or Agreements

VERDE conducted a series of local community meetings to describe the proposed Project and reported a favorable response from the community.

## 20.6. Mine Closure

The mine closure is the permanent cessation of mining operations. This process is governed by various procedures, including the presentation of the Mine Closure Plan (MCP). The studies of environmental impact and the analysis of mine operations allow an understanding of the scenario in which the necessary steps for the closing of the mine shall be proposed and established.

The MCP will study ways to recovery the area with alternative future use of it, and the facilities decommissioning, providing a conceptual closure plan and basis for a budgetary closure cost estimate.

It is important to highlight that the closure plan is a conceptual version, demonstrating that VERDE is aware of its responsibilities and that is prepared for an eventual closing. This plan must be prepared in accordance with the characteristics of the area and the Project that are updated over time. Thus, this study will have a dynamic, interactive and participative character, always taking into account the positioning of the environmental agency, the DNPM, the local community, government partnerships and of the non-governmental organizations.

The MCP and the Plan for Recovery of Degraded Areas (PRAD) will provide the suitable technical solutions to rehabilitate the soil and other aspects of the environment that might be degraded by mining operations.

# 21. Capital and Operating Costs

As part of the verification process for the reserves presented in this report, BNA conducted an economic valuation of the Cerrado Verde Project for the material classified as reserve. This section outlines the capital and operating costs considered in this valuation. All costs presented in this section are based on a conversion rate of US\$1.00 = R\$3.28. This is a long-term projection for the dollar according to the Focus Banco Central do Brasil Report of June 16, 2017.

### 21.1. CAPEX

The Project's technical team prepared an estimate of capital required to sustain the mining and processing operations. This capital estimate is broken down into the following main areas.

## **21.1.1.** Mining

Mining will be performed by a contractor and therefore the purchase of production equipment will not be required. Owner-related mine capital associated with mining are for minor support functions, which will not be performed by the mining contractor, and will be shown in Section 21.1.5.

# 21.1.2. Processing

The processing CAPEX was estimated by MINALAC, using data from suppliers' budgetary quotations and costs from similar projects.

Table 21.1.2-1 summarizes the investment in processing for the 3 phases.

Table 21.1.2-1 Investments - Processing

Investment Value (US\$x1,000)			
Phase 1	Phase 2	Phase 3	
1,349	8,721	143,518	

The next items detail the estimated costs for each phase.

### **Processing Plant Phase 1**

The estimated investments in processing for Phase 1 are as follows:

Table 21.1.2-2 Site Infrastructure - Processing Phase 1

Description	Investment US\$	
PRODUCTION BUILDING (including packed material	storage)	
Foundations of columns, without floor and walls	61,463.41	
Cover	66,731.71	
Surveying, topography and earthwork	31,609.76	
Well + Water network	26,390.24	
Lightning protection systems	12,345.37	
Rainwater Network	16,243.90	
Subtotal	214,784.39	
ADMINISTRATIVE BUILDING		
Foundations, floor, walls, etc.	54,718.54	
Subtotal	54,718.54	
COMPRESSOR ROOM		
2 Compressors	6,097.56	

Description	Investment US\$
Air Network	28,887.80
Subtotal	34,985.37
Telephone and IT Network	
Telephone and IT Network	5,695.61
Subtotal	5,695.61
Electrical network	
Power cable	10,800.00
Unipolar power cable	34,756.10
Bracket for trays	1,143.29
Conduits	1,352.20
Trays-Electroplate	13,353.66
Engine starts with individual pushbuttons	14,634.15
Transformer 0,75 Mw (750 kw)	208,975.61
Lighting	3,914.20
Light Distribution Panel	15,243.90
AVCB* (fire extinguishers and signage)	18,639.02
Subtotal	322,812.12
TOTAL	632,996.02

<sup>\*</sup> AVCB (*Auto de Vistoria do Corpo de Bombeiros*) is a document that proves that the building has safe conditions for abandonment in case of panic, easy access for members of the Fire Department, in addition to firefighting equipment.

Table 21.1.2-3 Investments in Equipment - Phase 1 Processing

Table 211112 o introctinonte in Equipment		· ····································		
Description	Quantity	Equipment (Unit) US\$	Setup (Unit) US\$	Total US\$
Dump hopper	1	46,829.27	20,400.00	67,229.27
Apron Feeder	1	27,393.29		27,393.29
Crusher	1	41,292.00	46,429.22	87,721.22
Belt conveyor 24" (3 rollers)	1	13,276.00	19,453.26	32,729.26
Magnetic separator	1	8,409.76		8,409.76
Surge bin	1	46,829.27	20,400.00	67,229.27
2 Vibratory Feeders	2	8,409.76		16,819.51
MM 75100 (2 Hammer Mills)	2	25,609.76	26,745.61	104,710.74
Belt conveyor 24" (3 rollers)	1	13,276.00	19,453.26	32,729.26
Surge bin	1	7,800.00	14,609.76	22,409.76
Big-Bag Packer	1	30,076.59		30,076.59
Belt conveyor 24" (3 rollers)	1	7,252.29	5,139.02	12,391.31
Road Scales	1	7,621.95		7,621.95
Bag Filter	1	36,600.00	97,747.56	134,347.56
TOTAL		320,675.94	270,377.69	651,818.75

Table 21.1.2-4 Summary of Investments - Phase 1 Processing

Description	Investment US\$
Site Infrastructure	632,996.02
Equipment	651,818.76
SUBTOTAL (without additional)	1,284,814.78
Engineering and Licenses (5%) from total	64,240.74
TOTAL	1,349,055.52

### Processing Phase 2

The estimated investments for the Phase 2 Processing are as follows:

Table 21.1.2-5 Structures - Processing Phase 2

Description	Investment US\$
Foundations, floor, walls, etc.	491,615.85
Cover	157,317.07
Surveying, topography and earthwork	35,396.34
Well + Water network	12,820.12
Lightning protection systems	22,243.90
Rainwater Network	26,341.46
Administrative Building - Foundations, floor, walls, roof, etc.	55,112.20
Compressed air network	13,902.44
Telephone + IT network	4,609.76
AVCB	81,219.51
Total	900,578.66

Table 21.1.2-6 Electrical Installations - Processing Phase 2

Description	Investment (US\$)
Power cable	18,600.00
Unipolar power cable	17,609.76
Bracket for trays	2,409.76
Conduits	1,112.20
Trays-Electroplate	27,063.41
Operation motors MCC (Motor Control Center)	88,292.68
Lighting	13,644.88
Light distribution panel	22,865.85
Transformer 2,55 Mw (2550 kw)	702,439.02
Three-phase transmission line	462,804.88
Total	1,356,842.44

Table 21.1.2-7 Investments in Equipment – Processing Phase 2

		•		
Description	Quantity	Equipment (Unit) US\$	Setup (Unit) US\$	Total US\$
Dump hopper	2	78,048.78	34,000.00	224,097.56
Vibrating Feeder	1	28,595.12	-	28,595.12
Belt conveyor	1	63,063.41	42,331.71	105,395.12
Magnetic separator	1	8,409.76	-	8,409.76
Surge bin	2	78,048.78	34,000.00	224,097.56
Vibratory Feeders	1	28,595.12	-	28,595.12
Hazemag Mills - HNM 1325	4	571,920.73	65,548.78	2,418,780.49
Belt conveyor	1	63,063.41	42,331.71	105,395.12
Surge bin	3	15,609.76	6,800.00	67,229.27
Pivoted Belt Conveyor with	3	15,765.85	10,278.05	78,131.71

Description	Quantity	Equipment (Unit) US\$	Setup (Unit) US\$	Total US\$
Adaptation for Loading Spouts				
Pivot Belt Conveyor Loading Spouts	3	11,707.32	-	35,121.95
Big-Bag Packer	3	11,353.66	-	34,060.98
Bag Filter	4	182,926.83	361,365.85	2,177,170.73
Road Scales	1	7,621.95	7,621.95	15,243.90
Apron Feeder	1	114,024.39	-	114,024.39
Primary Impact Crusher	2	366,615.85	65,548.78	798,780.49
TOTAL		1,645,370.73	669,826.83	6,463,129.27

Table 21.1.2-8 Summary of Investments - Processing Phase 2

Description	Investment (US\$)
Equipment	6,463,129.27
Building installations	900,578.66
Electrical Installations	1,356,842.44
Total	8,720,550.37

## **Processing Phase 3**

The estimated investments for the Phase 3 Processing are as follows:

