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Independent Technical Report

Três Estradas Phosphate Project, Rio Grande do Sul, Brazil

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1 EXECUTIVE SUMMARY

Águia Resources, Ltd. (Águia) contracted Millcreek Mining Group (Millcreek) to prepare a Technical Report that is compliant with Canadian National Instrument 43-101 (NI 43-101) for a Bankable Feasibility Study (BFS) of the Três Estradas Phosphate Project (Três Estradas Project). The Três Estradas Phosphate Project is located 320 kilometers (km) southwest of Porto Alegre, the capital city of Rio Grande do Sul State in southern Brazil (see Figure 1.1)

Águia is an exploration and development company focused on Brazilian phosphate projects to supply the Brazilian agriculture sector. Águia is listed on the Australian Stock Exchange (ASX) under the symbol AGR and earlier this year the company was listed on the TSX Venture Exchange (TSX-V) under the symbol AGRL. The company's corporate offices are located in Sydney, Australia and Belo Horizonte, Brazil. The company currently controls over 1,110 km^2 of land in the states of Rio Grande do Sul and Paraiba containing phosphate mineralization through exploration permits it has acquired from the Brazilian National Department of Mineral Production[1] (DNPM). The company seeks to develop its holdings of phosphate deposits into viable mining operations providing phosphate to Brazil's agriculture industry.

The Project will have three phases, according to three product types it will produce:

- **Phase 1 (Saprolite):** Open pit mining of 1.3Mtpy (run-of-mine, or ROM) of saprolitic ore, to the processing plant, which will produce an average of 307,000 tpy of phosphate concentrate (phosrock);
- **Phase 2 (Carbonatite):** Mining an average of 3.3Mtpy (ROM) of Carbonatite ore, with expansion of the processing plant to produce 300,000tpy of phosphate concentrate and 2.8Mtpyof agricultural limestone (aglime). 1 Mtpy of aglime will be sold, the remainder stored in a Tailings Dam.
- **Phase 3 (Aglime):** Following mining operations., recovery of 1 Mtpy of the remaining aglime from the tailings Dam.

[1]Brazil has recently enacted legislation that will replace the DNPM with the Brazilian Regulatory Mining Agency. Further details are provided in Appendix A (legal title opinion provided by Azevedo Sette Advogados).

Figure 1.1 General Location Map

FIGURE 1.1

General Location Map

DATE: 10/02/2017

By:

Millcreek Mining GROUP

1.1 GEOLOGY

The Três Estradas Phosphate Project is situated in the Santa Maria Chico Granulitic Complex (SMCGC), part of the Taquarembó domain. The SMCGC exposes the deepest structural levels within Brazil and may represent the western edge of the Precambrian Rio de la Plata Craton. The granulite complex is bounded to the northeast by the Ibaré Lineament, to the west by Phanerozoic cover, and to the south by Neoproterozoic Braziliano granites (potential melts of the granulite). The age of the granulite protolith is late Archean to early Paleoproterozoic (ca. 2.5-2.3 Ga), and can therefore be interpreted as the basement to the Taquarembó domain and as an extension of the Valentines-Rivera Granulitic Complex within bordering Uruguay.

The Três Estradas deposit consists of an elongated carbonatite intrusion (meta-carbonatite and amphibolite) with a strike of 50° to 60°. The meta-carbonatite and amphibolite form a tightly folded sequence with limbs dipping steeply from 70° to vertical (90°). The surface expression of the intrusion is approximately 2.5 km along strike with a width of approximately 300m. The Late Archean to Early Proterozoic intrusion is intensely recrystallized and metamorphosed to amphibolite assemblages. The carbonatite intrusion is bound mostly by biotite gneiss along with meta-syenite along its northeast and southeast boundaries

Phosphate mineralization, occurring as the mineral apatite ($Ca_5(PO_4)_3(F,Cl,OH)$), is the primary mineralization of economic interest at Três Estradas. Apatite is the only phosphate-bearing mineral occurring in the carbonatites. At Três Estradas phosphate mineralization occurs in both fresh and weathered meta-carbonatite and amphibolite. Phosphate also becomes highly enriched as secondary mineralization in the overlying saprolite.

1.2 MINERAL RESOURCES

The mineral resource is defined here as the portion of the in-situ geologic resource for which there is a reasonable expectation of economic extraction.

The estimated in-situ resource identifies 87.03Mt of Measured plus Indicated material with an average grade of 4.05% P_2O_5, using a minimum cut-off of 3.0% P_2O_5. The in-situ estimate also identifies a further 26.58MT of Inferred resource, with an average grade of 3.64% P_2O_5. Approximately 5% of the deposit (4.8Mt) is hosted in the saprolite ore which overlies the meta-carbonatite and amphibolite ores. (For the purpose of this report, the term ‘carbonatite’ is inclusive of the relatively minor quantity of amphibolite ore, unless specifically stated otherwise.)

Millcreek considers the phosphate mineralization at the Três Estradas phosphate deposit to be amenable to extraction using conventional open-pit mining and minerals processing methods Millcreek has used a Lerchs-Grossman optimizing algorithm to produce an economic pit shell for Três Estradas that capture the resources estimated in the block model with reasonable prospects for economic extraction (but are not necessarily reserves). Optimization parameters are derived from previous geologic studies and preliminary economic assessments of Três Estradas.

Table 1.1 Summary of Mineral Resource Estimate

Resource Classification	Domain	Volume (m^3 X 1000)	Tonnage (T X 1000)	Density (T/m^3)	P_2O_5%	CaO%	P_2O_5 as Apatite (%)	CaO as Calcite (%)
Total Measured Resources		12,975	36,196	2.82	4.01	33.59	9.50	59.95
Total Indicated Resources		17,671	47,014	2.74	4.18	31.72	9.91	56.63
Total Measured + Indicated Resources		**30,646**	**83,210**	**2.77**	**4.11**	**32.53**	**9.73**	**58.07**
Total Inferred Resources		7,605	21,845	2.88	3.67	33.62	8.69	60.01

* Mineral resources are not mineral reserves and do not have demonstrated economic viability. All numbers have been rounded to reflect relative accuracy of the estimates. Mineral resources are reported within a conceptual pit shell at a cut-off grade of 3% P_2O_5.

The Audited Mineral Resource identifies 83.21 Mt of Measured and Indicated material with an average grade of 4.11% P_2O_5 using a minimum cut-off of 3.0% P_2O_5. The estimate also identifies 21.85Mt of Inferred material with an average grade of 3.67% P_2O_5. By classification, 79% of the resources contained within the mineable resource pit shell are Measured and Indicated with the remaining 21% of the resource classified as Inferred resource.

The accuracy of resource and reserve estimates is, in part, a function of the quality and quantity of available data and of engineering and geological interpretation and judgment. Given the data available at the time this report was prepared, the estimates presented herein are considered reasonable. However, they should be accepted with the understanding that additional data and analysis available subsequent to the date of the estimates may necessitate revision. These revisions may be material. There is no guarantee that all or any part of the estimated resources or reserves will be recoverable.

1.3 MINERAL RESERVES

Mine planning, cost estimation and economic analysis has indicated that a significant portion of the resource may be reasonably considered to be feasible for economic recoverability.

Total estimated Proven and Probable reserves for the Três Estradas Phosphate Project assuming, considering a saleable product 'reference point', are summarized in Table 1.2, below. Reserves and head grade are reported on a mill-feed (post mining) basis and are inclusive of ore losses and dilution.

Table 1.2 Proven and Probable Reserves

Classification	Reserves (Sap.)	Reserves (Cbt. + Amp.)	Reserves (Total)	Head Grade (%P_2O_5)
Proven	844,302	27,023,619	27,867,921	3.92
Probable	4,352,915	11,334,168	15,687,083	5.01
Prove. + Prob.	**5,197,217**	**38,357,787**	**43,555,004**	**4.31**

1.4 MINING

Figure 1.1 shows a site layout plan indicating the pit, process plant, and various infrastructure and facilities.

Appropriate mining areas were defined using economic optimization of a 3D block model and took into account the need to optimize project value by considering haulage of ore and waste to the plant and final dumps (respectively), as well as scheduling of stripping / mining operations and quality considerations.

Early economic analyses indicated optimal production levels and Life-of-Mine (LOM) (considering market constraints and strategy), as well as an approach that derived most value from the characteristics of the ore types, as follows:

- Phase 1 (Saprolite): Take advantage of the high-head grade, low strip ratio, and relatively low processing costs to produce a high-value phosrock concentrate;
- Phase 2 (Carbonatite): As saprolite is depleted, the plant is expanded to handle the Carbonatite ore types, as well as produce an aglime by-product;
- Phase 3 (Aglime): Remaining stockpile of stored aglime is reclaimed and depleted.

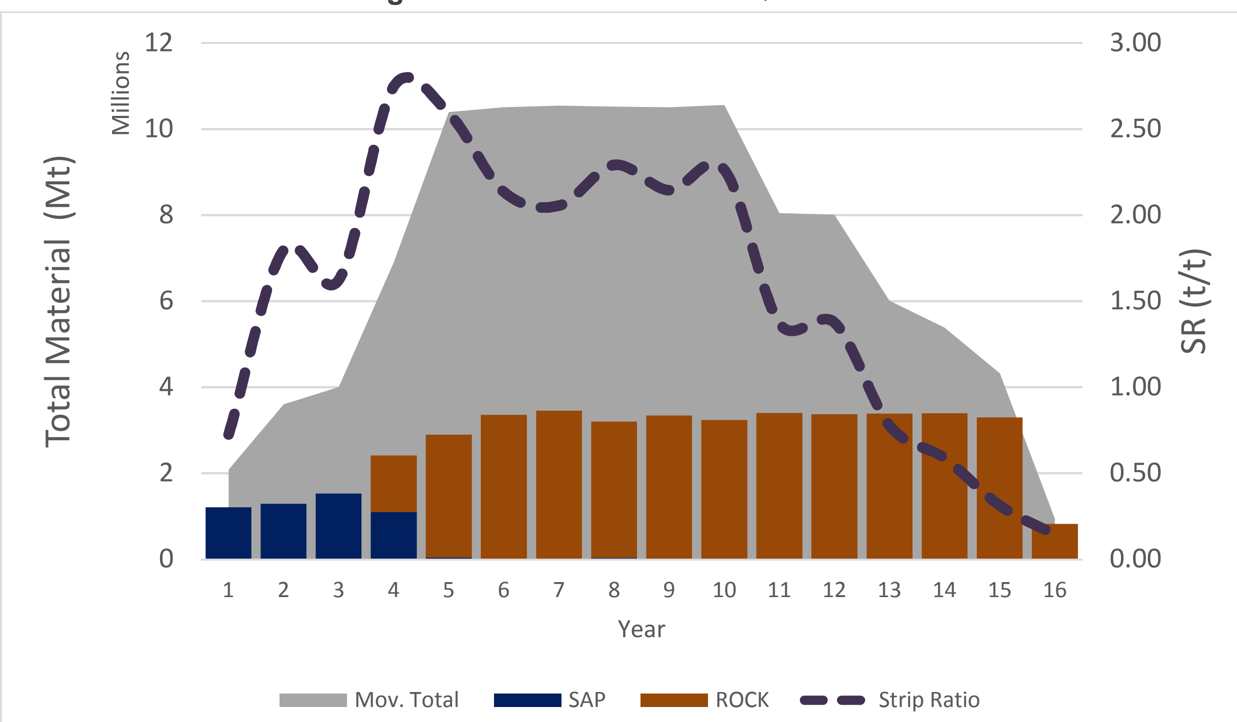
Mine operations for the Três Estradas Phosphate Project are planned as a conventional open-pit, truck and shovel mining methods for the phosphate ores and waste material. Waste and ore will be drilled and blasted before loading and haulage.

Pit designs were based on geotechnical and hydrogeologic studies and recommendations, taking into account the mining equipment and method. Waste is dumped in two dumps, located on the low-wall and high-wall sides of the ultimate pit, with sediment protection dykes.

Over the LOM, the pit is advanced according to the three phases described above, and the need to maximize the delivery of ore to the plant commensurate with the phase, to reduce truck haulage of ore and waste to the plant and dumps, respectively; and to minimize the need for stockpiling and rehandle. The steeply dipping nature of the deposit, it's size, and the over-riding value of the overlying saprolite ore, leads to a rapidly increasing strip ratio (SR) that peaks in Year 5 at 2.8 (2.8 tonnes waste : 1 tonne ore), before decreasing as the pit is completed (averaging 1.6 over the LOM). However, this study has confirmed that this approach is economically optimal.

Mine schedule quantities are summarized in Figure 1.2.

Figure 1.2 Mine Schedule – Quantities



Contractors will be used to provide equipment labor during Phase 1 (Saprolite), while employees will be used for the remainder of the LOM once the saprolite is depleted. Primary mining equipment will be leased-to-purchase to minimize up-front capital expenses. Proposed mining equipment and fleet sizes includes the following:

Table 1.3 Mining Equipment

Type	Purpose	Equivalent Model	Size	Productivity (Avg.)	Quantity (Max.)
Hydraulic Excavator	Waste / Ore, Sap. Phase	CAT 374F	4.4m^3 bucket	750 t/hr	1
Front End Loader	Waste / Ore, Carb. Phase	CAT 992 K	12.2m^3 bucket	1092 t/hr	2
Transport Truck	Waste / Ore, Sap. Phase	Scania G440	Max Cap. 26mt	122 t/hr	6
End Dump Truck	Waste / Ore, Carb. Phase	CAT 775G	65mt	180 t/hr	9
Support Equipment					
Water Truck	Waste / Ore. Lom	CAT 775 Chassis	75,000 liters	N/A	1
Grader	Waste / Ore. Lom	CAT 14M	14' (4.3m) blade	N/A	1
Track Dozer	Waste / Ore. Lom	CAT D8	231 kW	N/A	1
Wheeled Dozer	Waste / Ore. Lom	CAT 824 K	264 kW	N/A	1
Large Blast Hole Drill	Waste / Ore. Lom	AtlasCopco - FlexiROC D60	354 kW	1500 t/hr	2

1.5 METALLURGICAL TESTING

Metallurgical and process testing began in 2012 with a bench-top study that covered mineralogical composition, particle size distribution and liberation by size fraction. Potential grade-recovery projections were extrapolated, and the study also looked into the applicability of magnetic separation. This led to further work in 2014 which covered comminution and the first specific (bench-scale) flotation test work, resulting in a conclusion (among others) that the recovery of P_2O_5 through flotation might be commercially viable, and that column flotation should be considered. This was followed by additional test work (HDA, 2015), again at a bench-scale, that confirmed the commercial potential for phosphate recovery through flotation and provided better understanding of the nature of P_2O_5 mineral extraction by size fraction, and in slimes.

It was at this point of the study that the Eriez Flotation Division (Eriez) was engaged. Eriez had a proven record of designing and implementing column flotation applications at igneous phosphate projects around the world, including in Brazil, and it was determined that they would be well-positioned to develop the understanding the metallurgical nature of the Três Estradas ore to a point suitable for a feasibility-level study.

Eriez began their engagement with a program in 2016 that produced concentrates from various ore types at a commercially viable level of performance, using column flotation. Eriez was able to identify effective optimization of the process and concluded that effective flotation grade – recovery performance could be reasonably expected, and that it was a significant improvement over historical (i.e., non-optimized) projections.

Metallurgical and process testing has culminated in Eriez's recent pilot-plant testing for flotation (2017), backed-up with a recent comminution study (Metso, 2017), as well as testing for alternate reagents. A multi-month study, using bulk samples and performed at Eriez's pilot-plant facilities in Pennsylvania, USA, has confirmed the earlier bench-scale work, as well as further improvements in the process design to improve grade - recovery projections. The test work was structured to focus specifically on each of the major ore types.

Finally, a program was undertaken by Eriez in late 2017 to identify alternate 'collector; reagents for both saprolite and carbonatite floatation, once it was discovered that the previously assumed collector could be in short supply, and at higher cost than anticipated. Alternate collectors were proposed that, while not reaching the originally projected performance, were found to be significantly cheaper, leading to an overall improvement in unit operating costs.

The current findings and conclusions from the most recent pilot-plant program and collector reagents optimization test work are as follows:

- In saprolite ore, the global phosphate recovery of 81.4% is achievable at a concentrate grade of 32.7% P_2O_5;
- In carbonatite ore, the global phosphate recovery of 75.3% is achievable at a concentrate grade of 30.1% P_2O_5;

In addition to the 2017 pilot plant testing by Eriez, a test program was undertaken in order to determine the solids-liquid separation (SLS) characterization as well as geotechnical and rheological properties of the concentrates and tails from both saprolite and carbonatite. These formed the basis of further thickening and filtration testing and performance prediction, to help size equipment.

1.6 RECOVERY METHODS AND PROCESSING PLANT DESIGN

The processing facilities for the Três Estradas Phosphate Project are designed to operate in three phases:

1.6.1 PHASE 1 - SAPROLITE

The first phase comprises the facilities to treat the saprolite ore (higher grade, and naturally finer and softer ore when compared to the carbonatite ore). The concentration plant will produce approximately 300 ktpy (dry-basis) of phosphate (P_2O_5) concentrate from a feed rate of approximately 1.3 Mtpy.

During this phase the facility will consist of the following major processing circuits;

- Primary crushing circuit – Consisting of a Primary roll crusher mobile system, apron feeders, and conveyance to stockpile
- Stockpile and Reclaim system – Reclamation by a front-end loader to grinding circuit.
- Grinding Circuit – Open circuit utilizing a Rod Mill; discharge to pump box and transfer to conditioning tank.
- Phosphate Processing - Column Flotation Circuit consisting of a rougher and cleaner cell, magnetic separation utilizing a HIMS.
- Concentrate Thickening and Dewatering – Concentrate thickener and pressure filtrations to dewater concentrate.
- Concentrate drying – Fluid bed dryer with dust collection and transfer to truck loadout.
- Tailings Thickening and Tailings Collection Dam – Tailing thickener clarified water to return to process with underflow transfer to Tailings Dam storage.

1.6.2 PHASE 2 - CARBONATITE

The transition from first to second phase will consist of the installation of new primary crushing circuit, new mills, new flotation columns and the aglime dewatering facilities. The phosrock production will remain constant (300 ktpy) and a portion of the flotation tailings will be dewatered (through thickening and filtering) and sold as aglime (1 Mtpy). However, due to the lower grade of the carbonatite ore, the feed rate will be significantly higher, at approximately 3.3Mtpy. The process equipment of the saprolite phase (except the primary crushing) will be re-used in the expansion of the plant to treat the carbonatite phase.

- Primary Crushing Circuit – Due to the harder ore characteristics of the carbonatite mineral, the primary crushing circuit will be modified to utilize a primary jaw crusher and secondary cone crushing circuit prior to feeding material to the grinding circuit.
- Stockpile and Reclaim system – Reclamation via vibratory feeders to grinding circuit.
- Grinding Circuit – Modified to two-stage open grinding circuit utilizing a rod mill, hydrocylone, and ball mill. Discharge from the rod mill will be pumped to the hydroclones, while the fines will bypass the ball mill circuit with the coarse fraction being fed to the ball mill. The combined discharge of the bypassed fines and ball mill will discharge to pump box for transfer to conditioning tank.
- Phosphate Processing – Modified column flotation circuit consisting of a rougher and the addition of two new cleaner cells for a total of three cleaner cells in the circuit, Magnetic Separation utilizing a HIMS.
- Concentrate Thickening and Dewatering – Concentrate thickener and pressure filtrations to dewater concentrate; concentrate clarified water returned to the process.
- Concentrate drying – Fluid bed dryer with dust collection and transfer to truck loadout.
- Tailings thickening and Tailings Collection dam – Tailing thickener clarified water to return to process with underflow transfer to aglime conditioning tank. Aglime can be transferred to the tailings storage dam or a pressure filtration system to dewater prior to aglime delivery for sale. 1 Mtpa of aglime will be sold directly, while the remaining is stored.

1.6.3 PHASE 3 - AGLIME

After cessation of mining operations, the third phase will be to reclaim and deplete the remaining tailings from the tailings storage dam facility, dewater them, and to continue to sell them as an unprocessed aglime product. Operation will consist of reclaiming the tails as a slurry, and then dewatering it in the existing aglime filtering installation, at an annual production of 1 Mtpy.

1.7 MARKET STUDIES

For it's proposed phosrock products, Águia utilized market research data from three firms; Agroconsult Consultoria e Projetos (Agroconsult) on the phosrock market and; Lobo Engenharia and EY (Ernst & Young) on the Calcite market. These firms are local Brazilian companies specializing in fertilizers and agricultural products.

Rio Grande do Sul State currently imports 100% of their needs for rock phosphate (or 'phosrock', the basis of phosphoric fertilizers) approximately 550,000tpy. It is proposed that Três Estradas sell their entire production of phosrock domestically through existing local transportation and distribution systems as a substitute for imported phosrock. There is a robust demand for domestically produced phosrock and fertilizer products forecast for southern Brazil, and there are two ports at which domestic phosrock production must be competitive; the Rio Grande Port Hub, and the Paranagua Port Hub.

Netback pricing analysis suggests that the Três Estradas has a competitive advantage, due to logistics, of USD18.50/tonne when selling to the Rio Grande Hub, and intends to displace approximately 300 Ktpy of the total demand of 528 Ktpy at Rio Grande, with its own production.

Agroconsult has provided price projections for phosrock (free-on-board, or 'FOB', Morocco) varying from USD 97/ton phosrock concentrate in 2018, to USD 133/tonne phosrock concentrate for 2027. This results in a realized mine-gate price for Três Estradas ranging from USD 115.50/tonne to USD 151.50/tonne of P_2O_5 concentrate.

For the calcite by-product, Águia utilized market research data from EY (formerly Ernst and Young) and Lobo Engenharia to develop its aglime marketing strategy. It was found that of the various uses of calcite, agricultural lime offered the best option considering price, quality and market position, even though it was constrained in the region to 1 Mtpy, and stockpiling of the annual excess of approximately 1.8Mtpy would be required.

1.8 ENVIRONMENTAL AND PERMITTING

The environmental impact and permitting review relies on work completed by Golder Associates in 2015, 2016 and 2017. Golder Associates has been instrumental in collecting and analysing environmental field data to develop the necessary regulatory material submitted to the Rio Grande do Sul's Government. This information has been incorporated in this review.

A comprehensive Environmental and Social Impact Assessment (EIA / RIMA), that meets national and international standards, was undertaken in 2015 and 2016 by Golder Associates based on over 14 months of field data collection and subsequent interpretation. The EIA/RIMA was submitted to State Government Agency (FEPAM) in October 7th, 2016.

As a result of later changes in the BFS, mainly related to lay-out of the mine and facilities, mass / water balance optimization and phasing the project according to saprolite / carbonatite ore and aglime phases, Águia produced an updated version of the EIA / RIMA in September 1st, 2017, which is currently under FEPAM analysis.

During the final phase of the BFS, additional changes were made to the project mainly related to optimization of the project lay-out, reducing the impacted area. A further update will be required to reflect these recent changes in the project.

Prior to the start of a construction and commissioning phase, the following steps are necessary in accordance with Brazilian law:

- Public Hearings with local communities;
- FEPAM analysis and clarifications;
- Preliminary License (LP) issued by FEPAM;
- Basic Environmental Plan (PBA) and LP conditions addressed by the Project;
- FEPAM analysis and approval;
- Installation License (LI) issued by FEPAM.

Once evidence that all required environmental programs have been implemented, the Operation License may then be issued. Additional permits and authorizations to implement the project address explosives, an Importation Authorization, fuel storage, kitchen / restaurant, process plant / mine / offices buildings, water supply, energy supply, and road permits.

1.9 COST ESTIMATE

As with the operations, schedules of operating and capital expenditures ('opex' and 'capex', respectively) have been estimated for both Phase 1 (Saprolite) and Phase 2 (Carbonatite) for all project operations, with appropriate application of taxes and duties.

Capital and operating costs for the project have been generally completed according to an internationally recognized cost estimation classification system, as proposed by the American Association of Cost Engineers (AACE). The majority of costs have been estimated to a standard appropriate for post-feasibility study budgeting (‘Class 3’), while some costs have been estimated to a level appropriate for a feasibility study (‘Class 4’). These classifications meet, and in many some cases exceed, the basic level required for the definition of economic mineral reserves. An exchange rate of BRL 3.45 : USD 1.00 for the US Dollar (USD) to the Brazil Real (BRL) was assumed; costs are reported on a constant USD basis, as of December, 2017.

1.9.1 CAPITAL COSTS

The capital costs estimate includes all the direct and indirect costs, local taxes and duties, and appropriate contingencies for the facilities required to bring the Project into production, as defined by a feasibility level engineering study and cover the following major cost centers:

- Mine (mine preparation, equipment and support facilities);
- Waste dumps;
- Processing plant (from primary crusher up to product load out and tailings disposal at tailings dam, fresh water intake, internal accesses, electrical system and external roads refurbishing);
- Transmission line;
- Tailings and water dams.

Direct costs for equipment were estimated from budgetary quotes from equipment vendors, while others were derived for quantities ‘take off’ approach based on analysis of plans and designs for the processing plant and related infrastructure, completed by ECM Projetos Industriais Ltda. (ECM). Indirect costs were generally estimated by applying experience-based factors commensurate with the mining industry in Brazil.

Initial and sustaining capital costs, by phase, are summarized in Tables 1.4 and 1.5, respectively:

Table 1.4 Initial Capital Cost Summary

Area	Sub-Area	Phase 1 (Saprolite) (million USD)	Phase 2 (Carbonatite) (million USD)
Mining	Mine	-	3.5
	Waste Dump	2.8	-
Processing Plant	General - Access Roads and Earthworks	4.8	2.7
	Process Plant	28.2	40.4
	Administrative / Operational Buildings	2.7	0.7
	Utilities	10.2	2.9
	Electrical System	11.6	14.2
Dam	Aglime Dam	2.7	3.7
	Water Dam	4.2	-
Total - Direct Costs		**67.3**	**68.0**
Indirect Costs		8.3	5.4
Contingency		8.3	7.3
TOTAL PROJECT COSTS		**83.9**	**80.8**
Recoverable Taxes		(3.3)	(3.5)
TOTAL COSTS (Net of Recoverable taxes)		80.6	77.3

Table 1.5 Sustaining Capital Cost Summary

Year	Description	Capex (million USD)
5	South Waste Dump. Necessary to minimize waste transportation cost	6.2
6	Major Mining Equipment - 30% down payment for a new Truck CAT 775 (increasing numbers of truck to 9 units)	0.3
	Pit Drainage pipeline, supporting the mining activities	0.8
9	Tailings pipeline – Increase tailings pipeline in length, discharging downstream	0.5
10	South Tailings Dam - Final heightening	3.2
13	Mine Fleet - 30% down payment for a new Truck CAT 992 K .(fleet renewing)	0.7
15	Aglime Dragging structure	1.1
16 – 20	Mine and Phosrock Plant Closure	5.0
36 – 40	Aglime Closure	4.4
TOTAL PROJECT COSTS		**21.1**
Recoverable Taxes		(0.5)
TOTAL COSTS (Net of Recoverable Taxes)		**20.6**

1.9.2 OPERATING COSTS

Operating costs were estimated through a combination of experience and familiarity with similar mining projects in the region, as well as the use of industry guidelines and databases.

The annual total operating cost for Três Estradas Phosphate Project is estimated to be:

- Phase 1 (Saprolite): The average annual cost (Years 1 to 3) to produce 300 ktpy of phosrock is USD 15.8 million, or USD 51.30/tonne of phosphate concentrate;
- Phase 2 (Carbonatite): The average annual cost (Years 5 to 15) to produce 300 ktpy of phosrock and 1 Mtpy of aglime is USD 38.6 million or USD 77.21/tonne of phosphate concentrate and USD 5.26/tonne of aglime;
- Phase 3 (Aglime): The average annual cost (Years 17 to 35) to produce 1 Mtpy of aglime is USD 1.8 million, or USD 1.81/tonne of phosphate concentrate.

Table 1.6 Operating Costs – Três Estradas Phosphate Project

Area	Sub-Area	Phase 1 Average (y1-y3) (million USD/year)	Phase 2 Average (y5-y15) (million USD/year)	Phase 3 Average (y17-y36) (million USD/year)
Mining	Labor	1.2	1.6	0.0
	Diesel	2.6	5.6	0.0
	Lubricants	0.4	0.8	0.0
	Blasting	0.1	2.1	0.0
	Tires	0.4	0.9	0.0
	Repair Parts	0.4	1.0	0.0
	Wear Parts	0.1	0.2	0.0
	Drainage	0.0	0.3	0.0
	Outsourced Services	1.3	1.0	0.0
	Leasing	0.0	0.8	0.0
Total Cost - Mine		**6.5**	**14.3**	**0.0**
Process Plant	Labor	2.1	2.1	0.0
	Power	2.9	7.3	0.0
	Fuel and additives	0.3	0.3	0.0
	Reagents	2.3	10.3	0.0
	Consumables	0.2	2.1	0.0
	Parts and Maintenance Material	0.8	1.5	0.0
Total Cost - Process		**8.7**	**23.7**	**0.0**
G&A		**0.6**	**0.6**	**0.0**
Aglime Storage Reclaiming	Dredging and Filtration	0.0	0.0	1.2
	G&A	0.0	0.0	0.6
Total Cost - Aglime Storage Reclaiming		**0.0**	**0.0**	**1.8**
TOTAL OPERATIONAL COSTS		**15.8**	**38.6**	**1.8**
Taxes Recovery		(1.1)	(3.2)	(0.0)
TOTAL COSTS (Net of Recoverable Taxes)		**14.7**	**35.4**	**1.8**

1.10 ECONOMIC ANALYSIS

In summary, the economic analysis follows a discounted cash flow (DCF) model. This was performed by considering the detailed mining, processing and facilities capex and opex schedules, and applying them against net revenues (after deductions such as royalties, expenses and other deductions). After applying taxes, depreciation and amortization, the discounted cash flow (DCF) was generated, from which various valuation metrics could be derived including Net Present Value (NPV), Internal Rate of Return (IRR) an payback period.

Costs are as reported above. Revenues were generated by applying the price forecasts generated by industry experts. Proper applicating of taxes and duties in Brazil is relatively complex, and an expert in Brazilian taxes, L&M Assessoria Empresarial (L&M), was used to ensure that tax treatment was properly modelled.

The pre- and post-tax results of the economic model are summarized in Table 1.7.

Table 1.7 Financial Results Summary

Financial Analysis	Unit	Pre-Tax (2)	Post-Tax
NPV@5%	(USD Million)	300	212
NPV@7.5%	"	186	129
NPV@10%	"	116	78
IRR	(%)	20.7%	18.3%
Total Cash Flow	(USD Million)	1,041	849
Payback(1)	(Years)	5.9	6.2
EBITDA Years 1 to 3.5 (Phase 1 - Saprolite)	(USD Million)	28	
EBITDA Years 3.6 to 16 (Phase 2 - Carbonatite)	“	37	
EBITDA Years 17 to 36 (Phase 3 - Aglime)	“	26	
(1) Undiscounted, after start-up;			
(2) Before direct taxes;			

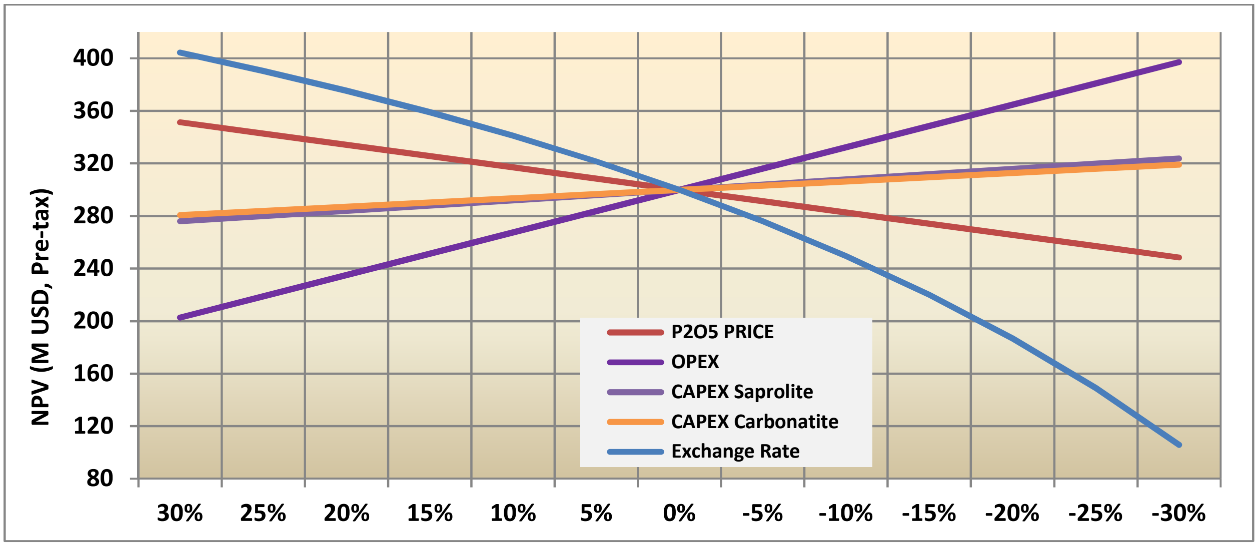
Sensitivity analyses were performed on a variety of independent factors, including:

- P_2O_5 concentrate price: ±30%
- Operating costs: ±30%

- iCapex Saprolite: ±30%
- iCapex Carbonatite: ±30%
- Exchange Rate: ±30%

The NPV was found to be most sensitive to exchange rate, followed by P_2O_5 concentrate pricing.

Figure 1.3 Sensitivity for Pre-tax, Unlevered NPV@5%



1.11 PROJECT IMPLEMENTATION SCHEDULE

The key activities of the schedule for the 1st Phase of Três Estradas Phosphate Project are summarized at the table below. The ramp-up will start at the beginning of Month #19.

Table 1.8 Construction Schedule for Initial Investment

Main activities	Start	End
Detailed Engineering	Month #1	Month # 7
Preparation of Procurement Packages	Month #1	Month # 4
Contracting	Month # 3	Month # 7
Implementation License (Li)		end of Month # 4
Construction - Civil and Mechanical Assembly	Month # 5	Month # 16
Commissioning & Start-Up	Month # 10	Month # 18
First Commercial Product		Month # 18 (end)

1.12 CONCLUSIONS

The following conclusions can be made, based on the current BFS level of work:

- The pit contains 83.21 MT of Measured plus Indicated resources with an average grade of 4.11% P_2O_5 using a minimum cut-off of 3.0% P_2O_5.
- Of the Measured plus Indicated resources, Total Proven and Probable Mineral Reserves are reported at 43.6Mt, at a head-grade of 4.31% P_2O_5 (this includes 5.2Mt of the higher-value saprolite ore, at a head-grade of 8.50% P_2O_5).
- In saprolite, tests results projects that a global phosphate recovery of 81.4 % can be expected at a concentrate grade of 32.7% P_2O_5;
- In carbonatite, tests results projects that a global phosphate recovery of 75.3% can be expected at a concentrate grade of 30.1% P_2O_5;
- Mine planning, detailed cost estimation and economic analysis has demonstrated the economic feasibility of a portion of the resource.
- There is demand in the region for both phosrock and calcite at the quality and cost that Três Estradas can produce.
- The Três Estradas Phosphate Project is technically and economically feasible. The mining and processing concepts applied represent conventional technologies that have been used successfully in international phosphate mining operations for several decades. The deposit's resources are sufficient to provide an economically viable open pit mining project under the circumstances described in this report.

2 INTRODUCTION

Millcreek Mining Group (Millcreek) has prepared this Technical Report on the Três Estradas Phosphate Project at the request of Águia Resources, Ltd. (Águia). The purpose of this report is to present the findings of a 'Bankable' Feasibility Study (the 'BFS') which builds upon a previous mineral resource estimate update and Preliminary Economic Assessment (PEA). The resource and reserves estimates presented in this report have effective dates of September 8, 2017, and March 13, 2018, respectively.

Águia Resources, Ltd. is an exploration and development company focused on Brazilian phosphate projects to supply the Brazilian agriculture sector. Águia is listed on the Australian Stock Exchange (ASX) under the symbol AGR and earlier this year the company was listed on the TSX Venture Exchange (TSX-V) under the symbol AGRL. The company's corporate offices are located in Sydney, Australia and Belo Horizonte, Brazil. The company currently controls over 1,110 km^2 of land in the states of Rio Grande do Sul and Paraiba containing phosphate mineralization through exploration permits it has acquired from the DNPM. The company seeks to develop its holdings of phosphate deposits into viable mining operations providing phosphate to Brazil's agriculture industry.

2.1 RECENT PROJECT HISTORY

In 2012, SRK Consulting (Canada) Inc., was engaged by Águia to prepare a geological model and mineral resource estimate for the project, in accordance with the JORC code. The results of additional drilling were incorporated in an updated resource estimate released by Águia in January, 2013. In April, 2013, permit exploration rights for Três Estradas were granted by the DNPM, and shortly thereafter SRK provided an updated mineral resource estimate to reflect Águia's revised permit status.

SRK's updated resource estimate and ITR for 2013 served as the basis for a conceptual mining study / PEA completed in September, 2014. This PEA study was developed and updated during the interim with a summary report released in August, 2015.

In early 2016, Millcreek was engaged by Águia to complete a new PEA for the Três Estradas Phosphate Project. Significant highlights of this PEA included:

- An updated mineral resource estimate following additional drilling at the Três Estradas deposit plus inclusion of another deposit, Joca Tavares;

- The introduction of column flotation testwork that yielded significantly better recoveries over standard flotation presented in the previous PEA completed by SRK;
- Producing phosphate concentrate to be sold at mine gate versus producing Super Single Phosphate (SSP).

The PEA completed by Millcreek was issued as a JORC compliant report on July 7, 2016. The PEA was later reformatted as an NI 43-101 technical report and issued on May 12, 2017, in support of Águia's listing on the TSX-V. A PEA reporting the latest resource estimate as a result of the 2016 - 2017 drilling program was later prepared.

Immediately following the PEA work, Águia began work on preparation of the BFS study. The intent of this study was to make use of the re-classification of a significant quantity of mineral reserves to Measure and Indicated status, as the basis of a reserves estimate.

Between November, 2016 and June, 2017, Águia carried out an extensive drilling campaign focused on further delineating the mineral resources to a higher level of geologic assurance. During this drilling program, Águia was also successful in identifying a new zone of mineralization along the southeast flank of the Três Estradas deposit. This latest drilling program was successful in growing the size of the overall deposit as well as increasing a significant majority of the resources to Measured and Indicated levels of resource classification.

2.2 TERMS OF REFERENCE

2.3 SITE VISIT

In accordance with accepted standards and best-practises for certification of resources, Millcreek personnel have completed two site visits to the Três Estradas Phosphate Project. The first site visit took place between March 17, 2016 and March 19, 2016. Millcreek's representatives included Mr. Steven Kerr (C.P.G.-10352) and Mr. Alister Horn (MMSAQP-01369), who are considered Competent Persons (CPs) under the NI 43-101 Standards of Disclosure for Mineral Projects. Mr. Kerr made a second site visit to the project on March 8 and 9, 2017, during the most recent drilling program. No material work has been done on the property since Mr. Kerr's most recent visit, and the CPs consider their personal inspections to be considered current, for their respective fields.

During their visits, Mr. Kerr and Mr. Horn were accompanied and assisted by various Águia staff, including Dr. Fernando Tallarico, Mr. Thiago Bonas and Mr. Alfredo Nunes during the site visits.

2.3.1 PURPOSE OF REPORT

The purpose of this report is to present the findings of the BFS which builds upon previous studies.

The mineral resource estimate presented in this report reflects significant changes from the 2016 estimate, due primarily to the latest drilling program completed in June 2017. Key changes in the mineral resource estimate presented in this report include:

- The previous estimate in 2016 identified 15.07 million tonnes (MT) of Measured plus Indicated resources at a P_2O_5 grade of 4.75% using a 3.0% cut-off. The new estimate identifies 83.2MT of Measured plus Indicated resources at a 4.11% P_2O_5 grade using a 3.0% cut-off. Inferred Resources have dropped from 58.9MT to 21.8MT in the 2017 estimate.
- The overall size of the deposit (Measured + Indicated + Inferred) has grown from 74.7MT to 105.1 MT;
- Tighter estimation parameters have been implemented in the 2017 Mineral Resource;
- Rock density values have been incorporated into the block model versus the usage of average density values for each of the mineralized domains;
- The July 2016 Mineral Resource Estimate included resources for the Joca Tavares deposit. There has been no additional work done at Joca Tavares and resources from that deposit are not included in this Mineral Resource estimate. Joca Tavares is no longer considered material to the Três Estradas Phosphate Project.

In addition to an updated mineral resource estimate based on most recent drilling, the BFS also took into account updated mining planning, minerals processing and optimization, cost estimation, market studies, economic analysis and environmental planning. These studies were undertaken by various recognized firms engaged by Águia, with management from Millcreek, as described in Item 3 of this report and their work is described throughout this document.

Work was done according to generally recognized standards for feasibility studies. Capital and operating costs for the project have been generally completed according to an internationally recognized cost estimation classification system, as proposed by the American Association of Cost Engineers (AACE). These classifications and standards either meet or exceed the basic level required for the definition of economic mineral reserves.

2.4 STATEMENTS OF LIMITATION

The accuracy of resource estimates is, in part, a function of the quality and quantity of available data and of engineering and geological interpretation and judgment. Given the data available at the time this report was prepared, the estimates presented herein are considered reasonable. However, they should be accepted with the understanding that additional data and analysis available subsequent to the date of the estimates may necessitate revision. These revisions may be material. There is no guarantee that all or any part of the estimated resources or reserves will be recoverable.

Economic analyses in technical reports are based on commodity prices, costs, sales, revenue, and other assumptions and projections that can change significantly over short periods of time. As a result, economic information in a technical report can quickly become outdated. Continued reference to outdated technical reports or economic projections without appropriate context and cautionary language could result in misleading disclosure.

3 DISCLAIMER

As described below, Millcreek has relied, in part, on information from Águia as well as the opinions and statements of other experts who are not competent persons. Further details on the sources of this information are included in Item 20.