Table 21.1.2-9 Structures - Processing Phase 3

Description	Investment US\$
Foundations, floor, walls, etc.	720,274.39
Cover	230,487.80
Surveying, topography and earthwork	51,859.76
Well + Water network	25,640.24
Lightning protection systems	44,487.80
Rain Network	52,682.93
Administrative Building - Foundations, floor, walls, roof, etc.	55,112.20
Compressed air network	27,804.88
Telephone + IT network	9,219.51
AVCB	117,804.88
Total	1,335,374.39

Table 21.1.2-10 Electrical Installations - Processing Phase 3

Description	Investment (US\$)
Power cable	37,200.00
Unipolar power cable	35,219.51
Bracket for trays	4,819.51
Conduits	2,224.39
Trays-Electroplate	54,126.83
Operation motors MCC	176,585.37
Lighting	18,193.17

Description	Investment (US\$)
Light distribution panel	22,865.85
Transformer 7.5 Mw (2 units of 7,500 kw)	1,170,731.71
Total	1,521,966.34

Table 21.1.2-11 Investments in Equipment - Phase 3 Processing

Description	Quantity	Equipment (Unit) US\$	Setup (Unit) US\$	Total US\$
	OPE	RATION EQUIPMEN	NT	
Dump hopper	4	78,048.78	34,000.00	448,195.12
Vibrating Feeder	3	28,595.12	-	85,785.37
Belt conveyor	2	63,063.41	42,331.71	210,790.24
Magnetic separator	2	8,409.76	-	16,819.51
Buffer bin	3	78,048.78	34,000.00	336,146.34
Vibratory Feeders	3	28,595.12	-	85,785.37
Hazemag Mills - HUV 1626	6	571,920.73	65,548.78	3,562,621.95
Belt conveyor	2	63,063.41	42,331.71	210,790.24
Buffer bin	3	15,609.76	6,800.00	67,229.27
Pivoted Belt Conveyor with Adaptation for Loading Spouts	3	15,765.85	10,278.05	78,131.71
Pivot Belt Conveyor Loading Spouts	3	11,707.32	-	35,121.95
Big-Bag Packer	3	11,353.66	-	34,060.98
Belt conveyor (to feed rail loading system)	2	63,063.41	42,331.71	210,790.24
Bag Filter	4	182,926.83	361,365.85	2,177,170.73
Road Scales	1	7,621.95	7,621.95	15,243.90
SUBTOTAL		1,227,793.90	646,609.76	7,574,682.93
	CRUSHIN	G TRANSHIPMENT	AREA	
Apron Feeder	4	114,024.39	-	456,097.56
Primary Crusher HPI 2225	2	1,451,798.78	65,548.78	3,034,695.12
Belt conveyor - 21,3 km	1	87,195,121.95	21,583,902.44	108,779,024.39
SUBTOTAL		88,760,945.12	21,649,451.22	112,269,817.07
	WAG	ON LOADING SYST	EM	
Wagon Loading Set	1	731,707.32	-	731,707.32
Foundation	1	-	1,839,024.39	1,839,024.39
Installations	1	-	457,317.07	457,317.07
SUBTOTAL		731,707.32	2,296,341.46	3,028,048.78
TOTAL		90,720,446.34	24,592,402.44	122,872,548.78

Table 21.1.2-12 Summary of Investments - Phase 3 Processing

Description	Investment (US\$)
Equipment	122,872,548.78
Building installations	1,335,374.39
Electrical Installations	1,521,966.34
Total	125,729,889.51

#### Primary Crusher Relocation - Year 11

This section presents the cost description for the relocation of the crushing facility.

Table 21.1.2-13 Structures - Crusher Relocation

Description	Investment US\$
Foundations, floor, walls, etc.	68,597.56
Coverage (US\$ market sheds)	21,951.22
Surveying, topography and earthwork	4,939.02
Well + Water network	25,640.24
Lightning protection systems	8,897.56
Rain Network	10,536.59
Compressed air network	27,804.88
Telephone + IT network	9,219.51
AVCB	10,975.61
Power Cable	37,200.00
Unipolar power cable	11,121.95
Bracket for trays	1,521.95
Conduits	1,404.88
Trays-Electroplate	17,092.68
Operation motors MCC (Motor Control Center)	60,975.61
Lighting	3,032.20
Light distribution panel	9,146.34
Mobilization for disassembly and assembly	152,439.02
Total	482,496.83

For this relocation, the belt conveyor will be expanded. Its expansion cost was valuated in US\$17,305,986.70.

Table 21.1.2-14 summarizes the investments for relocating the primary crusher

Table 21.1.2-14 Summary of Investments - Crusher Relocation - Year 11, Phase 3

Description	Investment (US\$)
Belt Conveyor Expansion	17,305,986.70
Crusher Relocation	482,496.83
Total	17,788,483.53

# 21.1.3. Railway Branch Line Expansion

The CAPEX for the railway branch line expansion (linking Ibiá to São Gotardo) was estimated at 145.427 million dollars. This value was taken from an estimate received by VLI MULTIMODAL S.A.

There is the possibility that this investment in the expansion of the railway branch will be borne by VLI MULTIMODAL S.A, and these costs would be passed on to VERDE in the rail transport fare. This alternative will be studied in the future.

## 21.1.4. Road Improvement

An initial investment (Phase 1 and 2) is foreseen to improve the accesses in the region, which connect the pit area to the location of the MG-235 highway.

An improvement of approximately 22 km of road is estimated for Phase 1. In Phase 2, the same stretch of road will be paved. Based on a quotation carried out with the company *Transforma Engenharia e Meio Ambiente*, amounts of US\$883,800.00 and US\$5,260,000.00 were estimated for Phase 1 and Phase 2, respectively.

It is important to note that in this study all road improvements were funded by VERDE, but part of these costs can be funded by the Government, since part of the improved road corresponds to the MG-235 highway.

#### 21.1.5. Owner's Costs

Most owner-related costs are included in the indirect cost estimate for process and infrastructure. However, provision for owner's costs not included elsewhere, for each Project phase, is shown in the tables below (Table 21.1.5-1 to Table 21.1.5-3).

Table 21.1.5-1 Owner's Cost - Phase 1

Description	Cost
Description	(US\$x1,000)
Licensing	183
Technical studies and projects	46
Land purchase	249
TOTAL	478

Table 21.1.5-2 Owner's Cost - Phase 2

Deceriation	Cost
Description	(US\$x1,000)
Licensing	305
Technical studies and projects	183
Land purchase	270
Equipment and personnel mobilization	83
Support facilities construction	58
Equipment and personnel demobilization	33
TOTAL	933

Table 21.1.5-3 Owner's Cost - Phase 3

Description	Cost
Description	(US\$x1,000)
Licensing	701
Technical studies and projects	762
Land purchase	6,777
Equipment and personnel mobilization	3,143
Support facilities construction	2,173
Equipment and personnel demobilization	1,257
TOTAL	14,815

## 21.1.6. Sustaining Capital

The sustaining capital is necessary for the maintenance of the production capacity throughout the life of the enterprise. The sustaining capital was estimated considering expenditures of US\$0.30 per ton of ore fed to the primary crusher, from Year 6 to Year 36. This value is based on BNA's work on other projects.

#### 21.1.7. Mine Closure Cost

In the last year of the Project, a sum was foreseen for the mine closure. The value was estimated by BNA at US\$5,183.00 per hectare of area affected by the Project. It is important to emphasize that, over the years of operation, activities will be developed to recover degraded areas. Expenditures on these activities were allocated as operating costs.

## 21.1.8. CAPEX Summary

The total capital cost for the Project (with a nominal accuracy of -25% to +25% and including a 15% contingency) is estimated at US\$369.59 million.

Table 21.1.8-1 shows the CAPEX summary for all Project phases.

Table 21.1.8-1 CAPEX Summar	y for all Project phases
-----------------------------	--------------------------

Danadatian		Investment (US\$x1,000)		
Description		Phase 1	Phase 2	Phase 3
Processing				
Plant		1,267	8,397	16,687
Belt Conveyor		82	324	126,831
Processing Total		1,349	8,721	143,518
Road Improvement		884	5,258	-
Railway Branch Line		-	-	145,427
Owner's Cost		478	933	14,815
Subtotal 1		2,710.45	14,911.29	303,759.71
Contingency	15%	406.57	2,236.69	45,563.95
TOTAL CAPEX		3,117.02	17,147.98	349,323.67

### 21.2. OPEX

Operating costs are estimated based on preliminary mine and process design criteria and engineering, as well as budgetary quotes. Operating costs are calculated to a PFS-level of accuracy and are expected to have an accuracy of ±25%, including a 15% contingency.