Millcreek has prepared this report specifically for Águia. The findings and conclusions are based on information developed by Millcreek available at the time of preparation and data supplied by outside sources. Millcreek staff have not conducted any independent field work for the preparation of this report and have relied on the results of exploration documented in various public reports and on recent drilling data supplied by Águia.

Águia has supplied the appropriate documentation that supports the exploration permits it holds with the DNPM of Brazil, believed to be in good standing. The existence of encumbrances to the exploration permits have not been investigated. Other Millcreek personnel assisted in the compilation and digitization of historical data and documents and the information contained within them. All of this work was reviewed and deemed reasonable for this level of study by the authors.

3.1 ENGINEERING

ECM S.A. Projetos Industriais (ECM) is a Brazilian engineering company founded in 1984. With their core business focus on the mineral industry, and extensive experience in mineral processing (including specifically on column floatation of phosphate and other ores) as well as bulk material handling systems, slurry and water handling systems and other expertise related to project start-up and construction, ECM was well-placed to execute the in-country engineering portions of this study. ECM's scope covered design and engineering for minerals processing, materials handling and project infrastructure.

The Eriez Flotation Division of Eriez Manufacturing Co., in Pennsylvania, USA, (Eriez) has been retained by Águia (since the PEA and through the BFS study) to complete various programs. These include a metallurgical testing program utilizing column flotation for extraction of phosrock concentrate, evaluation of recovery of calcite as a by-product, determination of the economically optimal collector reagent scheme as well as other trade-off studies and optimizations.

The Metso Corporation (Metso), through its Brazilian offices, was engaged to perform a comminution test work and study of the phosphate ores, and to make various recommendations.

Pocock Industrial (Pocock) is a well-respected firm specializing in laboratory and testing work related to solids liquid separation (SLS testing), and are based in Salt Lake City, USA. Pocock were charged with conducting SLS and geotechnical characterization and testing of the concentrates and tailings following pilot testing performed by Eriez.

Figener Engenheiros Associados Ltda., an energy consulting firm based in Brazil, undertook a study on alternatives for energy supply to the project site.

Walm Engenharia e Teconologia Ambiental (Walm), is a well-respected geotechnical engineering firm and based in Belo Horizonte, Brazil. Walm were charged with the geotechnical site management and design of the Water Dam, Tailings Dams and Waste Dumps.

These engineering firms produced work that applies primarily to Items 8, 12 and 13.

3.2 LEGAL, MARKETING AND ECONOMICS

Millcreek has not verified specific market information and sales prices. Our reliance on the information below applies to Items 15, 16, and 17.

Lobo Engenharia produced a study identifying the calcite technical specifications required by the Brazilian market, which was used to determine the technical specifications to generate a salable by-product from the phosphate tailings stream.

Agroconsult is an agricultural-firm, based in Brazil and with specific expertise in the domestic fertilizer and agricultural products. Agroconsult undertook several studies that looked into the fertilizer and phosrock markets of Brazil (in particular, the southern states), as well as a competitive analysis and recommendations on pricing, etc.

Macrologística Consultoria (Macrologistica), an engineering logistics firm also based in Brazil, performed a study looking at options for transportation of phosrock to markets and clients in the southern region of Brazil.

E&Y (formerly Ernst and Young) produced a study looking at the market outlook for aglime in the region.

Millcreek has relied on a title opinion supplied by Azevedo Sette Advogados regarding the mineral rights and tenure held by Águia. This title opinion, and other relevant documents, are provided in Appendix A of this report.

Millcreek relied on information regarding Brazil taxes and credits in Item 17 provided in a discounted cash flow analysis review conducted by L&M Assessoria Empresarial (L&M), a local company specializing in Brazilian taxation. This included a review of the estimation of the tax incidence on the Project, including revenues, operating costs, capital expenditure and profits, according to the Brazilian tax legislation, and also to the application of the potential benefits that should be negotiated with the State Government.

3.3 MINING AND ENVIRONMENTAL

Prominas, a mining engineering consultancy based in Sao Paulo, Brazil, assisted with additional computer modelling and mine simulation, as well as with in-country expertise on local costs and conditions. Contributions from Prominas are covered by Item 11.

Golder Associates (Golder), from their Brazilian offices, conducted environmental impact assessment and permitting review work from the PEA (starting 2015) through the BFS study. This work supported Golder's preparation of a comprehensive Environmental and Social Impact Assessment (EIA / RIMA).

4 PROPERTY DESCRIPTION

The Três Estradas Phosphate Project is located in the municipality of Lavras do Sul, approximately 320 kilometers (km) southwest of Porto Alegre, the capital city of Rio Grande do Sul State in southern Brazil and 1,790 km south of Brasilia, as shown in Figure 4.1.

The Três Estradas Phosphate Project area is situated at latitude -30.906137°, longitude -54.197328°. Mineral tenure is held through three mineral rights, all issued by the Brazilian Mining Regulatory Authority (the DNPM - Departamento Nacional de Produção Mineral2) as listed in Table 4.1.

The three mineral rights combined cover a total area of 2,075.34ha. Figure 4.2 shows the three exploration permits for Três Estradas.

Table 4.1 Summary of Águia's Mineral Rights

DNPM Permit	Issuing Date	Period	Expiry Date	Area (ha)	Status	Municipality/State	Title Holder
810.090/1991	08/16/2010	2	8/16/2012	1,000.00	Final Report Presented	Lavras do Sul/RS	Águia Fertilizantes S.A.
810.325/2012	05/03/2017	3	5/03/2020	990.95	Permit Extension	Lavras do Sul/RS	CBC*
810.988/2011	4/15/2015	3	4/15/2018	84.39	Extension Submitted	Lavras do Sul/RS	Falcon Petróleo S.A.
			Total Area	2,075.34			

*Companhia Brasileira do Cobre

4.1 OWNERSHIP

Águia holds 100% interest in the three mineral rights permits covering the Três Estradas Phosphate Project area.

On July 1, 2011, Companhia Brasileira do Cobre (CBC) and Águia Metais Ltda., a subsidiary of Águia Resources, Ltd. in Brazil, executed an option agreement

[2]DNPM shall be replaced by the Brazilian Regulatory Mining Agency, as detailed in Appendix A (legal title opinion provided by Azevedo Sette Advogados).

providing the irrevocable purchase option of mineral rights #810.090/1991 and #810.325/2012 by Águia Metais (or its affiliate or subsidiaries). On May 30, 2012, Águia Metais exercised the purchase option concerning the mineral rights of permit #810.090/1991 by means of its affiliate, Águia Fertilizantes S/A (Águia Fertilizantes). On July 20, 2012, CBC filed a request before the DNPM applying for the transfer of this mineral right to Águia Fertilizantes. On May 16, 2013, Águia Metais exercised the purchase option concerning mineral rights of permit #810.325/2012 by means of its affiliate Águia Fertilizantes. On April 07, 2014, CBC filed a request before the DNPM applying for the transfer of the mineral right #810.325/2012 to Águia Fertilizantes.

The permit to be transferred from CBC (#810.325/2012) to Águia Fertilizantes is currently operating under a permit extension. Falcon has requested for an extension of the permit 810.988/2011 which is currently under DNPM's review.

The transfer of the mineral rights 810.090/1991 from CBC to Águia Fertilizantes was approved by DNPM on November 30th, 2017 and registered by DNPM on December, 07th, 2017 (see Appendix A for notice as filed with the Brazilian Official Gazette, dated after the legal opinion). The transfer request of the mineral rights #810.325/2012 and 810.988/2011 are under DNPM´s review. As per the Brazilian mining legislation, in order to be considered lawful and to also have legal effectiveness, the DNPM will analyze technical and legal aspects in order to approve or oppose the transfer. The assignor shall continue to be liable for any rights or covenant regarding the mining title up to the regular register of the full assignment.

As stated in the legal title opinions provided by Azevedo Sette Advogados, Falcon and CBC (titleholders at the time of the opinion) were in compliance with the mining regulation related to the mineral rights, which includes meeting the requirements of the DNPM rules, the payment of the annual fee per hectare, or any other applicable fees. Águia is understood to have been in compliance since one of the titles was recently transferred, or since the transfer has been in review (see above). The legal title opinion, provided by Azevedo Sette Advogados, is included in Appendix A and is divided as follows: Section 1 contains the summary of the legal opinion. Exhibit A contains a table with the detailed description of each Mineral Right. Exhibit B provides a general overview regarding the mining regulatory framework in including a specific topic regarding surface rights. Exhibit C provides the corporate structure overview of the group in which Águia Fertilizantes is a part of. Exhibit D contains a chart with detailed information about the payments made by Águia Fertilizantes in favor of surface owners.

4.2 LICENSING PROCESS

Exploration permits are granted for up to a three-year period, renewable for a further period at the decision of DNPM, under the objective conditions stipulated in the mining code. Exploration must begin no later than 60 days after the granting of the permit. Exploration must not stop, without due reason, for more than three consecutive months or 120 non-consecutive days. The permit holder must notify the DNPM of any changes to the exploration plan and, on completion of the work, submit a final report on exploration. The holder of an exploration permit is required to pay annual fees to DNPM in the amount (i) R$3.21 (three Brazilian reais and twenty-one cents) per hectare, during the effectiveness of the authorization in its original term and (ii) R$4.86 (four Brazilian reais and eighty-three cents) per hectare, under the extended term of the authorization. The holder of an exploration permit is also responsible for all expenses related to DNPM site inspections of the area.

Mining concessions are granted, solely and exclusively, to individual firms or companies incorporated under Brazilian law, which have head offices and management in Brazil, and are authorized to operate as a mining company.

Mining concessions can be applied for upon the presentation of: (i) a mining plan within one (1) year[3], counted from the approval of the final exploration report by DNPM; and (ii) installation license issued by environmental license. The mining plan must include an economic feasibility analysis, and the company must demonstrate to the DNPM that it has the financial capability to carry out the forecasted plan. Once the legal and regulatory requirements are met, a mining concession is granted. Mining Code stipulates that the mining right holder shall (i) exploit the mine according to an exploitation plan previously approved by DNPM; (ii) not interrupt the exploitation works for a period of more than six consecutive months after the beginning of the operation; (iii) exploit only minerals expressly mentioned in the Mining Concession; (iv) comply with the applicable Environmental Law. As per the Mining Code, the mining right holder may exploit additional mineral substances (originally not mentioned in the mining title) upon their prior register in the respective mining title.

[3] . Upon holder request, this term may be renewable for one (1) year at DNPM's discretion.

The holder of a mining concession shall also comply with the Compensation for the Exploitation of a Mineral Resource (CFEM), which is a legal royalty based on the type of commodity and levied on the sale of the ore. The Law # 13.540, enacted on December 18, 2017 as a result of the Provisional Measure #789/2017[4], sets forth several modifications on the legal regime of CFEM. Pursuant to such law, in case of sale of the mineral production, CFEM is levied on the gross revenues resulting from the sale of raw or improved mineral at a rate of: (i) 2% (two percent) for "other mineral substances", such as phosphate; and (ii) 1,5% for gold. Its calculation base is the gross revenue from the sale of the mineral product, understood as the total of sales less taxation that arises from the commercialization of the mineral product and are paid or compensated in accordance with any applicable tax regimes

The company holding the mining concession has the right to mine the deposit until it is completely exhausted according to the mining plan approved by DNPM and the environmental license granted by the relevant agency. The mined product can be disposed of without any restriction except general taxation. The concession holder also has the right to sell, transfer or lease the mining rights to another mining company, with prior consent of the federal government.

4.3 MINING ACTIVITIES IN INTERNATIONAL BORDER ZONES

The project area falls within the International Border Zone of Brazil. The International Border Zone is a 150 km buffer zone to the country's international borders. Três Estradas is within this zone with respect to the Uruguay border. The mining activities in border zones are ruled by special laws. According to Federal Law No. 6.634/1979 and Decree No. 85.064/1980, mining activities in border areas must be submitted to prior approval of the National Defense Council. Companies interested in performing mining activities within the border areas must fulfill these requirements:

- At least 51% of the company's capital shares be held by Brazilians;
- At least two-thirds of the employees involved in the mining activities must be Brazilian citizens;
- The management of the company must be exercised by a majority of Brazilian individuals. Furthermore, the delegation of management or directory powers of the company to foreigners is forbidden, as stipulated in Decree #85.064/1980 (article 15, third paragraph)

[4] The wording of the Provisional Measure #789/2017 was changed in some aspects by the Law # 13.540/2017.

The legal title opinion provided by Azevedo Sette Advogados confirms that Águia Fertilizantes is in compliance with all the requirements stipulated in Brazilian Federal Law #6,634/1979 for the ownership of mineral rights located within Brazilian border areas and, thus, for the performance of mining activities within the Brazilian border areas.

4.4 SURFACE ACCESS RIGHTS FOR DEVELOPMENT

Brazilian Law grants to the titleholder of an exploration license the right to enter in the mineral right area and execute exploration activities by means of a private agreement with the landowner. Should any landowner refuse the access to a mineral right area, under article 27 of the Brazilian Mining Code, a judicial order could be obtained, through a specific lawsuit, under which the local court would guarantee the access of the titleholder to the area.

In relation to mining, the holder of the exploration license may, judicially or amicably with the land owner, obtain servitudes on the property where the mine is located, as well as on bordering and neighboring properties, with prior indemnification.

As project development moves forward, Águia will need to secure surface access rights for the lands it intends to develop. Águia has engaged Vaz de Mello, an independent consulting company to assess property values and to assist in discussions and negotiations with property owners to secure surface rights for the lands needed to develop the project.

4.5 ROYALTIES

Under terms of the Option Agreement, executed by and between CBC and Águia Metais Ltda. ("Águia Metais") on July 1st, 2011 and amended on December 13th, 2011 and March 27th, 2014, CBC is entitled to receive royalties levied at the rate of 2% (two percent) of the net revenue (royalties capped at USD10M) that results from the commercialization of the mineral products for Três Estradas, from mineral rights #810.090/1991 and #810.325/2012. However, Águia may, at any time, purchase the royalty right from CBC for USD 5,000,000, and indeed have expressed their intention to do so (as has been assumed in the economic analysis, see Item 17).

The legal opinion covers a Net Smelter Royalty (the NSR) granted to Sulliden Mining Capital (SMC). As summarized in a recent Press Release (also included in Appendix

A), Águia has repurchased the NSR from SMC, and as such it no longer has an effect.

As explained in Item 17.2.5, and elsewhere in this report, a CFEM royalty of 2% on net smelter returns, payable to the Brazilian government, has been estimated.

The legal opinion includes a description of rights forthcoming to CBC which include a pre-emptive right to acquire any calcium carbonate production in the mineral rights area, a right to purchase up to 30% of produced calcium carbonate (after exercising the option), and the issuance of 600,000 Águia shares upon exercise of the option. However, while these factors may affect share dilution or market, they do not impact the costs of the project, it's revenues, or it's NPV valuation.

4.6 ENVIRONMENTAL LIABILITIES

Properties required for the development of the open pit, beneficiation plant, tailings dam, water dam and waste piles are in the process of being acquired by Águia.

Águia is not aware of any environmental liabilities or any other royalties that may apply, other than described here and in the Title Opinion (Appendix A).

Current environmental liabilities are limited to cut lines for drilling, drill pad clearings, mud pumps and various infrastructures.

The Project will comply with the environmental provisions of the Brazilian Constitution and mining code, including:

- The rehabilitation of the surface soil or other areas adjacent to the mine or deposit in accordance with a rehabilitation plan or land use, concurrently, or with other work required in case of closure or cessation of work;
- The reinstatement of forests or other areas whose integrity has been impaired as a result of mining activities; and
- The work of exploration or exploitation of a mine or quarry will be in compliance with the obligations relating to:
  - Safety and health of personnel and the population;
  - Protection of the environment;
  - Preservation of the mine;
  - Conservation of buildings, ground safety and soundness of dwellings;

- Conditions of environmental permit license.

To the extent known, the CPs are not aware of any significant factors or risks besides those noted in this Technical Report that may affect access, title, or the right or ability to perform work on the property.

Figure 4.1 General Location Map

FIGURE 4.1

General Location Map

Figure 4.2 Três Estradas Mineral Tenure

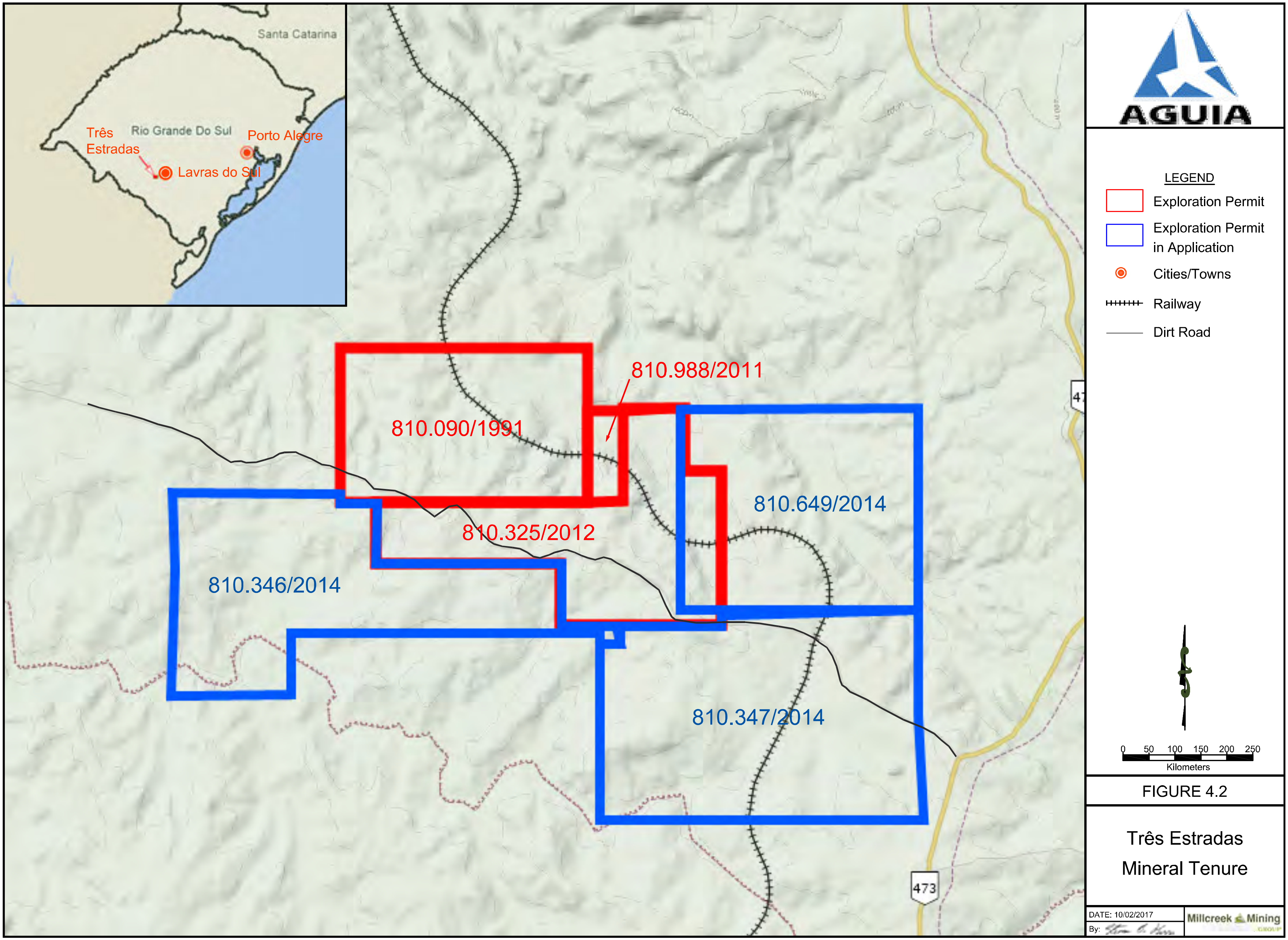


FIGURE 4.2

Três Estradas Mineral Tenure

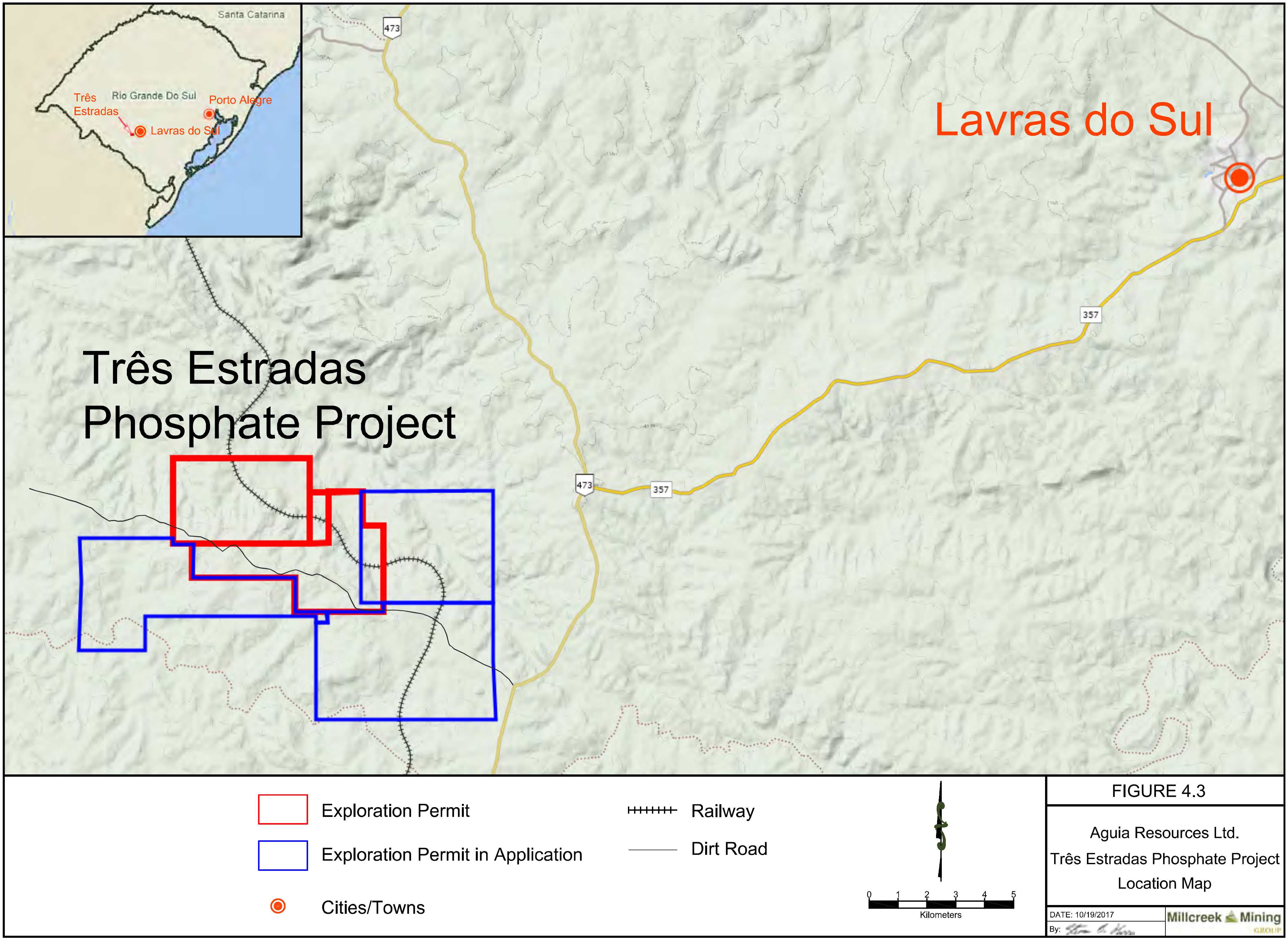
4.7 ACCESSIBILITY

The Três Estradas Phosphate Project is located approximately 30 km southwest of Lavras do Sul, located in the south-central portion of the state of Rio Grande do Sul. The project area is located approximately 320 km from Porto Alegre, the capital and largest city of Rio Grande do Sul State. Porto Alegre is a major metropolitan hub to the region with a population of approximately 4.4 million inhabitants and serviced by an international airport. A network of modern paved highways connect Lavras do Sul to Porto Alegre and other communities throughout the region. Highways BR-290, BR-392, and BR-357 are the primary links from Porto Alegre to Lavras do Sul.

Lavras do Sul is a community of 8,300 inhabitants. The town has a history founded in gold mining dating back to the 1880s. The town has a well-developed infrastructure, including an airstrip for small planes, availability of unskilled and semi-skilled mining personnel and access to non-specialized supplies. Águia bases its field operations in Lavras do Sul with an office complex and core storage facility.

From Lavras do Sul, the Três Estradas Phosphate Project area is accessed by RS-357, southwestward for approximately 23 km, then south on BR-473 for 7 km to an intersection with a secondary ranch road (Figure 4.3). The southeast corner of the property is located another 10 km northeast on the ranch road from the intersection with BR-473.

Figure 4.3 Três Estradas Phosphate Project Location Map


Santa Catarina
Três Estradas
Rio Grande Do Sul
Porto Alegre
Lavras do Sul
473
357
Lavras do Sul
Três Estradas Phosphate Project
Exploration Permit
Exploration Permit in Application
Cities/Towns
Railway
Dirt Road
0 1 2 3 4 5
Kilometers
FIGURE 4.3
Aguia Resources Ltd.
Três Estradas Phosphate Project
Location Map
DATE: 10/19/2017
By:
Millcreek Mining GROUP

4.8 CLIMATE AND PHYSIOGRAPHY

The region has a humid subtropical climate. Annual precipitation ranges from 1,300 to 1,800 millimeters (mm) and is relatively uniform throughout the year. April, May, November and December are typically the driest months of the year where monthly rainfall may fall below 100mm (Figure 4.4). Temperature ranges from 8° to 25°C between April and September and 13° to 31°C from October to March. Frost is known to occur during the winter months; the temperature occasionally reaches 40°C in the summer (Figure 4.5).

Figure 4.4 Average Monthly Rainfall for the Três Estradas Phosphate Project – INMET Station of Bagé (Normal Climate 1961-1990)

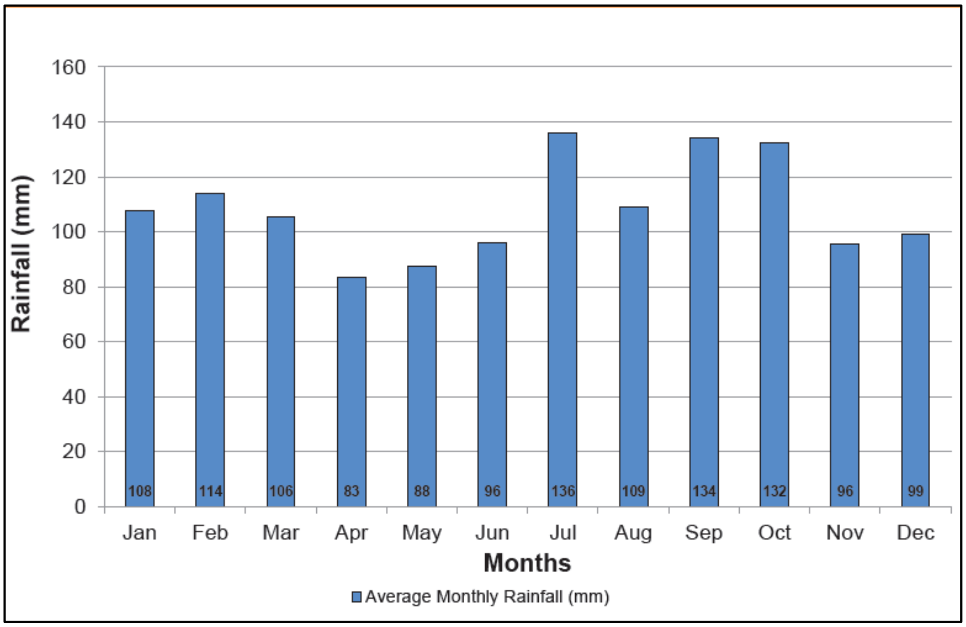
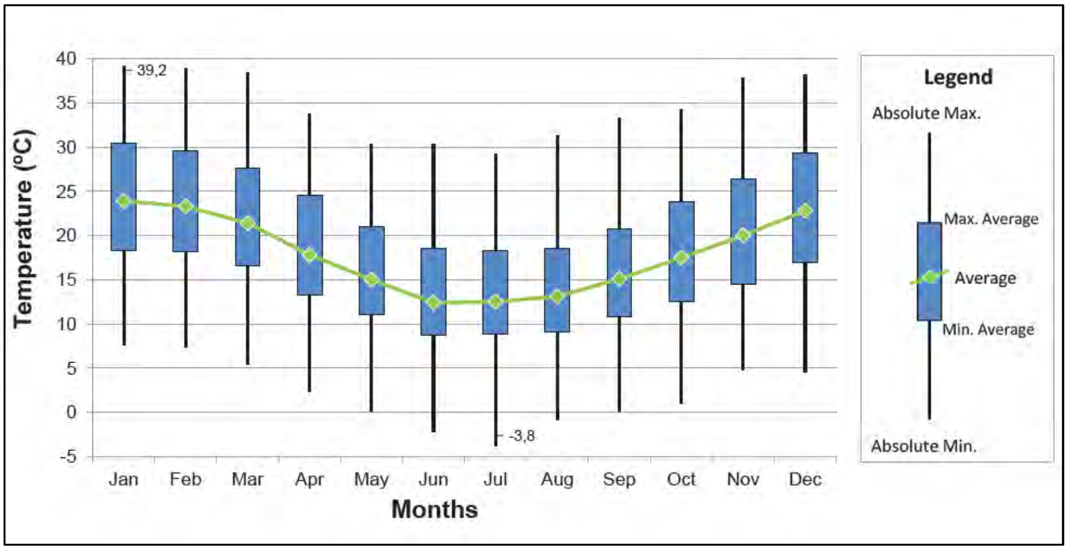


Figure 4.5 Monthly Temperature Variation in the Três Estradas Phosphate Project Region – INMET Station of Bagé (Normal Climate 1961-1990)



The landscape surrounding Lavras do Sul and the Três Estradas Phosphate Project site can be characterized as low, gently sloping hills. The gentle hills and intervening valleys are a mix of Pampas grass lands, shrubs and small to medium height trees. Três Estradas Phosphate Deposit is located between two hydrographic basins: the Santa Maria River Basin and the Camaquã River Basin. Elevation for the Três Estradas Phosphate Project area ranges from 249m to 367m with a mean elevation of 348m MASL for the deposit area.

Figure 4.6 Overview of the Três Estradas Phosphate Project Site

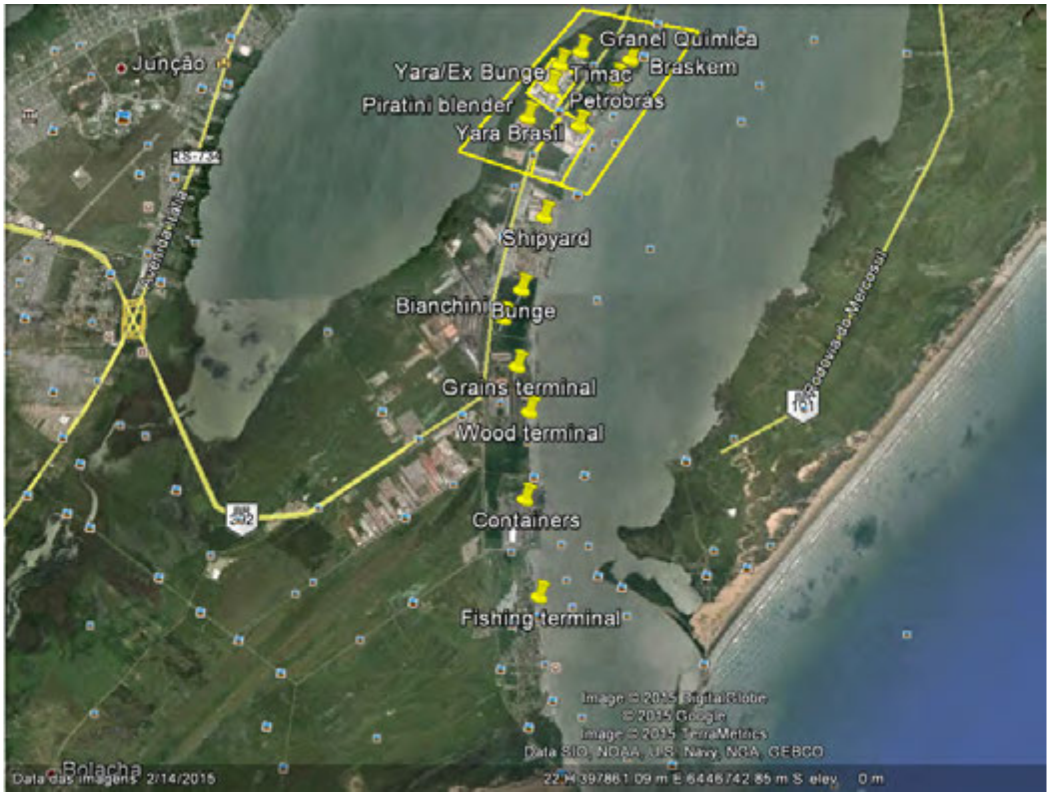
4.9 LOCAL RESOURCES AND INFRASTRUCTURE

Electric power for the region is provided by Companhia Estadual de Energia (CEEE – State Electric Power Company). CEEE has 62 substations in Rio Grande do Sul with a total capacity of 8,237.4MVA and 6,056 km of transmission lines that are supported by 15,058 structures and operate voltages of 230, 138, and 69 kilovolts.

The water supply in the Lavras do Sul and Bagé municipalities is managed by the Rio Grande do Sul State water utility, CORSAN. Regional water demands are carefully managed during the summer months when demand is high due to local rice farming in order to avoid impact on the urban supply.

A railroad crosses through the Três Estradas Phosphate Project area and through Lavras do Sul. The railroad is operated by RUMO Logistics and links the cities of Cecequi and Rio Grande. The city of Rio Grande is the largest port in the state. Figure 4.7 is an aerial image of the Rio Grande port area and delineates the area (in yellow) utilized by the fertilizer and petrochemical industries.

Figure 4.7 General Layout of Rio Grande Port Area



Google Earth, 2017

4.10 HISTORY

Lavras do Sul was originally developed in the 1880's as a gold mining camp on the Camaquã of Lavras River. In 1959, more detailed studies were organized by the DNPM, which were followed in the 1970s by major survey and sampling programs of all mineral occurrences by the Companhia de Pesquisa e Recursos Minerais (CPRM – The Geological Survey of Brazil). In recent years there have been renewed exploration activities for gold and base metals in the region by Companhia Brasileira do Cobre (CBC), Amarillo Mining, Companhia Riograndense de Mineração (CRM) and Votorantim Metais Zinco SA.

Phosphate mineralization was first observed at Três Estradas in a gold exploration program being conducted jointly by Santa Elina and CBC. Santa Elina was prospecting for gold in DNPM #810.090/1991, conducting soil, stream sediment and rock geochemistry, ground geophysical surveys (magnetrometry and induced polarization) and a limited drilling program.

Results of the soil sampling and drilling program led to the discovery of phosphate-rich rocks. A total of 944 soil samples were collected in a regular North-South grid of 400m by 500m and within detailed grids ranging from 25m by 50m to 200m by 50m.

Exploration results for gold were not encouraging and Santa Elina pulled out of the joint venture with CBC. However, the phosphate chemical analysis from two core boreholes in the DNPM #810.090/1991 area yielded results of 6.41% P_2O_5 from soil and 6.64% P_2O_5 from core. This information was communicated to CPRM. Following petrographic studies, apatite mineralization occurring in carbonatite was confirmed. This discovery was published in the proceedings of the 45° Congresso Brasileiro de Geologia (Brazilian Geology Congress), in Belém, Pará (Parisi et al., 2010), and in the Simpósio de Exploração Mineral (SIMEXMIN), in Ouro Preto, MG, in 2010 (Toniolo et al., 2010).

In July 2011, CBC entered into a partnership with Águia Metais Ltda, a subsidiary of Águia Resources Ltd., to explore and develop phosphate deposits in Rio Grande do Sul State. The two companies entered into an option agreement providing Águia the irrevocable purchase option for phosphate mineral rights. Águia exercised the purchase option the following year, granting them 100% interest in the Três Estradas deposit. Since 2011, Águia has carried out a systematic and detailed exploration program to delineate phosphate mineralization at the deposits.

In 2012 SRK Consulting (Canada) Inc., were engaged by Águia to prepare a geological model and mineral resource estimate for the project, in accordance with the JORC code. The results of additional drilling were incorporated in an updated resource estimate released by Águia in January, 2013. In April 2013, permit exploration rights for areas including Três Estradas were granted by the DNPM, and shortly thereafter SRK provided an updated mineral resource statement to reflect Águia's revised permit status.

SRK´s updated resource estimate and ITR for 2013 served as the basis for a conceptual mining study / Preliminary Economic Assessment (PEA) completed in September, 2014.

In February 2016, the Millcreek Mining Group (Millcreek) was engaged to perform an updated PEA of the project in accordance with the JORC code. The PEA was completed in July, 2016 and formed the basis of the decision to proceed with this BFS.

5 GEOLOGY

5.1 REGIONAL STRATIGRAPHY

The region surrounding Lavras do Sul consists of geologic domains within the Sul-rio-grandense Shield, a major lithotectonic assemblage in southernmost Brazil, which includes a Paleoproterozoic basement and Neoproterozoic orogenic belts linked to the Brasiliano/Pan-African cycle (Figure 5.1).

The Três Estradas Phosphate Project is situated in the Santa Maria Chico Granulitic Complex (SMCGC), part of the Taquarembó domain. The SMCGC exposes the deepest structural levels within Brazil and may represent the western edge of the Precambrian Rio de la Plata Craton. The granulite complex is bounded to the northeast by the Ibaré Lineament, to the west by Phanerozoic cover and to the south by Neoproterozoic Braziliano granites (potential melts of the granulite). The age of the granulite protolith is late Archean to early Paleoproterozoic (ca. 2.5-2.3 Ga), and can therefore be interpreted as the basement to the Taquarembó domain and as an extension of the Valentines-Rivera Granulitic Complex within bordering Uruguay.

The granulitic complex and post-tectonic granites are largely surrounded by volcanic and sedimentary cover rocks of the Camaquã Basin. These rocks were deposited as a result of Neoproterozoic to Early Cambrian post-orogenic extension.

5.2 TRÊS ESTRADAS

The Três Estradas Phosphate Project area is situated in the SMCGC, south of the northwest trending Ibaré Lineament (Figure 5.2). The area is characterized by Late Archean to Early Proterozoic rocks of the granulite complex and Neoproterozic felsic intrusive and sedimentary rocks of the Camaquã basin. The area has undergone amphibolite grade metamorphism and significant deformation throughout and following the emplacement of the granulite complex. This was followed by felsic intrusions and deposition of cover rocks during the formation of the Camaquã Basin during the Neoproterozoic and into the early Cambrian. The dominant rock types found within the local confines of the Três Estradas Phosphate Project include:

- Intermediate gneiss, amphibolite, schist, and metatonalite of the SMCGC. These lithologies have been strongly deformed and metamorphosed to amphibolite assemblages. They are interpreted to have experienced deformation during at least two tectonic events during the Paleo and Neoproterozoic, and subsequently have been affected by retrograde amphibolite metamorphism.

- Granites belonging to the São Gabriel Domain. Granites from this domain are poorly exposed. Where exposed the granites show little evidence of deformation though extensive quartz veins trending parallel to the Cerro dos Cabritos Fault are common where they are in contact with gneiss of the SMCGC.
- The Três Estradas meta-carbonatite. The meta-carbonatite is intensely recrystallized and metamorphosed to amphibolite assemblages. The carbonatite intrusion is characterized by three magmatic phases: apatite bearing pyroxenite, carbonatite and syenite.
- Medium to coarse grained, subangular to subrounded poorly sorted, white to grey sandstone of the Maricá Formation, a component of the Camaquã Basin sedimentary cover units. This unit is characterized by cross bedding, lenses of polymictic conglomerates and rhythmites associated with sandy to pelitic turbidites; and
- Quartz veins are common and are both concordant and crosscutting all lithologies. The veins can reach widths of up to 30m and can reach strike extents of up to 300m.

The majority of the Três Estradas Phosphate Project area is composed of the major rock types described above. The targeted area consists of an elongated carbonatite intrusion with a strike of 50° to 60° similar to that of the Cerro dos Cabritos Fault. Shear sense indicators suggest a sinistral sense of motion along this fault. The carbonatite and amphibolite form a tightly folded sequence with limbs dipping steeply from 70° to vertical (90°). The surface expression of the intrusion is approximately 2.5 km along strike with a width of approximately 300m.

With the exception of meta-syenite along its northeast and southeast boundaries, the carbonatite is surrounded by biotite gneiss of the SMCGC. The carbonatite is tightly folded and strongly foliated, resulting in a well-developed gneissic texture. Locally, abundant subparallel quartz veins are present resulting in elevated topographic ridges as the quartz is more resistant to weathering than the surrounding country rock. These veins range from a few centimeters to a couple of meters in width and can be up to 300m long. Also flanking the carbonatite is a minor unit of meta-tonalite with intercalated meta-carbonatite and amphibolite. The unit is characterized by gneissic banding, a gray-green color on weathered surfaces and a recrystallized granular texture.

Figure 5.1 Regional Geologic Setting

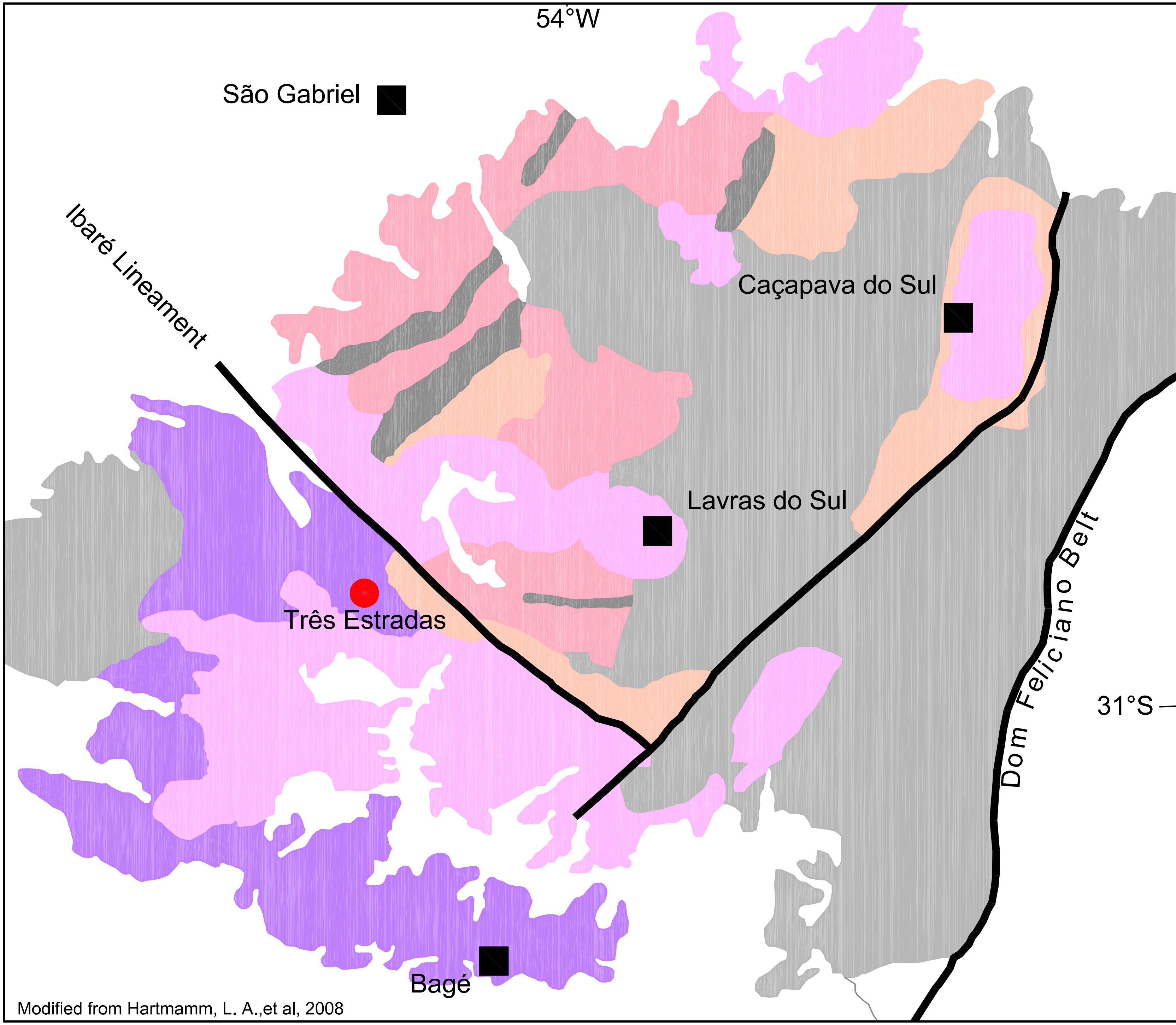


FIGURE 5.1

REGIONAL GEOLOGIC SETTING

DATE: 04/26/2016
By:
Millcreek Mining Group

The carbonatite intrusion is characterized by varying amounts of amphibolite. Amphibolite and carbonatite bands alternate on a meter- to millimeter-scale. Phosphate mineralization is disseminated and contained in apatite crystals throughout the carbonatite intrusion and in the overlying saprolite (discussed in detail in following section). Águia's current interpretation suggests that the carbonatite intrusion is formed from three magmatic phases that were later metamorphosed to an amphibolite assemblage.

5.3 MINERALIZATION

Phosphate mineralization, occurring as the mineral apatite ($Ca_5(PO_4)_3(F,Cl,OH)$), is the primary mineralization of economic interest at the Três Estradas Phosphate Project. Apatite is the only phosphate-bearing mineral occurring in the carbonatite. Phosphate mineralization occurs in both fresh and weathered meta-carbonatite and amphibolite. It also occurs as secondary mineralization in the saprolite directly overlying the meta-carbonatite and amphibolite.

Apatite is a common accessory mineral in carbonatite and ultramafic igneous deposits. The apatite forms submillimeter-sized, subhedral to euhedral crystals that are disseminated throughout the groundmass. Apatite crystals are pale in color, requiring care when observing fresh, unaltered rock. In weathered rock, apatite is resistive to weathering relative to the carbonate matrix, making then easier to identify with a hand lens.

Calcite is the primary carbonate mineral at Três Estradas and accounts for approximately 60% of the mass of the carbonatite.

Carbonatites are typically complex, multi-phase intrusions with subsequent phases showing signs of fractionation. Apatite along with anatase and magnetite tends to be dominant in early phases of an intrusion while later phases of intrusion tend to be dominated by higher concentrations of niobium and rare-earth elements. Águia geologists have noted up to three distinct phases within the cores from the Três Estradas Phosphate Project.

Figure 5.2 Três Estradas Geology Map

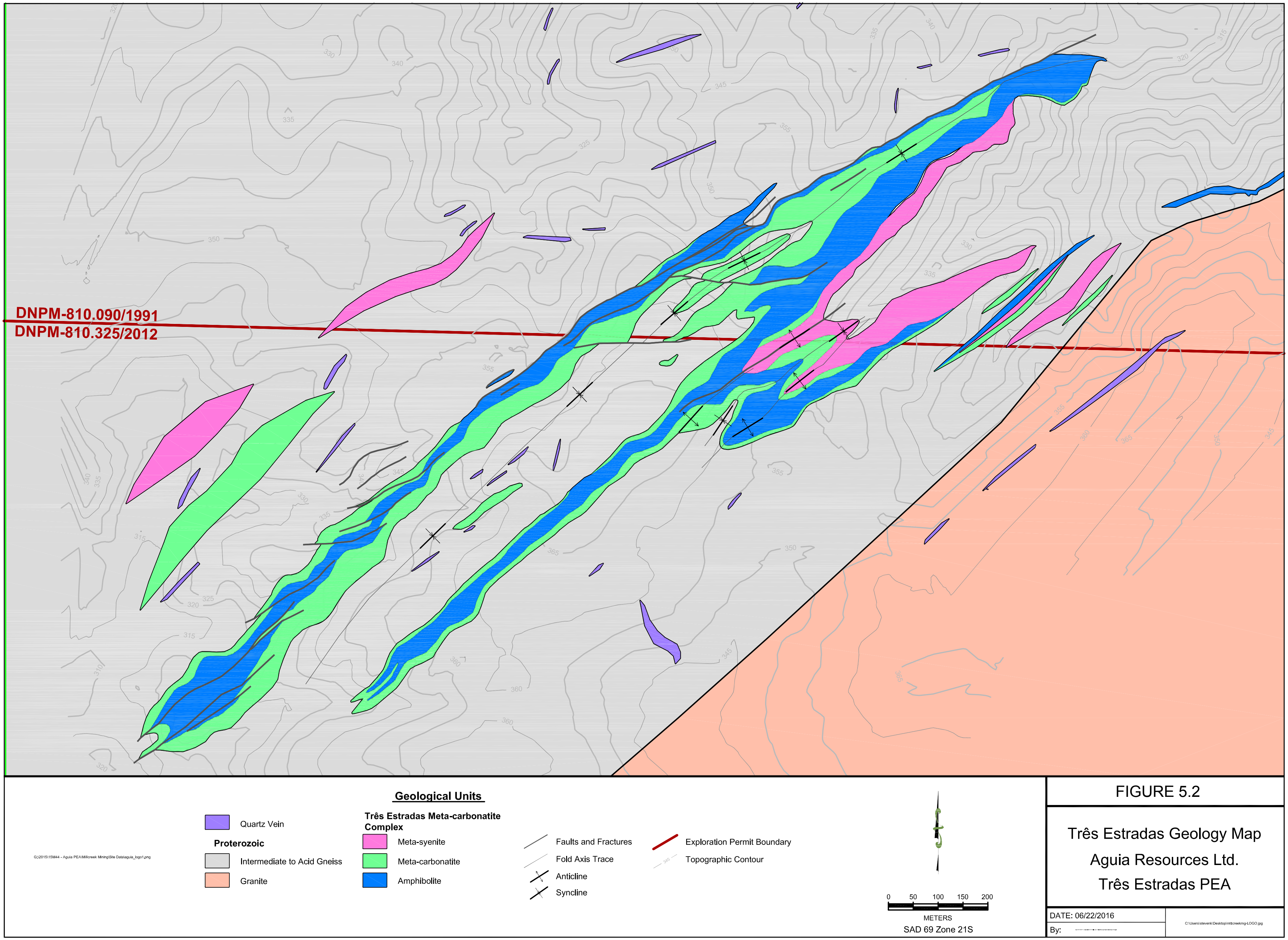


FIGURE 5.2

Três Estradas Geology Map
Aguia Resources Ltd.
Três Estradas PEA

DATE: 06/22/2016

By:

5.4 DEPOSIT TYPES

Phosphate is an important raw material that is used primarily for the production of fertilizers and for a variety of industrial applications. It occurs in both sedimentary and igneous deposits. In both types of deposits, the primary phosphate mineral is apatite. In igneous rocks appreciable quantities are most commonly found in layered mafic intrusions and carbonatite complexes. The Três Estradas deposit is a carbonatite intrusion. Carbonatite melts contain at least 50% carbonate by volume, rich in calcium, magnesium, iron and/or sodium and form as a result of fractional crystallization from silicate and carbonate-rich source rocks and/or through carbon dioxide degassing in the presence of calcium and magnesium.

Carbonatite intrusions are often complex bodies formed from multiple intrusive phases, and are typically small in size, with dimensions ranging from 1.5 to 2 km (Biondi, 2003). Carbonatites are often associated with ultramafic complexes in cratonic regions. The magma uses deep fractures as a conduit for emplacement. In an alkaline-carbonatitic ultramafic complex the first products are alkaline-ultramafic rocks and the carbonatite rock corresponds to the final phase of magma crystallization.

Carbonatite intrusions typically fall into two morphological classes: (i) central or dome type intrusions and (ii) linear type intrusions. Central-type carbonatites typically form in regions of tectonic and magmatic reactivation in stable cratons or platform regimes. They tend to be shallow seated events with high energy and are often the final fractionate of a larger alkalic intrusion. Central-type carbonatites have occurred throughout geologic history. Linear-type carbonatites are predominantly Paleoproterozic, preferential to deep faults and are typically not linked by magmatic differentiation to ultramafic rocks like central-type carbonatites.

Brazil hosts some of the best-known mineralized carbonatites in the world. Well known examples include Araxá - Minas Gerais, Catalão - Goiás, Cajati - São Paulo, and Tapira - Minas Gerais. All of these have an early Cretaceous to Eocene age range and are developed along the margins of the Parana Basin and can be classified as central-type carbonatites. Três Estradas is a linear-type carbonatite and is one of only two known linear-type carbonatite complexes known in Brazil.

The vast majority of Brazil's phosphate production is derived from the mining of carbonatite bodies and their near surface weathered products (Biondi, 2003).

6 EXPLORATION & DRILLING

Águia has been diligent following a systematic approach in its exploration programs for the Três Estradas Phosphate Project.

6.1 GEOLOGICAL MAPPING

The geological mapping of the three exploration permits was executed by Águia geologists on a scale of 1:10,000. Mapping was performed along north-south profiles at intervals of 100m. Within the area surrounding the meta-carbonatite, geologic mapping was completed at a scale of 1:1,000. Detailed mapping of the carbonatite complex was completed at a scale of 1:200.

6.2 TOPOGRAPHY

In March 2012, Águia commissioned a detailed topographic survey of the meta-carbonatite area using differential GPS technology. The survey was carried out by Planageo – Serviços e Consultoria Ltda., from Caçapava do Sul, RS, Brazil. The survey comprised 35.35 line kilometers, consisting of survey lines spaced 25m apart and control lines spaced 100m apart. In addition, relief points between the lines, borehole collars, and auger borehole collars from the first exploration campaign were used to build the topography. The topographic survey generated contour lines at 1 m intervals in the meta-carbonatite area. Contour lines at 5m intervals were obtained for the remaining area using shuttle radar topography mission (SRTM) and orthorectified Geoeye images with 0.5m resolution.

In December 2016, Águia completed an expanded detailed topographic survey of the area to cover an extended area beyond the main deposit. The air survey was carried out by SAI (Serviços Aéreos Industriais) or Industrial Air Services, using Lidar technology (light detection and ranging) including a new set of orthorectified images. The contour lines at 1 m intervals were obtained in 1:2000 scale and the adopted flight level returned orthophotographic images at 1:5000 scale.

6.3 REMOTE SENSING

Images from Landsat 7, sensor ETM+ and Geoeye-1 satellites were used to help in the geological interpretation and in the understanding of physiographic and infrastructure aspects.

6.4 SOIL GEOCHEMISTRY

Águia, in a partnership with CBC, executed a soil sampling program in the northern portion of the meta-carbonatite exposure. The program covered a small area of the meta-carbonatite along the southern edge of DNPM #810.090/91 to complement the historical soil sampling completed by Santa Elina. Soil samples were collected every 25m along lines spaced 100m apart, for a total of 52 soil samples.

Results of both soil sampling programs were used to delimit P_2O_5 anomalies in a northeast direction following the Cerro dos Cabritos Fault, to test for a continuation of the meta-carbonatite in that direction. Values higher than 1.42% P_2O_5 were considered first order anomalies and values between 0.83% and 1.42% P_2O_5, were considered second order anomalies.

6.5 ROCK GEOCHEMISTRY

A total of 77 rock samples have been collected from within the project area. The majority of these samples represent meta-carbonatite. Assay results yielded up to 32% P_2O_5 within the meta-carbonatite. Fresh or weathered carbonatite yielded mean values of 4% to 5% P_2O_5. Gneiss and meta-syenite rocks within the area did not return any significant P_2O_5 grades. Few results are available from the amphibolite unit, as outcrops are scarce in the area.

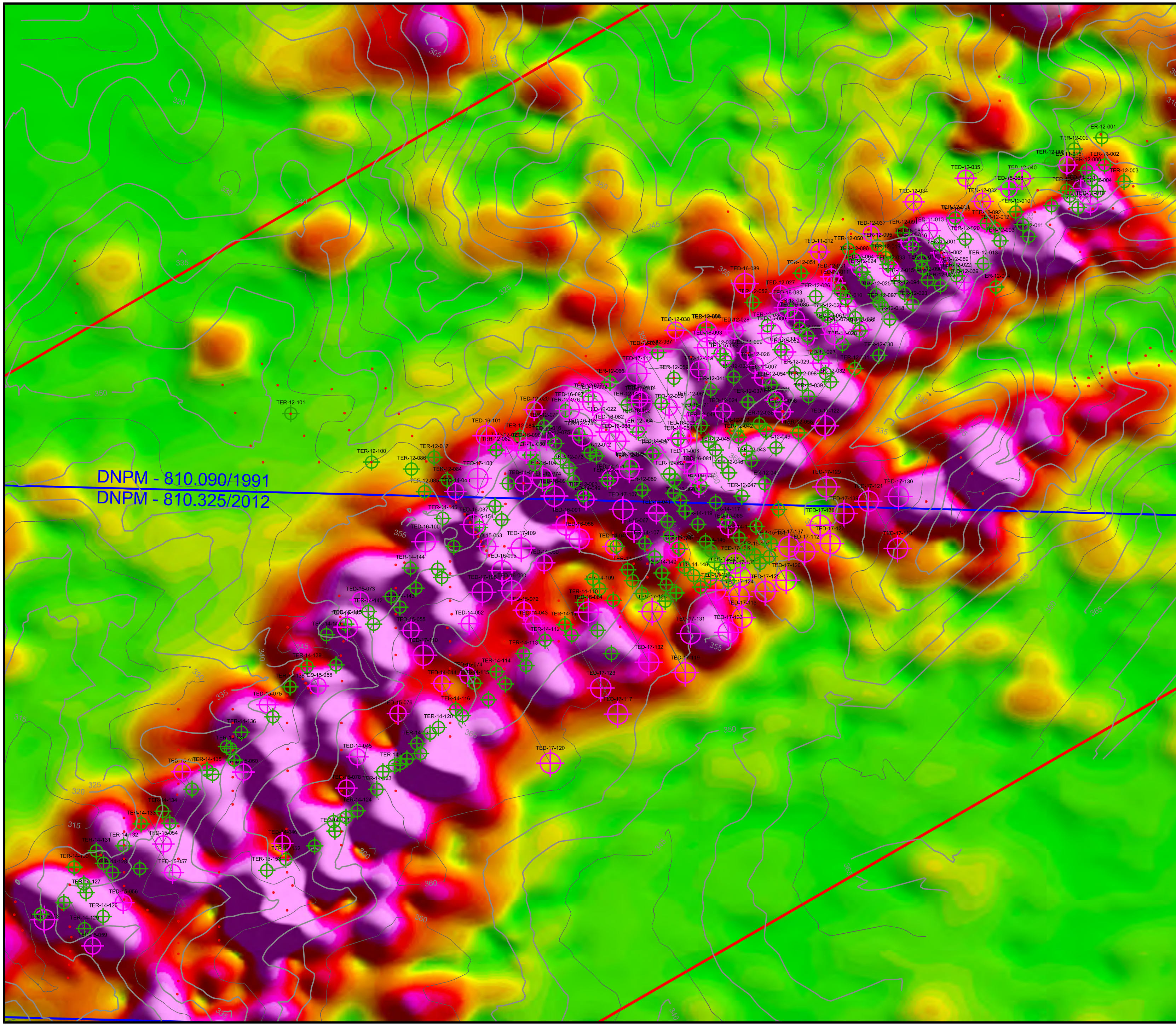
6.6 TRENCHING

One historical trench exists on the tenement, cut perpendicular to the meta-carbonatite. According to Águia, this trench was dug over 10 years ago by Santa Elina while prospecting for gold in the area. Within the trench Águia sampled three vertical channels. Within each channel, two samples were collected from bottom to top. The P_2O_5 results from these samples vary from 24.10% to 28.80%.

6.7 GEOPHYSICAL SURVEYS

Águia made use of data from an airborne geophysical survey completed by CPRM, using rectified imagery for Total Magnetic Field (TMF), signal amplitude of TMF, First Derivative of the TMF, Uranium Concentration and Total Count of Gamma spectrometry. The magnetic anomalies identified in the airborne survey assisted in delineating areas of interest and led to Águia completing a ground-based magnetic survey over the entire northern tenement area in March, 2012. The survey was carried out by AFC Geofísica, Ltda. from Porto Alegre, Brazil. The survey comprised 104 line kilometers oriented north-south. Survey lines and control lines were spaced at 25m and 100m apart respectively (Figure 6.1).

Figure 6.1 Três Estradas Phosphate Project Ground Magnetic Survey



AGUIA

License Boundary
Model Area
Core Drillhole
RC Drillhole
Auger Drillhole
Drillhole Trace
Topography Contour

0 50 100 150 200
METERS
SAD69 Zone 21S

FIGURE 6.1

Aguia Resources Ltd.
Três Estradas Phosphate Project
Ground Magnetic Survey

DATE: 10/18/2017
By:

Millcreek Mining GROUP

6.8 DRILLING

Águia has completed five drilling campaigns on the Três Estradas area between 2011 and 2017. Drilling has included 139 core holes (20,509.5m), 244 reverse circulation (RC) holes (7,800.0m) and 487 auger holes (2,481.65m). Table 6.1 presents a summary of Águia's drilling activities at Três Estradas. A complete listing of drill holes is provided in Appendix B. Drill hole locations are shown in Figure 6.2. Figures 6.3 through 6.5 shows representative cross sections of the Três Estradas Deposit. It should be noted that only data from the core and RC drilling has been used in developing the resource model.

Table 6.1 Summary of Drilling at Três Estradas

Company	Drilling Campaign	Time Period	Type	No. of Holes	Total Length (m)
Águia Resources, Ltd.	1	Oct - Nov 2011	Core	19	1,317.15
			Auger	26	169.90
	2	Jul - Oct 2012	Core	21	4,016.75
			Auger	158	994.65
			RC	105	2,151.00
	3	Nov 2014 - Jan 2015	Core	20	3,272.90
			RC	49	1,153.00
			Auger	203	818.70
	4	Oct - Dec 2015	Core	18	2,194.65
			Auger	100	498.40
	5	Nov 2016 – Jun 2017	Core	61	9,708.05
			RC	90	4,496.00
			Total	**719**	**30,791.15**

6.9 DRILLING METHODS

Águia used REDE Engenharia e Sondagens S.A. (REDE) to complete all core drilling in the five drilling campaigns at Três Estradas. Auger drilling was completed by Águia personnel and RC drilling was undertaken by Geosedna Perfurações Especiais S.A. (Geosedna). All drill collars are surveyed using differential GPS both before and after drill hole completion. Coordinates are recorded in Universal Transverse Mercator (UTM) using the SAD69 Datum, Zone 21S.

Following completion of a drill hole, collar locations are marked by concrete markers with an embedded plastic collar pipe and an aluminum tag identifying drill hole ID, UTM coordinates, azimuth, dip, and penetration depth. All core and RC drill collars are marked by concrete markers as shown in Figure 6.6.

6.9.1 EXPLORATION CORE DRILLING

All core holes were drilled using wireline coring methods. HQ size (63.5mm diameter core) core tools were used for drilling through weathered material and NQ size (47.6mm diameter core) tools were used for drilling through fresh rock. Core recovery has exceeded 90% in 97% of all core holes.

All but 10 of the core holes (129) have been drilled as angle holes with dip angles ranging from -45° to -75°, with the majority drilled at -60°. Two principal orientations have been used in core drilling. Ninety-six (96) of the core holes have an azimuth bearing of 150°, with the remaining 33 angle holes having an azimuth of 330°. Beginning in the second drilling campaign at Três Estradas, down hole surveys were completed on core holes using a Maxibore II down-hole survey tool. Readings are collected on three-meter intervals. A total of 96 core holes have received down-hole surveys at Três Estradas.

6.9.2 RC DRILLING

RC drilling was used to complete 244 holes with a cumulative length of 7,800.0m. All RC holes were drilled vertically (-90°) using 140mm button hammer bit. Holes were primarily drilled dry.

6.9.3 AUGER DRILLING

Auger drilling was completed by Águia personnel testing the extents of mineralization in the overlying saprolites. Auger holes were drilled to a maximum depth of 15m. Two tipper scarifier motorized augers were used to drill the auger holes.

6.10 COMMENTS ON DRILLING

Águia has followed standard practices in their core, RC, and auger drilling programs. They have followed a set of standard procedures in collecting cuttings and core samples, logging, and data acquisition for the project. Their procedures are well documented and meet generally recognized industry standards and practices. Millcreek considers the exploration data collected by Águia to be of sufficient quality to support mineral resource evaluation.

Figure 6.2 Drilling Locations for Três Estradas

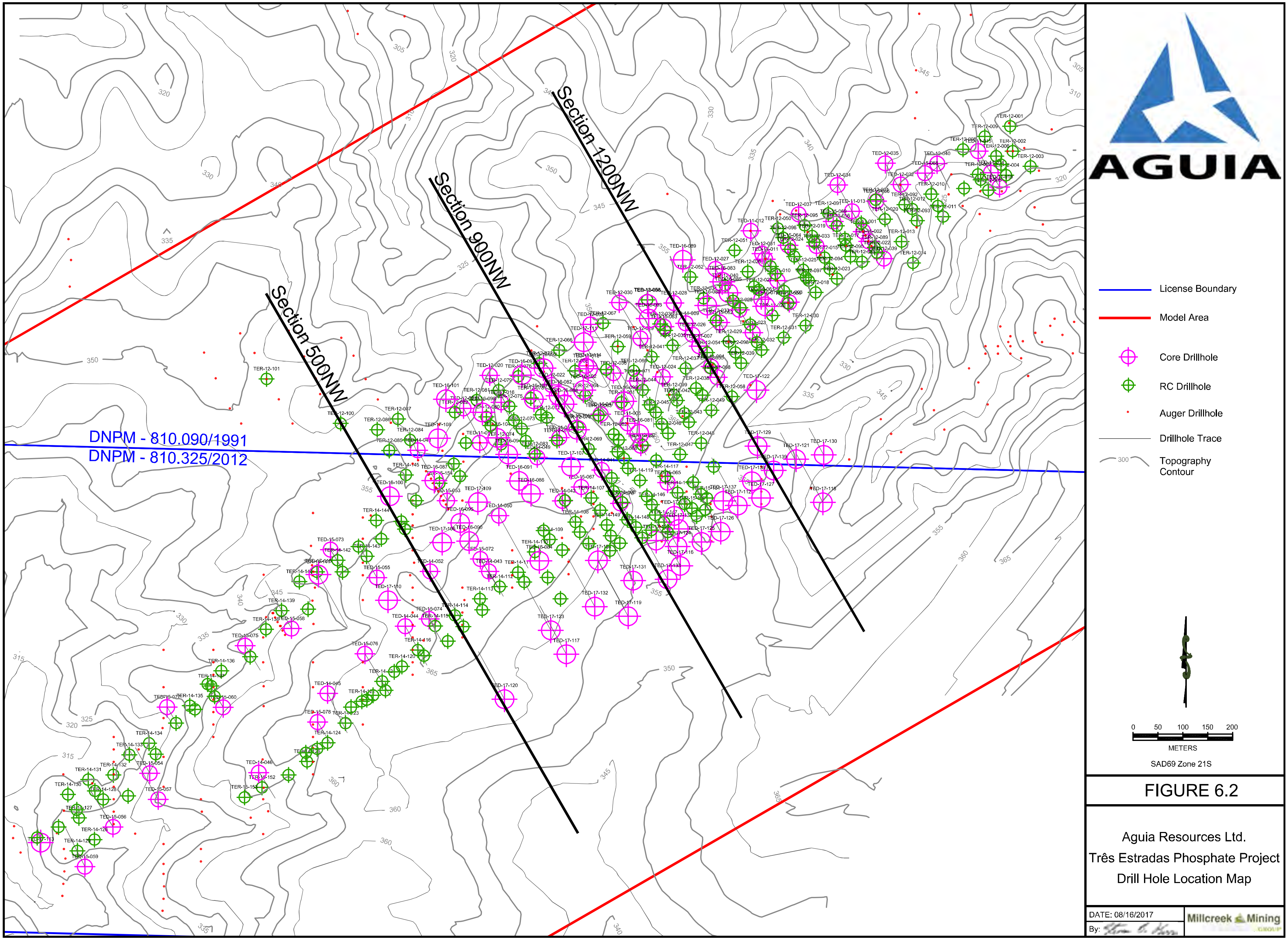


FIGURE 6.2

Aguia Resources Ltd.
Três Estradas Phosphate Project
Drill Hole Location Map

DATE: 08/16/2017
By:
Millcreek Mining GROUP

Figure 6.3 Section 500NW

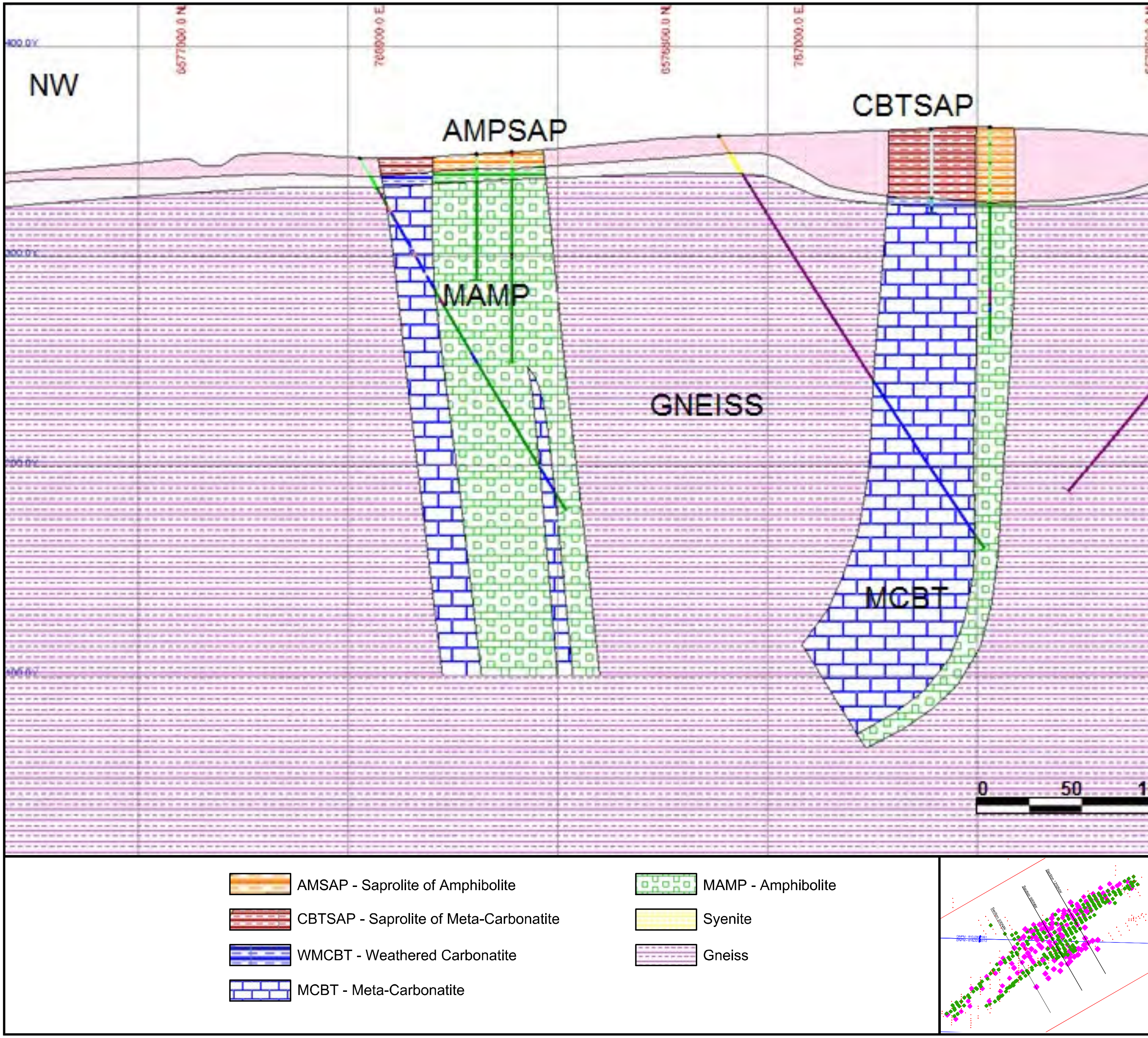


FIGURE 6.3

Três Estradas Phosphate Project

Aguia Resources Ltd.

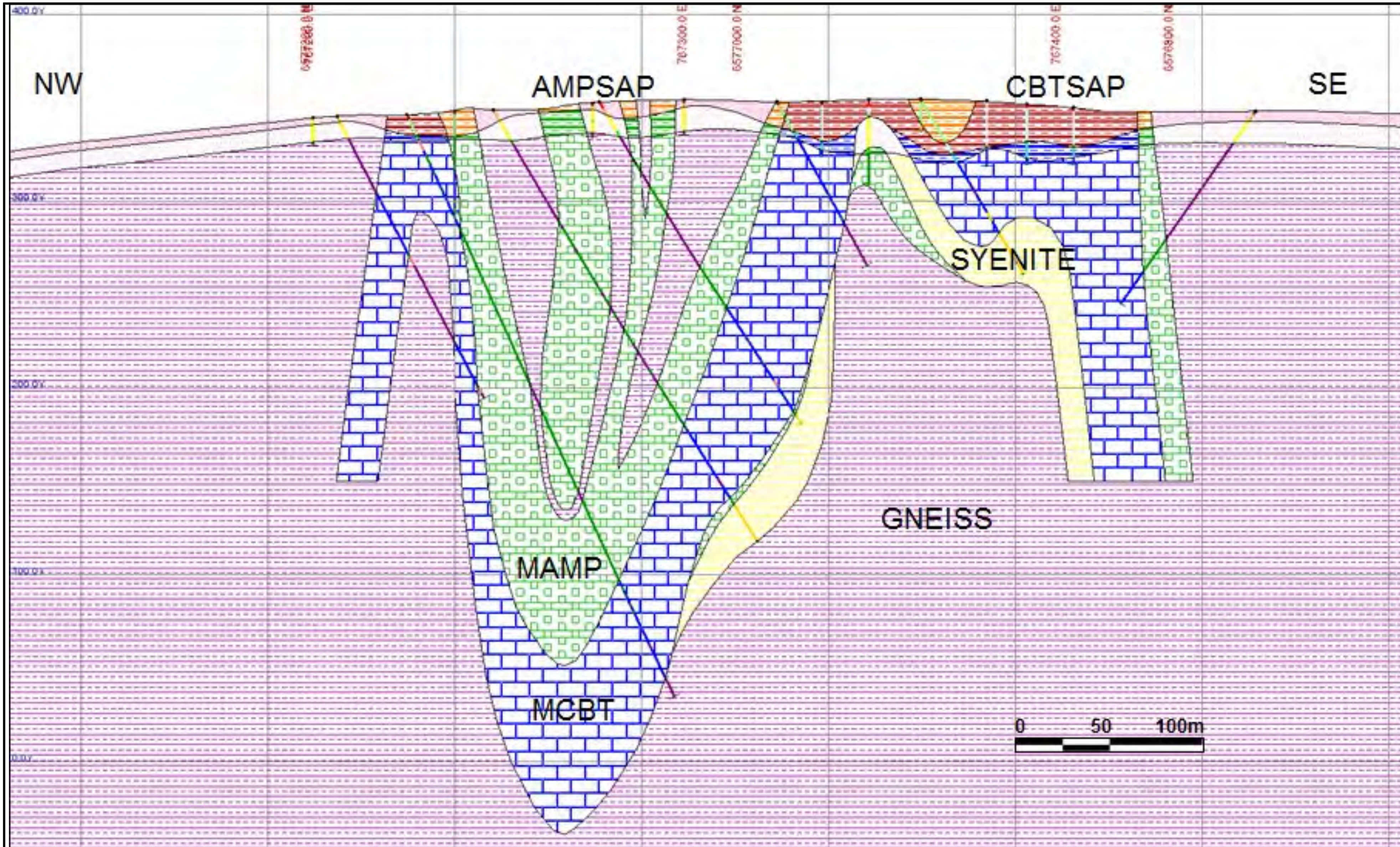
Section 500NW

DATE: 09/08/2017

BY:

Millcreek Mining Group

Figure 6.4 Section 900NW



AMSAP - Saprolite of Amphibolite
CBTSAP - Saprolite of Meta-Carbonatite
WMCBT - Weathered Carbonatite
MCBT - Meta-Carbonatite
MAMP - Amphibolite
Syenite
Gneiss

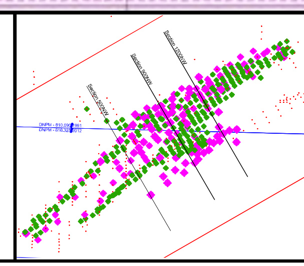


FIGURE 6.4

Três Estradas Phosphate Project
Aguia Resources Ltd.
Section 900NW

DATE: 09/08/2017
BY:

Millcreek Mining GROUP

Figure 6.5 Section 1200NW

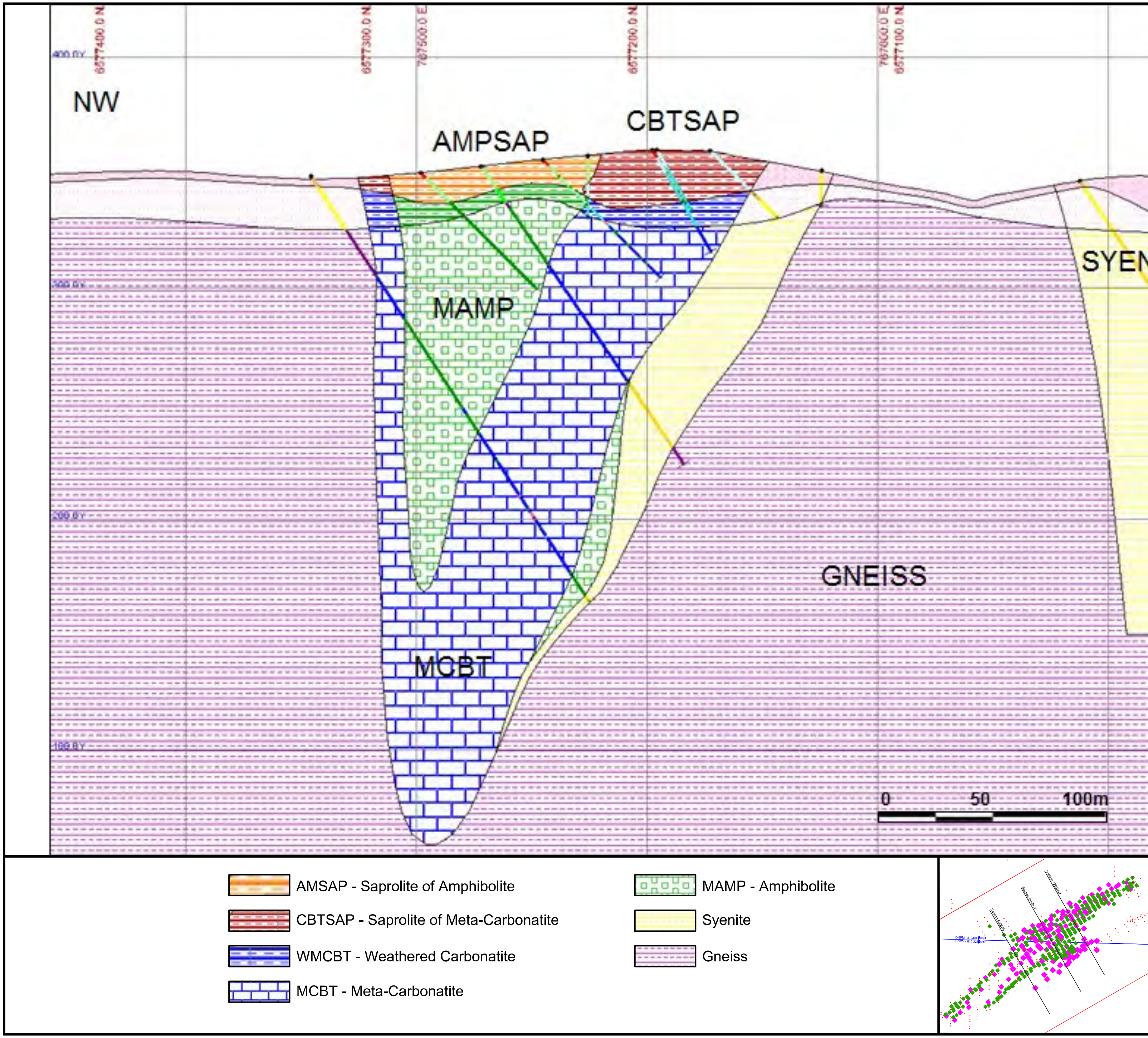


FIGURE 6.5

Três Estradas Phosphate Project

Aguia Resources Ltd.

Section 1200NW

Figure 6.6 Concrete Markers Used to Identify Drill Hole Collars: A) Core Hole marker; B) RC Hole marker

7 SAMPLING, ANALYSIS & DATA VERIFICATION

Águia has followed standard practices in their geochemical surveys, core, RC and auger drilling programs. They have followed a set of standard procedures in collecting cuttings and core samples, logging and data acquisition for the project. Their procedures are well documented and meet generally recognized industry standards and practices. Millcreek considers the exploration data collected by Águia to be of sufficient quality to support mineral resource evaluation.

7.1 SAMPLING METHOD AND APPROACH

All core and drilling samples are transported from the project sites to Águia's sample storage and preparation facility in Lavras do Sul.

7.1.1 CORE DRILLING

All core logging is completed by Águia geologists and directly entered into a comprehensive database program. Águia's geologists are responsible for identifying and marking core intervals for sampling. Sample intervals range in length from 0.15m to 6.20m with 90% of all core samples falling within the range of 0.8m to 1.2m. Águia's procedures for the sampling of core drill holes were as follows:

- The driller and/or driller's helper removes the core from the core barrel and places the core in the core tray;
- Core depths, core cut and recovery measurements are confirmed;
- Core is gently washed and rinsed of drilling muds and fluids with clean water;
- Core is then transferred to standard wooden core boxes;
- Core boxes are labeled with a metal tag denoting hole ID, box number, and depth intervals. Depth markers are inserted in the core boxes marking the depths at the start and end of each core run.
- Core is transferred at routine intervals by Águia personnel from the drill site to the sample storage and preparation facility in Lavras do Sul.
- One sampling card is completed for each sample. The sampling cards have two detachable tags that are used further in the sampling process. One tag is inserted into the core box in the interval that has been sampled and the second tag is inserted into the sample bag together with the sample.

- Each sample is assigned a unique sample number that allows it to be traced through the sampling and analytical procedures and for validation against the original sample site.
- Three readings per meter are performed with a portable x-ray fluorescence (XRF) analyzer. Each set of readings is averaged to produce a semi-quantitative P_2O_5 log. This log is referenced to ensure the proper insertion of control samples. This procedure was used during the first drilling campaign at Três Estradas and from the beginning of the second drilling campaign until the drilling of Borehole TED-12-027. Portable XRF was used as a semi-quantitative tool for screening samples. Portable XRF readings are not used in resource estimation. This procedure was abandoned with subsequent holes at Três Estradas.
- A photographic record is maintained for all core boxes with each photograph recording three boxes;
- Detailed geological logs are completed for every core hole using an appropriate logging form. Sampling intervals in the amphibolite and the carbonatite are typically targeted for a 1.0m length but may fall within a range of 0.50m to 1.50m. Samples in the un-mineralized gneiss host rock may have considerably longer lengths of up to 6.2m.
- For the weathered material, a spatula or a machete is used to split the sample into two subsamples along the core axis;
- Fresh core is split lengthwise using a core saw;
- Samples are systematically taken using the right half of the core, returning the left half of the core to the core box for archival storage. One paper tag with the sample number is inserted into the core box with the remaining left half-core to register the sampling interval.
- Samples are then packed in plastic bags and a second paper tag with the sample number is inserted into the bag for identification;
- Blanks and standards are inserted systematically;
- A geologist determines the number of standards and blanks to be sent to the laboratories by reviewing the sampling cards and sample bags;
- Archived core is stored in Águia's facility in Lavras do Sul. All sample pulps and rejects returned from the laboratory are subsequently returned for storage in Lavras do Sul.