## 21.2.1. Mining

Mine operating costs were calculated as a function of the production schedule, equipment operation and consumption factors.

#### Mining Operation

The mining costs were obtained through budgetary quotations with companies specialized in mining operation.

The values presented for Phase 1 were based on a quotation made by KS Terraplenagem e Serviços. The quotation was initially prepared for an annual production of 233,000 t of ore per year, for a distance of 23 km. The unit value per ton of this quotation was used, proportional to the hauling

distances of the Project. Due to the small amount of material handled in Phase 1, large national companies present disadvantages when compared to local companies, due to the high cost of mobilization and demobilization of personnel and equipment.

The values presented for Phase 2 and 3 were taken from the quotation chosen by BNA. This quotation was made by *U&M Mineração e Construção S/A* on November 2, 2017

The values of the operational costs were discriminated by ranges of hauling distances, with and without explosive dismantling. Separate costs were also budgeted for the type of material. The unit cost per ton is given in Table 21.2.1-1 and Table 21.2.1-2.

**Table 21.2.1-1 Ore Operational Cost** 

MATERIAL	ACTIVITY DESCRIPTION - ORE	Unit Price per ton (US\$)
Weathered Ore	Excavation, Loading and Haulage - Average Hauling Distance up to 1.00Km	2.29
Weathered Ore	Excavation, Loading and Haulage - Average Hauling Distance from 1.01 to 1.50Km	2.52
Weathered Ore	Excavation, Loading and Haulage - Average Hauling Distance from 1.51 to 2.00Km	2.63
Weathered Ore	Excavation, Loading and Haulage - Average Hauling Distance from 2.01 to 2.50Km	2.86
Weathered Ore	Excavation, Loading and Haulage - Average Hauling Distance from 2.51 to 3.00Km	2.93
Weathered Ore	Excavation, Loading and Haulage - Average Hauling Distance from 3.01 to 4.00Km	3.23
Weathered Ore	Excavation, Loading and Haulage - Average Hauling Distance from 4.01 to 6.00Km	3.80
Weathered Ore	Excavation, Loading and Haulage - Average Hauling Distance from 6.01 to 8.00Km	4.45
Fresh Rock Ore	Excavation, Loading and Haulage - Average Hauling Distance up to 1.00Km	2.57
Fresh Rock Ore	Excavation, Loading and Haulage - Average Hauling Distance from 1.01 to 1.50Km	2.83
Fresh Rock Ore	Excavation, Loading and Haulage - Average Hauling Distance from 1.51 to 2.00Km	2.96
Fresh Rock Ore	Excavation, Loading and Haulage - Average Hauling Distance from 2.01 to 2.50Km	3.22
Fresh Rock Ore	Excavation, Loading and Haulage - Average Hauling Distance from 2.51 to 3.00Km	3.30
Fresh Rock Ore	Excavation, Loading and Haulage - Average Hauling Distance from 3.01 to 4.00Km	3.65
Fresh Rock Ore	Excavation, Loading and Haulage - Average Hauling Distance from 4.01 to 6.00Km	4.15
Fresh Rock Ore	Excavation, Loading and Haulage - Average Hauling Distance from 6.01 to 8.00Km	4.89
Fresh Rock Ore	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance up to 1.00Km	3.99
Fresh Rock Ore	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance from 1.01 to 1.50Km	4.23
Fresh Rock Ore	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance from 1.51 to 2.00Km	4.34
Fresh Rock Ore	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance from 2.01 to 2.50Km	4.58
Fresh Rock Ore	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance from 2.51 to 3.00Km	4.65
Fresh Rock Ore	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance from 3.01 to 4.00Km	4.96
Fresh Rock Ore	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance from 4.01 to 6.00Km	5.41
Fresh Rock Ore	Drilling, Blasting, Excavation, Loading and Haulage- Average Hauling Distance from 6.01 to 8.00Km	6.08

**Table 21.2.1-2 Waste Operational Cost** 

MATERIAL	ACTIVITY DESCRIPTION - WASTE	Unit Price per ton (US\$)
Waste Rock	Excavation, Loading and Haulage - Average Hauling Distance up to 1.00Km	2.46
Waste Rock	Excavation, Loading and Haulage - Average Hauling Distance from 1.01 to 1.50Km	2.72
Waste Rock	Excavation, Loading and Haulage - Average Hauling Distance from 1.51 to 2.00Km	2.97
Waste Rock	Excavation, Loading and Haulage - Average Hauling Distance from 2.01 to 2.50Km	3.05
Waste Rock	Excavation, Loading and Haulage - Average Hauling Distance from 2.51 to 3.00Km	3.12
Waste Rock	Excavation, Loading and Haulage - Average Hauling Distance from 3.01 to 3.50Km	3.33
Waste Rock	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance up to 1.00Km	3.80
Waste Rock	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance from 1.01 to 1.50Km	4.05
Waste Rock	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance from 1.51 to 2.00Km	4.29
Waste Rock	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance from 2.01 to 2.50Km	4.36
Waste Rock	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance from 2.51 to 3.00Km	4.43
Waste Rock	Drilling, Blasting, Excavation, Loading and Haulage - Average Hauling Distance from 3.01 to 3.50Km	4.63

An average movement of ore and waste from year 9 was considered for the mining operating cost estimation, based on the defined hauling distances. For Phase 1, due to the low depth of the pit, it was considered that 100% of the mining operations would be performed mechanically. In Phase 2 and Phase 3, it was considered that 30% of ore and waste would require a blasting operation. Table 21.2.1-3 shows the summary of mining operating costs.

**Table 21.2.1-3 Mining OPEX Summary** 

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9 to 11	Year 12 to 18	Year 19 to 25	Year 26 to 28	Year 29 to 31	Year 32 to 36
Weathered Ore (kt)	0	4	14	0	37	39	3,110	3,019	1,187	1,043	1,043	1,043	1,043	1,043
Fresh Rock Ore (kt)	609	606	5,018	5,007	4,997	4,970	21,911	21,976	24,501	24,113	24,113	24,113	24,113	24,113
Total Ore (kt)	609	611	5,032	5,007	5,034	5,010	25,021	24,995	25,689	25,156	25,156	25,156	25,156	25,156
Waste (kt)	32	148	808	739	407	255	13,115	8,888	5,352	7,255	7,255	7,255	7,255	7,255
Average Haulage Distance Ore (m)	872	1,033	1,088	1,506	1,596	1,758	1,680	2,070	3,550	2,250	2,625	4,600	6,050	8,000
Unit Cost - Weathered Ore (US\$/t)	8.09	8.09	2.52	2.63	2.63	2.63	2.63	2.86	3.23	2.86	2.93	3.80	4.45	4.45
Unit Cost - Fresh Rock Ore Without Blasting (US\$/t)	8.09	8.09	2.83	2.96	2.96	2.96	2.96	3.22	3.65	3.22	3.30	4.15	4.89	4.89
Unit Cost - Fresh Rock Ore with Blasting (US\$/t)			4.23	4.34	4.34	4.34	4.34	4.34	4.96	4.58	4.65	5.41	6.08	6.08
Average Haulage Distance - Waste (m)	670	938	1,270	1,347	1,370	1,437	1,760	2,030	2,750	3,400	3,275	1,750	1,950	2,150
Unit Cost - Waste Without Blasting (US\$/t)	2.50	2.50	2.72	2.72	2.72	2.72	2.97	3.05	3.12	3.33	3.33	2.97	2.97	3.05
Unit Cost - Waste with Blasting (US\$/t)			4.05	4.05	4.05	4.05	4.05	4.36	4.43	4.63	4.63	4.29	4.29	4.36
Total Cost(US\$)	5,004	5,312	18,871	19,208	18,236	17,678	125,369	117,321	121,653	117,363	119,413	137,503	155,497	156,043
Total Unit Cost (US\$/t)	7.81	7.00	3.23	3.34	3.35	3.36	3.29	3.46	3.92	3.62	3.68	4.24	4.80	4.81
Unit Cost - Ore (US\$/t)	8.09	8.09	3.25	3.38	3.37	3.37	3.28	3.47	4.00	3.59	3.67	4.50	5.21	5.21
Unit Cost - Waste (US\$/t)	2.50	2.50	3.12	3.12	3.12	3.12	3.30	3.44	3.52	3.72	3.72	3.36	3.36	3.44

#### <u>Labor</u>

The quantity and annual labor cost of the mining activities were estimated and are composed by the labor costs of the engineers, geologists, technicians and auxiliaries that are responsible for the areas of exploration, geology, planning and operations. As the mining activities will be outsourced, there will be no labor costs associated with equipment operators. Additional 80% of the salary amounts were considered as charges and benefits in accordance with the Brazilian labor law and the Company's policies.

Table 21.2.1-4 Mining Labor – Number of Professionals per Phase of the Project

		-	-
Description	Phase 1	Phase 2	Phase 3
Management			
Manager	1	1	2
Administrative assistant	1	1	2
Geology, Planning and Exploration			
Geology Supervisor	1	1	1
Planning Supervisor		1	1
Mining Engineer	1	1	2
Geologist	1	1	2
Technician	1	3	9
Surveyor	1	1	4
Operation and Maintenance			
Supervisor	1	1	3
Mining Engineer		1	1
Production Controller	1	1	1
Production assistant	1	1	1
Technician	1	2	4
Assistant	1	2	4

Table 21.2.1-5 Mining Labor – Annual Cost

Description	Salary (R\$/month)	Salary (US\$/month)	Phase 1 US\$	Phase 2 US\$	Phase 3 US\$
Management					
Manager	15,000	4,573	98,780	98,780	197,561
Administrative assistant	3,000	915	19,756	19,756	39,512
Geology, Planning and Exploration					
Geology Supervisor	12,000	3,659	79,024	79,024	79,024
Planning Supervisor	12,000	3,659		79,024	79,024
Mining Engineer	9,000	2,744	59,268	59,268	118,537
Geologist	9,000	2,744	59,268	59,268	118,537
Technician	4,000	1,220	26,341	79,024	237,073
Surveyor	4,000	1,220	26,341	26,341	105,366
Operation and Maintenance					
Supervisor	12,000	3,659	79,024	79,024	237,073
Mining Engineer	9,000	2,744		59,268	59,268
Production Controller	4,000	1,220	26,341	26,341	26,341
Production assistant	4,000	1,220	26,341	26,341	26,341

Description	Salary (R\$/month)	Salary (US\$/month)	Phase 1 US\$	Phase 2 US\$	Phase 3 US\$
Technician	4,000	1,220	26,341	52,683	105,366
Assistant	2,500	762	16,463	32,927	65,854
Total			543,293	777,073	1,494,878

# 21.2.2. Processing Plant

Process operating costs for the Project were estimated by MINALAC.

LoM average processing operating cost is US\$1.71/t-Product. Table 21.2.2-1 summarizes the annual operating costs for the processing plant for the 3 phases.

**Table 21.2.2-1 Summary Opex Processing Plant** 

	Phase 1	Phase 2	Phase 3
Value (US\$/t)	2.74	1.36	1.04

The costs in the processing expenses include manpower requirements, mechanical equipment maintenance and spares, electricity and fuel consumption.

The main process consumables for the processing plant include the mill and crusher liners. The prices of the consumables were taken from vendor's quotes, while the replacement frequencies were determined based on information available from similar operations and based on the vendors' operational experience.

An electricity cost of US\$18.30/mWh was used for the site and power consumption.

Maintenance costs were factored at 8%.

Third parties' costs considered property security, cleaning and food provision services, while Overhead costs included 9 professionals of: quality/environment, administration, concierge, human resources, IT, nursing work/security, supervision and warehouse. Salary and hourly rates are consistent with those in Brazil.

In the next items the Opex detailing of the processing plant is presented for the 3 phases.

#### Processing Plant Phase 1

Process operating costs for Phase 1 were developed using first principles and based upon the flowsheet described in Section 17.1, shown in Figure 17.1-1, and detailed in Table 21.2.2-2.

For this phase, labor will consist of 18 operators. One wheel loader and 2 forklifts were considered for material manipulation.

Table 21.2.2-2 Opex Processing Plant - Phase 1

Items	Cost US\$/t
Labor (Operation)	0.55
Crushing/Grinding Consumables	0.61
Overhead	0.53
Packing	0.15
Material Manipulation	0.38
Other Parties	0.16
Electricity (Low Voltage)	0.16
Maintenance	0.20
Total	2.74

#### Processing Plant Phase 2

Process operating costs for Phase 2 were developed using first principles and based upon the flowsheet described in Section 17.2, shown in Figure 17.2-1, and detailed in Table 21.2.2-3.

For this phase, labor will consist of 18 operators. Two wheel loaders and 4 forklifts were considered for material manipulation.

Table 21.2.2-3 Opex Processing Plant - Phase 2

Items	Cost
	US\$/t
Labor	0.07
Crushing/Grinding and BC Consumables	0.76
Overhead	0.06
Packing	0.14
Movement	0.09
Other Parties	0.05
Electricity (Low Voltage)	0.08
Maintenance	0.10
Total	1.36

#### Processing Plant Phase 3

Process operating costs for Phase 3 were developed using first principles and based upon the flowsheet described in Section 17.3, shown in Figure 17.3-1, and detailed in Table 21.2.2-4.

For this phase, labor will consist of 35 operators. Four forklifts were considered for material manipulation.

Table 21.2.2-4 Opex Processing Plant - Phase 3

Items	Cost
nems	US\$/t
Labor	0.03
Crushing/Grinding/BC/ and Wagons Consumables	0.76
Overhead	0.02
Packing	0.00
Movement	0.01
Other Parties	0.01
Electricity (Low Voltage)	0.13
Maintenance	0.08
Total	1.04

# 21.2.3. Environmental Compensations

Environmental compensation costs were allocated as operating costs. The estimated total value was divided by the mine's operating years, resulting in an annual cost of approximately US\$121,000. The total estimate of environmental compensation costs, provided by VERDE, are shown in Table 21.2.3-1.

Table 21.2.3-1 Environmental Compensation – Total Costs Estimate

Environmental Obligations - Mining	Legal Provision	Cost Estimate US\$
Compliance with the requirements for compensation of vegetation suppression in permanent preservation areas (APP) and compensation for suppression of isolated trees	State law No. 20.922/2013, Federal law No. 12.651/2012, CONAMA Resolution 369/2006	1,516,225
Compliance with the requirements for compensation of vegetation suppression in Atlantic Forest	Federal law No. 11.428/06, Decree 6.660/08, IEF Ordinance 30/2015.	71,086
Compliance with the requirements of SNUC (Sistema Nacional de Unidades Conservação) for Environmental Compensation	Decree No. 45.629/2011 Federal law No. 9.985/2000, Federal Decree No. 6.848/2009, Federal Decree No. 4.340/2002, IEF Ordinance 55/2012	1,249,826
Fulfilling the requirements for Mining Compensation	Law No. 20.922/13 and IEF Ordinance 27/ 2017	789,971
Subtotal	,	3,627,108
Contingencies (20%)		725,422
Estimated Total		4,352,530

# 21.2.4. OPEX Summary

In addition to the production costs, expenses with recovery of degraded areas were foreseen. For this item, annual allocations were estimated at US\$0.15 per ton of produced ore. In addition, a general and administrative cost (G&A) of US\$0.50 per ton of produced ore was considered. The maintenance costs of the support activities were taken from the mining activities budgetary quotation obtained from U&M. In addition, a value of 15% of the costs was adopted for contingencies.

Table 21.2.4-1 shows the operating costs for each phase of the Project.

Table 21.2.4-1 Operating Costs for each phase of the Project

Phase	Total (US\$x1,000)	ROM Unit Cost (US\$/t)	Total Unit Cost (US\$/t)
Phase 1	18,778	14.53	12.73
Phase 2	144,132	6.77	6.11
Phase 3	6,345,890	7.92	6.14

Table 21.2.4-2 summarizes the operating costs of the Project for the first 10 years.