Digital and hard copies of all sampling and shipment documentation are stored in the project office at Lavras do Sul. Documentation includes: geological logs, core photographs, core recovery records, portable XRF readings and down-hole surveys.

7.1.2 RC DRILLING

The sampling procedures for RC drilling are as follows:

- The sequential distribution of samples, as well as the sampled interval, are checked;
- Moist samples are split using a plastic liner and a metal cross-blade device. Saturated samples are dried before being homogenized.
- Dry samples are split using a Jones riffle splitter;
- Every metre drilled produces two aliquots with a minimum weight of 500g and a maximum of 2 kg. The two aliquots are identified as “archive” and “analysis”; and

The “archive” samples are identified by hole ID and the sampling interval. The “analysis” samples are identified by hole ID, sample interval and an assigned sample number.

7.1.3 AUGER DRILLING

Auger sampling procedures are as follows:

- The first 20 centimeters of cuttings is discarded;
- Samples are taken at 1 m increments;
- Sample cuttings are transferred from the auger to a plastic box and then to a large plastic sheet;
- On the plastic sheet any large pieces of sample material are manually broken apart;
- Two technicians then shake the contents onto the plastic sheet in a rolling motion to homogenize and blend the sample cuttings;
- After homogenizing the cuttings, approximately 2 kg of sample material is collected from the sample mound and labeled with auger borehole ID and depth interval;
- Throughout the drilling, a representative piece of rock is collected and stored at 1 m intervals. These samples are analyzed for phosphorus, calcium and aluminum content using a portable XRF analyzer. For every 30 readings, two standard certified materials (samples GRE-03, GRE-04) and a blank certified material are analyzed.

During each stage of the field sample preparation, a small sample is taken and archived in a purpose-build box for geological logging and for later reference;

- The portable XRF is used to screen samples for further testing at the analytical laboratory. Portable XRF is not a substitute to analytical testing performed at the commercial laboratory. Samples yielding greater than 1.31% phosphorus (equivalent to 3% P_2O_5) are forwarded on to the analytical laboratory. Samples yielding less than 1.31% Phosphorous are placed in storage.
- Certified reference samples are inserted with every 20 samples followed by a fine and coarse blank sample. Blanks were also inserted at the end of mineralized intervals;
- A batch of samples for shipment can contain samples from more than one auger borehole. However, all samples from an individual auger borehole are shipped within the same batch to the laboratory; and

Samples are shipped to the ALS or SGS laboratories, in Vespasiano, MG, Brazil in plastic bags and are labeled with the sample identification along with another label provided in a small plastic bag.

7.1.4 SAMPLE DISPATCH

Samples from drilling were transported from Lavras do Sul to Bagé, RS by Águia personnel using Águia vehicles. From Bagé, samples were transported by a commercial carrier, TNT Mercurio, to Belo Horizonte, MG. In Belo Horizonte, a dispatcher was responsible for transporting samples to the appropriate testing facility.

7.2 SAMPLING ANALYSES

From the start of exploration activities up through October, 2012, ALS Laboratory in Vespasiano, MG was the primary facility used for the analysis of soil, rock and drilling samples. After October, 2012, all subsequent samples from Três Estradas were sent to SGS Geosol, also in Vespasiano, as the primary analytical laboratory.

The ALS laboratory in Vespasiano is primarily an intake and preparation facility. Samples are crushed and pulverized into rejects and pulps and entered into the ALS tracking system before being forwarded to ALS Peru S.A. in Lima or ALS Minerals in North Vancouver, Canada. The Vespasiano facility is not specifically accredited but operates as part of the ALS Group whose management system is consistent with ISO 9001:2008 requirements. Both the Lima and North Vancouver facilities have ISO/IEC17025:2005 accreditation through the Standards Council of Canada. ALS is not specifically accredited for the methods used to analyze the samples submitted by Águia. The ALS laboratories used by Águia are commercial fee-for-service testing facilities and are independent of Águia.

The SGS Geosol laboratory is a full analytical facility. SGS Geosol is an internationally recognized mineral testing laboratory. Its management system is accredited to ISO 9001:2008 by ABS Quality Evaluation Inc., Texas, USA. SGS Geosol is not specifically accredited for the methods used to analyze the samples submitted by Águia. The SGS Geosol laboratory is a commercial fee-for-service testing facility and is independent of Águia.

Águia used blanks in the first drilling campaign that were prepared by Acme Analítica Laboratórios, Ltda in Aparecida de Goiânia, Goiás, Brazil and analyzed and certified by Acme Analytical Laboratories S.A, in Santiago, Chile. Mechanical preparation of mineral samples in Aparecida de Goiania operates as part of a management system that fulfills the requirements of ISO 9001:2008. Acme Santiago is accredited under ISO/IEC 17025:2005 by the Standards Council of Canada (accredited laboratory no. 764). Acme is not accredited for the specific methods used to analyze the samples submitted by Águia.

Águia also commissioned two laboratories at the University of São Paulo (Technological Characterization Laboratory and Ore Treatment Research Group) to carry out a mineralogical characterization study and a beneficiation study. Though both labs are highly reputable research facilities, they have not undergone any accreditation programs common with commercial laboratories. At the University of São Paulo, the mineralogical analysis included scanning electron microscope (SEM) with an energy dispersive spectrometer (EDS) and employed a mineral liberation analysis (MLA) routine.

Beneficiation studies were performed first at the University of São Paulo (USP). Studies were also performed at SGS Lakefield, Canada that basically reproduced the USP results with slight improvements. SGS Lakefield is a recognized facility, meeting ISO/IEC 17025 standards for 67 specific registered tests for the minerals industry, including flotation tests performed for Águia. Finally, we have recent beneficiation work from Eriez USA that are of outstanding quality. Beneficiation testing completed by USP, SGS Lakefield, and Eriez USA were completed on a commercial, fee-for-service basis.

7.2.1 SOIL SAMPLES

Soil samples were collected from the B Horizon of the soil profile. Sample locations were excavated completely to the base of the B Horizon before collecting a representative 2 kg sample. Both ALS and SGS were used for soil geochemistry. Since Três Estradas started out as a gold exploration play, samples were analyzed for gold using fire assay with an atomic absorption finish and a 31 element analytical package using inductively coupled plasma (ICP) spectrometry. Soil samples were sent for analysis to SGS Geosol in Belo Horizonte. Samples of 50 grams passing 80 mesh were analyzed for gold using fire assay with an atomic absorption finish and for a suite of 31 elements using ICP.

7.2.2 ROCK SAMPLES

Rock samples were collected in order to represent every distinct lithology outcropping over the entire project area. All samples were screened using a portable XRF unit. Samples yielding more than 3% P_2O_5 were shipped to the laboratories (ALS and/or SGS Geosol) for preparation and laboratory analysis. Samples were weighed and dried to a maximum of 120°C and crushed to 70% passing through a 2mm screen. A 250g split was then pulverized to 85% percent passing 75µm to produce the analytical pulp. Samples underwent two analytical procedures. XRF was used to determine major oxides: Al_2O_3, CaO, Fe_2O_3, K_2O, MgO, MnO_2, Na_2O, P_2O_5, SiO_2, and TiO_2. XRF uses a sample fused with lithium metaborate. The loss on ignition (LOI) from the analysis is calculated from the difference in weight of a 1.0g sample prior and after placing the sample in an oven at 1,000 °C for one hour, then allowing the sample to cool. Samples were also analyzed for a suite of 31 minor, trace and rare-earth elements using an aqua regia digestion and ICP - Mass Spectrometry.

7.2.3 AUGER, CORE AND REVERSE CIRCULATION SAMPLE

XRF analysis has been used to determine major oxide amounts on all auger, core and RC samples following the same procedures outlined above for rock samples. Sample pulps are fused with lithium metaborate and analyzed by XRF for Al_2O_3, CaO, Fe_2O_3, K_2O, MgO, MnO_2, Na_2O, P_2O_5, SiO_2, and TiO_2. All oxides are reported in weight percent. In addition, samples from the first campaign of drilling at Três Estradas were also subjected to the 31 element ICP analysis.

7.2.4 SPECIFIC GRAVITY MEASUREMENTS

During the first drilling campaign in 2011, the specific gravity of 48 core samples were measured by SGS Geosol using a standard weight in water and weight in air methodology. Uncut core segments of approximately 15 to 20 centimeter lengths were wrapped in PVC film and submerged in water. Águia took over this testing with all subsequent drilling following the same procedures used by SGS Geolsol. To date, 4,216 specific gravity measurements have been determined for Três Estradas.

7.3 DATA VERIFICATION

The CPs completed a site visit to the Três Estradas project site on March 17, 18 and 19, 2016. The site visit confirmed the location and access routes of previous and current exploration activities. The CPs were able to visit outcrops hosting phosphate mineralization, view exposures of surrounding country rock, as well as visiting numerous drill sites at both project areas. During the site visits, photographs and GPS coordinates were taken at drill sites and outcrops that were later compared to coordinates in the drilling databases and maps provided by Águia. The CPs also spent time at Águia's core storage and logging facility in Lavras do Sul where they were able to examine drill core, review procedures used in logging, archiving information, density measurements and sample preparation.

A second site visit was made to the property by the Geology CP on March 8 and 9, 2017. The purpose of this site visit was to review the outcome of the delineation drilling carried out during the previous few months and to observe first-hand the drilling currently underway to test mineralization in the new zone located along the southeast side of the main deposit. The CP was able to observe drilling that was underway by two core rigs on the new zone as well as drilling that was ongoing for geotechnical/hydrological characterization and comminution sampling. In total, there were four core rigs operating at the time of the site visit.

During the second site visit, the Geology CP reviewed core and working cross-sections of the recent delineation drilling and from core from recently completed holes in the new zone. During the site visit, the CP selected a list of 85 coarse reject samples to be used as an independent confirmation program.

7.3.1 VERIFICATION OF CORE LOGS

During our first site visit, Millcreek submitted a list of randomly selected core holes for Águia to retrieve from storage for Millcreek to examine in detail. Table 7.1 provides a listing of core holes examined by Millcreek. The core storage and logging facility has a large viewing area outdoors but is under cover for viewing the core, which allowed the CPs to lay out the core boxes for up to four complete core holes at a time for examination. The cores were directly compared to the original logs prepared by Águia geologists to verify intervals and measurements, lithologic, and alteration descriptions. Our detailed review of the cores with logging records found no discrepancies. The logs Millcreek reviewed with the cores show a good level of detail in the descriptions and consistency in nomenclature and terminology. During the second site visit, an additional

11 core holes that were part of the recent delineation drilling campaign and drilling on the new zone were examined.

Table 7.1 Selected Core Holes for Detailed Examination

2016 Site Visit	2017 Site Visit
TED-11-001	TED-16-091
TED-11-002	TED-16-095
TED-11-004	TED-17-109
TED-11-006	TED-17-112
TED-11-008	TED-17-116
TED-12-024	TED-17-117
TED-14-043	TED-17-118
TED-15-065	TED-17-119
TED-15-067	TED-17-120
	TED-17-121
	TED-17-122

7.3.2 DATABASE VERIFICATION

Millcreek completed a series or routine verifications to ensure reliability of the compiled databases provided by Águia. This work including checking the compiled databases with assay certificates for both core and RC drill holes. Twenty-four (24) core holes and 36 RC were reviewed against the assay certificates. More than 15% of the drill holes and 15% of the assays were audited against the laboratory assay certificates. Table 7.2 identifies the drill holes audited against assay certificates.

Table 7.2 Database Verification Holes

Core Holes		RC Holes		
TED-11-007	TEC-15-071	TER-12-013	TER-12-078	TER-16-162
TED-11-015	TED-15-076	TER-12-020	TER-12-088	TER-16-169
TED-11-019	TED-16-083	TER-12-024	TER-12-090	TER-16-176
TED-12-025	TED-16-084	TER-12-026	TER-12-095	TER-16-184
TED-12-029	TED-16-092	TER-12-031	TER-14-106	TER-16-191
TED-12-033	TED-16-102	TER-12-034	TER-14-117	TER-17-199
TED-14-043	TED-17-107	TER-12-037	TER-14-130	TER-17-207
TED-14-050	TED-17-111	TER-12-045	TER-14-136	TER-17-213
TED-15-054	TED-17-116	TER-12-059	TER-14-145	TER-17-222
TED-15-055	TED-17-122	TER-12-062	TER-15-150	TER-17-230
TED-15-061	TED-17-132	TER-12-064	TER-15-153	TER-17-237
TED-15-068	TED-17-137	TER-12-074	TER-16-155	TER-17-242

7.4 QUALITY ASSURANCE / QUALITY CONTROL (QA / QC)

For quality assurance and quality control of analyses, Águia uses a combination of reference samples, blanks, duplicate samples and umpire check assays. Águia follows a protocol for accepting/refusing each batch of assays returned from the analytical laboratory:

- If a reference sample fails between two and three standard deviations and no other failure occurs in the batch, the batch is accepted;
- If a reference sample fails beyond three standard deviations the reference sample is classified as a failure;
- If two or more reference samples fail between two and three standard deviations in a batch, the batch is deemed a failure;
- If both blank samples (coarse and fine) fall over the warning line, the batch is classified as a failure until the next blank sample sequence;
- If a duplicate sample exceeds 5% difference over the mean of the original and duplicate sample and no other failure occurs with other duplicates samples in the batch, then the batch is accepted.

Reference, blanks and duplicate samples were inserted into the stream of drill samples such that one in 20 samples was a reference sample, one in every 30 samples was a blank sample, and one in every 30 samples was a duplicate sample. Care has been taken in the sequencing to distribute references and blanks so that reference and blanks didn't immediately follow each other, though a coarse-grained blank does immediately precede a fine-grained blank to track carryover contamination. Tables 7.3 and 7.4 summarize the samples used to evaluate QA/QC of the drilling samples.

Table 7.3 Summary of Quality Control Samples for Três Estradas

Type		Core	%	RC	%	Total	%
Sample Assays		16,046	67.29	7,800	32.71	23,846	100.00
Reference Samples	**GRE-3**	15	0.06	104	0.44	119	0.50
	GRE-4	182	0.76	0	0.00	182	0.76
	ITAK-910	561	2.35	192	0.81	753	3.16
	ITAK-911	57	0.24	102	0.43	159	0.67
Blanks	**Fine**	466	1.95	237	0.99	703	2.95
	Coarse	470	1.97	237	0.99	707	2.96
Check Assays		478	2.00	301	1.26	779	3.27
Duplicates		733	3.07	412	1.73	1,145	4.80
Total QA/QC Samples						**4,547**	**19.07**

7.4.1 REFERENCE SAMPLES

During the first two drilling campaigns at Três Estradas, Águia used two certified control samples, GRE-3 and GRE-4, prepared by Geostats Pty. The reference samples were certified for phosphorous and several trace elements (P reported in ppm and converted to wt.% P_2O_5 by Águia). The control samples are not certified for the other five oxides considered in the resource evaluation. ALS delivered consistent P_2O_5 results, mostly within two standard deviations and always within three standard deviations. With all subsequent drilling at Três Estradas, Águia had two samples prepared by Instituto de Technologia August Kekulé (ITAK) to be used as certified reference samples. Both samples were prepared from carbonatite material sourced from Três Estradas. Reference samples were inserted at regular intervals with each batch of samples sent to the laboratory. Table 7.4 summarizes the characteristics and analytical results for the reference samples utilized with the drilling at Três Estradas.

Table 7.4 Três Estradas Reference Samples

Reference Sample	GRE-3	GRE-4	ITAK-910						ITAK-911					
	P_2O_5	P_2O_5	P_2O_5	CaO	SiO_2	MgO	Al_2O_3	Fe_2O_3	P_2O_5	CaO	SiO_2	MgO	Al_2O_3	Fe_2O_3
Certified Value	15.23	6.19	4.42	39.70	7.71	6.10	1.27	6.92	11.06	18.52	26.64	5.67	5.40	19.44
Standard Deviation	0.08	0.03	0.10	0.67	0.08	0.10	0.05	0.12	0.18	0.28	0.21	0.10	0.20	0.13
Estimated Uncertainty	0.22	0.10	0.21	1.40	0.17	0.20	0.10	0.24	0.37	0.57	0.43	0.20	0.41	0.27
Sample Count	119	182	753	753	753	753	753	753	159	159	159	159	159	159
Average Value	15.02	6.09	4.40	39.89	7.63	6.07	1.24	6.96	10.86	18.44	26.35	5.59	5.23	19.36
Minimum	14.70	5.95	4.18	38.30	7.32	5.72	1.16	6.62	10.51	17.80	25.60	5.40	5.04	18.80
Maximum	15.55	6.45	4.57	42.30	8.11	6.50	1.62	7.43	11.13	18.80	26.90	5.82	5.46	20.10
Standard Deviation	0.16	0.08	0.63	0.42	0.09	0.11	0.34	0.11	0.11	0.16	0.24	0.09	0.06	0.28

7.4.2 BLANK SAMPLES

Blank samples are used to monitor physical contamination during sample preparation. A coarse-grained blank was created using locally-sourced quartz. The coarse-grained blank is used to track possible carryover contamination of samples through crushing and pulverizing of samples. The fine-grained blank is used to monitor and track any other signs of physical contamination that may affect analytical results. Table 7.5 summarizes the characteristics and analytical results for the two blank samples.

Table 7.5 Blank Sample Characteristics

Sample	Parameter	P_2O_5%	CaO%	SiO_2%	MgO%	Al_2O_3%	Fe_2O_3%
Coarse Blank	Average Value	0.012	0.022	98.000	<0.1	<0.1	0.642
	Detection Limit	0.010	0.010	0.100	0.100	0.100	0.010
	Upper Warning Limit (Avg + 5X Detection Limit)	0.062	0.072	98.500	0.500	0.500	0.692
	Lower Warning Limit - SiO2(Avg-2X Detection Limit)			97.800			
Fine Blank	Average Value	0.012	0.022	98.000	<0.1	<0.1	0.642
	Detection Limit	0.010	0.010	0.100	0.100	0.100	0.010
	Upper Warning Limit (Avg + 3X Detection Limit)	0.042	0.052	98.300	0.300	0.300	0.672
	Lower Warning Limit - SiO2 (Avg - 2X Detection Limit)			97.800			

Blank samples were analyzed for six oxides utilized by Águia to evaluate the mineral resource (P_2O5, CaO, Al_2O_3, Fe_2O_3, MgO, and SiO_2). The most relevant of these oxides (P_2O_5) typically yielded values below the 0.062% upper warning limit for coarse blanks and is always below the 0.04% upper warning limit for fine blanks. Four of the remaining oxides, CaO, Al_2O_3, Fe_2O_3, MgO, commonly yielded values over the upper warning limits on coarse blanks and occasionally with the fine blanks. Coarse blanks yielded considerably more results over the upper warning limit than fine blanks, particularly for Al_2O_3 and MgO. Values for Fe_2O_3 are consistently above their respective warning limits, though this might reflect contamination from crushing and grinding. Fe_2O_3 was not determined in the coarse blank samples assayed by SGS. Figures 7.1 and 7.2 displays the results of the coarse and fine blanks, respectively.

Figure 7.1 Coarse Blanks

FIGURE 7.1 COARSE BLANK SAMPLES

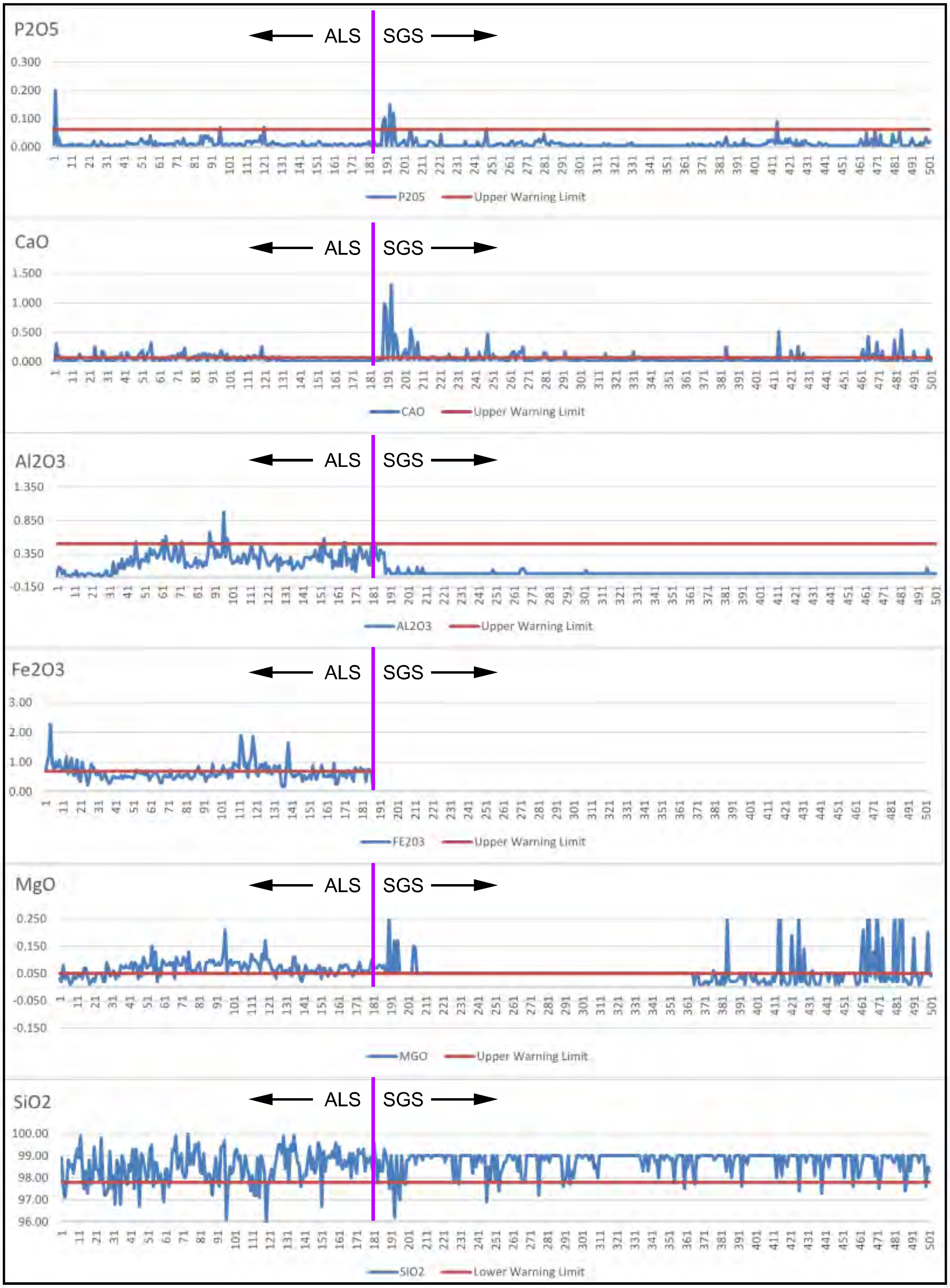
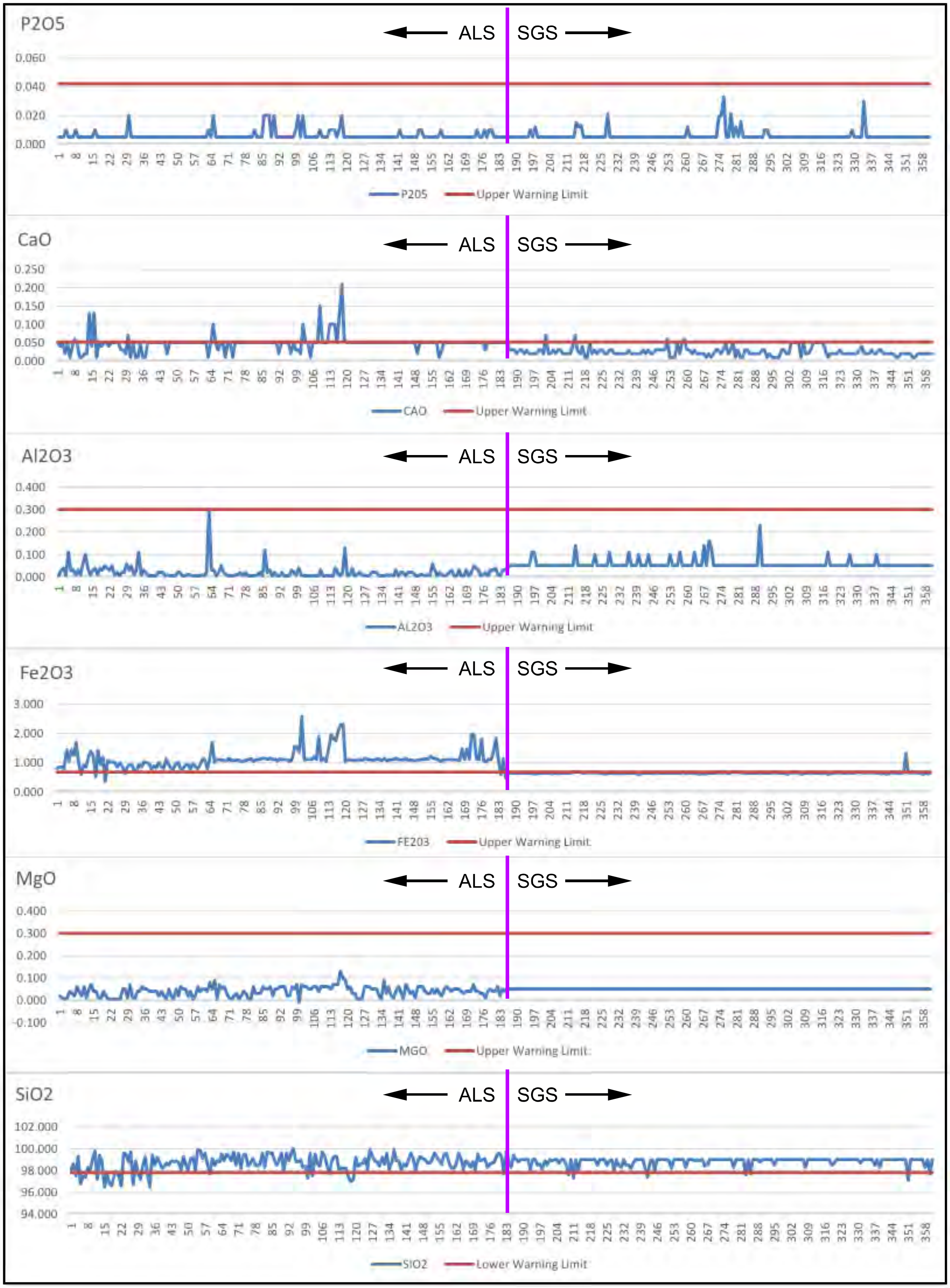


Figure 7.2 Fine Blanks

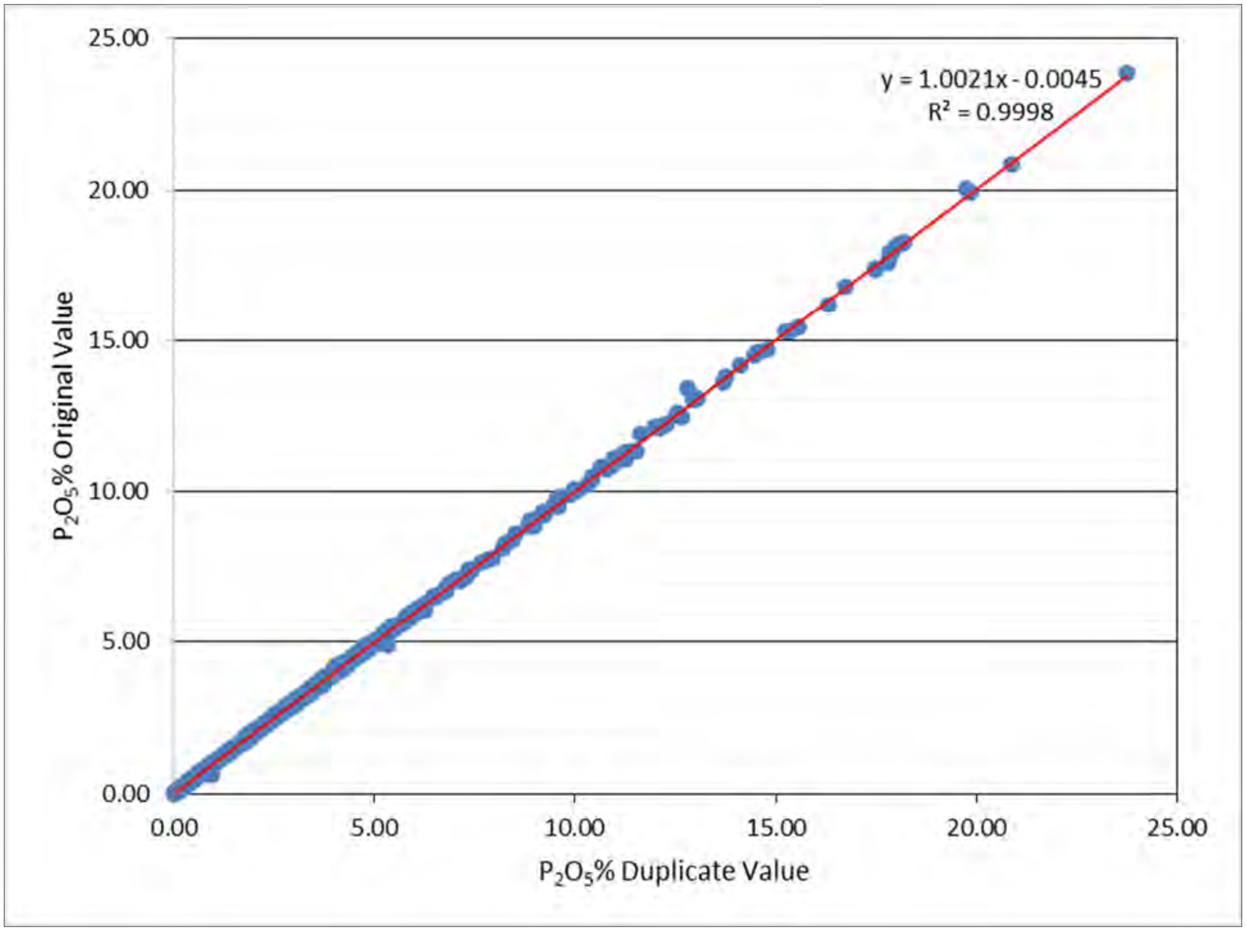
FIGURE 7.2 FINE BLANK SAMPLES



7.4.3 DUPLICATE SAMPLES

Duplicate samples are used to track analytical precision. Duplicate samples are prepared by creating two identical samples for an interval. The second pulp is re-inserted with a blind identity into the submitted samples. There are 1,145 pairs of duplicate samples for Três Estradas. Figure 7.3 compares the results of the duplicate samples with the original pulps. Comparison of duplicates to original samples show a very good correlation coefficient (R^2) equal to 0.9999 for Três Estradas. Only one pair of duplicates have a rank absolute difference (HARD) in excess of 10%.

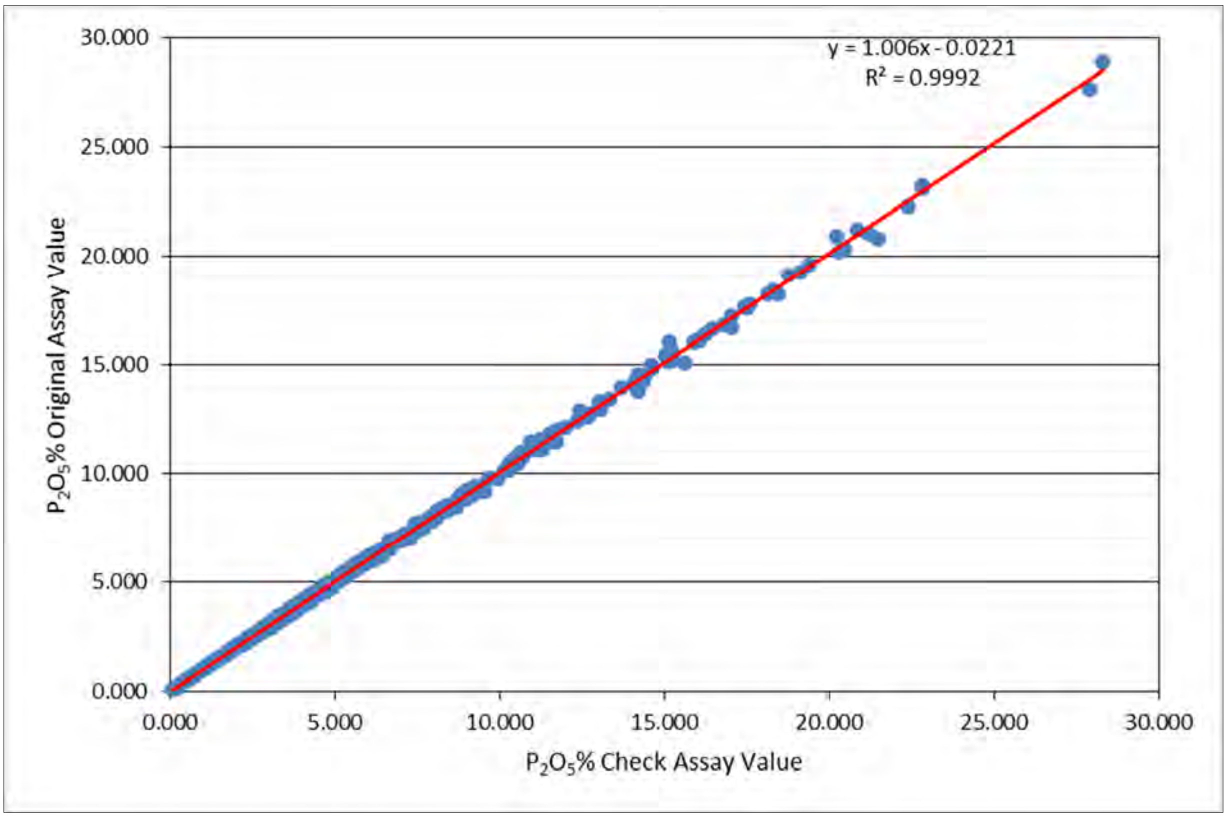
Figure 7.3 Comparison of Duplicate Samples for Três Estradas



7.4.4 CHECK ASSAYS

Selected samples are routinely subject to a second umpire analysis as a further check to laboratory performance. During the first two drilling campaigns at Três Estradas, ALS was the primary lab and SGS was used for umpire assays. With subsequent drilling at Três Estradas, SGS became the primary laboratory and ALS was used for umpire testing. There are 713 check assays for Três Estradas showing a strong correlation with R^2 equal to 0.9992. Only one sample has a HARD value in excess of 10%. Figure 7.4 compares the results of the check assays for P_2O_5.

Figure 7.4 Comparison of Check Assays with Original Assay Values

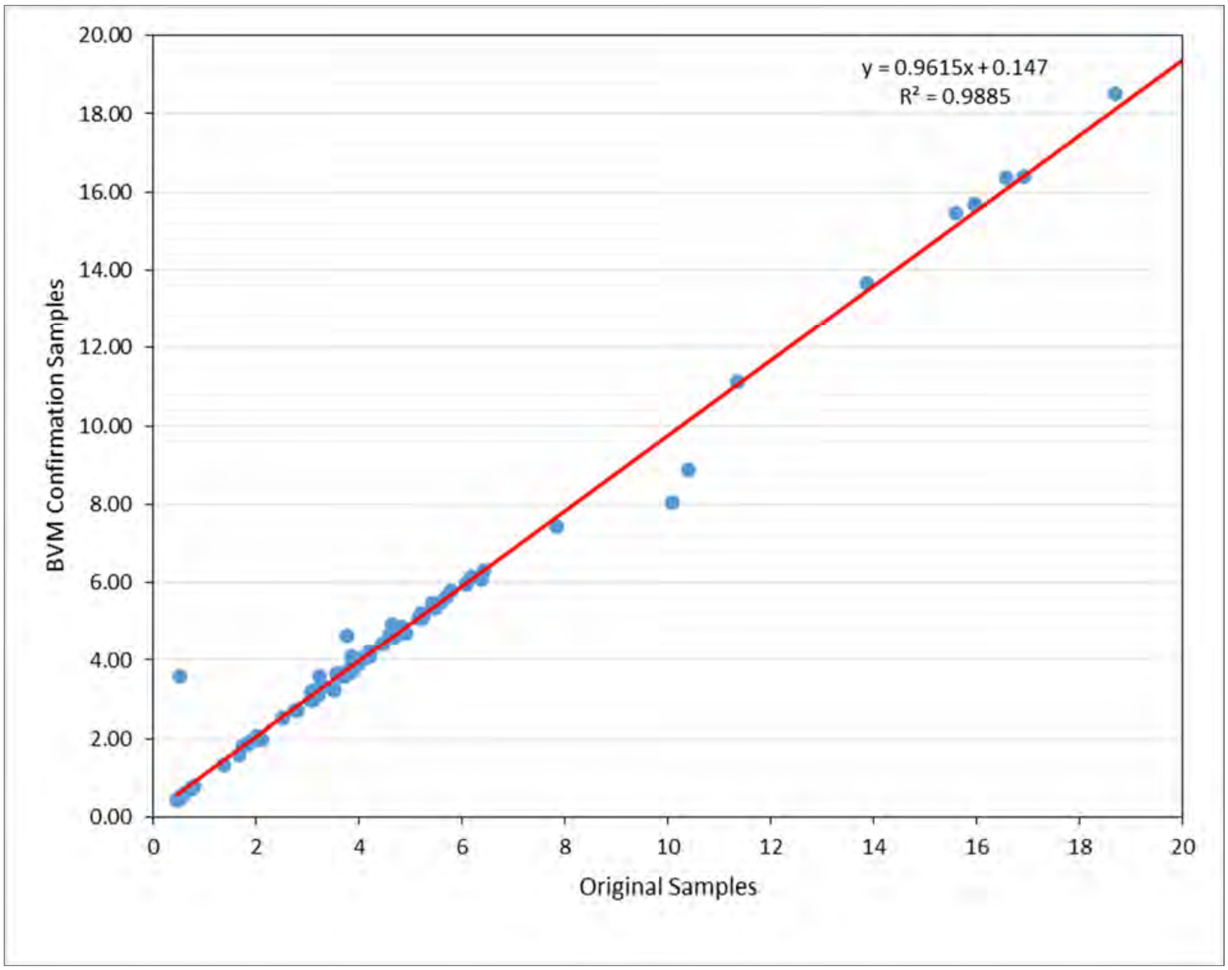


7.4.5 CONFIRMATION TESTING

During the second site visit, the Geology CP selected a suite of 85 coarse reject samples for confirmation testing. The selected suite of samples represents each phase of drilling, is spatially representative of the deposit and mineral domains and from both core and RC drilling. The selected samples also include five each of reference samples ITAK-910 and ITAK-911 and blank QF-08. Samples were sent to Bureau Veritas

Minerals in Vancouver, BC for XRF analysis. Eighty-two of the samples compare closely with the original samples. Three samples have HARD vales that exceed 10% and upon closer inspection, one of these samples has oxide values that indicate the sample is amphibolite when it should be meta-carbonatite. Figure 7.5 compares the results of the confirmation samples for P_2O_5%.

Figure 7.5 Comparison of Confirmation Assays with Original Assay Values



7.4.6 QA / QC CONCLUSIONS

References, blanks, duplicates and check assays show a strong continuity in the dataset without any significant anomalies. The CPs are of the opinion that the data used in this report adequately depicts the geology and mineralization. The data is sufficient for resource estimation.

8 METALLURGICAL TESTING

8.1 INTRODUCTION/ SUMMARY

Mineral processing and metallurgical testing for the Três Estradas Phosphate project has been ongoing since 2012. Over that time the understanding of the metallurgical properties and characteristics of the ore and its response to various processes to concentrate and recover phosphate has gradually improved as a series of studies have steadily increased their relevance and level of detail. The most current level of work reflects a well-developed and considered approach to phosphate recovery that is optimized and verified to a level suitable to support a selection of a process route as well as the basis for preliminary equipment sizing.

Metallurgical and process testing began in 2012 with a bench-top study that covered mineralogical composition, particle size distribution, and liberation by size fraction. Potential grade-recovery projections were extrapolated and the study also looked into the applicability of magnetic separation. This led to further work in 2014 which covered comminution and the first specific (bench-scale) flotation test work and resulted in the conclusion (among others) that the recovery of P_2O_5 through flotation might be commercially viable and that column flotation should be considered. This was followed by additional test work (HDA, 2014), again at a bench-scale, that confirmed the commercial potential for phosphate recovery through flotation and provided a better understanding of the nature of P_2O_5 by size fraction and in slimes.

In 2015 a beneficiation bench-scale study was conducted on carbonatite and saprolite ore samples by SGS. This study confirmed phosphate recoveries of the previous study. Additionally, the slimes (-20µm) fraction were very significant, with similar chemical composition to the coarse fractions, which if discarded would result in high losses of P_2O_5.

It was at this point that the Eriez Flotation Division (Eriez) was engaged. Eriez had a proven record of designing and implementing column flotation applications at igneous phosphate projects around the world, including in Brazil, and it was determined that they would be well-positioned to develop an understanding of the metallurgical nature of the Três Estradas Phosphate ore to a point suitable for a feasibility-level study.

Eriez began their engagement with a program in 2016 that produced concentrates from various ore types at a commercially viable level of performance using column flotation. Preliminary bench-scale testing was performed using mechanical test cells in order to optimize the process approach, which was then tested using columns. As a direct result of this approach, Eriez was able to identify effective optimizations of the process and concluded that flotation grade – recovery performance could be reasonably expected to have a significant improvement over historical (mechanical cell) projections. Such optimizations included retention of the fines in the plant feed, the use of a second cleaner circuit on the fresh carbonatite, and reduction of the Minor Element Ratio, MER, (and subsequent increase in concentrate grade) with the use of magnetic separation.