**Table 21.2.4-2 Annual Operating Costs** 

Possibility.	Annual Operating Cost (US\$x1,000)									
Description	1	2	3	4	5	6	7	8	9	10
A – Mining Labor	543	543	777	777	777	777	1,495	1,495	1,495	1,495
B – Mining Operation	5,004	5,312	18,871	19,208	18,236	17,678	125,369	117,321	121,653	121,653
C – Environmental Recovery	97	97	800	796	800	797	3,978	3,974	4,084	4,084
D - Process	1,769	1,775	7,247	7,211	7,250	7,215	27,697	27,669	28,437	28,437
E - G&A	323	324	2,667	2,654	2,668	2,655	13,261	13,247	13,615	13,615
F - Environmental Compensation	121	121	121	121	121	121	121	121	121	121
G - Support Facility Maintenance	150	150	1,246	1,246	1,246	1,246	6,256	6,256	6,256	6,256
Subtotal	8,007	8,322	31,730	32,014	31,099	30,489	178,178	170,084	175,661	175,661
. Contingency (15%)	1,201	1,248	4,759	4,802	4,665	4,573	26,727	25,513	26,349	26,349
TOTAL OPERATING COST	9,208	9,571	36,489	36,816	35,764	35,063	204,904	195,596	202,011	202,011
H- Unit Cost <sup>1</sup>	(US\$/t)									
. ROM	14.27	14.78	6.84	6.94	6.70	6.60	7.73	7.38	7.42	7.42
. TOTAL (ore+waste)	13.56	11.89	5.90	6.04	6.20	6.28	5.07	5.45	6.14	6.14

<sup>1.</sup> The Unit Cost for the ROM is given by the total operating cost divided by the produced ROM tonnage, while the Total Unit cost is given by the total operating cost divided by the sum of both ROM and Waste produced tonnes. Since the operational cost for the waste is smaller than the operational cost for the ROM, the Total Unit cost is smaller than the ROM Unit cost.

# 22. Economic Analysis

The financial results of this report are based upon work performed by BNA, AMS and VERDE and have been prepared on an annual basis. All costs are in US dollars.

# 22.1. Principal Assumptions

A financial model was prepared on an unleveraged, post-tax basis; the results are presented in this Section. Key criteria used in the analysis are discussed in detail throughout this report. Financial assumptions used are shown summarized in Table 22.1-1.

**Table 22.1-1 Model Parameters** 

Model Parameter	Technical Input
Pre-Production Period	1 year
Mine Life	36 years
Price per Tonne of Product (Phase 1)	US\$38.15
Price per Tonne of Product (Phase 2)	US\$35.17
Price per Tonne of Product (Phase 3)	US\$25.10
Operating Days per Year (Phase 1 and Phase 2)	350
Operating Days per Year (Phase 3)	355
Discount Rate	8.0%

A one-year preproduction period is assumed to allow for permitting, detailed engineering, and due diligence/financing. The mine will have an estimated mine life of 36 years given the Mineral Reserve described in this report.

The analysis calculates a market prices of US\$38.15, US\$35.17 and US\$25.10 per ton of Super Greensand® for Phases 1, 2 and 3, respectively.

Financial Assumptions used in the analysis are shown in Table 22.1-2.

**Table 22.1-2 Financial Assumptions** 

Description	Parameter	
Project Equity	100%	(no gearing)
Working Capital Requirement	3-months	of production costs
Depreciation	10-yr	
Discount Rate	8.0%	
Mining Royalty (CFEM)	2%	
Income Tax	34%	

### 22.2. Cashflow Forecasts and Annual Production Forecasts

The financial analysis results, shown in Table 22.2-1, indicate an NPV 8% of US\$1,987.93 million and an IRR of 287% on an after-tax basis. Payback will be 0.5 years for Phase 1, 0.2 years for Phase 2 and 1.2 years for Phase 3, from the start of production in each phase. The following assumptions and estimates provide the basis of the BNA LoM plan and economics:

- A mine life of 36 years;
- Total 777 Mt (dry) of product is produced;
- An average operating cost of US\$8.16/t-product;
- Total capital expenditure of US\$369.6 million; and
- The analysis does not include any allowance for salvage value.

Table 22.2-1 Economic-financial analysis of the Project

				Year														
Item	Item Description	Unit	-1	1	2	3	4	5	6	7	8	9 to 11 (average)	12 to 18 (average)	19 to 25 (average)	26 to 28 (average)	29 to 31 (average)	32 to 35 (average)	36
1	Production																	
1.1	Final Product (dry basis)	kt		609	611	5,032	5,007	5,034	5,010	25,021	24,995	25,689	25,156	25,156	25,156	25,156	25,156	25,156
2	Revenue																	
2.1	Total revenue	10 <sup>6</sup> US\$		23.2	23.3	177.0	176.1	177.1	176.2	628.1	627.5	644.9	631.5	631.5	631.5	631.5	631.5	631.5
3	Production cost																	
3.1	Total	10 <sup>6</sup> US\$		9.2	9.6	39.5	36.8	35.8	35.1	204.9	195.6	202.0	196.0	198.3	219.1	239.8	240.5	240.5
4	EBTIDA	10 <sup>6</sup> US\$		14	14	138	139	141	141	423	432	443	436	433	412	392	391	391
4	EBIIDA	%		60%	59%	78%	79%	80%	80%	67%	69%	69%	69%	69%	65%	62%	62%	62%
5	Operating profit	10 <sup>6</sup> US\$		14	14	138	139	141	141	423	432	443	436	433	412	392	391	391
6	Mining Royalties	10 <sup>6</sup> US\$		0	0	4	4	4	4	13	13	13	13	13	13	13	13	13
7	Depreciation and amortization	10 <sup>6</sup> US\$		0	0	2	2	2	2	35	35	35	35	0	0	0	0	0
8	Profit before income tax	10 <sup>6</sup> US\$		13	13	132	134	136	136	376	384	395	388	421	400	379	378	378
9	Income Tax	10 <sup>6</sup> US\$		5	4	45	45	46	46	128	131	134	132	143	136	129	129	129
10	Net profit	10 <sup>6</sup> US\$		9	9	87	88	90	89	248	254	261	256	278	264	250	250	250
11	Royalty Finder's Fee	10 <sup>6</sup> US\$		0.3	0.3													
12	Initial Investments	10 <sup>6</sup> US\$	3.1		17				329									
13	Sustaining Capital	10 <sup>6</sup> US\$							1.5	1.5	7.5	7.5	7.7	7.5	7.5	7.5	7.5	7.5
14	Working capital	10 <sup>6</sup> US\$		2.3														-2
15	Cash Balance	106 US\$	-3	6	-9	89	90	92	-239	281	281	288	283	270	256	243	242	239
16	NPV at 8% per year	106 US\$	1,988															
17	IRR	%	287%															
18	Payback	years		0.5		0.2					1.2							

# 22.3. Taxes, Royalties and Other Interests

As described in the following sections, VERDE will be subject to the following taxes as they relate to the Project:

- Federal income tax;
- Mining Royalties (CFEM); and
- Finder's Fee.

### 22.3.1. Federal Income Tax

The Brazilian federal income tax is determined as 15% of the net profit. For periods in which the profit exceeds R\$20,000 per month (approximately US\$6,097.56 per month), there will be an additional tax of 10%.

An additional federal income tax is the Social Contribution on Profit. For this, the rate of 9% was applied on the real profit calculated in the period.

## 22.3.2. Mining Royalties

Financial Compensation for the Exploitation of Mineral Resources (CFEM) is a royalty payment obligation to the federal government. For fertilizers, the CFEM is established at 2% of the gross sales price of the mineral product, less taxes levied on its sale.

#### 22.3.3. Finder's Fee

VERDE is required to pay a 3.0% royalty on the net smelter return, as discussed in Section 4.3.

# 22.4. Project Sensitivity Analysis

A sensitivity analysis of the Project's NPV was performed, varying the capital expenditure, operating cost and sales price of the product, for each scenario. Figure 22.4-1 shows the Project's cashflow profile. The results of the sensitivity analysis are shown in Figure 22.4-2, Figure 22.4-3 and Table 22.4-1. The Project NPV is most sensitive to changes in the selling price, followed by changes to discount rate, operating costs, tax rate and capital cost.