Metallurgical and process testing has culminated in Eriez's most recent pilot-plant testing for flotation (2017), supported with a recent comminution study (Metso, 2017). A multi-month study, using bulk samples and performed at Eriez Flotation Division's pilot-plant facilities in Pennsylvania, USA, has confirmed the earlier bench-scale work as well as further improvements in the process design to improve grade - recovery projections. The test work was structured to focus specifically on each of the major ore types, including:

1. Phase I: Carbonatite;
2. Phase II: Calcite;
3. Phase III: Saprolite;
4. Phase IV: Amphibolite (both 'fresh', and saprolitic).

The current findings and conclusions from the most recent pilot-plant program, are as follows:

- Phosphate grade and recovery are highly dependent on feed size distribution and grade;
- MIMS and WHIMS magnetic separation can improve the concentrate grades by over 2%, and reduce the MER;
- In saprolite, pilot-plant testing projects that a global phosphate recovery of 87% is achievable at a concentrate grade of 35% P_2O_5;
- In carbonatite:
    - Typically, recirculation of the second cleaner tails can provide up to a 2.5% increase in P_2O_5 recovery at a 30% final grade (P_2O_5 increase from 74.8% to 77.4% on average of the recirculation simulations). The percentage of which recovery is expected to increase is highly dependent upon the circuit feed grade and size distribution.

- The use of additional cleaner stages may be more effective than a scavenger stage (not accounted for in grade – recovery projections);
- At a feed-grade of 4% P_2O_5, pilot-plant testing projects that a global phosphate of 80% may be achievable at a concentrate grade of 32% P_2O_5.

Testing of the flotation performance for amphibolites, while only at a bench-scale, indicates that the impact of amphibolite on overall plant performance will be negligible.

The conclusions from the latest pilot-plant metrical testing program are based solely on the technical merits.

8.2 'BENCH-SCALE' METALLURGICAL TESTING – HISTORICAL DATA SUMMARY

Prior to the current pilot-plant work, four 'bench scale' metallurgical testing programs were performed on material taken from Três Estradas phosphate project since 2012 (in addition to a costing study, by KEMWorks, in 2015). A summary of these historical test programs and results is presented in Table 8.1 and described below.

Table 8.1 Summary of Historical Metallurgical Test Programs

Laboratory	Date	Samples	Testwork Performed	Objectives
Escola Politécnica da Universidade de São Paulo, Departamento de Engenharia de Minas e Petróleo, Laboratório de Caracterização Tecnológica - LCT - EPUSP	2012	RG-CM-01: Saprolite of carbonatite; RG-CM-02: Fresh carbonatite; RG-CM-03: Saprolite of amphibolite; RG-CM-04: Fresh amphibolite	Chemical and mineralogical analyses; Mineral separation by size fraction using heavy liquids; Magnetic separation.	To develop mineral associations and liberation studies by size fraction . Determination of a process route to recover P_2O_5 into a saleable concentrate, focusing on heavy media gravity separation, as well as magnetic separation
HDA Serviços S/S ltda. Laboratório de Fenômenos de Transporte e Química de Interfaces Aplicados à Engenharia Mineral (LFQI)	2014	RG-EB-06: Saprolite; RG-EB-07: fresh carbonatite.	Comminution, magnetic separation, desliming and bench scale flotation, at different particle size distributions.	To investigate and propose an adequate comminution and flotation circuit for processing
SGS Canada Inc.	2015	Saprolite and fresh Carbonatite samploes	Comminution, desliming, and flotation (chemical analysis, grindability testing, stage-grinding and desliming, size fraction chemical analysis, flotation, magnetic separation, product mineralogical analysis)	To confirm metallurgy established in previous studies, improve overall P_2O_5 recovery to 65% (at 30% P_2O_5 grade), and to evaluate column flotation performance.
Eriez Flotation Division	2016	Saprolite and fresh Carbonatite samples	Comminution, bench-top mechanical flotation tests (to determine reagents scheme), magnetic separation (low intensity and medium intensity), column flotation.	To produce concentrates from each ore type (fresh carbonatite and saprolite), bearing a P_2O_5 grade of 30%, or greater, at a global P_2O_5 recovery of 80%, using column flotation.

8.3 TECHNOLOGICAL CHARACTERIZATION (EPUSP, 2012)

The first two studies on processing of Três Estradas ore types were performed in 2012 by two departments of the Escola Politécnica da Universidade de Sao Paulo (EPUSP). The first study was titled “Technological Characterization Study on Phosphate Ore Samples” and the second was titled “Complementary Study on the Concentration of Phosphate Ores”.

The scope of testing covered:

- Chemical and mineralogical analyses;
- Mineral separation by size fraction using heavy liquids;
- Magnetic separation.

Mineral associations and liberation studies by size fraction were performed and potential grade recovery curves were generated for P_2O_5. The studies included the determination of the best process route to recover P_2O_5 into a saleable concentrate, focusing on heavy media gravity separation, as well as magnetic separation.

Four composite samples were provided to LCT-EPUSP for testing: RG-CM-01 (saprolite), RG-CM-02 (fresh carbonatite), RG-CM-03, (saprolite of amphibolites) and RG-CM-04 (fresh amphibolite). The samples were prepared by crushing, milling and wet screening (desliming) on a 20 µm screen with the screen undersize discarded.

The major findings are described below.

Geochemical characterization of the four major rock types, represented by samples RG-CM-01 through 04, is summarized below:

Table 8.2 Chemical Composition

Sample	Grades (%)											
	P_2O_5	CaO	SiO_2	Al_2O3	Fe_2O_3	MgO	Na_2O	K_2O	TiO_2	SrO	BaO	PF
RG-CM-01	15.0	19.5	23.2	3.7	24.8	2.56	<0.10	<0.10	2.24	0.25	0.20	4.22
RG-CM-02	4.32	38.2	6.8	1.2	7.28	8.05	<0.10	0.40	0.83	<0.10	0.19	31.3
RG-CM-03	3.73	11.2	38.3	8.5	16.6	8.79	0.95	1.19	4.68	4.68	<0.10	6.64
RG-CM-04	3.04	17.0	32.2	6.7	14.7	9.39	0.59	2.43	0.20	0.20	0.23	7.32

Apatite content was found to be as follows (note: apatite was the only identified phosphate bearing mineral);39% - RG-CM-01 – (saprolite);

- 10% - RG-CM-02 – (fresh carbonatite);
- 9% - RG-CM-03 – (saprolite of amphibolite);
- 6% - RG-CM-04 – (fresh amphibolite).

The remaining mineral composition of each of the composite samples is summarized below:

Table 8.3 Mineral Composition

Samples				
Mineral	CM-01	CM-02	CM-03	CM-04
Apatite	39	10	9	6
Carbonates	-	70	-	11
Oxides (Fe, Ti, Mn)	31	4	9	5
Philosilicates	10	9	32	31
Quartz + Feldspar	16	2	9	6
Titanite	-	-	9	9
Amphibole	3	3	31	31
Others	1	2	1	1

It was found that the mass and recovery losses of P_2O_5 at the 20µm fraction were significant in both the saprolites and fresh rock samples (both carbonatite and amphibolite):

- Saprolite of Carbonatite: mass loss of 39.0%, recovery loss of 25.7%;
- Saprolite of Amphibolite: mass loss of 21.5%, recovery loss of 16.0%;
- Fresh Carbonatite: mass loss of 51.6%, recovery loss of 44.5%;
- Fresh Amphibolite: mass loss of 44.3%, recovery loss of 41.5%;

Degree of liberation for P_2O_5 was found to be as follows:

- 85% at 0.15 mm fraction - RG-CM-01 (saprolite of carbonatite);
- 90% at 0.074 mm fraction - RG-CM-02 (fresh carbonatite);
- 82% at 0.074 mm fraction - RG-CM-03 (saprolite of amphibolite);
- 84% at0.15mm fraction - RG-CM-04 (fresh amphibolite).

The sink /float and distribution of magnetic/non-magnetic products is as follows:

Table 8.4 Sink /Float and Magnetics Separation Results

Flow		CM-01			CM-02		
		% Yield	% P_2O_5	% Dist. P_2O_5	% Yield	% P_2O_5	% Dist. P_2O_5
+ 37 µm fraction	Float	21.8%	3.9%	5.2%	67.6%	1.6%	25.8%
	Sink Mag	24.8%	5.1%	7.8%	11.4%	4.7%	12.5%
	Sink Non-Mag	25.8%	38.4%	61.2%	5.4%	30.5%	38.5%
	Total	72.4%	16.6%	74.2%	84.4%	3.9%	76.7%
- 37 µm Fraction		27.6%	15.2%	25.8%	15.6%	6.4%	23.3%
Feed		100.0%	16.2%	100.0%	100.0%	4.3%	100.0%
Flow		CM-03			CM-04		
		% Yield	% P_2O_5	% Dist. P_2O_5	% Yield	% P_2O_5	% Dist. P_2O_5
+ 37 µm fraction	Float	36.0%	1.2%	11.0%	20.2%	0.9%	6.6%
	Sink mag	32.8%	1.5%	12.5%	58.2%	1.1%	24.4%
	Sink Non-Mag	9.1%	22.7%	52.4%	5.9%	20.6%	46.1%
	Total	77.9%	3.8%	75.9%	84.3%	2.4%	77.0%
- 37 µm Fraction		22.1%	4.3%	24.1%	15.7%	3.9%	23.0%
Feed		100.0%	3.9%	100.0%	100.0%	2.6%	100.0%

From this early testing phase, the following conclusions were reached:

The four samples present the same mineralogical assembly varying only in the proportion of components minerals. Apatite is the P_2O_5 bearing mineral with contents varying from 6% to 39%, depending on the lithology of the sample.

The apatite liberates at a relatively fine size, suggesting that a fine grinding will be required to obtain the commercial grade concentrate.

Gravity and magnetic concentration technologies might produce commercial grade concentrate (sink, non-mag) for the saprolite (CM-01) and fresh carbonatite (CM-02) but the P_2O_5 recovery is low, (61.2% and 38.5%, respectively). For amphibolites, the concentrate grade was below 23%. These results indicated that gravity and magnetic concentration would not be a good option for concentration.

8.4 TECHNOLOGICAL CHARACTERIZATION AND FLOTATION (HDA, 2014)

In 2014, HDA Services performed a study with the objective of proposing an adequate comminution and flotation circuit for processing the Três Estradas phosphate project. The Scope of Work included comminution, magnetic separation, desliming, and bench scale flotation, at different particle size distributions. Tests were performed on both fresh carbonatite and saprolite samples using conventional mechanical flotation cells.

The oxidized (saprolite) sample was labeled as RG-EB-06, while the fresh carbonatite (carbonatite) sample was referred to as RG-EB-07 (the two samples were obtained from auger holes, and drill cores, respectively). A detailed description for the processing test can be found in HDA's report "*Comminution and Flotation Test Work for Rio Grande Project*" (HDA, 2014).

The main results of the characterization and test work are summarized as follow.

- Average feed grade (% P_2O_5):
  - 11.1% (EB06 – saprolite);
  - 4.54% (EB07 – fresh carbonatite).
- Average density:
  - 2.94 (EB06 – saprolite);
  - 2.93 (EB07 – fresh carbonatite);
- Grindability testing (Bond Work Index):
  - 4.9 kWh/t (EB06 – saprolite);
  - 12.2 kWh/t (EB07 – fresh carbonatite).
- Losses at desliming (minus 20 µm):
  - 50.1% yield, and 32.1% P_2O_5 at P90 = 212 µm (EB06 – saprolite);
  - 27.7% yield, and 30.6% P_2O_5 at P90 = 150 µm (EB07 – fresh carbonatite).
- Losses at desliming (minus 10 µm):
  - 27.6% yield, and 9% P_2O_5 at P90 = 212 µm (EB06 – saprolite);
  - 26.2% yield, and 17.3% P_2O_5 at P90 = 76 µm (EB07 – fresh carbonatite).
- Flotation results (deslimed feed):
  - 30.8% grade and 58.4% P_2O_5 metallurgical recovery (EB06 – saprolite);
  - 27.0% grade and 58.1% P_2O_5 metallurgical recovery (EB07 – fresh carbonatite).

From this early testing phase, the following conclusions were reached:

This test campaign indicated that a flotation circuit might produce a commercial grade P_2O_5 concentrate, treating saprolite or fresh carbonatite, in spite of the relatively low metallurgical recovery.

The metallurgical recovery was strongly affected by the significant loss of mass at the desliming stage (- 20 micron). Finer-cut desliming and a staged grinding circuit was recommended to reduce the slimes produced during the grinding operation, while producing sufficient liberation for flotation.

The batch-testing provided a solid basis for planning a pilot-plant campaign in order to fully assess realistic mass and metallurgical recovery figures. Moreover, it was concluded that column flotation should provide adequate hydrodynamic conditions for enhanced metallurgical performance.

8.5 FLOTATION TESTWORK (SGS, 2015)

In 2015, SGS Canada Inc. (SGS) performed a study similar to that of HDA, titled "*A Scoping Level Flotation Test Program on Samples from Três Estradas Phosphate Project*" (SGS, 2015). The objectives of this test program were to confirm metallurgy established in previous studies, the feasibility of improving overall P_2O_5 recovery to 65% (at 30% P_2O_5 grade), and to evaluate column flotation performance on slimes.

As before, the study was conducted on drill core samples for saprolite and fresh carbonatite. The program covered comminution, desliming, and flotation with specific testwork including: sample receipt and preparation; head-sample chemical analysis; grindability testing; stage-grinding and desliming; size fraction chemical analysis; flotation testing; magnetic separation testing; and product mineralogical analysis.

The majority of the flotation work was performed using mechanical flotation cells and included pyrite flotation followed by flotation of deslimed feed and slimes feed separately. Two column flotation tests were performed on each of the fresh composite samples (the deslimed sample and the slimes sample) for a total of 4 column flotation tests.

The main results of the characterization and test work are summarized as follows:

- Average feed grade (% P_2O_5):
  - 11.3% (saprolite);
  - 4.38% (carbonatite).
- Grindability testing (Bond Work Index):
  - 6.2 kWh/t (saprolite)
  - 9.5 kWh/t (sample 11-006 - fresh carbonatite)
  - 9.9 kWh/t (sample 11-007/10 - fresh carbonatite).
- Grindability testing (SMC A x b):
  - 57.3 (sample 11-006 – fresh carbonatite).
  - 54.6 (sample 11-007/10 – fresh carbonatite).
- Flotation combined results (flotation was completed on combined deslimed feed and slimes):
  - 29.6% grade and 75 % P_2O_5 metallurgical recovery (saprolite);
  - 22.9% grade and 69% P_2O_5 metallurgical recovery (fresh carbonatite).

As in earlier testing (EPUSP, 2012), it was confirmed that slimes (-20 µm) generation was significant for both saprolite and fresh rock, with similar chemical compositions in both the fine and coarse fractions.

From this early testing phase, grindability test results suggested that the fresh carbonatite would require more power for grinding.

The results of this flotation test campaign suggested that there could be significant loss of P_2O_5 without adequate processing and that separate flotation of the coarse (+ 20 µm) fraction and fine fraction (- 20 µm), for both types of ore, would not be a very effective solution.

The combined final concentrate grade (produced by separate flotation circuit) was below 23% P_2O_5 and the recoveries were below 75%.

8.6 FLOTATION AND MAGNETIC SEPARATION TEST WORK (ERIEZ, 2016)

In 2016, Eriez performed a flotation study, entitled "*Final Report SAN 18850 - MTR 16-004* (Eriez, 2016)". The objective of this study was to produce concentrates from each ore type (fresh carbonatite and saprolite), bearing a P_2O_5 grade of 30%, or greater, at a global P_2O_5 recovery of 80%, using column flotation. The study also served as the basis for a preliminary flowsheet based on column flotation.

Classification and comminution techniques were used to prepare individual fresh rock and oxide material feeds at 95% passing 212 µm prior to flotation. Preliminary bench-top mechanical flotation tests were carried out to determine the optimal reagent scheme required for the successful flotation of both types of ore. Before flotation, the ore was submitted to a magnetic separation (low-intensity magnetic separation (LIMS) and medium-intensity magnetic separation (MIMS)). The flotation test work was executed with the whole ore, without desliming. The final concentrate was also submitted to a wet high magnetic separation (WHIMS) operation.

The main results of this test campaign to produce P_2O_5 concentrate, are summarized as follows:

- Average feed grade (% P_2O_5):
    - 11.76% (saprolite);
    - 4.21% (carbonatite).
- Specific gravity:
    - 2.27 (saprolite);
    - 2.61 (fresh carbonatite).
- Magnetic wet drum separation of plant feed (LIMS/MIMS results –non-magnetic flotation feed):
    - 96.8% yield and 99.5 %P_2O_5 recovery (saprolite);
    - 95.1% yield and 99.5 %P_2O_5 recovery (fresh carbonatite).
- Proposed flotation circuit (columns):
    - Rougher-Cleaner (saprolite);
    - Rougher – Cleaner – Cleaner - Scavenger column flotation circuit (fresh carbonatite).
- Flotation results (grade / recovery):
    - 31.1% P_2O_5 concentrate with 80.1 % P_2O_5 recovery (saprolite);
    - 30.25% P_2O_5 concentrate with 84.6% P_2O_5 (fresh carbonatite).
- Magnetic separation of phosphate concentrates (WHIMS results – non-magnetic – flotation feed):
    - 91.1% yield and 98.3 % P_2O_5 recovery with 37.3% P_2O_5 concentrate (saprolite);
    - 95.1% yield and 98.7%P_2O_5 recovery with 33.5% P_2O_5 concentrate (fresh carbonatite).

From this early testing phase, the following conclusions were reached:

During project development, it was confirmed that a significant percentage of the inherent P_2O_5 was present in the minus 20 µm fraction. As a result, it was found that removal of this fine material from the flotation feed would significantly reduce the global or total recovery. Bench-top mechanical flotation testing performed on both ores indicated that the 212 x 60 µm size fractions were more amenable to flotation than the 60 x 0 µm size fraction (which exhibited a very poor performance). Thus, the subsequent column flotation tests were conducted on unclassified 212 x 0 µm size fractions, i.e., no desliming.

In fresh carbonatite, the column flotation test results confirmed that a final concentrate grade of 30.25% P_2O_5 with a global P_2O_5 recovery of 84.6% can be achieved.

Column flotation results of tests performed on the saprolite ore, produced a 31.1% P_2O_5 concentrate at a P_2O_5 recovery of 80.1%.

LIMS and WHIMS testing conducted on the fresh carbonatite and saprolite column concentrates demonstrated that the minor element ratio (MER) could be reduced using magnetic separation. As a result of removing magnetic material from the concentrate, the P_2O_5 grade of both concentrates also increased by approximately 1 to 2%. The P_2O_5 recovery from the magnetic separation circuit (non-magnetic fraction) is higher than 98% for both types of ore.

8.7 BULK SAMPLING PROGRAM

Over the period of late-2016 through early-2017, Águia executed a bulk sampling program at the Três Estradas Phosphate Project site. The aim of the program was to generate data as the basis for further testing, including pilot plant testing by Eriez, taking into account key variability criteria including:

- Lithology: Samples of each ore type (fresh rock of meta-carbonatite (MCBT) and amphibolite (MAMP), as we all their saprolitic alterations (CBTSAP and AMPSAP, respectively), including samples at their contacts;
- The distribution of the saprolitic and weathered alterations of differing ore types;
- Major elements in the various ore and waste types;
- Variation of grade of over the projected LOM;
- Vertical drift analysis for various oxides to understand the variation of grade at depth, in different ore types.

The bulk sampling program was designed to meet the requirements for Eriez sampling, as well as some additional material for further testing, as needed. Eriez' requirements were as follows:

- 1200 kg of fresh rock meta-carbonatite (MCBT);
- 150 kg of fresh rock amphibolite (MAMP);
- 700 kg of saprolite of meta-carbonatite (CBTSAP);
- 150 kg of saprolite of amphibolite (AMPSAP).

8.8 'PILOT-PLANT' METALLURGICAL TESTS AND RESULTS (2017)

In 2017, a new testing program was carried out with the following objectives:

- To confirm the previous metallurgical findings defined in the 2016 test campaign by Eriez and/or establish more reliable and detailed information to define Design Criteria for Project development;
- To generate data to support selection of a process route and appropriate equipment sizing;

Several companies and laboratories were involved in this program: Metso Minerals developed and executed the comminution testwork. Eriez continued their work by performing pilot-plant scale column flotation studies. Pocock Industrial (Pocock), of Salt Lake City, developed thickening and filtration tests of concentrate and tailings as well as geotechnical and rheological properties determinations. Laboratories included Bureau Veritas for assays on concentrates and tailings.

8.9 COMMINUTION TESTING (METSO, 2017)

Metso Minerals (Metso) was selected to develop the comminution testwork. The objective of this test program was to establish the characteristics of the ore at Três Estradas, regarding crushability and grindability in order to provide reliable and consistent data to support the selection of the comminution circuit as well as the sizing of the comminution equipment for the industrial plant.

To achieve this objective a testing program was carried out covering the following determination and assays: Sag Mill Comminution (SMC) tests, Crushing Bond Work Index (CWI tests), Bond Ball Mill Work Index (BWi), Rod Mill Work Index (RWi), Point Load Test - PLT (UCS) and Bond Abrasion Index (Bond Ai).

8.9.1 SAMPLING FOR COMMINUTION TESTING

To cover the main lithology of Três Estradas samples of fresh carbonatite (MCBT, nine samples), saprolite of carbonatite (CBTSAP, two samples), fresh amphibolite (MAMP, one sample) and saprolite of amphibolite (AMPSAP, one sample) were gathered. The MCBT (plus weathered MCBT) is the predominant type of mineable ore corresponding to 87% of the total reported resource. The CBTSAP represents 6% of the total and the MAMP and AMPSAP represent, respectively, 6% and 1% of the total resource. The criteria to select the samples were based on the geo-spatial approach.

To ensure good representation, the samples were selected considering the lithological and mineralogical composition. In addition to the lithological characterization, geospatial representation was ensured by sampling from different depths, along the strike of the ore body. The sampling distribution considered five cross-sections, spaced 400 to 550m, along three different levels. In order to provide the samples for this program, a specific HQ drilling campaign was carried out. The campaign totalized 870m in six drill holes to generate 13 samples (nine in MCBT, 1 in MAMP, 2 in CBTSAP and 1 in AMPSAP).

8.9.2 COMMINUTION TESTING PROGRAM

A detailed description for the procedures and test work results is given in the report "*Programa de Testes de Cominuição para o Projeto Três Estradas – Relatório Final*" (Metso, 2017).

Metso established the required amount of each one of the samples to perform the proposed tests. The total amount of samples delivered to Metso was:

- 1,500 kg of fresh carbonatite (MCBT);
- 240 kg of saprolite of carbonatite (CBTSAP);
- 110 kg of fresh amphibolite (MAMP);
- 120 kg of saprolite of amphibolite (AMPSAP).

The main results of Metso comminution testing campaign are summarized below. Abrasion index testing yielded the following results:

Table 8.5 Abrasion Index

ID Samples		Abrasion Index (g)	Abrasiveness Classification
CT-001	Fresh Carbonatite	0.029	Non-Abrasive
CT-002	Saprolite of Carbonatite	Na	Non-Abrasive
CT-003	Fresh Carbonatite	0.011	Non-Abrasive
CT-004	Fresh Carbonatite	0.071	Slightly Abrasive
CT-005	Saprolite of Amphibolite	Na	Non-Abrasive
CT-006	Fresh Carbonatite	0.175	Average Abrasion
CT-007	Saprolite of Carbonatite	Na	Non-Abrasive
CT-008	Fresh Carbonatite	0.050	Slightly Abrasive
CT-009	Fresh Carbonatite	0.097	Slightly Abrasive
CT-010	Fresh Carbonatite	0.038	Non-Abrasive
CT-011	Fresh Carbonatite	0.048	Non-Abrasive
CT-012	Fresh Carbonatite	0.030	Non-Abrasive
CT-013	Fresh Amphibolite	0.033	Non-Abrasive

Results of testing to determine the Bond Work Index (for ball and rod milling) are as follows:

Table 8.6 Bond Work Index (Ball and Rod Milling)

ID Samples		Bond Ball Mill Work Index		Bond Rod Mill Work Index	
		(kWh/t)	(kWh/st)	(kWh/t)	(kWh/st)
CT-001	Fresh Carbonatite	11.56	10.49	12.00	10.88
CT-002	Saprolite of Carbonatite	9.30	8.43	6.23	5.65
CT-003	Fresh Carbonatite	9.80	8.89	10.19	9.25
CT-004	Fresh Carbonatite	11.98	10.87	13.64	12.37
CT-005	Saprolite of Carbonatite	8.97	8.14	4.96	4.50
CT-006	Fresh Carbonatite	11.90	10.80	11.89	10.78
CT-007	Saprolite of Amphibolite	8.43	7.65	4.85	4.40
CT-008	Fresh Carbonatite	10.89	9.88	13.78	12.50
CT-009	Fresh Carbonatite	11.13	10.10	13.04	11.83
CT-010	Fresh Carbonatite	8.82	8.00	10.24	9.29
CT-011	Fresh Carbonatite	9.04	8.20	10.64	9.65
CT-012	Fresh Carbonatite	10.15	9.21	9.48	8.60
CT-013	Fresh Amphibolite	10.63	9.64	13.87	12.59

The Bulk Density and Specific Gravity for each ore type is reported below:

Table 8.7 Bulk Density and Specific Gravity

ID SAMPLE		Bulk Density (t/m^3)	Specific Gravity (t/m^3)
CT-001	Fresh Carbonatite	1.79	2.87
CT-002	Saprolite	1.28	1.70
CT-003	Fresh Carbonatite	1.85	2.91
CT-004	Fresh Carbonatite	1.81	2.94
CT-005	Saprolite of Amphibolite	1.20	2.10
CT-006	Fresh Carbonatite	1.76	2.74
CT-007	Saprolite	1.04	1.90
CT-008	Fresh Carbonatite	1.83	2.90
CT-009	Fresh Carbonatite	1.85	2.87
CT-010	Fresh Carbonatite	1.98	2.99
CT-011	Fresh Carbonatite	1.84	2.97
CT-012	Fresh Carbonatite	1.79	2.90
CT-013	Fresh Amphibolite	1.69	2.79

Point Load testing results are summarized as follows:

Table 8.8 Point Load Tests

ID Samples		Point Load Test - Is50		
		Average (Mpa)	Std. Dev. (Mpa)	Estimate UCS
CT-002	Saprolite of Carbonatite	0.31	0.04	7.44
CT-005	Saprolite of Amphibolite	0.27	0.05	6.48
CT-007	Saprolite of Carbonatite	0.28	0.04	6.72

The results of Impact Work Index testing are summarized below:

Table 8.9 Impact Work Index

ID Samples		Impact Work Index (IWi)
		Results (kWh/t)
CT-001	Fresh Carbonatite	5.75
CT-010	Fresh Carbonatite	5.00
CT-011	Fresh Carbonatite	7.41

SMC tests results are covered in the table below:

Table 8.10 SMC Results

Sample ID		SMC Test						
		Dwi	A	b	A*b		Sg	ta
		Result (kWh/m³)	-	-	-	Class	(t/m³)	-
CT-001	Fresh Carbonatite	4.00	70.4	1.02	71.8	Soft	2.87	0.65
CT-002	Saprolite of Carbonatite	na	na	na	na	na	na	na
CT-003	Fresh Carbonatite	4.13	78.2	0.90	70.4	Soft	2.91	0.63
CT-004	Fresh Carbonatite	4.67	75.1	0.84	63.1	Mod. Soft	2.94	0.56
CT-005	Saprolite of Amphibolite	na	na	na	na	na	na	na
CT-006	Fresh Carbonatite	na	na	na	na	na	na	na
CT-007	Saprolite of Carbonatite	na	na	na	na	na	na	na
CT-008	Fresh Carbonatite	5.07	78.9	0.73	57.6	Mod. Soft	2.90	0.51
CT-009	Fresh Carbonatite	4.22	75.7	0.90	68.1	Soft	2.87	0.61
CT-010	Fresh Carbonatite	3.67	78.7	1.04	81.8	Soft	2.99	0.71
CT-011	Fresh Carbonatite	2.28	74.0	1.76	130.2	Very Soft	2.97	1.14
CT-012	Fresh Carbonatite	3.61	80.5	1.00	80.5	Soft	2.90	0.73
CT-013	Fresh Amphibolite	4.25	76.5	0.86	65.8	Mod. Soft	2.79	0.61

The comminution testing program results confirmed, as previously suggested in earlier testing, that the saprolites are less abrasive and required less power to achieve the required size distribution. Also, the results indicated that the grinding behavior of the saprolite of amphibolite would be similar to that of the saprolite. Despite being more abrasive than saprolite ore, the fresh rock samples, regardless of geospatial location, are generally considered non-abrasive, or slightly abrasive. Sample pairs taken from the same section of ore body but at different elevations, indicated a slight trend of hardening with greater depth.

8.10 FLOTATION PILOT-PLANT TESTING (ERIEZ, 2017)

The objective of the study was to produce phosrock (P_2O_5 concentrate) according to accepted market specifications, with maximum global recovery of P_2O_5, using column flotation with verification at a pilot-plant scale. Producing this concentrate would verify global phosphate grades and recoveries (proposed during the open-circuit test program of 2016) for use in a feasibility study. In addition, the Eriez test program was used as the basis of establishing the process flowsheet for the flotation section, defining mass balance, indicating reagents and dosages and the sizing/selection of flotation equipment.

8.10.1 SAMPLING FOR FLOTATION TESTING

To cover the main lithologies of the ore from the Três Estradas Phosphate Project, samples of fresh carbonatite and amphibolites as well as the saprolite of each the two ore types, were gathered. The quantity of each ore-type sample provided by Águia to ERIEZ is listed below:

- 1,889 kg of fresh carbonatite (MCBT);
- 791 kg of saprolite of carbonatite (CBTSAP);
- 731 kg of fresh amphibolite (MAMP);
- 469 kg of saprolite of amphibolite (AMPSAP).

The criteria to select and make the composite samples for flotation metallurgical tests, that would ensure an adequate representation of run-of-mine (ROM) plant feed, was defined by Águia and based on reasonable industry practices, as described in document. "*Três Estradas Sample Selection Memo - Pilot Tests – ERIEZ*" (Águia, March 15, 2017).

8.10.2 SAPROLITE TESTING

For saprolite, the primary requirement of the test program was to confirm or re-define the global phosphate grades and recoveries determined in the open circuit test program (2016 'bench-scale' campaign), using a rougher-cleaner flotation circuit. In addition, continuous column flotation testing was utilized to generate bulk concentrate and tailings samples for subsequent characterization studies, for use in feasibility-level engineering and design.

Of approximately 1,000 kg of sample received, 600 kg of saprolite ore was split to provide a final sample. The as-received material was classified and wet-screened before being homogenized and split to form representative samples in the form of a slurry (25% solids, by weight), in preparation for continuous operation of an automated column flotation circuit (consisting of two, 3-inch diameter column flotation cells). In accordance with the sample preparation procedure for saprolitic material, the coarser screen overflow was not used in testing.

The tables below show the particle size and phosphate distribution of the coarse and fine fractions (plus and minus 212µm).

Table 8.11 Coarse and Fine Fractions Particle Size and Phosphate Distribution

Saprolite 212µm Screen Oversize					
Screen Size (µm)	Weight (g)	Weight (%)	Cum. % Passing	$\%P_2O_5$	P_2O_5 Dist.
+1000	271.6	29.8	100.0	6.6	19.77
-1000x850	31.1	3.4	70.2	8.7	2.98
-850x600	90.8	10.0	66.8	10.1	10.11
-600x425	140.6	15.4	56.8	12.3	19.07
-425x300	126.7	13.9	41.3	12.4	17.33
-300x212	102.9	11.3	27.4	12.8	14.53
-212	146.9	16.1	16.1	10.0	16.20
Cumulative	910.6	100.0	378.6	9.96	100.00
Saprolite 212µm Screen Undersize (Column Flotation Feed)					
Screen Size (µm)	Weight (g)	Weight (%)	Cum. % Passing	$\%P_2O_5$	P_2O_5 Dist.
+212	101.5	7.0	100	9.7	6.73
212x150	136.6	9.4	93.0	11.4	10.65
150x106	166.4	11.5	83.6	11.7	13.31
106x75	148.4	10.2	72.1	13.5	13.71
75x53	121.9	8.4	61.9	13.9	11.59
-53	776.8	53.5	53.5	8.2	44.01
Cumulative	1451.6	100.0		10.0	100.0

Eriez performed the pilot testing at their Eriez Flotation Division test facilities in Pennsylvania, USA, using a sophisticated pilot-plant circuit that can be adjusted to accommodate various circuit configurations and conditions, as well as accounting for re-circulating loads. The following figures show the flotation apparatus and details of the saprolite flotation. In Figure 8.2, the difference in color of the froth in the columns as well as of the tails and concentrate between the rougher and cleaner is clearly visible, thus demonstrating the effect of the cleaner stage.

Figure 8.1 Two-Stage Automated Column Flotation Circuit

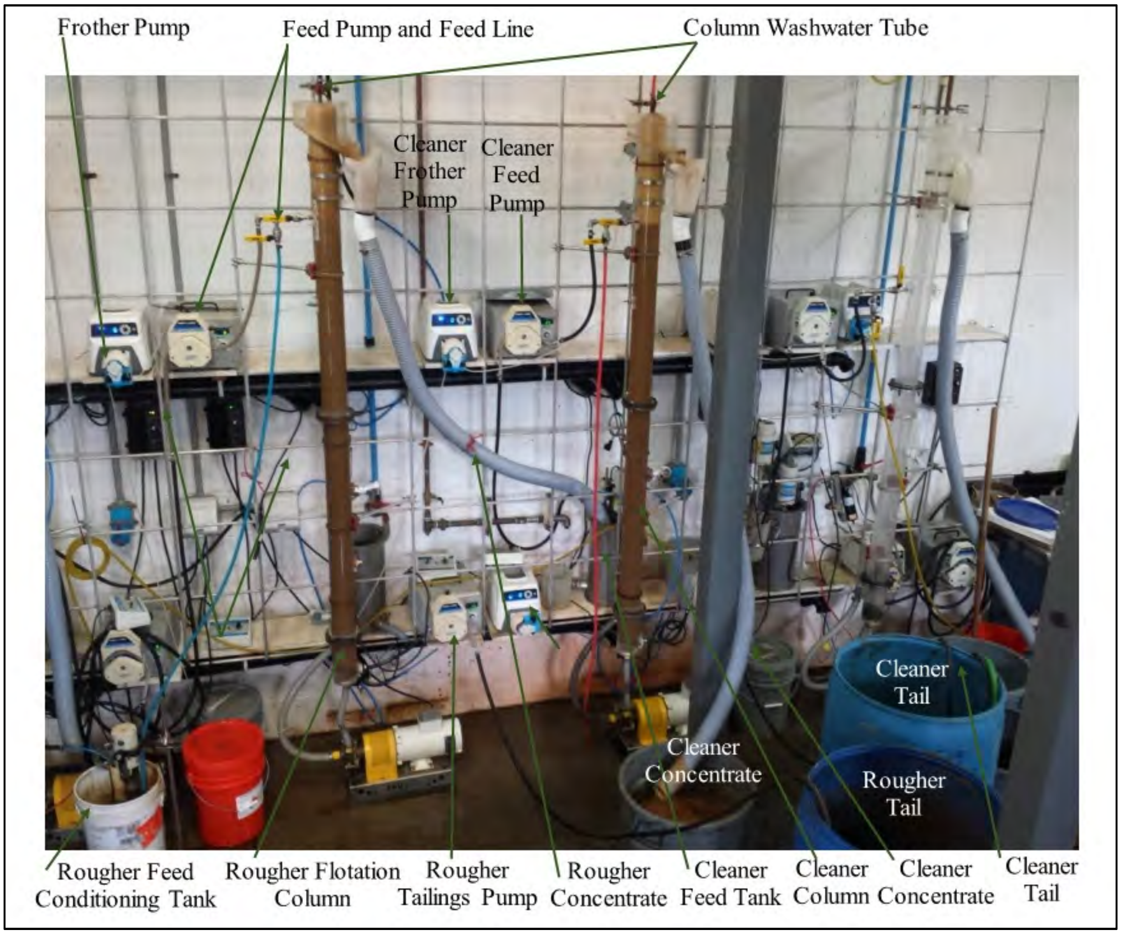
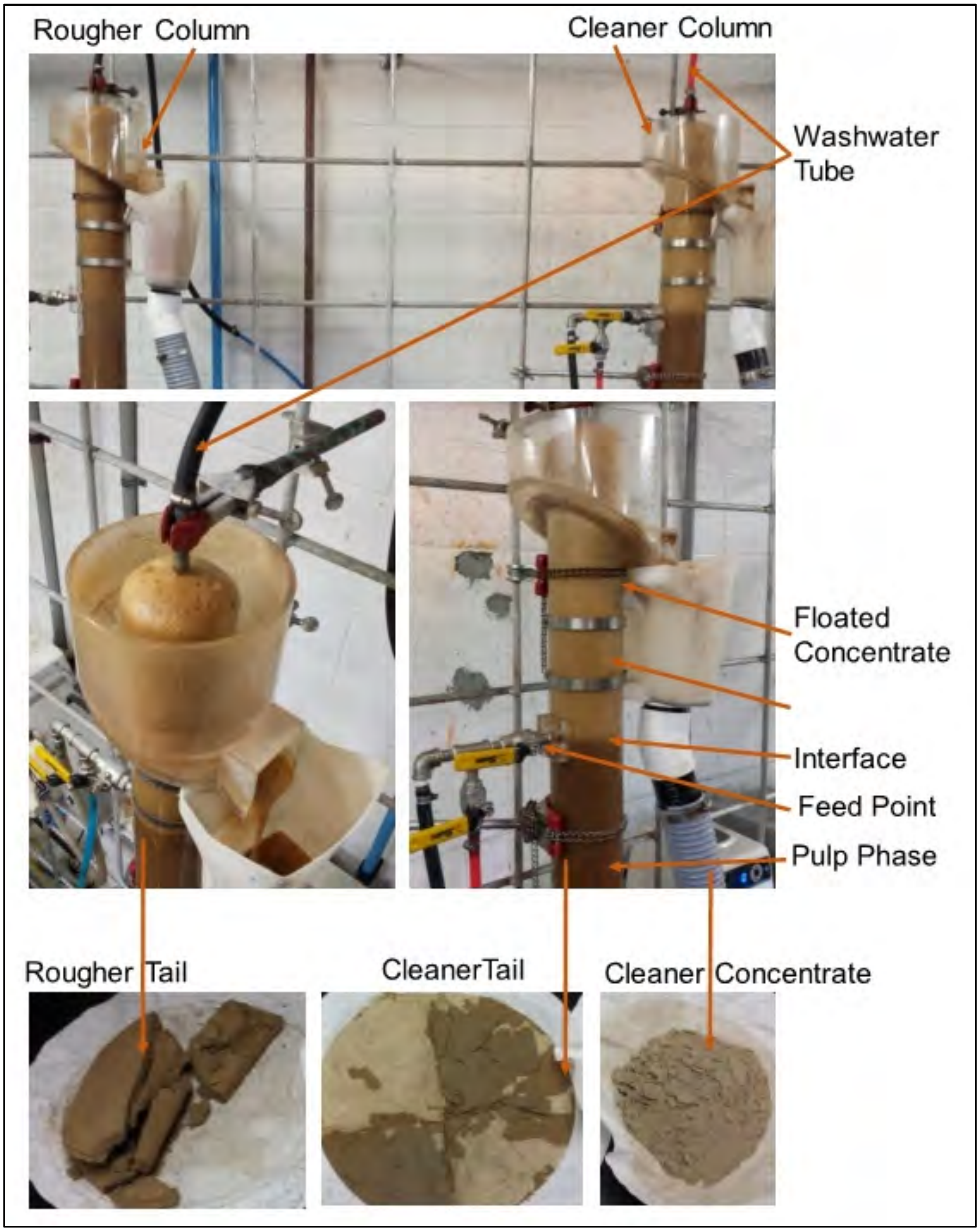


Figure 8.2 Details of Saprolite Flotation Circuit



Continuous operation of a fully automated, two-stage column flotation circuit yielded phosphate (P_2O_5) recoveries ranging from 85% to 90% at an average final product grade of nearly 32.7% P_2O_5.

Following flotation, magnetic separation testing was performed to determine the impact on reducing the MER (or ($MgO + Al_2O_3 + Fe_2O_3)/P_2O_5$)). It was found that subsequent medium and high wet magnetic separations (MIMS / WHIMS) improved the rougher-cleaner flotation concentrate grade from approximately 32.7% to 34.9% P_2O_5, and the MER was decreased from 0.2 to 0.06. In addition, after application of MIMS and WHIMS, the P_2O_5 recovery was even higher at over 99%, with an overall global phosphate recovery (after flotation and magnetic separation) conservatively estimated at approximately 87% (see Table 8.12, below). Approximately 50 kg of final concentrate was produced for further characterization studies.

Details of the saprolite flotation results are summarized in the table below.

Table 8.12 Saprolite - Rougher / Cleaner and Magnetic Separation Results

Test	Stage	Stream	Mass-Balanced Assays						Grade, Yield & Recovery			
			P_2O_5	MgO	Al2O3	SiO2	Fe2O3	CaO	MER	Concentrate		Re.
			(%)	(%)	(%)	(%)	(%)	(%)		P_2O_5 (%)	Yield(%)	(%)
Bulk Run	Column Rougher	Ro. Overflow	30.13	1.08	0.78	6.26	7.57	42.79	0.31	30.13	29.78	90.1
		Ro. Underflow	1.41	8.4	7.9	41.66	20.69	42.79				
		Ro. Feed	9.96	6.22	5.78	31.12	16.78	15.27	2.89			
	Column Cleaner	Cleaner OF	32.72	0.59	0.38	3.48	5.72	46.27	0.20	32.72	90.97	96.8
		Cleaner UF	4.02	6.01	4.82	34.18	26.22	7.69				
		Cleaner Feed	30.13	1.08	0.78	6.26	7.57	42.79	0.31			
	Combined Rougher Cleaner	Cleaner OF	32.72	0.59	0.38	3.48	5.72	46.27	0.2	32.72	27.09	89
		Ro.&Cl.UF	1.50	8.31	7.79	41.38	20.89	3.76				
		Rougher Feed	9.96	6.22	5.78	31.12	16.78	15.27	2.89			
	MIMS 6.100 Gauss	Non-Mag	33.93	0.59	0.37	3.52	2.57	47.95	0.10	33.93	96.08	99.7
		Mag	2.9	0.56	0.68	2.59	83.83	5.1				
		Feed	32.72	0.59	0.38	3.49	5.71	46.27	0.20			
	WHIMS 14.000 Gauss	Non-Mag	34.92	0.5	0.33	3.22	1.31	49.36	0.06	34.92	96.61	99.4
		Mag	5.79	3.27	1.53	12.42	38.22	8.08				
		Feed	33.93	0.59	0.37	3.53	2.56	47.96	0.10			
Circuit	Ro.-Cl MIMS-WHIMS Circuit	Final Conc.	34.92	0.50	0.33	3.22	1.31	49.36	0.06	34.92	25.15	88.2
		Tails & Mag	1.57	8.14	7.61	40.49	21.97	3.83				
		Feed	9.96	6.22	5.78	31.12	16.78	15.27	2.89			

A detailed description of the test work performed with saprolite is given in the report "*SAN 20603 - MTR 17-041 – Final Report Phase III: Saprolite Flotation and Magnetic Separation*" (Eriez, 2017).

8.10.3 FRESH CARBONATITE TESTING

For fresh carbonatite, the primary requirement of the test program was to confirm or re-define global phosphate grades and recoveries determined in the preceding open circuit test program (2016 'bench-scale' campaign) using a closed rougher-cleaner-cleaner-scavenger flotation circuit (i.e. incorporating recirculating loads). In addition, continuous column flotation testing was utilized to generate bulk concentrate and tailings samples for subsequent characterization studies.

Of approximately 1.9 tonnes of MCBT sample received, after crushing and setting aside of a 'reserve' sample for future testing, Eriez split 1.5 tonnes of the sample for testing. After crushing both sample forms were independently crushed, classified and milled to nearly 95% passing 212µm (half-core and the crushed core reject forms were handled separately to ensure that flotation performance testing was not compromised).

A grinding study was performed to determine how best to obtain a mill product of P95 at 212µm. The results of this study were then used as the basis to determine the approach to milling for the sample program. Following crushing, the fresh carbonatite ore was wet classified at 212µm. The plus 212µm screen oversize was milled to a P95 of 212µm. After milling was complete, the milled products were combined and then blended back with the existing minus 212µm fraction produced during wet classification to form sample slurries (30% solids, by weight) for testing.

The tables below show the particle size and phosphate distribution of the ground ore used for flotation tests, by sample type.

Table 8.13 Fresh Feed (Whole Core) - Particle Size and Phosphate Distribution

Screen Size (µm)	Weight (%)	Cum. % Passing	% P_2O_5	P_2O_5 Dist.
+150	22.0	100.0	1.7	11.4
150x106	13.1	78.0	2.3	8.9
106x75	14.2	65.0	3.1	13.1
75x53	11.4	50.8	4.1	13.9
53x25	12.7	39.4	5.1	19.4
-25	26.6	26.6	4.2	33.3
Cumulative	**100.0**		**3.4**	**100.0**

Table 8.14 Fresh Feed (Core Rejects) - Particle Size and Phosphate Distribution

Screen Size (µm)	Weight (%)	Cum. % Passing	% P_2O_5	P_2O_5 Dist.
+150	22.0	100.0	1.7	14.9
150x106	13.1	69.4	2.6	11.8
106x75	14.2	53.5	4	16
75x53	11.4	39.6	5.8	11.4
53x25	12.7	32.7	6.1	21
-25	26.6	20.7	4.2	24.9
Cumulative	100.0		3.5	100

Continuous operation of a fully automated, four-stage column flotation circuit (see Figure 8.3, below) yielded P_2O_5 recoveries ranging from 71% to 80%, at an average final product grade of nearly 31% P_2O_5.

Phosphate recovery and grade were determined to be highly dependent upon the feed size distribution and head grade. Optimal flotation performances were achieved when processing coarser size or a higher feed grade. For example, from a 3.6% P_2O_5 feed bearing a P50 of 106 micron (µm), a 30% P_2O_5 concentrate was achieved at a circuit P_2O_5recovery of 79%. Upon a decrease in feed P50 to 75 µm, the global phosphate recovery decreased to 71% - 76% under a majority of steady state operating conditions. Additionally, when treating a P50 of 75 µm feed bearing a 4.1% P_2O_5 head grade, global phosphate recovery improved to approximately 80% at a 29% P_2O_5 head grade.

Figure 8.3 Four-Stage Column Flotation Circuit

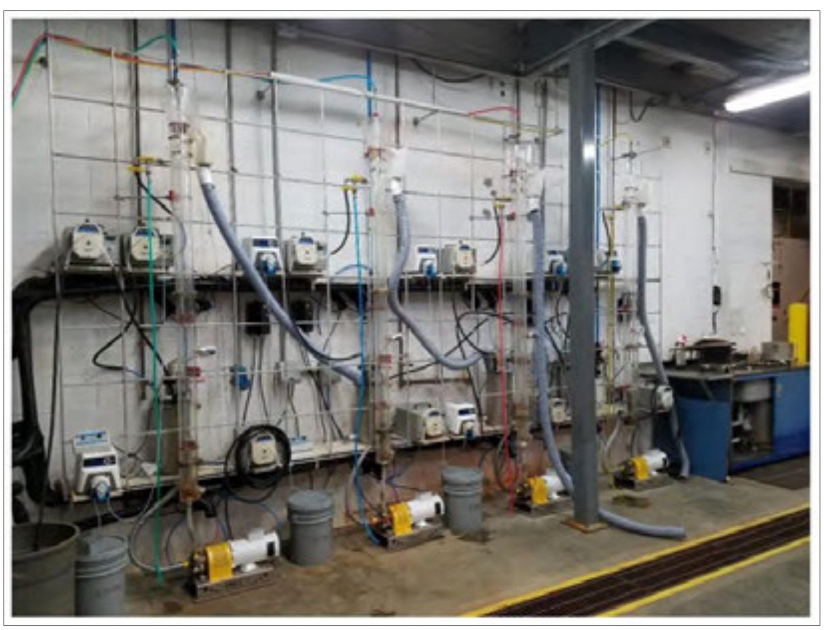


Table 8.15, below, details the mass balanced circuit results ascertained during continuous operation of the rougher-cleaner-cleaner-scavenger column flotation circuit. Final circuit P_2O_5 recoveries and grades varied, as a result of variations in feed size distribution, head grade, and operating parameters.

Table 8.15 Flotation Results Summary – Fresh Carbonatite

Test	Feed					Float					Non-Float					Float	P_2O_5
No.	% P_2O_5	% MgO	%SiO_2	%Fe_2O_3	%CaO	% P_2O_5	% MgO	%SiO_2	%Fe_2O_3	%CaO	% P_2O_5	% MgO	%SiO_2	%Fe_2O_3	%CaO	Yield (%)	Recovery (%)
22	3.75	5.55	7.83	3.62	41.52	28.74	3.8	5.1	1.9	47.9	0.87	5.75	8.15	3.82	40.78	10.3	79.1
23	3.69	5.4	7.65	3.81	41.67	31.26	3.1	4.2	2	48.49	0.92	5.63	8	3.99	40.98	9.1	77.3
24	3.6	5.21	7.46	4.61	41.63	30.02	3.4	4.5	2.7	47.6	0.87	5.4	7.77	4.81	41.01	9.4	78.2
25	3.59	5.27	7.47	3.8	41.53	30.22	3.5	4.5	2.7	47.4	0.84	5.45	7.78	3.92	40.93	9.4	78.7
29	3.61	5.98	8.27	4.2	40.38	29.44	4.1	5.3	2.6	44.6	1.17	6.16	8.55	4.35	39.98	8.6	70.4
33	3.91	6.36	8.61	4.27	41.2	30.87	3.6	4.5	2	46.68	1.27	6.64	9.02	4.49	40.66	8.9	70.4
34	3.63	6.15	7.42	4.39	41.39	29.46	4	4.6	2.4	45.8	1.14	6.38	7.7	4.58	40.97	8.8	71.3
35	3.69	5.95	7.95	4.57	40.61	29.11	4.2	4.8	2.8	44.59	1.06	6.13	8.28	4.75	40.2	9.4	73.9
36	3.59	5.5	6.3	3.35	43.15	29.06	4.11	4.91	2.61	46.31	1.12	5.83	6.43	3.42	42.85	8.8	71.5
37	3.18	6.17	8.29	3.96	40.4	29.4	4.2	4.8	2.5	46.9	1.02	6.33	8.57	4.08	39.87	7.6	70.4
38	3.37	6.08	8.62	5.09	40.29	27.38	4.4	5	3	45.6	1.04	6.25	8.97	5.3	39.78	8.9	71.9
39	3.56	5.88	8.28	6.14	40.2	28.16	4.3	5.1	3.1	45.5	1.05	6.04	8.61	6.45	39.66	9.3	73.3
40	4.27	5.68	8.22	4.49	41.05	28.13	4.3	5.1	3.7	45.69	0.84	5.88	8.67	4.6	40.38	12.6	82.8
41	4.12	5.84	8.1	4.65	40.99	28.82	4.1	4.9	3.31	45.87	0.95	6.06	8.51	4.82	40.36	11.4	79.6
43	4.12	5.84	8.1	4.65	40.99	28.82	4.1	4.9	3.31	45.87	0.95	6.06	8.51	4.82	40.36	11.4	79.6
46	3.73	6.11	8.3	4.65	40.81	32.81	2.8	4.1	2.3	47	1.16	6.41	8.68	4.85	40.26	8.1	71.4
53	3.72	6.05	8.31	4.05	40.29	31.34	3.4	4.8	3.2	45.6	0.98	6.31	8.66	4.14	39.76	9	76
54	3.61	6.12	8.48	4.18	39.77	31.47	3.3	4.7	3.1	46.1	1.16	6.36	8.81	4.27	39.22	8.1	70.3
55	3.75	6.07	8.33	4.52	40.07	30.1	3.8	4.9	3.1	46.1	1.09	6.3	8.68	4.66	39.47	9.2	73.7
56	4.04	6.15	8.15	4.22	40.8	29.06	3.8	4.7	3.2	45.92	1.09	6.42	8.56	4.34	40.2	10.5	75.8

Given the inherent characteristics of the laboratory-scale pilot equipment, recirculation of the tailings was not applied within the program. However, data from the continuous flotation test period was employed to simulate the inclusion of the tailings recirculating load in a cleaner circuit. On average, recirculation of the tailings will provide up to a 2.5% increase in phosphate (P_2O_5) recovery at a 30% P_2O_5 final concentrate grade. The increase in recovery is also highly dependent upon the circuit feed grade and size distribution.

Following the production of a bulk phosphate flotation concentrate, magnetic separation tests were performed to reduce the MER of the final concentrate product. Upon application of medium and high intensity magnetic separation, the flotation concentrate was improved from to approximately 31 to 33% P_2O_5 as the minor element ratio was decreased from 0.21 to 0.14. The P_2O_5 recovery at WHIMS was higher than 99%. The following table summarizes the results of magnetic separation.

Table 8.16 Magnetic Separation Results Summary – Fresh Carbonatite

Description	Mass (%)	Assay P_2O_5 (%)	MgO (%)	Al_2O_3 (%)	SiO_2 (%)	Fe_2O_3 (%)	CaO (%)	Recovery $\%P_2O_5$	Total Rec. $\%P_2O_5$	MER	CaO/P_2O_5
Bulk Core MIMS Calculated Feed	100.0	31.1	3.5	0.7	4.5	2.3	48.3	-	99.2	0.21	1.6
Bulk Core MIMS Mag	0.5	5.8	3.1	0.9	5.4	53.5	8.1	0.1		9.91	1.4
Bulk Core MIMS Non Mag	99.5	31.2	3.5	0.7	4.5	2.1	48.5	99.9		0.20	1.6
Bulk Core WHIMS Mag 1	3.7	6.6	11.0	1.9	12.0	9.2	32.0	0.7		3.35	4.8
Bulk Core WHIMS Non Mag 1	96.3	33.7	2.6	0.3	3.5	1.7	48.5	99.3		0.14	1.4

As previously stated, phosphate, recovery and concentrate grade are dependent upon the feed size distribution and head grade and optimal flotation performances that are achieved when processing coarser and/or higher-grade feeds.

Given the inherent characteristics of the laboratory-scale pilot test, some overgrinding has occurred, which can easily be avoided in an industrial scale grinding circuit by using a two-stage grinding circuit (rod and ball mills) with pre-classification before the 2nd grinding circuit. Also, the final resource evaluation allows a selection of a higher cut-off grade and the average feed grade would be around 4.0 % P_2O_5, which would favor an increased recovery.

Finally, the industrial circuit was sized and designed with three cleaner stages. This circuit configuration would provide a more stable operation and ultimately would favor recovery. The results from this extensive pilot-scale program indicate that a global phosphate recovery of 80% producing concentrate grading 32% P_2O_5 is achievable at an industrial scale.

A detailed description of the test work performed and corresponding results is given in the report "*SAN 20603 MTR 17-041 - Final Report – Phase I – Rev. 2 Fresh Carbonatite Pilot Phosphate Flotation"* (Eriez, 2017).

8.10.4 AMPHIBOLITE TESTING

Laboratory-scale, batch, mechanical flotation tests were performed on samples of fresh amphibolite (MAMP) and saprolite of amphibolites (AMPSAP) phosphate ores. As with the fresh and saprolitic carbonatites, samples were gathered in order to ensure adequate geospatial representation.

Of the sample provided, (731 kg of MAMP and 469 kg of AMPSAP) Eriez split approximately 200 kg and 135 kg of MAMP and AMSAP sample, respectively. Samples were classified and wet-screened before being homogenized and split to form representative samples in the form of a slurry (25% solids, by weight). In accordance with the sample preparation procedure for saprolitic material, the coarser screen overflow from the AMPSAP sample preparation was not used in testing.

Laboratory-scale, batch, mechanical flotation testing of the ore samples was first performed using the fresh carbonatite reagent scheme and a multi-stage mechanical flotation circuit (rougher-cleaner-cleaner) as indicated by testing of the carbonatite in the earlier phase of the program. Additionally, mechanical flotation tests were performed using various collectors. For AMPSAP, inclusion of a 3rd cleaner in the circuit was also tested.

Laboratory-scale bench-top flotation testing was performed with the use of mechanical 'Denver' cells, as shown in Figure 8.4 below.

Figure 8.4 ‘Bench-top’ Flotation Apparatus

The following photos show the rougher flotation of fresh amphibolites (MAMP) and saprolite of amphibolites (AMPSAP), respectively.

Figure 8.5 Fresh Amphibolite (MAMP) Rougher Flotation

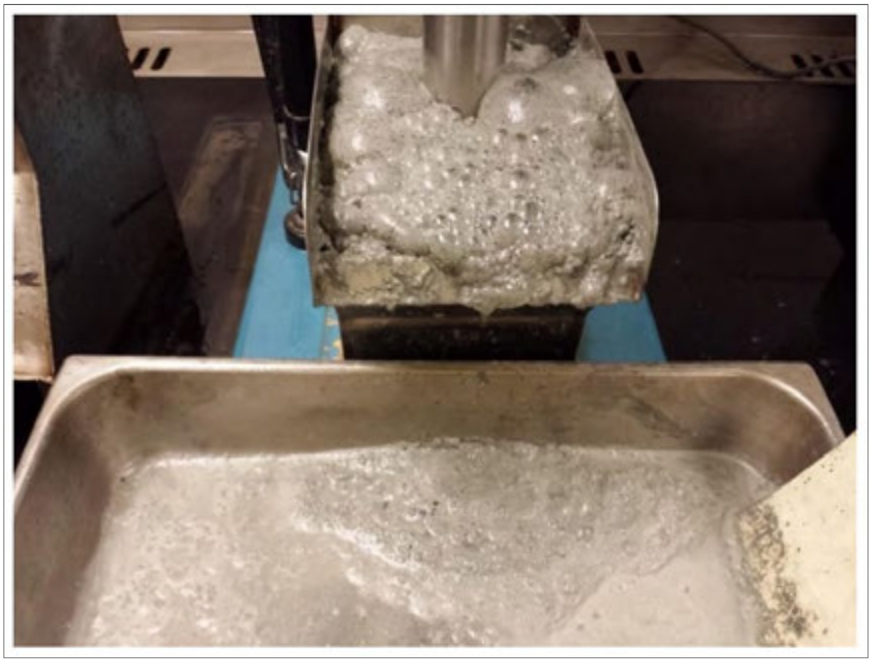


Figure 8.6 Saprolite of Amphibolite (AMPSAP) Rougher Flotation

Figure 8.7 illustrates the impact of the cleaner stages of concentration; of significance is the color of the rougher tails (on the left) and the third cleaner concentrate (on right).

Figure 8.7 (AMPSAP) Rougher Tails vs 3rd Cleaner Concentrate

Various operational conditions were tested and Figures 8.8 and 8.9 indicate the relationship of concentrate grade vs recovery for different types of collectors for both the fresh amphibolite and saprolite of amphibolite.

For amphibolites, using a rougher-cleaner-cleaner circuit configuration, a flotation concentrate grade of 30.4% P_2O_5 was achieved at a 77.5% P_2O_5 recovery.

Figure 8.8 MAMP Grade vs Recovery Relationship by Collector Type

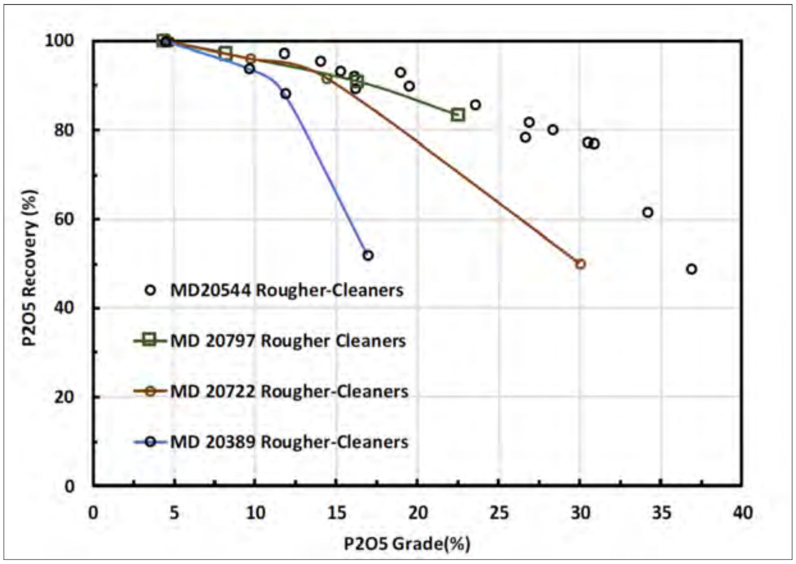
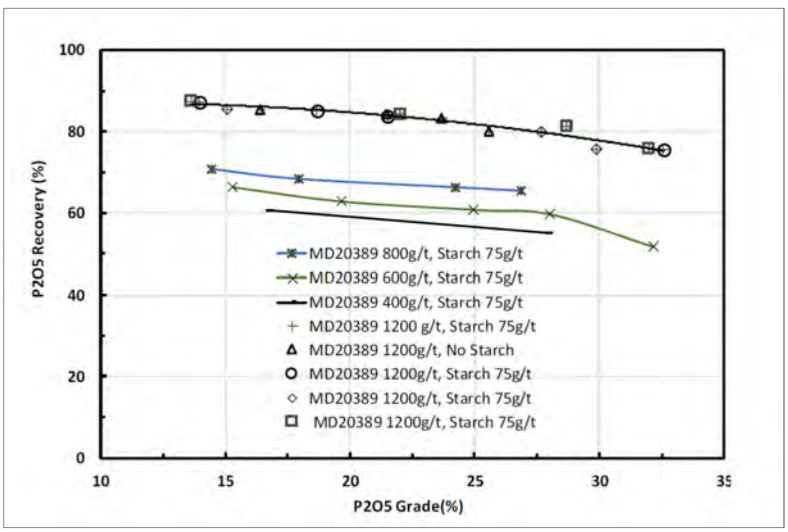


Figure 8.9 AMPSAP Grade vs Recovery Relationship by Collector Type



Using a rougher-cleaner-cleaner circuit configuration, a 30-32% P_2O_5 concentrate was achieved at a 75-76% P_2O_5 recovery for saprolite of amphibolites. In addition, it is noted that that this testing accounted only for bench-top flotation performance and does not reflect the potential performance of column flotation. A significant improvement of concentrate grade and recovery was noted in saprolite of carbonatite (CBTSAP) when comparing the results of mechanical cell and column flotation.

Based on the results above, it was demonstrated that a viable P_2O_5 concentrate can be produced from amphibolite ores at recovery levels compatible to an open circuit with mechanical cells. Considering that the proportion of amphibolites (MAMP and AMPSAP) in the deposit is approximately 7%, the presence of amphibolites as a dilutant in the carbonatite-predominant feed is not expected to have a significant adverse on flotation performance.

It is important to note that laboratory-scale, 'bench-top' testing of the amphibolites indicates the flotation response of these ore types and is not intended to reflect expected flotation performance (concentrate grades, recovery) at an industrial scale. Steady-state column flotation tests must be conducted and further regent screening tests performed, before verifying potential improvements in product grade and recovery.

8.11 SOLIDS-LIQUID SEPARATION TESTING – SLS (POCOCK, 2017)

Solids-liquid separation tests (SLS) were conducted on flotation concentrate and tailings samples of both Saprolite and Meta carbonatite materials in order to generate data to design and size thickening and filtration equipment. Additionally, geotechnical and rheological properties determinations were also performed. Pocock Industrial, located in Salt Lake City, Utah, conducted the SLS testwork program.

The samples tested were produced during the pilot flotation tests campaigns developed by Eriez in 2017.

Phosphate concentrate dewatering process requires a final moisture of 2%. The process consists of a combination of thickening, filtration and hot gas drying. The Pocock SLS testing program included thickening and filtration stages.

The dewatering of meta carbonatite flotation tailings is intended to get a dry material able to be handled/ transported to be sold as aglime.

The following thickening testing results were obtained from the report "Sample Characterization & PSA, Flocculant Screening, Gravity Sedimentation, Pulp Rheology, Pressure Filtration and Vacuum Filtration Studies" (Pocock, July-September 2017).

8.11.1 THICKENING TESTING RESULTS

Two types of thickening tests were performed, static tests for conventional type thickener design, and dynamic tests for high-rate type thickener design.

In this thickening test work, a high rate thickener is defined as having a feed well with auto-dilution capabilities for pre-diluting feed prior flocculant contact, ability to dilute flocculant with thickener overflow and multiple flocculant injection points in feed pipe and feed well for efficient flocculant delivery.

Table 8.17: Conventional Thickening Testing Results

Conventional Thickening	Feed Slurry Solids wt %	Flocculant Type	Flocculant Dosage	Underflow Slurry Solids wt%	Unit Area
	%	-	g/t	%	$m^2/(t.d)$
P_2O_5 Flotation Concentrate - Saprolite	25%	SNF AN 905 SH	5	74.9, 76.1, 77.1	0.060, 0.064, 0.067
	25%		10		0.058, 0.062, 0.065
	25%		15		0.061, 0.065, 0.069
	30%		10		0.065, 0.070, 0.075
	35%		10		0.082, 0.093, 0.102
P_2O_5 Flotation Tailings Saprolite	5%	SNF AN 910 SH	80	39.0, 41.2, 42.9	0.732, 0.759, 0.777
	5%		90		0.706, 0.733, 0.752
	5%		100		0.658, 0.684, 0.703
	10%		90		0.535, 0.570, 0.595
	15%		90		1.6, 1.85, 2.03
P_2O_5 Flotation Concentrate - Meta Carbonatite	25%	SNF AN 905 SH	10	74.6, 75.6, 76.4	0.092, 0.096, 0.098
	25%		15		0.088, 0.092, 0.094
	25%		20		0.088, 0.091, 0.094
	30%		15		0.092, 0.097, 0.101
	35%		15		0.117, 0.126, 0.133
P_2O_5 Flotation Tailings - Meta Carbonatite	25%	SNF AN 905 SH	10	70.2, 72.3, 73.9	0.085. 0.093, 0.099
	25%		15		0.075, 0.084, 0.090
	25%		20		0.081, 0.090, 0.095
	30%		15		0.082, 0.093, 0.101
	35%		15		0.131, 0.153, 0.169

Table 8.18: High Rate Thickening Testing Results

High Rate Thickening	Feed Slurry Solids wt %	Flocculant Type	Flocculant Dosage	Underflow Slurry solids wt%	Maximum Design Net Feed Loading Rate
	%	-	g/t	%	$m^3/(m^2.h)$
P_2O_5 Flotation Concentrate - Saprolite	15% - 30%	SNF AN 905 SH	10-15	70.9 % - 74.9%	3.70-4.80 (4.25 average)
P_2O_5 Flotation Tailings - Saprolite	5% - 8%	SNF AN 910 SH	85 - 100	35.0% - 39.0%	2.00 - 4.00 (3.00 average)
P_2O_5 Flotation Concentrate - Meta Carbonatite	15% - 30%	SNF AN 905 SH	15-20	70.6 % - 74.6%	3.70-4.80 (4.25 average)
P_2O_5 Flotation Tailings - Meta Carbonatite	15% - 30%	SNF AN 905 SH	15	65.2% - 69.2%	3.70 - 4.80 (4.25 average)

Conventional thickener was designed for P_2O_5 concentrate thickener and high-rate thickener was considered for tailings thickener.

8.11.2 FILTRATION TESTING

The filtration tests were conducted on thickening underflow samples during sedimentation testing. Pressure and vacuum filtration methods were used for testing thickened phosphate flotation concentrates and tailings of both Saprolite and Meta Carbonatite materials.

The main parameters for designing filtration facilities are cake moisture and the unit filtration rate of each filtration method (pressure or vacuum filtration).

In the case of P_2O_5 concentrate filtration (of both Saprolite and Meta Carbonatite materials), lower cake moistures are desirable because of the downstream drying process required to obtain a final product with 2% moisture. For the Meta Carbonatite flotation tailings (the portion to be sold as aglime), the desired cake moisture is related to its ability to be handled/ transported without fluidizing. As a general guideline, tails materials are likely to fluidize in transport at or above about 12% moisture.

The following filtration testing results were obtained from the report “Sample Characterization & PSA, Flocculant Screening, Gravity Sedimentation, Pulp Rheology, Pressure Filtration and Vacuum Filtration Studies” (Pocock, July-September 2017).

Pressure Filter Testing

Pressure filtration testing was performed using a lab scale pressure filtration device. The following table shows the test results.

Table 8.19: Pressure Filter Testing Results

Description	Unit	Meta Carbonatite				Saprolite	
		P_2O_5 Flotation Tails		P_2O_5 Flotation Concentrate		P_2O_5 Flotation Concentrate	
Feed slurry Solids %	%	65.7%	45.0%	74.7%	45.0%	67.2%	45.0%
Feed Pressure	kPa	551.6	551.6	551.6	551.6	551.6	551.6
Cake thickness (full cake)	mm	60	60	60	60	60	60
Cake thickness (half cake)	mm	30	30	30	30	30	30
Effective filtration rate	$kg/(m^2.h)$	190	190	190.6	190.7	190.6	190.6
Cake Moisture	%	11.2%	11.2%	5.5%	6.7%	5.2%	5.2%

Vacuum Filter Testing

Vacuum filtration testing was performed using a lab scale pressure filtration device (leaf testing). The following tables shows the test results for vacuum filters (belt and disc/ drum filters).

Table 8.20: Vacuum Filter (Belt Filter) Testing Results

Description	Unit	Meta Carbonatite						Saprolite		
		P_2O_5 Flotation Tails			P_2O_5 Flotation Concentrate			P_2O_5 Flotation Concentrate		
Feed slurry Solids %	%	66.7%	66.7%	66.7%	73.7%	73.7%	73.7%	73.3%	73.3%	73.3%
Cake thickness	mm	12	12	12	14	14	14	18	18	18
Effective filtration rate	$kg/(m^2.h)$	535	693	867	1292	2310	3550	686	2602	6287
Cake Moisture	%	14	15	16	10	12	14	8	10	12

Table 8.21: Vacuum Filter (Disc/ Drum Filter) Testing Results

Description	Unit	Meta Carbonatite						Saprolite		
		P_2O_5 Flotation Tails			P_2O_5 Flotation Concentrate			P_2O_5 Flotation Concentrate		
Feed slurry Solids %	%	66.7%	66.7%	66.7%	73.7%	73.7%	73.7%	73.7%	73.7%	73.7%
Cake thickness	mm	20	13.5	9.2	17	17	19	17	16	14
Effective filtration rate	$kg/(m^2.h)$	319	472	693	632	1264	2263	305	1295	4440
Cake Moisture	%	14	15	16	10	12	14	8	10	12

The filtration testing results of the P_2O_5 concentrates of both Saprolite and Meta Carbonatite materials resulted in the combination of the lowest moisture (5 to 7%) and also lower effective filtration rates (190 to 191 kg/m2/h) compared to the vacuum method (moisture varying in the range of 8-14% and filtration rates equal or above 305 kg/m2/h). The pressure filter was then adopted in the project for concentrate filtration.

In the case of the filtration of aglime (meta carbonatite P_2O_5 flotation tailings), a trade off study was developed in order to compare the pressure filter and vacuum filters (disc/ drum) on the technical/ economical point of view. The pressure filter technology resulted in the most attractive solution on both technical and economical point of view and was then considered in the project.

8.12 ALTERNATIVE COLLECTORS TESTING (ERIEZ, 2017/2018)

The continuous flotation tests program developed in 2017 which served as the basis of Três Estradas Phosphate project were conducted out using the collector (AKZO NOBEL MD20389) that provided the best performance in terms or recovery and concentrate grade.

However, it was discovered that the collector, MD20389, would be in limited supply in late 2018 due to production scheduling issues. An alternative collector similar MD20389 is being developed but still it is not available in the market. Additionally, the price of the collector (MD20389 or its replacement), is expected to rise resulting in a significant increase in the operating cost.

As a result, Eriez was commissioned to conduct a bench scale evaluation of alternative collectors (including collectors of the fatty acids family) from different manufacturers. Bench scale evaluations of the alternative collectors were conducted using the same samples of Saprolite and Metacarbonatite used at the Pilot campaign reported in Item 7.3.2.

All tests were performed using mechanical flotation cells (Denver D12). Multiple cleaning stages, run in open circuit, were carried out aiming to generate a plus 30% P_2O_5 flotation concentrate. Tests with the base case reagents (Akzo Nobel) were also conducted for direct comparison with the alternative collectors.

8.12.1 SAPROLITE TESTING RESULTS

The following table shows the alternative collectors selected for saprolite testing, compared to the base case (Akzo Nobel MD20389).

Table 8.22: Alternative Collectors - Saprolite

Supplier	AKZO NOBEL	CLARIANT	HIDROVEG	ARRMAZ
Collector	MD20389	Flotinor 9904	Hidrocol V	CustFloat 171A
	-	Flotinor 9912	-	CustFloat 171C
	-	Flotinor 7654	-	CustFloat 167
	-	-	-	CustFloat 216
	-	-	-	CustFloat 408
	-	-	-	CustFloat 664

The flotation tests results of the saprolite ore with alternative collectors are presented in the following table:

Table 8.23: Alternative Collectors -Test Results (Saprolite)

Description	P_2O_5 Feed Grade	P_2O_5 Recovery	P_2O_5 Mass Yield	P_2O_5 Grade - Concentrate	Flotation Stages	Collector	Dosage	Collector Price (with taxes)
	%	%	%	%	-	-	g/t	USD/t
AKZO NOBEL (TEST BASE CASE)	10,66%	85,95%	30,34%	30,20%	RG/CL1/CL2/CL3	MD20389	400	USD 13,510.34
CLARIANT	**10,61%**	**80,39%**	**27,34%**	**31,20%**	**RG/CL1/CL2**	**Flotinor 9904**	**1200**	**USD 3,676.00**
	10,81%	80,80%	28,73%	30,40%	RG/CL1/CL2	Flotinor 9912	1200	USD 10,015.59
	10,54%	82,46%	30,18%	28,80%	RG/CL1/CL2	Flotinor 7654	1200	USD 9,296.46
HIDROVEG	10,52%	77,84%	25,43%	32,20%	RG/CL1/CL2	Hidrocol V	1200	USD 1,623.32
	10,95%	**77,08%**	**27,14%**	**31,10%**	**RG/CL1/CL2**	**Hidrocol V**	**800**	**USD 1,623.32**
	10,33%	35,32%	10,73%	34,00%	RG/CL1/CL2	Hidrocol V	500	USD 1,623.32
	10,82%	44,48%	14,63%	32,90%	RG/CL1/CL2/CL3	Hidrocol V	1200	USD 1,623.32
ARMAZ	**10,82%**	**80,75%**	**28,00%**	**31,20%**	**RG/CL1/CL2**	**CustFloat 171A**	**900**	**USD 4,451.20**
	10,23%	85,22%	36,94%	23,60%	RG/CL1/CL2	CustFloat 171A	700	USD 4,451.20
	10,49%	61,98%	23,90%	27,20%	RG/CL1/CL2	CustFloat 171C	700	USD 3,794.30
	10,60%	80,45%	31,70%	26,90%	RG/CL1/CL2	CustFloat 167	950	USD 1,958.34
	10,47%	71,92%	30,99%	24,30%	RG/CL1/CL2	CustFloat 167	700	USD 1,958.34
	10,54%	57,44%	20,59%	29,40%	RG/CL1/CL2	CustFloat 216	700	USD 1,958.34
	10,51%	86,59%	40,09%	22,70%	RG/CL1/CL2	CustFloat 408	700	USD 1,958.34
	10,69%	73,64%	27,24%	28,90%	RG/CL1/CL2	CustFloat 664	700	USD 1,958.34

The base case (Akzo Nobel MD 20389) yielded the highest P_2O_5 recovery (86%) at 30% P_2O_5 concentrate grade. However, Flotinor 9904 (Clariant), Hidrocol V (Hidroveg) and

CustFloat 171A (Arrmaz) offered comparable results, at slightly reduced recoveries. Although a reduction in recovery is not desired, these reagents offer a significant reduction in operating cost, because of the lower prices compared to the base case.

8.12.2 META CARBONATITE TESTING RESULTS

The flotation test results of the metacarbonatite ore with alternative collectors are presented in the following table.

Table 8.24: Alternative Collectors -Test Results (Meta Carbonatite)

Description	P_2O_5 Feed Grade	P_2O_5 Recovery	P_2O_5 Mass Yield	P_2O_5 Grade - Concentrate	Flotation Stages	Collector	Dosage	Collector Price (with taxes)
	%	%	%	%	-	-	g/t	USD/t
AKZO NOBEL (TEST BASE CASE)	4.89%	72.74%	8.54%	32.10%	RG/CL1/CL2/CL3/CL4/CL5	MD20544	800	USD 13,510.34
CLARIANT	4.47%	66.84%	20.83%	12.10%	RG/CL1/CL2/CL3	Flotinor 9912	400	USD 10,015.59
	4.79%	62.78%	10.91%	21.70%	RG/CL1/CL2/CL3	Flotinor 7654	300	USD 9,296.46
	4.86%	68.42%	8.48%	30.40%	RG/CL1/CL2/CL3	Flotinor 7654	400	USD 9,296.46
	4.84%	74.34%	9.31%	30.10%	RG/CL1/CL2/CL3/CL4/CL5	Flotinor 7654	600	USD 9,296.46
	4.84%	74.49%	9.82%	28.60%	RG/CL1/CL2/CL3/CL4/CL5	Flotinor 7654	800	USD 9,296.46
HIDROVEG	4.50%	45.84%	25.05%	6.90%	RG/CL1/CL2/CL3	Hidrocol V	300	USD 1,623.32
	4.45%	54.12%	28.74%	7.10%	RG/CL1/CL2/CL3	Hidrocol V	450	USD 1,623.32
ARMAZ	4.62%	98.63%	71.51%	5.20%	RG	CustFloat 171A	500	USD 4,451.20
	4.51%	98.40%	78.93%	4.70%	RG	CustFloat 167	450	USD 1,958.34
	4.51%	84.10%	51.98%	6.10%	RG	CustFloat 216	400	USD 1,958.34
	4.30%	82.13%	60.71%	5.10%	RG	CustFloat 664	300	USD 1,958.34

The bench scale testing showed that the lower cost Clariant collector Flotinor 7654 achieved the best results compared to more expensive Akzo Nobel MD20544 collector (base case). Using 400g/t dosage of Flotinor 7654, a 30.4% P_2O_5 concentrate at 68.42% recovery was achieved. At a 600g/t dosage, a 30.1% P_2O_5 concentrate at 74.34% recovery was achieved exceeding the performance of the MD20544 collector.

The alternative reagents provided by Hidroveg and Arrmaz did not provide reasonable flotation results in term of concentrate P_2O_5 grade and recovery.

9 MINERAL RESOURCES

9.1 INTRODUCTION

This section presents the mineral resource estimates determined by Águia and audited by Millcreek. Millcreek has reviewed the methodology and assumptions used by Águia and has completed a detailed audit of the geologic model and resource estimation. The mineral resource model prepared by Águia for Três Estradas considers 139 core holes and 244 RC holes drilled during the period of October 2011 to June 2017. Sampling information from auger holes are not considered in the model.

9.2 RESOURCE DATABASE

The database used for mineral resource evaluation includes 139 core holes (20,509.5m) and 244 RC holes (7,800m) for the Três Estradas deposit (Table 9.1). The database was provided to Millcreek in a digital format and represents the Três Estradas Project exploration dataset as of August 8, 2017.

All drill hole collars were surveyed using differential GPS equipment in UTM coordinates (SAD69 datum, Zone 21S). Down-hole surveys were initiated in the second drilling campaign. In all, 96 core holes, representing 69% of the core drilled have been surveyed at three-meter intervals using a Maxibore tool. Core recovery exceeded 90% in 97% in all core holes. All RC holes have vertical orientations and have relatively shallow depths and are likely to have insignificant down-hole deviations.

Table 9.1 Summary of Drilling Database

Drilling	Count	Cumulative Meters	Assay Intervals
Core Holes	139	20,509.5	16,046
RC Holes	244	7,800.0	7,800
Total	**383**	**28,309.5**	**23,846**

Millcreek has completed a thorough review and verification of the drilling database and found the database to be sufficient for resource modeling.

9.3 GEOLOGIC MODEL

Águia has developed a geologic block model of the Três Estradas Property phosphate deposit using GEMS™ software. Modeling was constructed by developing a series of vertical sections spaced at 50m intervals. Three-dimensional shells were developed by linking the vertical sections together with tie lines. Mineralization has an approximate strike length of 2,400m and extends to a depth of 370m below surface. Mineralized zones range in thickness from 5m to 100m. The outer mineralized envelopes were modeled into wireframe solids using a 3.00% P_2O_5 cut-off grade.

The model recognizes five mineralized, lithologic domains and nine non-mineralized domains as listed in Table 9.2.

Table 9.2 Model Lithologic Domains

Typology	Domain	Average Ordinary Kriging Density	Block Model Code	Description
MINERALIZED	CBTSAP	1.60	120	Saprolite of Carbonatite
	WMCBT	2.80	110	Weathered Carbonatite
	MCBT	2.85	100	Meta-Carbonatite
	AMPSAP	1.65	220	Saprolite of Amphibolite
	MAMP	2.87	200	Amphibolite
WASTE	AMPSAP-WASTE	1.77	22	Saprolite of Amphibolite Waste
	WMAMP-WASTE	2.83	21	Weathered Amphibolite Waste
	MAMP-WASTE	2.91	20	Amphibolite Waste
	W-SAP	1.81	32	Saprolite Waste (Meta-Syenite, Gneiss)
	W-WEATH	2.59	31	Weathered Waste (Meta-Syenite, Gneiss)
	W-ROCK	2.68	30	Fresh Rock Waste (Meta-Syenite, Gneiss)
	CBTSAP-WASTE	1.63	42	Saprolite of Carbonatite Waste
	WMCBT-WASTE	2.76	41	Weathered Carbonatite Waste
	MCBT-WASTE	2.80	40	Meta-Carbonatite Waste

Águia constructed wireframes of the meta-carbonatite and the amphibolite. Meta-carbonatite is differentiated by weathering into three domains: saprolite, weathered carbonatite, and fresh meta-carbonatite. Amphibolite is separated into two domains: saprolite and fresh amphibolite.

Grade estimations were made using ordinary kriging interpolation for all of the mineralized domains. All assays were composited to 1.0m lengths. All estimations are based on a homogeneous block model. Dimensions of the block model are displayed in Table 9.3.

Table 9.3 Block Model Dimensions

Dimensions	Minimum	Maximum	Block Size	Number of blocks
X	766,350	769,110	12	230
Y	6,575,650	6,576,820	6	195
Z	-100	400	10	50
Rotation	40°			

Figure 9.1 presents a perspective view of the modeled 3D solids and surfaces of the model.

9.3.1 STATISTICAL ANALYSIS, COMPOSITING AND CAPPING

Millcreek reviewed the statistics for assay samples in the five mineralized domains. There are sufficient samples in each domain to support resource estimation. Table 9.4 presents the length-weighted averages and summary statistics for each of the six oxides within the five mineralized domains.