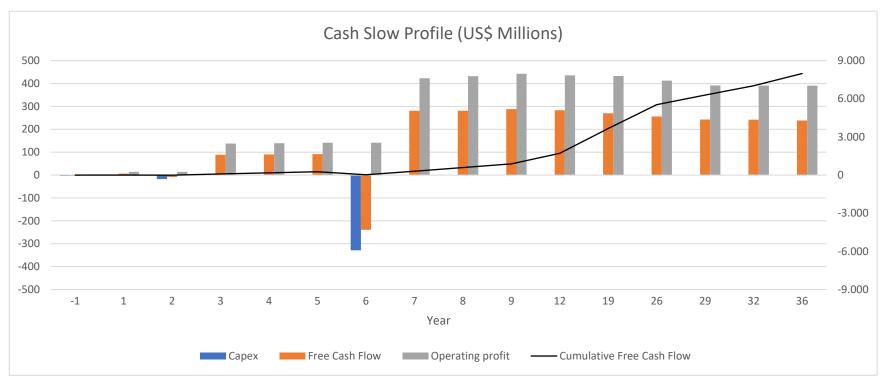


Figure 22.4-1 Cashflow Profile

Table 22.4-1 Sensitivity Analysis of the Project's NPV

Sensitivity Analysis								
% Variation	-20%	-10%	0%	10%	20%			
NPV – Product Sales Price (M US\$)	1,336	1,662	1,988	2,314	2,639			
NPV - CAPEX (M US\$)	2,024	2,006	1,988	1,970	1,951			
NPV – Operating Cost (M US\$)	2,195	2,091	1,988	1,884	1,781			

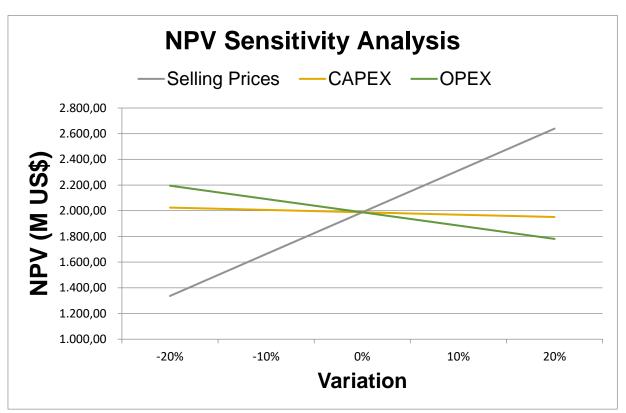


Figure 22.4-2 Sensitivity Analysis of the Project's NPV

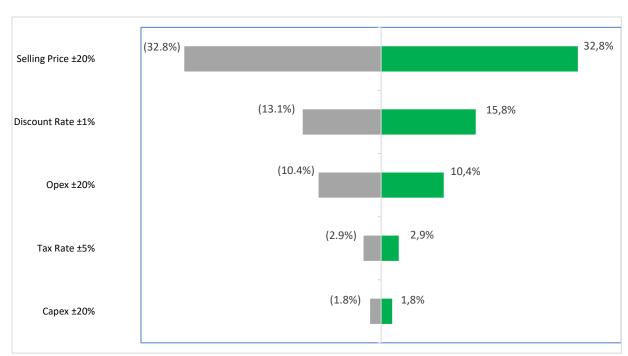


Figure 22.4-3 Sensitivity Analysis of the Project

# 23. Adjacent Properties

To the best of the authors' knowledge, there are no other advanced potassium Projects in the immediate vicinity of the Cerrado Verde Project.

# 24. Other Relevant Data and Information

The authors are not aware of any other relevant data and or information pertaining to the Cerrado Verde Project area that has not been presented within the appropriate sections of this report.

# 25. Interpretation and Conclusions

This section summarizes the results of this PFS and the risks and uncertainties associated with the Project.

#### 25.1. Results

The results of this PFS evaluation indicate that VERDE can produce Super Greensand® in the desired purity, and that there is demand in the market in its use as a ertilizer.

Based on the updated mineral reserves and mining plan, approximately 777.28 Mt of mineral materials would be produced with an anticipated Project LoM of 36 years. The economic analysis results indicate a NPV of US\$1.99 billion at an 8% discount rate with an IRR of 287%. The economics are based on distinct sale prices for each phase of the Project: US\$38.15 per tonne for Phase 1, US\$35.17 per tonne for Phase 2 and US\$25.10 per tonne for Phase 3. The operating cost was estimated at US\$967.43 million, with an average unit production cost of US\$7.27 per tonne (ore + waste). Total capital costs are estimated at US\$369.59 million.

# 25.2. Significant Risks and Uncertainties

## 25.2.1. Exploration

There are no significant risks or uncertainties associated with the exploration of the Project area.

#### 25.2.2. Mineral Resource Estimate

There are no significant risks or uncertainties associated with the mineral resources. The mineral resource estimate is adequate to support the current study.

### 25.2.3. Mineral Reserve Estimate

There are no significant risks or uncertainties associated with the mineral reserves. The reserve estimate is adequate to support the current study.

## 25.2.4. Processing

There are no significant risks or uncertainties associated with the Project's mineral processing.

#### 25.2.5. Environmental

There are no significant risks or uncertainties associated with the Project's environmental aspects.

## 25.2.6. Projected Economic Outcomes

The economic analysis shows positive results which would indicate that the Project could move to the next phase of advancement.

# 26. Recommendations

Recommendations for future work programs and costs are provided below. The financial results for the project justify advancing and refining the Pre-Feasibility engineering designs to the feasibility level within the next 12 to 18 months. BNA recommends that VERDE conduct the following activities:

- A geotechnical study to evaluate the stability of the final pit and waste piles;
- Evaluation of the impact of the waste piles, located inside the exhausted pits, on the remaining mineral resource;
- Trade-off studies focused on new relocations for the primary crusher and expansion of the belt conveyor aimed at reducing the hauling cost;
- Extension of the existing hydrogeological study to cover the entire Project area;
- A detailed study of the inclusion of the blasting operation for both ore and waste mining;
- A detailed study of the pit's external access roads aimed at minimizing the hauling distances and the amount of cut and fill required for their construction, considering the rugged relief of the region;
- Detailed quotes for the execution of the mining activities in Phase 1;
- An evaluation of the use of road trucks with trailers for ore haulage in Phase 1 in order to reduce hauling costs.

Additional elements of the recommended work program include environmental permit application support, marketing studies; more comprehensive metallurgical testing; and a more detailed evaluation of process equipment and infrastructure.

AMS recommends that VERDE re-assay the pulp residues from previous drilling in the glauconitic siltstone unit in order to roughly determine the overall quantity of exploitable Lithium.

The cost of the recommended work programs is estimated at US\$4.96 million, as shown in Table 26-1.

**Table 26-1 Definitive Feasibility Study Work Program** 

Activity	Total (US\$ x 1,000)
Engineering Studies	3,125
Administration	375
Geotechnical Drilling	177
Environmental Studies	278
Exploration (Lithium)	1,000
Total	4,957

# 27. References

AMEC, 2014. Pre-Feasibility Study, Cerrado Verde ThermoPotash Project, Minas Gerais State, Brazil.

Camilotti, Luis Antônio, 2017. Estudos de CAPEX e OPEX para as operações de processo do Projeto Cerrado Verde.

Canadian Institute of Mining, Metallurgy and Petroleum (CIM), 2014. CIM Standards for Mineral Resources and Mineral Reserves, Definitions and Guidelines: Canadian Institute of Mining, Metallurgy and Petroleum, May 10, 2014.

Consórcio Mineiro de Engenheiros Consultores (CMEC), 2012. Cerrado Verde Project The mine pit general slope of the pit preliminary geotechnical studies.

Costa-Filho, P. L. D. R., 2007. Estudo preliminar da vegetação da parte do médio curso do Rio Indaiá (MG) utilizando imagem ASTER. Anais XIII Simpósio Brasileiro de Sensoriamento Remoto, Florianópolis, Brasil, 21-26 abril 2007, INPE, p. 1631-1638.

J.Mendo, 2009. Relatório Técnico 09 Análise Comparativa de Royalties. Available at <a href="http://www.mme.gov.br/documents/1138775/1256656/P03">http://www.mme.gov.br/documents/1138775/1256656/P03</a> RT09 Anxlise Comparativa de Royalties .pdf/b3fe42a7-d7f5-41bf-8ee9-3e78644bed6f (Accessed in October, 2017)

King, L.C. 1956. A geomorfologia do Brasil oriental. Rev. Bras. Geogr., 18(2): 147-265.

MDGEO Hidrogeologia e Meio Ambiente, 2015. Estudos Hidrogeológicos Projeto Cerrado Verde - TK

Moreira, D. S. 2015. Estratigrafia, Petrografia e Gênese da Mineralização de Potássio em Siltitos Verdes (Verdetes) do Grupo Bambuí na Região de São Gotardo, Minas Gerais. Dissertação de Mestrado, Instituto de Geociências, Universidade Federal de Minas Gerais. Belo Horizonte, 125p.