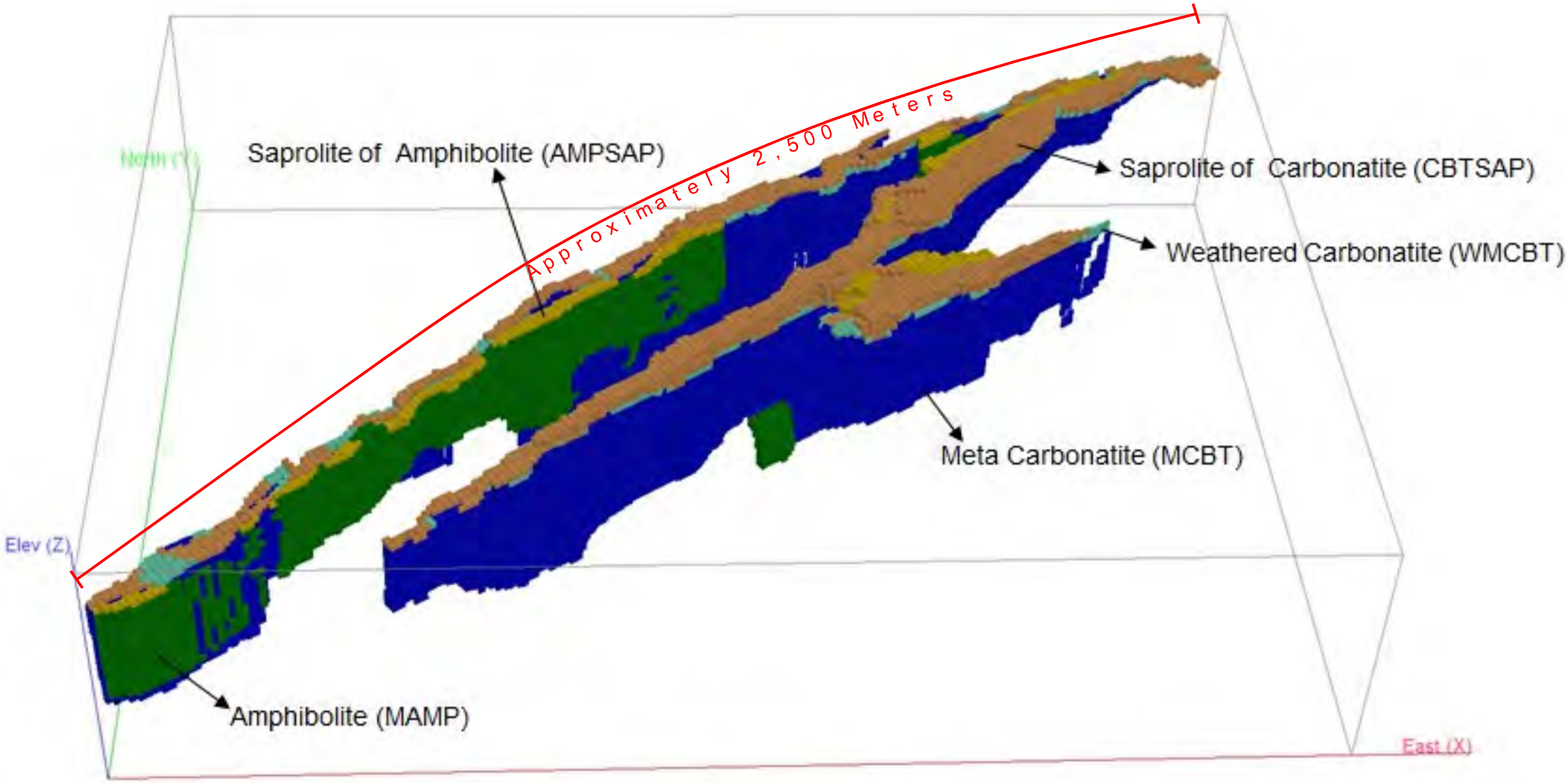
Table 9.4 Summary Statistics of Oxide Grades for Mineralized Domains

Domain	Rock Code	Stats*	P_2O_5	CaO	Al_2O_3	Fe_2O_3	MgO	SiO_2
AMPSAP	210	Average	5.22	10.75	8.44	15.21	7.42	40.67
		Std. Dev.	2.99	4.48	3.18	2.90	3.28	8.87
		Minimum	0.16	0.44	2.24	6.28	0.24	22.60
		Maximum	15.10	24.50	21.20	24.90	14.60	81.30
		Count	447					
CBTSAP	110	Average	9.67	16.57	5.60	18.45	4.80	31.32
		Std. Dev.	5.29	8.36	3.17	6.66	3.43	11.77
		Minimum	0.00	0.00	0.00	0.00	0.00	0.00
		Maximum	36.90	49.30	19.70	73.40	15.50	96.60
		Count	2122					
WMCBT	120	Average	4.49	34.82	2.26	9.02	5.89	13.87
		Std. Dev.	2.08	8.74	2.00	3.75	2.86	8.80
		Minimum	0.99	5.17	0.09	2.57	0.76	1.34
		Maximum	19.00	50.90	14.74	39.80	16.60	79.10
		Count	993					
MCBT	100	Average	3.79	34.31	2.10	7.95	7.71	11.94
		Std. Dev.	1.33	7.85	2.12	2.81	3.20	8.65
		Minimum	0.00	0.00	0.00	0.00	0.00	0.00
		Maximum	19.00	52.40	20.20	67.10	17.50	98.50
		Count	8743					
MAMP	200	Average	3.81	19.49	6.75	12.60	9.04	33.31
		Std. Dev.	1.55	4.25	1.62	2.57	1.52	6.94
		Minimum	0.03	0.14	0.00	1.45	0.10	2.44
		Maximum	11.77	43.00	13.40	22.10	16.70	97.60
		Count	670					

*Length-weighted averages

Águia has composited all assay intervals for the five domains to 1.0m lengths. Figure 9.2 shows the cumulative distribution of assay sample lengths. The cumulative frequency plot shows that 91% of all mineralized samples have a sample length less than or equal to 1.0m and approximately 76% of the samples are 1.0m in length. Millcreek considers the 1.0m composite length to be an appropriate length for sample composites. Table 9.5 presents the length-weighted averages and summary statistics for each of the six oxides within the five mineralized domains following compositing.

Figure 9.1 Perspective View of Modeled 3D Solids from Três Estradas Block Model



Saprolite of Carbonatite (CBTSAP)
Saprolite of Amphibolite (AMPSAP)
Weathered Meta-Carbonatite (WMCBT)
Meta-Carbonatite (MCBT)
Amphibolite (MAMP)

FIGURE 9.1

Perspective View of Modeled 3D Solids from Três Estradas Block Model

DATE: 10/19/2017

BY:

Millcreek Mining GROUP

Figure 9.2 Sample Length Probability

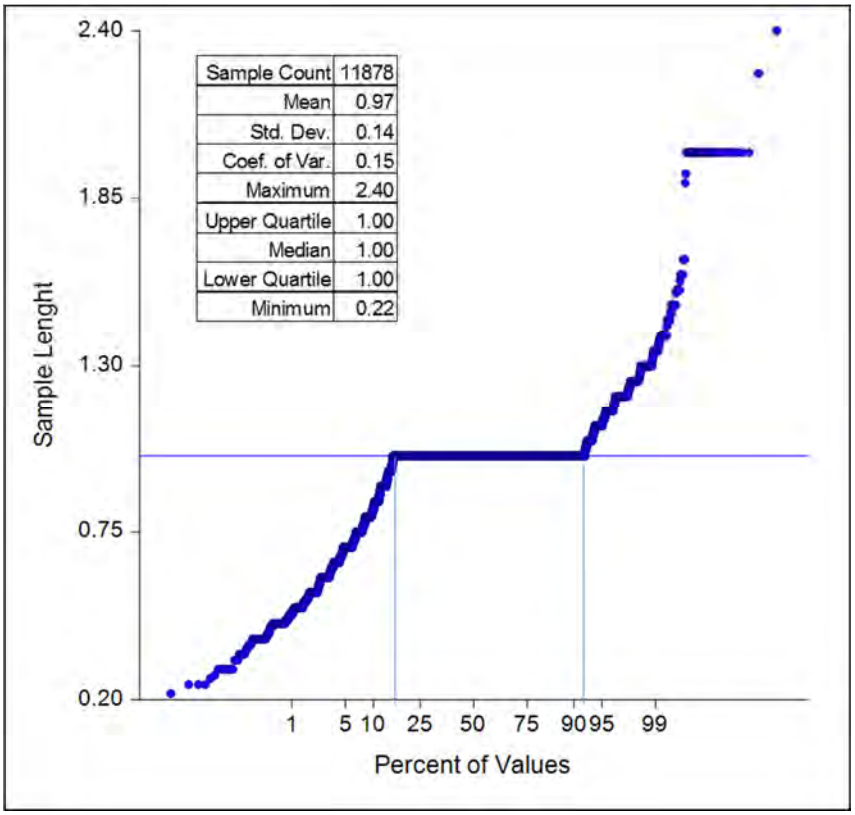


Table 9.5 Summary Statistics* of Composite Grades for Mineralized Domains

CBTSAP	Rock Code	Stats*	P_2O_5	CaO	Al_2O_3	Fe_2O_3	MgO	SiO_2
AMPSAP	210	Average	5.24	10.78	8.45	15.25	7.41	40.57
		Std. Dev.	2.95	4.44	3.14	2.87	3.27	8.68
		Minimum	0.19	0.44	2.24	6.28	0.24	22.60
		Maximum	15.10	24.50	21.20	24.90	14.60	81.30
		Count	449					
CBTSAP	110	Average	9.67	16.58	5.62	18.45	4.80	31.29
		Std. Dev.	5.22	8.29	3.16	6.62	3.40	11.53
		Minimum	0.00	0.00	0.00	0.00	0.00	0.00
		Maximum	29.81	49.30	19.70	73.40	15.50	90.20
		Count	2,120					
WMCBT	120	Average	4.49	34.82	2.26	9.02	5.89	13.87
		Std. Dev.	2.08	8.74	2.00	3.75	2.86	8.80
		Minimum	0.99	5.17	0.09	2.57	0.76	1.34
		Maximum	19.00	50.90	14.74	39.80	16.60	79.10
		Count	993					
MCBT	100	Average	3.80	34.43	2.07	7.95	7.70	11.79
		Std. Dev.	1.26	7.28	1.97	2.60	3.08	7.66
		Minimum	0.00	0.00	0.00	0.00	0.00	0.00
		Maximum	19.00	50.92	20.05	56.60	17.50	83.47
		Count	8,540					
MAMP	200	Average	3.81	19.41	6.75	12.73	9.03	33.49
		Std. Dev.	1.47	3.72	1.45	2.47	1.38	6.06
		Minimum	0.03	0.14	0.10	1.45	0.10	5.04
		Maximum	11.77	43.00	43.00	22.10	16.00	97.60
		Count	709					

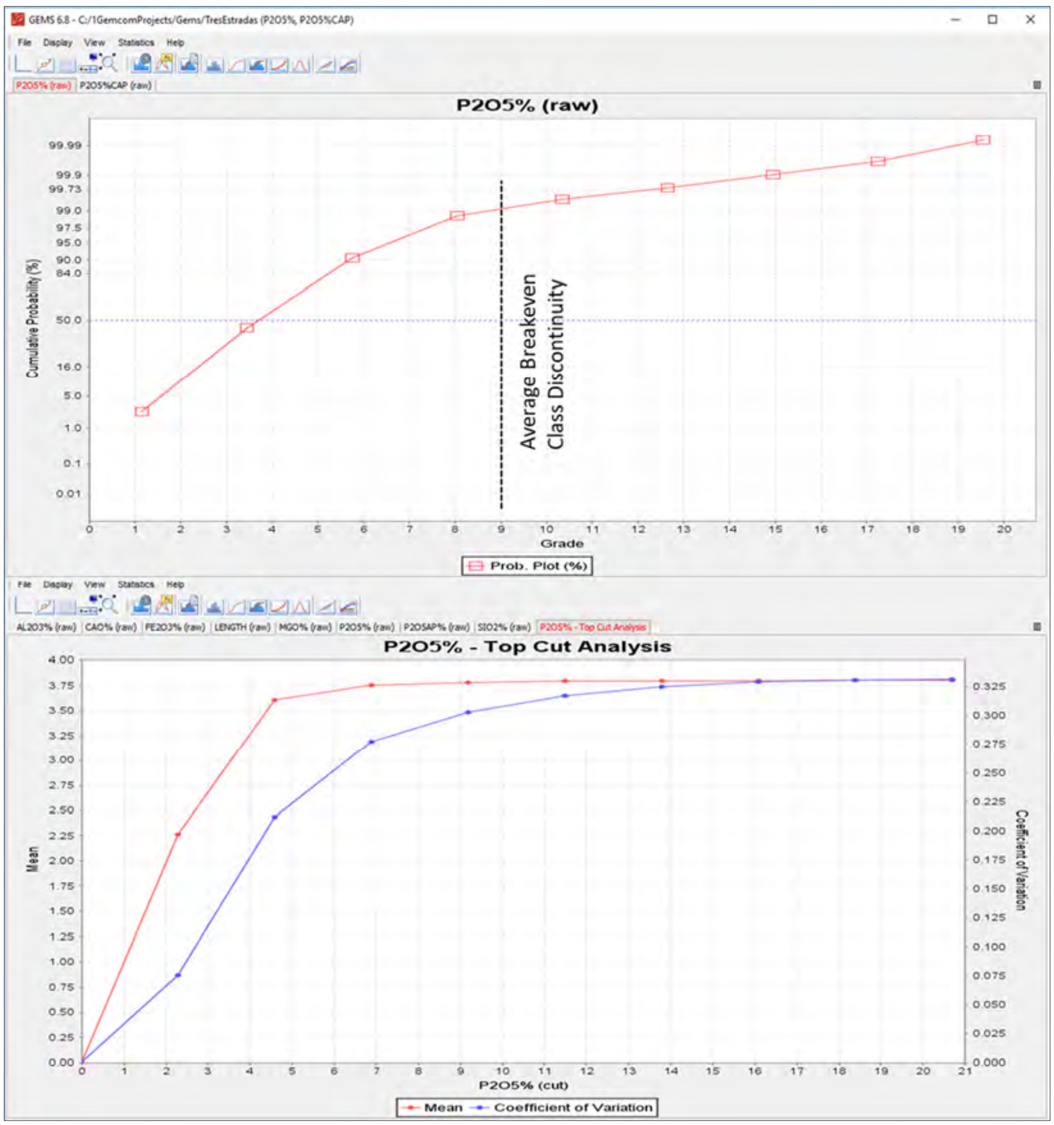
*Length-weighted averages

Águia has not employed any grade capping to limit the influence of high-grade outliers. Rather a high-grade limit was applied to reduce the influence of the high-grade values. Under supervision of Millcreek, Águia conducted a top-cut analysis. Through visual inspection of the gradual changes of the mean values, a high-grade limit was identified for each mineral domain. Figure 9.3 shows 9% P_2O_5 was selected as the high-grade limit. Therefore, in the grade estimation process of P_2O_5, when the composite grade reaches 9% or more the size of search ellipsoids reduces to half of its original size. This approach has two main benefits:

i. Compared to the grade capping process[5], the high-grade composites will have some effect on estimation, therefore comparable proportions of blocks will be estimated with high grade values.

ii. The smearing effect of the high grades composites were reduced hence reducing the effect of ‘conditional bias’.

Figure 9.3 The Top Cut Process for P_2O_5



[5] In the capping process the high-grade composites are trimmed to the capping grade and hence blocks will be estimated with grades lower than the capping grade.

9.4 VARIOGRAPHY

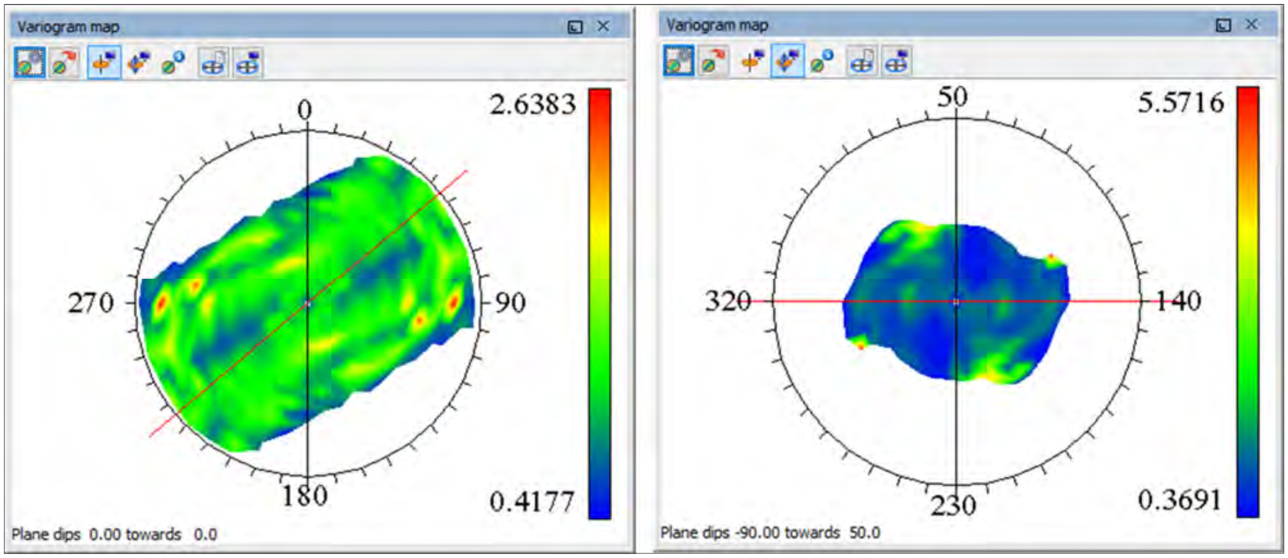
Águia performed a series of variograms and variogram maps in GEMS mining software to model the spatial continuity of the six oxides (P_2O_5, CaO, Al_2O_3, Fe_2O_3, MgO, and SiO2) and for specific gravity of MCBT and MAMP. Figure 9.4 is an example of a variogram map for P_2O_5 for meta-carbonatite. Search ellipsoids and different orientations for strike, dip and plunge were evaluated using variogram maps. The test results of the normalized anisotropic variograms are presented below. The variography studies were performed using the composites in the meta-carbonatite (MCBT**)**. Variography shows a preference in orientation that is nearly coincidental to the strike and dip of the meta-carbonatite and the Cerro dos Cabritos Fault. The variograms were normalized before running the resource estimation. Additionally, in order to improve the quality of estimation, variograms for specific gravity were modeled for meta-carbonatite and amphibolite. The parameters of the normalized omnidirectional variograms of SG are also shown in Table 9.6.

Table 9.6 Normalized Variogram Parameters Used in the Grade Estimation Process

Domain	Variable	GEMS Rotation (ADA)			Variogram Model						
		Azimuth	Dip	Azimuth	Nugget	Str. No.	Type	CC	Y Range (width)	X Range (strike)	Z Range (vertical)
MCBT	P2O5%	50	0	140	0.1	1	spherical	0.50	15	100	5
		50	0	140		2	spherical	0.40	35	160	45
MCBT	CAO%	50	0	140	0.25	1	spherical	0.40	15	80	7
		50	0	140		2	spherical	0.35	30	170	36
MCBT	MGO%	50	0	140	0.1	1	spherical	0.30	15	95	7
		50	0	140		2	spherical	0.60	40	180	50
MCBT	FE2O3%	50	0	140	0.25	1	spherical	0.35	40	35	3
		50	0	140		2	spherical	0.40	55	70	11
MCBT	SIO2	50	0	140	0.1	1	spherical	0.55	25	60	3.5
		50	0	140		2	spherical	0.35	25	110	12
MCBT	AL2O3	50	0	140	0.25	1	spherical	0.40	30	95	6
		50	0	140		2	spherical	0.35	40	150	25

Domain	Variable	GEMS Rotation (ADA)			Variogram Model						
		Azimuth	Dip	Azimuth	Nugget	Str. No.	Type	CC	Y Range (width)	X Range (strike)	Z Range (vertical)
MCBT	S.G.	0	0	0	0	1	spherical	0.50	110	110	110
		0	0	0		2	spherical	0.50	190	190	190
MAMP	S.G.	0	0	0	0.1	1	spherical	0.20	45	45	45
		0	0	0		2	spherical	0.70	225	225	225

Figure 9.4 Variogram Map for P_2O_5 Grade in MCBT



9.4.1 DENSITY AND GRADE ESTIMATION

The estimation for the six oxide variables (P_2O_5, CaO, Al_2O_3, Fe_2O_3, MgO, and SiO2) and specific gravity were done using ordinary kriging interpolation for all the domains: MCBT, WMCBT, MAMP, CBTSAP and AMPSAP. All estimations are based on 1.0m composites on a homogeneous block model with unitary dimensions of 12m N, by 6m E, and 10m in elevation rotated 40^{o} in a clock-wise direction. Three estimation passes were used with progressively relaxed search ellipsoids and data requirements based on the Variography.

- Pass 1: Blocks estimated in the first pass using half the distance of variogram range and based on composites from a minimum of three boreholes;
- Pass 2: Blocks estimated in the first two passes within the full range of the variogram and based on composites from a minimum of two boreholes; and
- Pass 3: All remaining blocks within the wireframe limits in an unconfined search not classified in the first two estimation passes.

Table 9.7 shows the search parameters used for each mineralized domain and Table 9.8 shows the search parameters employed for specific gravity.

Table 9.7 Search Parameters for Grade Estimation

		Search Ellipse											HG Transition Search		
		Composites		SVx*	Svy*	SVz*	GEMS Rotation (ADA)					High Grade (HG) Transition Value	SVx*	Svy*	SVz*
Domain	Estimation Run	Min.	Max.	(m)	(m)	(m)	Principal Azimuth	Principal Dip	Intermediate Azimuth	Estimation Method	Search Type		(m)	(m)	(m)
MCBT / WMCBT / MAMP															
P2O5%	1	6	16	80	18	22	50	0	140	OK / NN	Ellipsoid	9.00	40	9	11
P2O5%	2	6	16	160	50	50	50	0	140	OK / NN	Ellipsoid	9.00	80	25	25
P2O5%	3	6	16	320	70	90	50	0	140	OK / NN	Ellipsoid	9.00	160	35	45
CAO%	1	6	16	80	18	22	50	0	140	OK	Ellipsoid				
CAO%	2	6	16	160	50	50	50	0	140	OK	Ellipsoid				
CAO%	3	6	16	320	70	90	50	0	140	OK	Ellipsoid				
MGO%	1	6	16	80	18	22	50	0	140	OK	Ellipsoid				
MGO%	2	6	16	160	50	50	50	0	140	OK	Ellipsoid				
MGO%	3	6	16	320	70	90	50	0	140	OK	Ellipsoid				
FE2O3%	1	6	16	80	18	22	50	0	140	OK	Ellipsoid				
FE2O3%	2	6	16	160	50	50	50	0	140	OK	Ellipsoid				
FE2O3%	3	6	16	320	70	90	50	0	140	OK	Ellipsoid				
SIO2%	1	6	16	80	18	22	50	0	140	OK	Ellipsoid				
SIO2%	2	6	16	160	50	50	50	0	140	OK	Ellipsoid				
SIO2%	3	6	16	320	70	90	50	0	140	OK	Ellipsoid				
AL2O3%	1	6	16	80	18	22	50	0	140	OK	Ellipsoid				
AL2O3%	2	6	16	160	50	50	50	0	140	OK	Ellipsoid				
AL2O3%	3	6	16	320	70	90	50	0	140	OK	Ellipsoid				
CBTSAP															
P2O5%	1	6	12	80	18	22	50	0	140	OK / NN	Ellipsoid	25	40	9	11
P2O5%	2	6	24	160	50	50	50	0	140	OK / NN	Ellipsoid	25	80	25	25
P2O5%	3	6	24	320	70	90	50	0	140	OK / NN	Ellipsoid	25	160	35	45
CAO%	1	6	12	80	18	22	50	0	140	OK	Ellipsoid				
CAO%	2	6	24	160	50	50	50	0	140	OK	Ellipsoid				
CAO%	3	6	24	320	70	90	50	0	140	OK	Ellipsoid				
MGO%	1	6	12	80	18	22	50	0	140	OK	Ellipsoid				
MGO%	2	6	24	160	50	50	50	0	140	OK	Ellipsoid				
MGO%	3	6	24	320	70	90	50	0	140	OK	Ellipsoid				
FE2O3%	1	6	12	80	18	22	50	0	140	OK	Ellipsoid				
FE2O3%	2	6	24	160	50	50	50	0	140	OK	Ellipsoid				
FE2O3%	3	6	24	320	70	90	50	0	140	OK	Ellipsoid				
SIO2%	1	6	12	80	18	22	50	0	140	OK	Ellipsoid				
SIO2%	2	6	24	160	50	50	50	0	140	OK	Ellipsoid				
SIO2%	3	6	24	320	70	90	50	0	140	OK	Ellipsoid				
AL2O3%	1	6	12	80	18	22	50	0	140	OK	Ellipsoid				
AL2O3%	2	6	24	160	50	50	50	0	140	OK	Ellipsoid				
AL2O3%	3	6	24	320	70	90	50	0	140	OK	Ellipsoid				
AMPSAP															
P2O5%	1	6	12	80	18	22	50	0	140	OK / NN	Ellipsoid	13	40	9	11
P2O5%	2	6	24	160	50	50	50	0	140	OK / NN	Ellipsoid	13	80	25	25
P2O5%	3	6	24	320	70	90	50	0	140	OK / NN	Ellipsoid	13	160	35	45
CAO%	1	6	12	80	18	22	50	0	140	OK	Ellipsoid				
CAO%	2	6	24	160	50	50	50	0	140	OK	Ellipsoid				
CAO%	3	6	24	320	70	90	50	0	140	OK	Ellipsoid				
MGO%	1	6	12	80	18	22	50	0	140	OK	Ellipsoid				
MGO%	2	6	24	160	50	50	50	0	140	OK	Ellipsoid				
MGO%	3	6	24	320	70	90	50	0	140	OK	Ellipsoid				
FE2O3%	1	6	12	80	18	22	50	0	140	OK	Ellipsoid				
FE2O3%	2	6	24	160	50	50	50	0	140	OK	Ellipsoid				
FE2O3%	3	6	24	320	70	90	50	0	140	OK	Ellipsoid				
SIO2%	1	6	12	80	18	22	50	0	140	OK	Ellipsoid				
SIO2%	2	6	24	160	50	50	50	0	140	OK	Ellipsoid				
SIO2%	3	6	24	320	70	90	50	0	140	OK	Ellipsoid				
AL2O3%	1	6	12	80	18	22	50	0	140	OK	Ellipsoid				
AL2O3%	2	6	24	160	50	50	50	0	140	OK	Ellipsoid				
AL2O3%	3	6	24	320	70	90	50	0	140	OK	Ellipsoid				

* GEMS rotations

Table 9.8 Search Parameters Specific Gravity

Domain	Estimation Run	Search Ellipse								Estimation Method	Search type
		Composites		SVx	Svy	SVz	GEMS Rotation (ADA)				
		Min.	Max.	(m)	(m)	(m)	Principal Azimuth	Principal Dip	Intermediate Azimuth		
MCBT / WMCBT / CBTSAP (ORE and WASTE)											
S.G.	1	6	16	190	190	190	0	0	0	OK	Ellipsoid
S.G.	2	6	16	400	400	400	0	0	0	OK	Ellipsoid
S.G.	3	6	16	1500	1500	1500	0	0	0	OK	Ellipsoid
MAMP / WMAMP / AMPSAP (ORE and WASTE)											
S.G.	1	6	16	225	225	225	0	0	0	OK	Ellipsoid
S.G.	2	6	16	450	450	450	0	0	0	OK	Ellipsoid
S.G.	3	6	16	1500	1500	1500	0	0	0	OK	Ellipsoid
ROCK / WEATHER / SAP (WASTE)*											
S.G.	1	6	16	225	225	225	0	0	0	OK	Ellipsoid
S.G.	2	6	16	450	450	450	0	0	0	OK	Ellipsoid
S.G.	3	6	16	1500	1500	1500	0	0	0	OK	Ellipsoid

*** Meta-syenite and Gneiss**

9.4.2 RESOURCE CLASSIFICATION

The resource classification involved a two-stage process.

Stage 1: Relevant mathematical parameters were saved in the block model and the blocks. These variables are:

i. Interpolation pass ***(pass);***

ii. Distance of the closest sample from the block center ***(mindist);***

iii. Average distance of samples used in estimating any block ***(avdist);***

iv. Number of drill holes used for estimating any block ***(nndh);***

v. The kriging variance of grade estimation ***(kvar).***

Stage 2: The above variables were used as supporting mathematical variables for finalization of the resource classification process. At this stage, the resource blocks were coded manually for achieving the following:

i. Most of **Measured** category blocks were supported by three or more holes and nearly 20 composites;

ii. **Measured** category blocks have at least one drill hole within half of the variogram range (major axis);

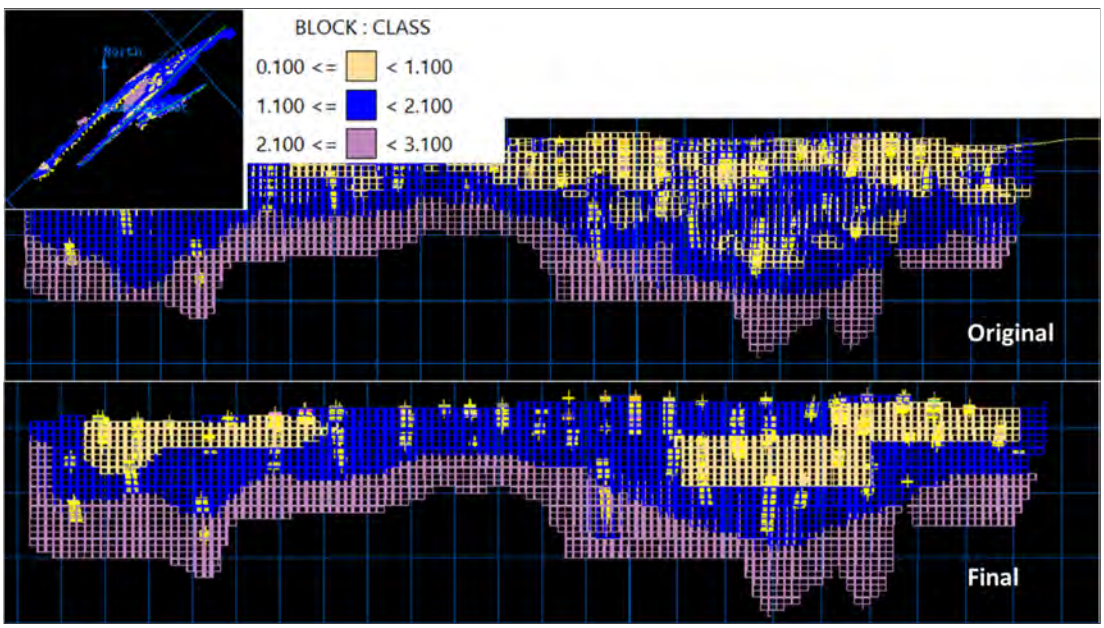
iii. Most of **indicated** category blocks are supported by at least two drill holes and nearly 15 composites;

iv. Measured category blocks have at least one drill hole within half of the variogram range (major axis);

v. Remaining blocks with a P_2O_5 grade estimation were coded as an **Inferred** Resource.

The two-stage process of classifying resources follows a 'best practices' approach allowing the CP to ensure that unreasonable conditions of: 1) measured blocks and inferred category blocks occurring side-by-side and 2) the measured and indicated blocks are not dominated by blocks with low sample support i.e., one drill hole with less than 10 composites[6]. The two-stage approach is a time-consuming process of smoothing the mixed Measured, Indicated and Inferred category blocks. However, this process eliminates the stripe or, spotted dog effect. Figure 9.5 demonstrates the difference between the initial and final resource classification.

Figure 9.5 Example of Stage 2 Resource Coding



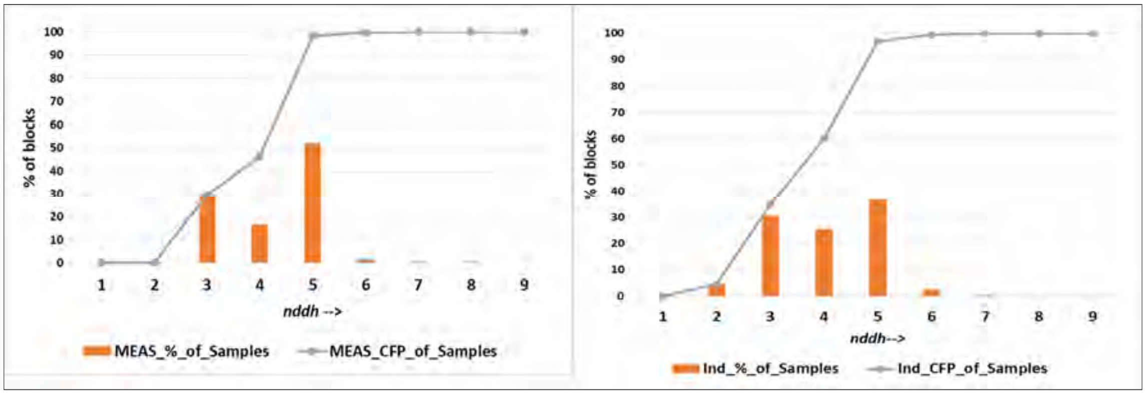
As a result of the two-stage process, the following was achieved:

i. 70% of Measured blocks are supported by 3 or more drill holes;

95% of Indicated blocks are supported by two or more holes and more than 70% of Indicated blocks are supported by 3 or more holes as seen in Figure 9.6.

[6] Compared to the block height of 10 m, the composites are of 1 m length.

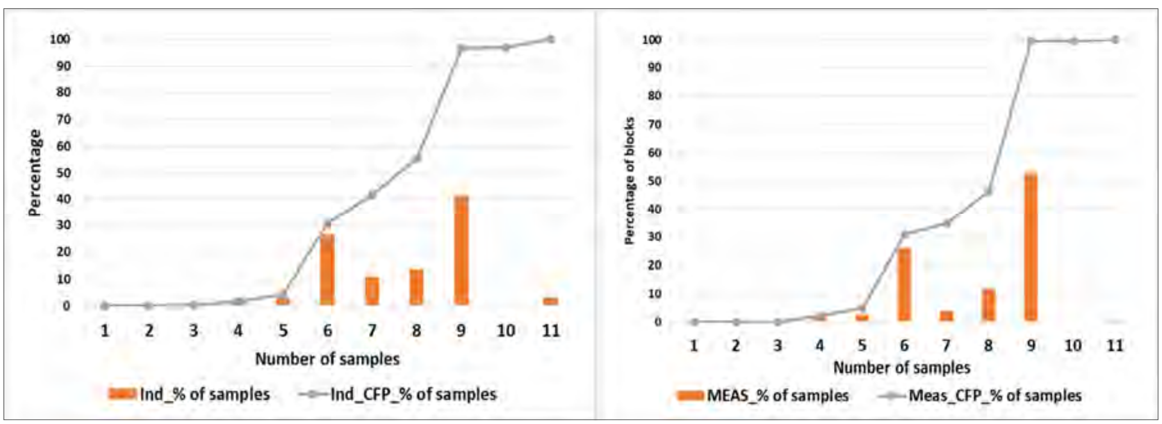
Figure 9.6 Comparisons of Measured Model Blocks to Supported Drill Holes



ii. > 90 % of Measured blocks are supported by 10 or more drill hole composites;

iii. Similar sample support exists for indicated resources as seen in Figure 9.7.

Figure 9.7 Comparisons of Indicated Model Blocks to Supported Drill Holes



iv. Most of the inferred category blocks are supported by 10 or more composite samples;

v. The average kvar values are much lower in Measured and Indicated blocks compared to inferred resources;

vi. The distribution of kvar values proves that the measured resources have lower kvar values, hence indication of lower error of estimation as seen in Figure 9.8.

Figure 9.8 Kriging Variances

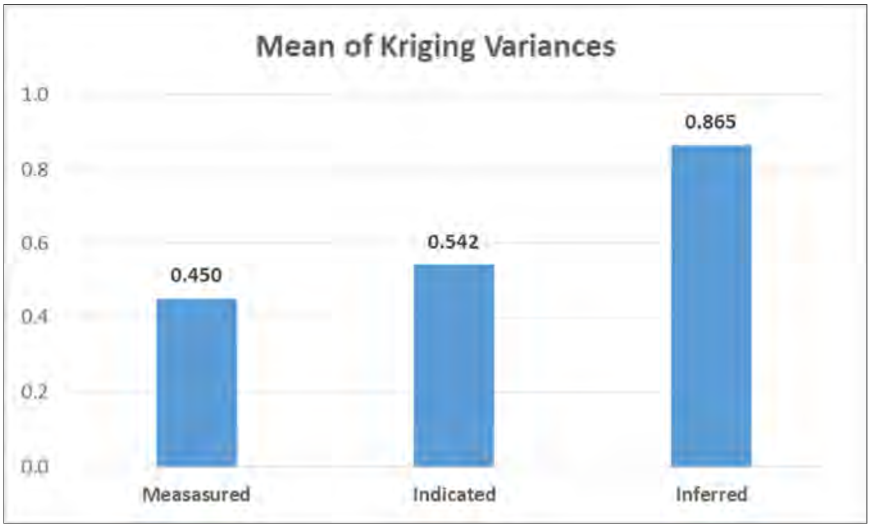


Table 9.9 presents the in-situ resource estimate for the geologic block model. This is the in-place estimate without consideration for mining method, recovery, processing or economic constraints. The in-situ estimate is based on the above stated parameters for estimation and classification of the phosphate mineralization and serves as the basis for the Mineral Resource Estimate presented in Item 9.4.

Table 9.9 In-Situ Resource for the Três Estradas Phosphate Deposit

Domain	Class	Volume (m^3 X 1000)	Density (T/m^3)	In-Situ Tonnes (T X 1000)	Grade (wt. %)					
					P_2O_5%	CaO%	MgO%	Fe_2O_3%	SiO_2%	Al_2O_3%
AMSAP	Measured	36	1.54	55	6.63	10.75	9.32	15.19	37.94	7.39
	Indicated	435	1.66	711	4.82	11.31	7.52	15.42	40.08	8.57
	Sub-Total	**471**	**1.65**	**766**	**4.95**	**11.27**	**7.65**	**15.4**	**39.93**	**8.49**
CBTSAP	Measured	501	1.63	812	10.03	18.11	5.42	18.62	28.83	4.75
	Indicated	2,348	1.66	3,862	9.16	16.2	4.56	18.41	31.77	5.87
	Inferred	27	1.64	45	5.41	20.17	5.61	12.17	29.81	6.8
	Sub-Total	**2,876**	**1.65**	**4,719**	**9.28**	**16.57**	**4.71**	**18.38**	**31.25**	**5.68**
WMCBT	Measured	653	2.81	1,833	4.12	33.93	6.76	8.92	13.38	2.16
	Indicated	390	2.79	1,083	4.3	34.35	6.15	8.81	14.53	2.32
	Inferred	16	2.83	45	3.93	33.86	8.13	8.2	11.13	1.8
	Sub-Total	**1,059**	**2.8**	**2,961**	**4.18**	**34.09**	**6.56**	**8.87**	**13.76**	**2.21**
MCBT	Measured	12,139	2.84	34,461	3.8	34.17	8.09	8.01	11.33	1.94
	Indicated	13,637	2.85	38,788	3.64	35.02	7.49	7.6	11.36	2.15
	Inferred	8,574	2.87	24,555	3.58	34.69	7.87	7.61	11.69	2.09
	Sub-Total	**34,350**	**2.85**	**97,804**	**3.68**	**34.64**	**7.8**	**7.75**	**11.43**	**2.06**
MAMP	Measured	233	2.89	671	3.69	19.1	8.89	13.69	33.52	6.44
	Indicated	1,654	2.88	4,751	3.93	19.58	9.05	12.78	33.1	6.78
	Inferred	681	2.85	1,938	3.9	19.3	9.15	12.68	32.78	7.11
	Sub-Total	**2,568**	**2.87**	**7,360**	**3.9**	**19.46**	**9.06**	**12.84**	**33.05**	**6.83**
Total		**41,324**	**2.79**	**113,610**	**3.95**	**32.73**	**7.72**	**8.6**	**13.91**	**2.57**

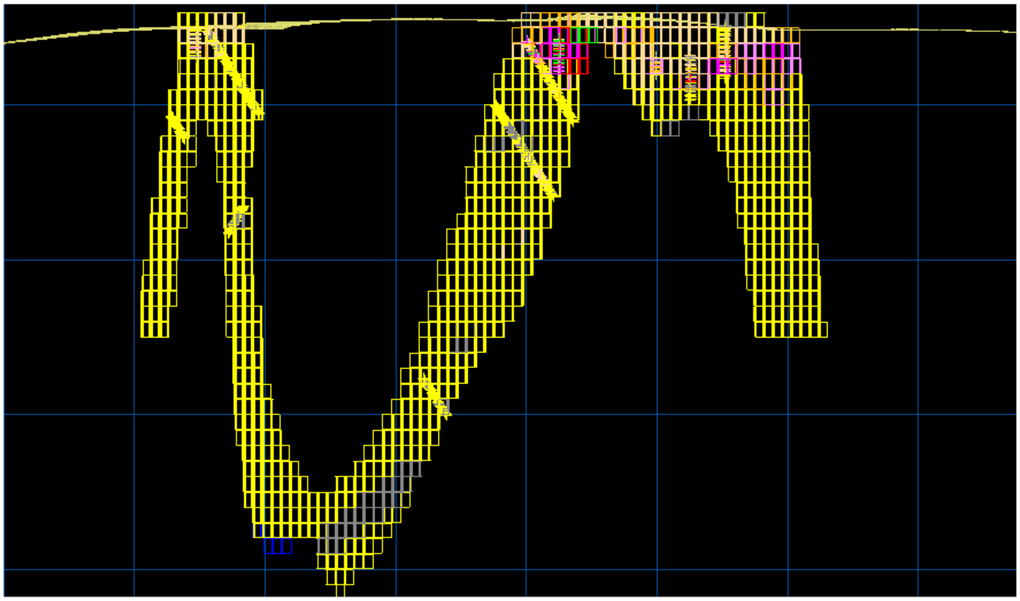
The estimated in-situ resource identifies 87.03Mt of measured plus indicated material with an average grade of 4.05% P_2O_5 and 32.48% CaO (57.98% calcite equiv.), using a minimum cut-off of 3.0% P_2O_5. By classification, 76.6% of the in-situ resources identified in the model are Measured and Indicated. The in-situ estimate also identifies 26.58MT of Inferred resource, with an average grade of 3.64% P_2O_5 and 33.54% CaO (59.87% calcite equiv.). Inferred resources account for 23.4% of the in-situ resources. Approximately 5% of the deposit (4.8Mt) is hosted in the saprolite (CBTSAP & AMPSAP) overlying the meta-carbonatite and amphibolite. The weathered transitional zone (WMCBT) represents 2.6% of the deposit (2.96Mt) and 105.2Mt (92%) of the resource is found in the two fresh rock domains (MAMP & MCBT).