Scotiabank Global Banking and Markets, 2016. Compelling Long Ideas Are Almost Non-Existent.

Secretaria de Estado de Ciência e Tecnologia, Fundação Centro Tecnológico de Minas Gerais (SECTES), 1938. Estudos integrados de recursos naturais: Bacia do alto São Francisco e parte central da área mineira da Sudene. Geomorfologia. Relatório Final. Belo Horizonte 1938. p. 50-56.

Sheldon, R.P., 1963. Physical stratigraphy and mineral resources of Permian rocks in western Wyoming; US Geological Survey, Professional Paper, 313-B, 273 pages.

Solosconsult Engenharia Ltda., 2013. Pilha de disposição de estéril - Definição de parâmetros geométricos. SC 504-VP-GT-RT-001.

# 28. Glossary

## 28.1. Mineral Resources

The mineral resources and mineral reserves have been classified according to the "CIM Standards on Mineral Resources and Reserves: Definitions and Guidelines" (May 10, 2014). Accordingly, the Resources have been classified as measured, indicated or inferred, the reserves have been classified as proven, and probable based on the measured and indicated resources as defined below.

A mineral resource is a concentration or occurrence of natural, solid, inorganic or fossilized organic material in or on the Earth's crust in such form and quantity and of such a grade or quality that it has reasonable prospects for economic extraction. The location, quantity, grade, geological characteristics and continuity of a mineral resource are known, estimated or interpreted from specific geological evidence and knowledge.

An 'inferred mineral resource' is that part of a mineral resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity. The estimate is based on limited information and sampling gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes.

An 'indicated mineral resource' is that part of a mineral resource for which quantity, grade or quality, densities, shape and physical characteristics can be estimated with a level of confidence sufficient to allow the appropriate application of technical and economic parameters, to support mine planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes that are spaced closely enough for geological and grade continuity to be reasonably assumed.

A 'measured mineral resource' is that part of a mineral resource for which quantity, grade or quality, densities, shape, physical characteristics are so well established that they can be estimated with confidence sufficient to allow the appropriate application of technical and economic parameters, to support production planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes that are spaced closely enough to confirm both geological and grade continuity.

#### 28.2. Mineral Reserves

A mineral reserve is the economically mineable part of a measured or indicated mineral resource demonstrated by at least a Preliminary Feasibility Study. This study must include adequate information on mining, processing, metallurgical, economic and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified. A mineral reserve includes diluting materials and allowances for losses that may occur when the material is mined.

A 'probable mineral reserve' is the economically mineable part of an indicated, and in some circumstances a measured mineral resource demonstrated by at least a Preliminary Feasibility Study. This study must include adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified.

A 'proven mineral reserve' is the economically mineable part of a measured mineral resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction is justified.

## 28.3. Abbreviations

The following abbreviations may be used in this report.

Table 28.3-1 Abbreviations

Abbreviation	Unit or Term
п	inches
%	percent
0	degrees
°C	degrees centigrade
μm	micron
3D	tridimensional
AAF	Environmental Authorization for Operation
AMS	Andes Mining Services
ANDA	Associação Nacional para Difusão de Adubos
APP	permanent preservation area
ASL	Above Sea Level
AVCB	Auto de Vistoria do Corpo de Bombeiros
BPC	Belarusian Potash Company
CAPEX	capital expenditure
CFEM	Financial Compensation for the Exploitation of Mineral Resources
CFR	Cost and Freight
CIM	Canadian Institute of Mining, Metallurgy and Petroleum
cm	centimeter
cm <sup>3</sup>	cubic centimeter
CMEC	Consórcio Mineiro de Engenheiros Consultores Ltda
COFINS	Contribuição para o Financiamento da Seguridade Social
CONAB	Companhia Nacional de Abastecimento
CONAMA	Conselho Nacional do Meio Ambiente
CRM	certified reference material
0011	Contribuição Social sobre o Lucro Líquido (Brazilian federal tax levied on the net
CSLL	income of the base period, before the provision for Income Tax)
DC	diamond core drilling
DDH	diamond drill hole
DGPS DNPM	differential global positioning system
DNPM	National Department of Mineral Production
DTM	National Department of Mineral Production digital terrain model
E	
	Carriage Refere Interest Depresiation and Americanian
EBITDA EIA	Earnings Before Interest, Depreciation and Amortization
	Environmental Impact Study
EPAMIG	Empresa de Pesquisa Agropecuária de Minas Gerais
FCE	Project Characterization Form
FEAM	Fundação Estadual do Meio Ambiente
FOB	Free on Board
FOB	Basic Orientation Form
ft	foot
g	grams
g/cm³	grams per cubic centimeter

Abbreviation	Unit or Term
GDP	Gross domestic product
G&A	General and administrative cost
GI	glauconite
GPS	global positioning system
h	hour
ha	hectare
hp	horsepower
HV	High-voltage
IBGE	Brazilian Institute of Geography and Statistics
IBRD	International Bank for Reconstruction and Development
ICMS	imposto sobre circulação de mercadorias e prestação de serviços
IDW2	inverse distance weighting with power two
IEF	Instituto Estadual de Florestas
IFA	International Fertilizer Industry Association
IGAM	Instituto Mineiro de Gestão das Águas
INMETRO	National Institute of Meteorology, Normalization and Industrial Quality
IPT	Instituto de Pesquisas Tecnológicas
IRR	Internal Rate of Return
K	potassium
K <sub>2</sub> O	potassium oxide
KCI	Potassium Chloride
Kf	K-feldspar
kg	kilogram
km	kilometers
km²	square kilometers
Kt	Kilo tons
Ktpy	Kilo tons per year
kV	kilo Volts
Kw	Kilo-watt
lb	pound
LDBC	Long-Distance Belt Conveyor
LG	Lerchs-Grossman
LI	Construction Permit
LO	Operational Permit
LOI	loss on ignition
LoM	life of mine
LP	Preliminary Permit
LR	Legal Reserve
m	meter
m³	cubic meters
Mm <sup>3</sup>	Million cubic meters
MAIG	Member of the Australian Institute of Geoscientists
MCC	motor control center
MCP	Mine Closure Plan
Mg	magnesium
mm	milimeter
Mt	million tons
Mtpy	million tons per year
Му	million years
N	north
N	nitrogen
Na	sodium
NE	northeast

Abbreviation	Unit or Term
NI 43-101	Canadian National Instrument 43-101
NNW	north-northwest
NPK	nitrogen (N), phosphorus (P), and potassium (K)
NPV	Net Present Value
ОК	ordinary kriging
OPEX	operational expenditure
PAE	Economic Development Plan
PCA	Environmental Control Plan
PDA	personal digital assistant
PEA	Preliminary Economic Assessment
PFS	Pre-Feasibility Study
PIS	Programa de Integração Social
PRAD	plan for recovery of degraded areas
P-rem	remaining phosphorus
psi	pound force per square inch
PVC	Polyvinyl chloride
QA/QC	quality assurance/quality control
QP	Qualified Person
QQ	quantile quantile
R	coefficient of correlation
R\$	brazilian reais
RAF	Revenue Adjustment Factor
RC	rotary-percussion reverse circulation drilling
RC	rotary-percussion reverse circulation drilling
RIMA	Environmental Impact Report
RL	relative level
ROM	run-of-mine
RQD	rock quality designation
S	south
s	second
SECTES	Secretaria do Estado de Ciência e Tecnologia de Minas Gerais
SEMAD	Secretaria de Estado de Meio-Ambiente e Desenvolvimento Sustentável
Si	Silicon
SNUC	Sistema Nacional de Unidades Conservação
SOP	Potassium Sulfate
SRTM	Shuttle Radar Topography Mission
SUPRAM	Superintendência Regional de Meio Ambiente
SW	southwest
t	metric tons
t/d	tons per day
t/h	tons per hour
tpy	tons per year
TDS	Total dissolved solids
Tonne	Metric ton
TK	ThermoPotash
US\$	united states dollar
UTM	Universal Transverse Mercator coordinate system
V	Volt
W	west
WGS84	World Geodetic System 1984
XRF	X-ray fluorescence
Y	year

# 29. Date and Signature Page

The "qualified person" (within the meaning of NI43-101) for the purposes of this report is Beck Nader, who is an employee of BNA Consultoria e Sistemas. The effective date of this Technical Report entitled "NI 43-101 Pre-Feasibility Technical Report – Cerrado Verde Project, Minas Gerais, Brazil" is December 22, 2017.

"Signed and sealed"

Beck Nader, D.Sc., M.Sc. Mining Engineer, Member (MAIG - 4472)

Dated December 22, 2017

The "qualified person" (within the meaning of NI43-101) for the purposes of this report is Bradley Ackroyd, who is an employee of Andes Mining Services Ltd. The effective date of this Technical Report entitled "NI 43-101 Pre-Feasibility Technical Report – Cerrado Verde Project, Minas Gerais, Brazil" is December 22, 2017.

"Signed and sealed"

Bradley Ackroyd, B.Sc Geol. Member (MAIG - 3565)

Dated December 22, 2017

# 30. Certificates of Qualified Persons

#### CONSENT OF QUALIFIED PERSON

**TO:** British Columbia Securities Commission

Alberta Securities Commission

Saskatchewan Financial Services Commission, Securities Division

Manitoba Securities Commission

Ontario Securities Commission

Nova Scotia Securities Commission

New Brunswick Securities Commission

Registrar of Securities, Prince Edward Island

Securities Commission of Newfoundland and Labrador

**RE:** Verde Potash - NI 43-101 – Pre-Feasibility Study (PFS) – Cerrado Verde Project, dated December 22, 2017

This letter is being filed as the consent of Bradley Ackroyd to being named in the Disclosure and to the use and public filing of the report entitled "NI 43-101 Pre-Feasibility Technical Report – Cerrado Verde Project, Minas Gerais, Brazil" dated December 22, 2017 (the "Technical Report") by Verde Potash PLC in connection with the filing of the Disclosure and to the inclusion of the written disclosure of the Technical Report and of extracts from or a summary of the Technical Report in the written disclosure contained in the Disclosure or incorporated by reference therein.

I hereby confirm that I have read the Technical Report, including the written disclosure and extracts from or a summary of the Technical Report contained in the Disclosure or incorporated by reference therein and that it fairly and accurately represents the information in the Technical Report.

Dated this 22<sup>nd</sup> day of December 2017.

ANDES MINING SERVICES SAC Bradley J. Ackroyd Gerente General

Bradley Ackroyd Principal Consulting Geologist BSc(Geo) Member (MAIG - 3565)

#### CONSENT OF QUALIFIED PERSON

TO: British Columbia Securities Commission

Alberta Securities Commission

Saskatchewan Financial Services Commission, Securities Division

Manitoba Securities Commission

Ontario Securities Commission

Nova Scotia Securities Commission

New Brunswick Securities Commission

Registrar of Securities, Prince Edward Island

Securities Commission of Newfoundland and Labrador

RE: Verde Potash - NI 43-101 – Pre-Feasibility Study (PFS) – Cerrado Verde Project, dated March 31, 2014

This letter is being filed as the consent of Beck Nader to being named in the Disclosure and to the use and public filing of the report entitled "NI 43-101 Pre-Feasibility Technical Report – Cerrado Verde Project, Minas Gerais, Brazil" dated December 22, 2017 (the "Technical Report") by Verde Potash PLC in connection with the filing of the Disclosure and to the inclusion of the written disclosure of the Technical Report and of extracts from or a summary of the Technical Report in the written disclosure contained in the Disclosure or incorporated by reference therein.

I hereby confirm that I have read the Technical Report, including the written disclosure and extracts from or a summary of the Technical Report contained in the Disclosure or incorporated by reference therein and that it fairly and accurately represents the information in the Technical Report.

Dated this 22<sup>nd</sup> day of December 2017.

Beck Nader

DSc, MSc (Mining Engineer); Member (MAIG - 4472)

Senior Technical Advisor – Mining Solutions Consultant

#### **CERTIFICATE OF QUALIFIED PERSON**

- I, Beck Nader, do hereby certify that:
- 1. I have been working since 2012 as a Senior Technical Advisor for the firm BNA Mining Solutions, located at Rua Desembargador Leão Starling, 200, Bairro Ouro Preto, Belo Horizonte, Minas Gerais, Brazil. My residential address is Rua Três, 640, Bairro Chácara Novo Horizonte, Contagem, Minas Gerais, Brazil.
- 2. I am a practicing mining engineer with more than 35 years of Mining experience. I have worked in Brazil. I am a Member of the Australian Institute of Geoscientists (MAIG) and a Registered Member of CREA-MG, the Regional Council of Engineering and Agronomy of the Minas Gerais State.
- 3. I am a graduate of the Universidade de São Paulo and hold a Bachelor of Science Degree in Mining Engineering (Hons) (1981). In addition, I have obtained a Mineral Technology MSc title, from the Universidade Federal de Minas Gerais (2004) and a DSc title, from the Universidade de São Paulo, in Mineral Engineering (2012).
- 4. I have practiced my profession continuously since 1982.
- 5. I am a "qualified person" as that term is defined in National Instrument 43-101 Standards of Disclosure for Mineral Projects (the "Instrument").
- 6. I have visited the Cerrado Verde Project on November 10, 2017.
- 7. I am responsible for sections 1 to 3, 6, 13 and 15 to 27, of this technical report dated effective December 22, 2017 and titled "NI 43-101 Pre-Feasibility Technical Report Cerrado Verde Project, Minas Gerais, Brazil" (the "Report").
- 8. I am independent of Verde Potash Plc pursuant to section 1.5 of the Instrument.
- 9. I have read the Instrument and Form 43-101F1 (the "Form") and the sections of the Report for which I am responsible have been prepared in compliance with the Instrument and the Form.
- 10. I do not have nor do I expect to receive a direct or indirect interest in the Cerrado Verde Project of Verde Potash Plc. and I do not beneficially own, directly or indirectly, any securities of Verde Potash Plc. or any associate or affiliate of such company.
- 11. I have not had any prior involvement with the Cerrado Verde Project of Verde Potash Plc.
- 12. As of the effective date of this report, to the best of my knowledge, information and belief, the Report contains all scientific and technical information that is required to be disclosed to make the Report not misleading.

#### **Beck Nader**

D.Sc., M.Sc., Mining Engineer, Member (MAIG - 4472) Registered Member of CREA-MG Senior Technical Advisor, BNA. Dated December 22, 2017

<sup>&</sup>quot;Signed and sealed"

#### **CERTIFICATE OF QUALIFIED PERSON**

- I, Bradley Ackroyd, do hereby certify that:
- 1. I have been working since 2012 as a Principal Consulting Geologist with the firm Andes Mining Services Ltd. of Avenue Diagonal 550, Departmento 203, Miraflores, Lima, Peru 18. My residential address is Jose Pardo 1040, Miraflores, Lima, Peru 27.
- 2. I am a practicing geologist with 11 years of Mining and Exploration geological experience. I have worked in Australia, PNG, West Africa and the Americas. I am a member of the Australian Institute of Geoscientists Member (MAIG).
- 3. I am a graduate of the University of Western Australia (UWA) and hold a Bachelor of Science Degree in Geology (Hons) (2000).
- 4. I have practiced my profession continuously since 2001.
- 5. I am a "qualified person" as that term is defined in National Instrument 43-101 Standards of Disclosure for Mineral Projects (the "Instrument").
- 6. I have visited the Cerrado Verde Project between the 7<sup>th</sup> and 10<sup>th</sup> of August 2012.
- 7. I am responsible for sections 4, 5, 7 to 12 and 14, of this technical report dated effective December 22, 2017 and titled "NI 43-101 Pre-Feasibility Technical Report Cerrado Verde Project, Minas Gerais, Brazil" (the "Report").
- 8. I am independent of Verde Potash Plc pursuant to section 1.5 of the Instrument.
- 9. I have read the Instrument and Form 43-101F1 (the "Form") and the sections of the Report for which I am responsible have been prepared in compliance with the Instrument and the Form.
- 10. I do not have nor do I expect to receive a direct or indirect interest in the Cerrado Verde Project of Verde Potash Plc. and I do not beneficially own, directly or indirectly, any securities of Verde Potash Plc. or any associate or affiliate of such company.
- 11. I have not had any prior involvement with the Cerrado Verde Project of Verde Potash Plc.
- 12. As of the effective date of this report, to the best of my knowledge, information and belief, the Report contains all scientific and technical information that is required to be disclosed to make the Report not misleading.

#### **Bradley Ackroyd**

BSc(Geo) Member (MAIG - 3565) Principal Consulting Geologist, AMS. Dated December 22, 2017

<sup>&</sup>quot;Signed and sealed"