9.4.3 MODEL VALIDATION

Millcreek has conducted an audit of the block model prepared by Águia and of the resources estimated from the model. Millcreek loaded the Três Estradas block model into the Maptek Vulcan® software system, a geology and mine planning software that competes directly with GEMS. The Millcreek audit and validation of the Três Estradas block model consisted of the following steps:

1. Visual Validation: The drill hole composited drilling data was loaded into Vulcan software to compare the grade estimation block/drill hole grade relationships in cross section view. A visual inspection of vertical cross sections spaced at 50m spacing along the strike of the mineralization showed strong correlation between drill hole assays and composited values in the model. An example of cross sections viewed through visual inspection are shown in Figure 9.9.

Figure 9.9 Representative Cross-Section



2. Statistical Validation: Two types of statistical validations were carried out: general statistical comparisons and statistical structures

    a. General statistics: The statistics of the estimated block model are compared with the composite data (Table 9.10).

Table 9.10 General Statistics Comparing Composites to Block Model

P_2O_5								
Composited Data								
Condition Title	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Mean**	**Standard Dev.**	**Number of Samples**
CBTSAP	0.140	5.650	9.280	12.980	30.120	9.679	5.218	2,118
MCBT	0.090	3.140	3.600	4.240	19.000	3.801	1.258	8,539
AMPSAP	0.190	3.068	4.490	7.318	15.100	5.240	2.949	449
MAMP	0.030	2.918	3.590	4.613	11.770	3.812	1.471	709
Block Model								
CBTSAP	1.240	5.630	8.300	11.030	21.500	8.606	3.624	5,225
MCBT	1.230	3.360	3.610	3.970	7.870	3.681	0.492	47,709
AMPSAP	1.480	3.388	4.030	5.870	12.440	4.758	1.851	869
MAMP	2.070	3.470	3.860	4.210	6.060	3.898	0.573	3,566
Al_2O_3								
Composited Data								
Condition Title	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Mean**	**Standard Dev.**	**Number of Samples**
CBTSAP	0.160	3.380	5.025	7.270	19.700	5.621	3.145	2,118
MCBT	0.010	1.020	1.600	2.320	20.050	2.068	1.974	8,539
AMPSAP	2.240	6.118	8.140	10.200	21.200	8.446	3.134	449
MAMP	0.100	5.858	6.720	7.600	13.230	6.751	1.445	709
Block Model								
CBTSAP	1.440	4.410	5.790	7.430	15.270	6.035	2.242	5,225
MCBT	0.050	1.460	1.790	2.370	10.920	2.064	1.108	47,709
AMPSAP	3.820	7.400	8.690	9.822	14.860	8.665	1.961	869
MAMP	4.400	6.270	6.880	7.330	10.240	6.834	0.818	3,566

Table 9.10 General Statistics Comparing Composites to Block Model (continued)

Condition Title	Min	Q1	Median	Q3	Max	Mean	Standard Dev.	Number of Samples
Fe_2O_3								
Composited Data								
CBTSAP	1.450	14.600	17.900	21.500	73.400	18.469	6.564	2,118
MCBT	1.520	6.370	7.390	8.960	56.600	7.946	2.603	8,539
AMPSAP	6.280	13.500	15.500	17.100	24.900	15.249	2.868	449
MAMP	1.450	11.100	12.600	14.103	22.100	12.727	2.467	709
Block model								
CBTSAP	7.090	14.590	17.030	21.160	40.110	18.088	5.439	5,225
MCBT	3.600	6.870	7.510	8.390	19.400	7.743	1.284	47,709
AMPSAP	10.780	13.910	15.300	16.482	19.260	15.304	1.739	869
MAMP	9.000	11.900	12.670	13.630	19.840	12.841	1.433	3,566
SiO_2								
Composited Data								
Condition Title	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Mean**	**Standard Dev.**	**Number of Samples**
CBTSAP	2.420	23.800	31.300	38.000	90.200	31.324	11.462	2,118
MCBT	0.970	7.230	9.980	13.850	83.470	11.795	7.656	8,539
AMPSAP	22.600	35.375	39.640	43.600	81.300	40.569	8.668	449
MAMP	5.040	30.800	34.100	36.600	97.600	33.489	6.053	709
Block Model								
CBTSAP	10.270	27.440	32.780	37.770	59.050	32.586	7.956	5,225
MCBT	1.720	8.910	10.710	13.440	35.180	11.448	3.870	47,709
AMPSAP	29.010	38.007	40.540	43.500	61.790	40.824	5.635	869
MAMP	20.240	30.460	33.680	35.540	53.360	33.094	3.599	3,566
MgO								
Composited Data								
Condition Title	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Mean**	**Standard Dev.**	**Number of Samples**
CBTSAP	0.100	1.700	4.385	7.360	15.500	4.806	3.402	2,118
MCBT	0.760	5.580	6.950	9.330	17.500	7.702	3.083	8,539
AMPSAP	0.240	4.840	8.040	9.730	14.600	7.414	3.269	449
MAMP	0.100	8.358	9.100	9.823	16.000	9.027	1.375	709
Block Model								
CBTSAP	0.330	2.460	4.570	6.260	12.200	4.483	2.401	5,225
MCBT	2.160	6.320	7.270	9.000	15.670	7.790	2.010	47,709
AMPSAP	0.830	6.333	7.770	9.043	12.410	7.252	2.645	869
MAMP	6.350	8.610	9.250	9.590	11.340	9.067	0.775	3,566

Table 9.10 General Statistics Comparing Composites to Block Model (continued)

CaO								
Composited Data								
Condition Title	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Mean**	**Standard Dev.**	**Number of Samples**
CBTSAP	0.370	11.300	15.400	20.560	49.300	16.596	8.255	2,118
MCBT	2.200	30.262	35.570	39.580	50.900	34.436	7.266	8,539
AMPSAP	0.440	7.740	11.100	13.625	24.500	10.782	4.437	449
MAMP	0.140	17.500	19.100	21.300	43.000	19.408	3.717	709
Block Model								
CBTSAP	2.350	12.280	15.110	18.863	40.800	15.838	5.559	5,225
MCBT	14.920	32.170	34.850	37.930	46.510	34.643	4.118	47,709
AMPSAP	3.490	8.835	11.340	13.112	19.330	10.870	3.187	869
MAMP	10.930	18.370	19.250	20.000	27.310	19.428	2.013	3,566

b. Comparison of Histograms: Comparison of histograms of the input composites of P_2O_5 with that of the block model (Figure 9.10 – 9.13) suggest that the P_2O_5 grade estimations are closely matched with the statistical structure of the composited data.

Figure 9.10 Statistical Comparison of P_2O_5 Block Model Grade Estimates with that of the Composited Data in Mineralized Amphibolite (MAMP)

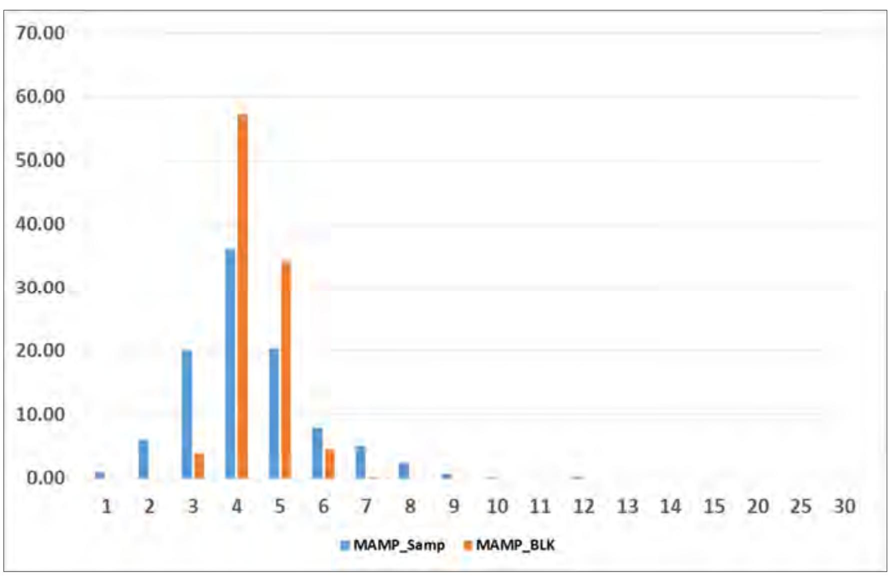


Figure 9.11 Statistical Comparison of P_2O_5 Block Model Grade Estimates with that of the Composited Data in Saprolitic Amphibolite (AMPSAP)

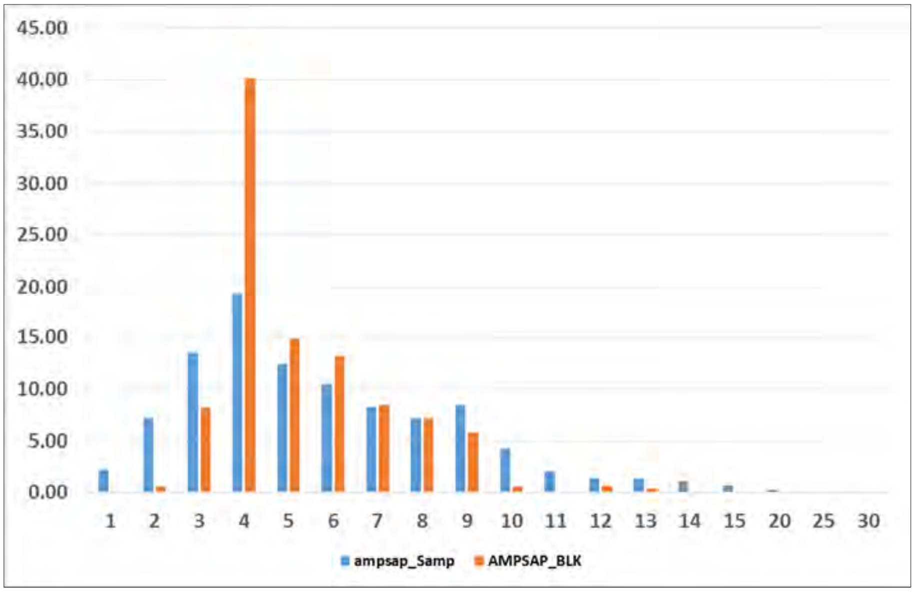


Figure 9.12 Statistical Comparison of P_2O_5 Block Model Grade Estimates with that of the Composited Data in Mineralized Carbonatite (MCBT)

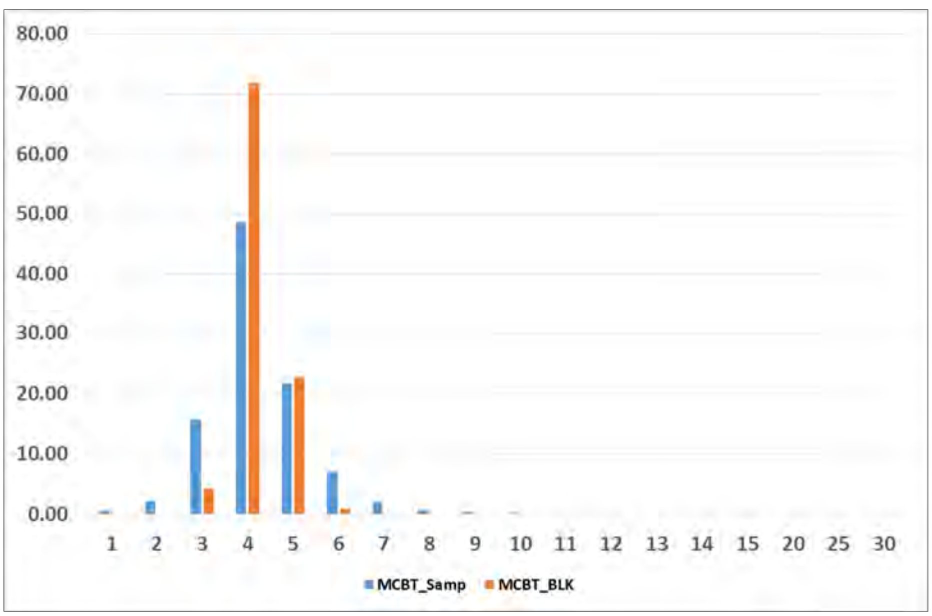
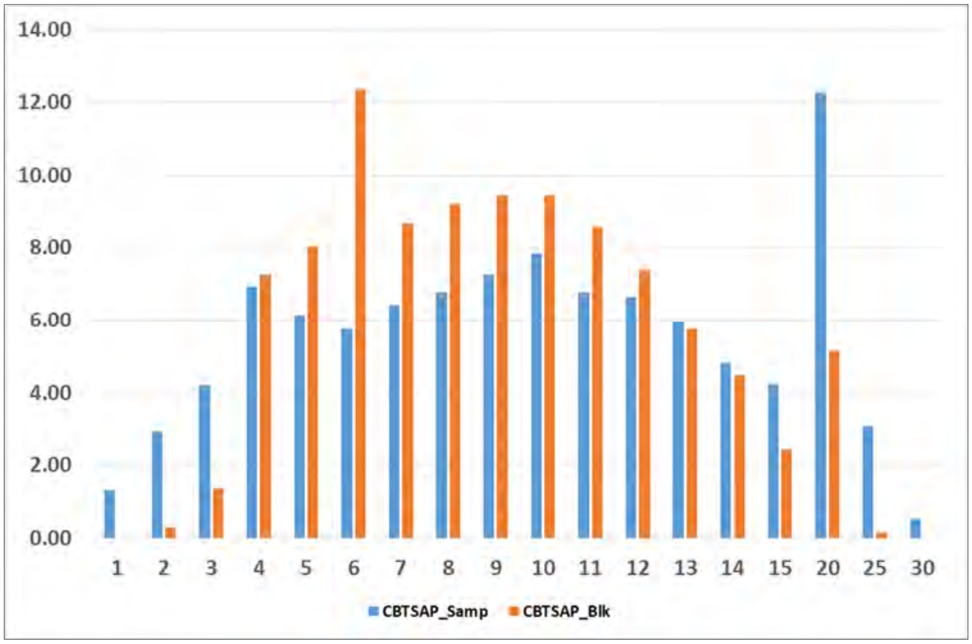


Figure 9.13 Statistical Comparison of P_2O_5 Block Model Grade Estimates with that of the Composited Data in the Saprolitic Meta-Carbonatite (CBTSAP)

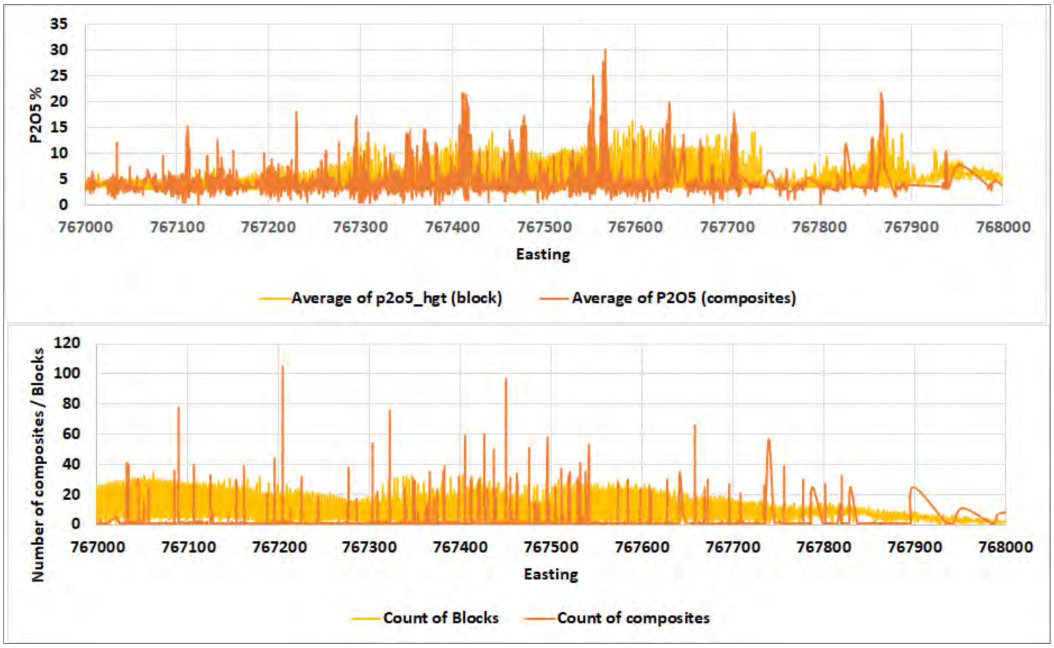


Close observation of these comparisons suggests that the estimates of P_2O_5 in the block models compare very well within the P_2O_5 values of the composites.

3. Spatial Validation (Swath plots): The block model was evaluated using a series of swath plots. A swath plot is a graphical display of the grade distribution derived from a series of bands, or swaths, generated as sections through the deposit.

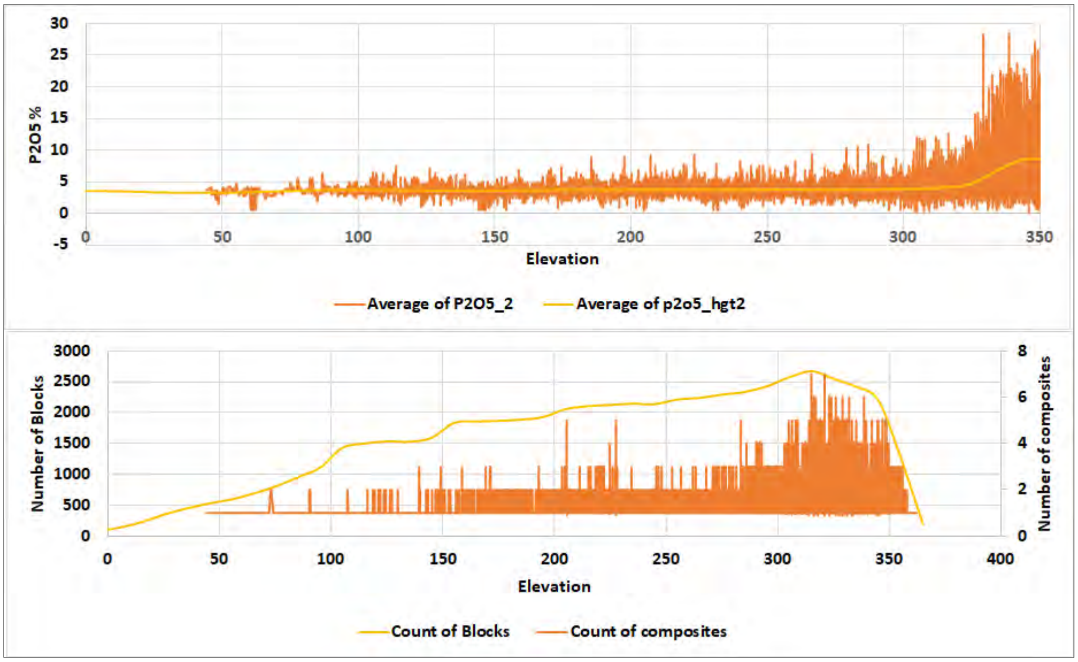
   a. Along East-West: Grade variations from the ordinary kriging model are compared to the original composites along East-West (Figure 9.14) shows that the estimates of P_2O_5 grades in the block model with better sample support match closely with that of composites.

Figure 9.14 Swath plots Comparing the P_2O_5 Block Model Grade Estimates with that of the Composited Data Along Easting



b. Vertical: A similar comparison of the grade variations of P_2O_5 block model estimates to the original composites along vertical direction (Figure 9.15) further validates the observation made from the east-west swath plots. The averages of the block model are much smoother due to interpolation.

Figure 9.15 Swath Plots Comparing the P_2O_5 Block Model Grade Estimates with that of the Composited Data Along Vertical Direction



4. Specific Gravity (SG) Model Validation: The SG composited data was used to create a krigged model that represents the variability of SG in the deposit.

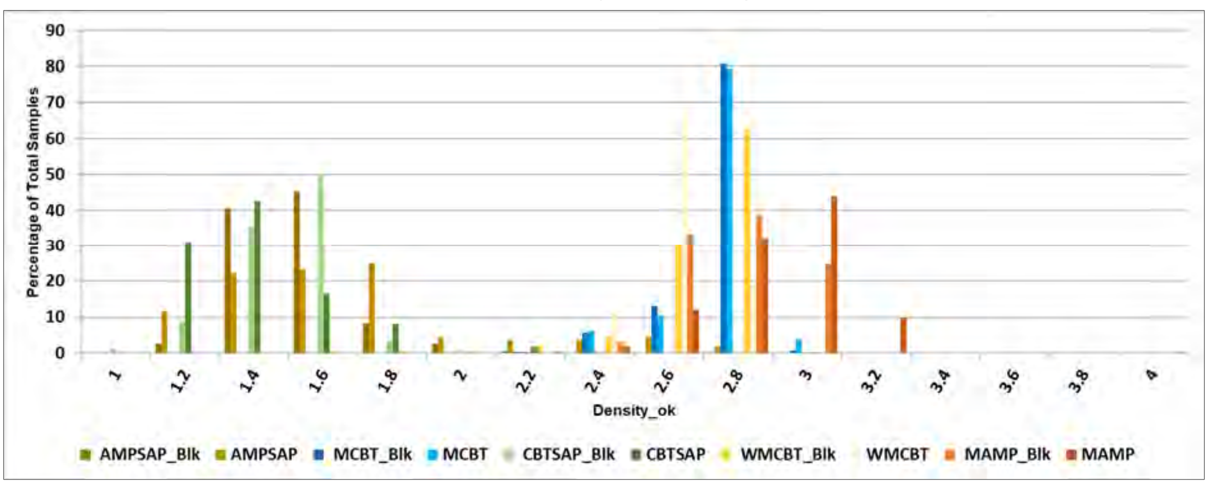
    a. Statistical comparison: A statistical comparison of SG (Table 9.11) suggests a reasonable match of estimated values with the input composite data.

Table 9.11 Statistical Comparison of Density Model

SG								
Composited Data								
Condition Title	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Mean**	**Standard Dev.**	**Number of Samples**
MCBT	2.310	2.823	2.865	2.910	3.180	2.849	0.116	1606
CBTSAP	1.260	1.370	1.510	1.610	2.330	1.522	0.196	61
WMCBT	1.770	2.643	2.720	2.775	2.935	2.702	0.145	79
MAMP	2.366	2.890	3.013	3.120	4.490	2.994	0.178	937
AMPSAP	1.200	1.525	1.714	1.910	2.960	1.783	0.366	112
Block Model								
MCBT	2.355	2.830	2.874	2.911	3.071	2.847	0.108	47709
CBTSAP	1.023	1.536	1.610	1.678	2.549	1.597	0.146	16745
WMCBT	1.767	2.760	2.829	2.880	3.002	2.795	0.138	1476
MAMP	2.510	2.742	2.866	2.999	3.167	2.866	0.141	3566
AMPSAP	1.283	1.500	1.656	1.763	2.219	1.647	0.167	3201

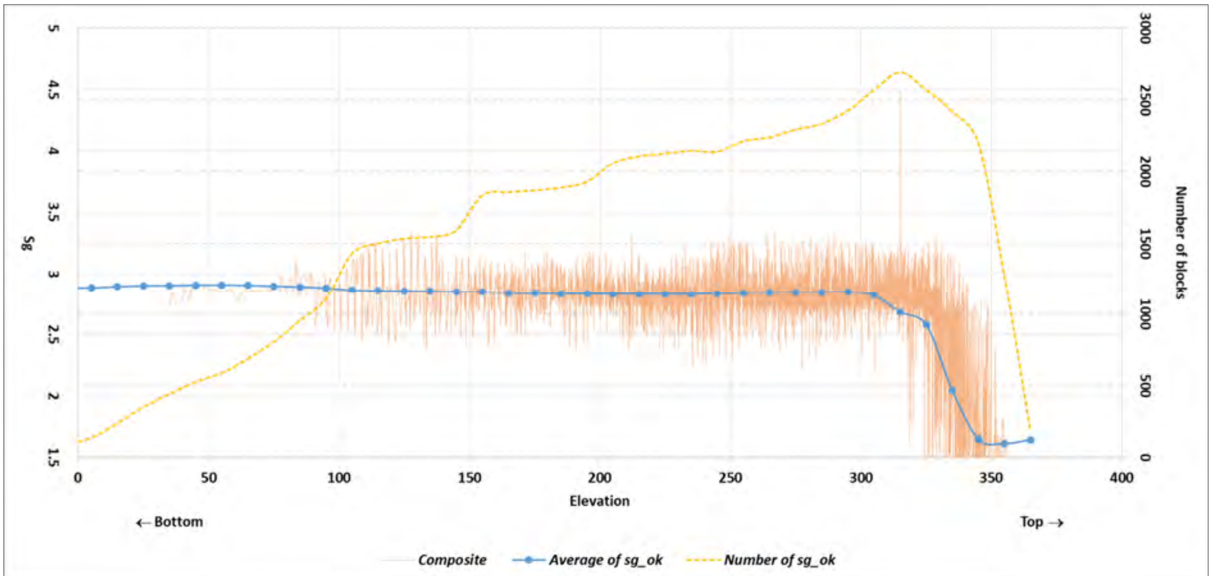
b. Comparison of statistical distribution: The comparison of histograms of the composites and block model show a good match of the statistical distribution. (Figure 9.16) This is a major improvement over use of averaged density values for each rock type.

Figure 9.16 Histograms of SG Block Model Grade Estimates with that of the Composited Data for all Major Rock Types



c. Swath plots of SG: Due to change in type and quality of rocks along vertical direction, a swath plot of SG along vertical direction (Figure 9.17) was generated to compare the spatial variation of SG. This diagram along with the histograms in Figure 9.16 proves that the density variability is well represented in this resource model.

Figure 9.17 Histograms of SG Block Model Grade Estimates with that of the Composited Data for All Major Rock Types



9.5 MINERAL RESOURCE ESTIMATE

The CIM Definition Standards defines:

"A 'Mineral Resource" is a concentration or occurrence of natural solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling."

The phrase "reasonable prospects for eventual economic extraction" implies that the quantity and grade estimates meet certain economic thresholds and that the mineral resources are reported at an appropriate cut-off grade that takes into account the extraction method and processing recovery. Millcreek considers the phosphate mineralization at the Três Estradas deposit to be amenable to extraction using open-pit mining methods. Millcreek has used the Lerchs-Grossman optimizing algorithm to evaluate the profitability of each resource block in the model based on its value. Optimization parameters are summarized in Table 9.12 and are derived from recent pilot-plant testing presented in Item 8 and updated geotechnical assumptions.

Table 9.12 Três Estradas Pit Optimization Parameters

Parameters	Value
Cut-off Grade P_2O_5	3.0%
Mining Recovery/Mining Dilution	100 / 0
Process Recovery P_2O_5 Saprolite	87%
Process Recovery P_2O_5 Fresh	80%
Process Recovery Calcite as Aglime	100%
Concentrate Grade Saprolite	35.0%
Concentrate Grade Fresh Rock	32.0%
Overall Pit Slope Angle Saprolite/Fresh Rock	34/51 & 55 Degrees
Mining Cost (USD/tonne Mined)	1.32
Process Cost (USD/tonne ROM)	4.06
G&A (USD/tonne of ROM)	0.79
Aglime Production Cost (USD/tonne of concentrate)	$4.00
Selling Price (US$/tonne of concentrate at 30.2% P_2O_5)	$215.00
Selling Price of Aglime (USD/tonne)	$47.00
Royalties (CFEM Tax) - Gross	2%
Marketing Costs - Gross	2%
Exchange Rate (US$ to R$)	3.2

Using the Lerchs-Grossman algorithm, Millcreek has developed a mineable pit shell using the above parameters. The pit shell captures the resources estimated in the block model that have reasonable prospects for economic extraction. The pit optimization also considers the recovery of calcite as a by-product to mining and processing of the meta-carbonatite. Calcite recovery through column flotation is further addressed in subsequent sections of the report.

The pit optimization results are used solely for the purpose of testing the “reasonable prospects for economic extraction” and do not represent an attempt to estimate mineral reserves, simply what portion of the resource is considered ‘mineable’. Further work has been performed to propose the portion of the ‘mineable’ resource that is economically optimized (see Item 6.1). Table 9.13 presents the Mineral Resource Estimate for the Três Estradas Phosphate Project, audited and confirmed by Millcreek.

Table 9.13 Audited Mineral Resource Estimate*, Três Estradas Phosphate Project, Millcreek Mining Group, September 8, 2017

Resource Classification	Domain	Volume (m^3 X 1000)	Tonnage (T X 1000)	Density (T/m^3)	P_2O_5%	CaO%	P_2O_5 as Apatite (%)	CaO as Calcite (%)
Measured	**AMSAP**	36	55	1.54	6.63	10.75	15.70	19.19
	CBTSAP	491	796	1.63	10.18	18.20	24.11	32.49
	WMCBT	602	1,686	2.81	4.24	34.07	10.03	60.82
	MCBT	11,619	33,004	2.85	3.85	34.26	9.12	61.15
	MAMP	227	655	2.89	3.72	19.09	8.81	34.08
Total Measured		**12,975**	**36,196**	**2.82**	**4.01**	**33.59**	9.50	59.95
Indicated	**AMSAP**	400	653	1.65	5.00	11.49	11.85	20.50
	CBTSAP	2,330	3,834	1.66	9.21	16.24	21.82	28.99
	WMCBT	370	1,026	2.78	4.38	34.57	10.39	61.71
	MCBT	13,000	36,984	2.85	3.67	35.08	8.69	62.62
	MAMP	1,571	4,517	2.88	3.98	19.63	9.43	35.04
Total Indicated		**17,671**	**47,014**	**2.74**	**4.18**	**31.72**	9.91	56.63
Total Measured + Indicated Resources		**30,646**	**83,210**	**2.77**	**4.11**	**32.53**	**9.73**	**58.07**
Inferred	**CBTSAP**	27	45	1.64	5.41	20.17	12.82	36.01
	WMCBT	16	45	2.83	3.93	33.86	9.32	60.44
	MCBT	7,034	20,247	2.88	3.65	34.72	8.64	61.98
	MAMP	528	1,508	2.87	3.89	19.21	9.22	34.30
Total Inferred		**7,605**	**21,845**	**2.88**	**3.67**	**33.62**	**8.69**	**60.01**

* Mineral resources are not mineral reserves and do not have demonstrated economic viability. All numbers have been rounded to reflect relative accuracy of the estimates. Mineral resources are reported within a conceptual pit shell at a cut-off grade of 3% P_2O_5. Optimization parameters are stated in Table 9.12

The Audited Mineral Resource identifies 83.21 Mt of measured and indicated material with an average grade of 4.11% P_2O_5 and 32.53% CaO (58.07% calcite equiv.), using a minimum cut-off of 3.0% P_2O_5. The estimate also identifies 21.85Mt of inferred material with an average grade of 3.67% P_2O_5 and 33.62% CaO (60.01 calcite equiv.). By classification, 79% of the resources contained within the optimized pit shell are Measured and Indicated with the remaining 21% of the resource classified as Inferred resource.

The Geology CP is not aware of or perceives any environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other relevant factors having any material impact on the resource estimates other than what has already been discussed in this report.

The accuracy of resource and reserve estimates is, in part, a function of the quality and quantity of available data and of engineering and geological interpretation and judgment. Given the data available at the time this report was prepared, the estimates presented herein are considered reasonable. However, they should be accepted with the understanding that additional data and analysis available subsequent to the date of the estimates may necessitate revision. These revisions may be material. There is no guarantee that all or any part of the estimated resources or reserves will be recoverable.

10 MINERAL RESERVES

Mineral reserves are the economically feasible portion of the mineral resource, as demonstrated by a pre-feasibility or feasibility study. In general, the bulk of the work reported in this document has been done at a feasibility study level, and all work has been done to a minimum pre-feasibility study level standard.

The Três Estradas Phosphate Project was advanced through several years of preliminary economic assessments and numerous ‘stand-alone’ studies before the BFS was completed. Geology and resource estimates were prepared by geologists experienced in resource estimation, geologic modelling and interpretation, and application of variographic and geostatistical techniques to improve geologic understanding and interpretation. Metallurgical testing and process design / costing was performed by experts with specific expertise and understanding of column flotation of phosphate ores in Brazil, and after extensive studies. Mine planning and costing was undertaken by experts experienced in open-pit hard-rock mining in Brazil. Market studies were performed by experienced groups with an understanding of the fertilizer markets in Brazil. Costing, economic and tax analyses were undertaken by professionals with an excellent understanding of mining costs in Brazil, and of the tax treatments that are available. Environmental and legal considerations were all provided by well-respected groups, with specific experience with the mining industry in Brazil. Details of the engineering, mine planning, costing and economic work that was required to arrive at this conclusion are provided and discussed in Items 8, and 12 – 17.

In the opinion of the CP, the study summarized in this Technical Report is sufficient to make a reasonable determination of the economic feasibility of a portion of the mineral resources (see Item 9), and as the basis for conversion of Mineral Resources to Mineral Reserves.

As discussed in the CIM Definition Standards, there is a direct relationship between Indicated Mineral Resources and Probable Mineral Reserves, as well as between Measured Mineral Resources and Proven Mineral Reserves, respectively. While it is possible to state Measured Mineral Resources as Probable (i.e., not Proven) reserves by applying modifying factors, in the case of the reserve estimate reported here that is not considered necessary or appropriate. Measured and Indicated resources that are the subject of the economic mine plan have been classified as Proved and Probable Reserves, respectively.

Total estimated Proven and Probable reserves for the Três Estradas Phosphate Project assuming, considering a saleable product as a ‘reference point’, are summarized in Table 10.1, below. Reserves and head grade are reported on a mill-feed (post mining) basis and are inclusive of ore losses and dilution. Further areas of risks and opportunities are covered in Item 18.

Table 10.1 Proven and Probable Reserves

Classification	Reserves (Sap.)	Reserves (Cbt. + Amp.)	Reserves (Total)	Head Grade (%P_2O_5)
Proven	844,302	27,023,619	27,867,921	3.92
Probable	4,352,915	11,334,168	15,687,083	5.01
Prove. + Prob.	**5,197,217**	**38,357,787**	**43,555,004**	**4.31**

11 MINING

Mine operations for the Três Estradas Phosphate Project are planned to use conventional open-pit, truck and shovel mining methods for the phosphate ores and waste material.

Initially, phosphate will be produced through mining of separate saprolite and ‘fresh rock’ (carbonatite / amphibolite) phases. (For the purpose of this report, the term ‘carbonatite’ is inclusive of the relatively minor quantity of amphibolite ore, unless specifically stated otherwise.)

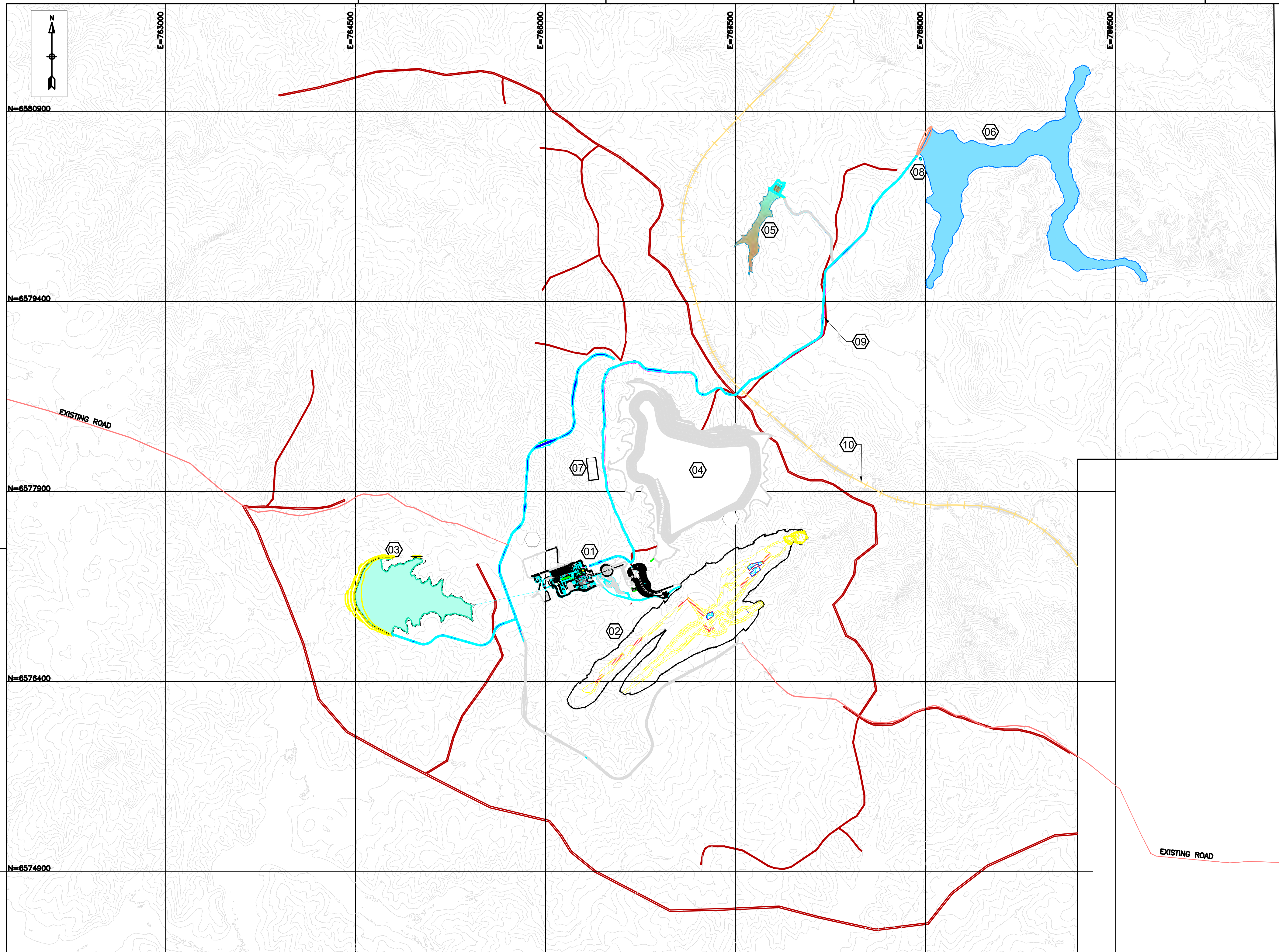
The processing of carbonatite ores will produce on average just under 3Mtpy of calcite, which will be sold as an ‘aglime’ by-product. While this aglime is marketable with no further processing, the market capacity for Três Estradas aglime in the region is constrained to 1 Mtpy. The remainder of the produced aglime will be pumped to an on-site tailings storage facility, where it will be stockpiled until the end of mining operations, at which point it will be reclaimed and sold at 1 Mtpy until depleted (an additional 20 years after cessation of mining).

The mining areas were defined using economic optimization analysis of the geologic block model and took into account the need to optimize project value by considering haulage of ore and waste to the plant and final dumps (respectively), as well as scheduling of stripping / mining operations and quality considerations.

Figure 7.1 - 2 shows the site plan for the Três Estradas Phosphate Project facilities, pit, dump and dams.

Throughout this section, the term fresh rock and / or carbonatite will refer to all non-saprolite ores including carbonatite and the relatively small amount of amphibolite.

Figure 11.1 Três Estradas Site Plan - Phase I (Saprolite)



ITEM	DESCRIPTION
01	BENEFICIATION PLANT
02	MINE – SAPROLITE FINAL PIT
03	SAPROLITE TAILINGS DAM
04	NORTH WASTE PILE – PHASE 1
05	NORTH DIKE
06	WATER DAM
07	SANITARY FILL
08	RAW WATER INTAKE
09	RAW WATER PIPELINE
10	EXISTING RAILROAD

1

LEGEND:

- EXISTING ROAD
- EXISTING RAILWAY
- NEW ROADS
- SECONDARY ROAD
- PIPELINE
- OBJECTS ON GRAY COLOR REPRESENT PHASE 2 PROJECT
- OBJECTS ON COLORS CYAN, GREEN OR WHITE REPRESENT PHASE 1 PROJECT

1

INSTRUÇÕES P/ PLOTAGEM	
COR	ESPESSURA
COR N. 8	0,05
WHITE	0,1
YELLOW	0,1
GREEN	0,2
CYAN	0,3
BLUE	0,4
RED	0,6
MAGENTA	0,8

NOTES

1 – ALL DIMENSIONS ARE IN MILLIMETER, ELEVATION IN METER.
2 – COORDINATE SYSTEM, DATUM SAD-69
3 – TO BENEFICIATION PLANT – GENERAL ARRANGEMENT – PHASE 1 – SEE DWG AGUIA No. 1000-C-M13-0003 (ECM 766-01-1000-C-M13-0003).

1

REFERENCE DOCUMENTS

REV.	IT	DESCRIPTION	BY	DRAW.	VER.	APPR.	AUTH.	DATE
1	B	WHERE INDICATED	ICR	ICR	RAG	CAS	CAS	06/03/18
0	B	INITIAL ISSUE	ICR	ICR	RAG	CAS	CAS	12/12/17

REVIEWS

(IT) ISSUE TYPE: (A) PRELIMINARY (B) FOR APPROVAL (C) FOR INFORMATION (D) FOR QUOTATION (E) FOR CONSTRUCTION (F) AS BOUGHT (G) AS BUILT (H) CANCELLED

AGUIA

Millcreek Mining GROUP

ECM

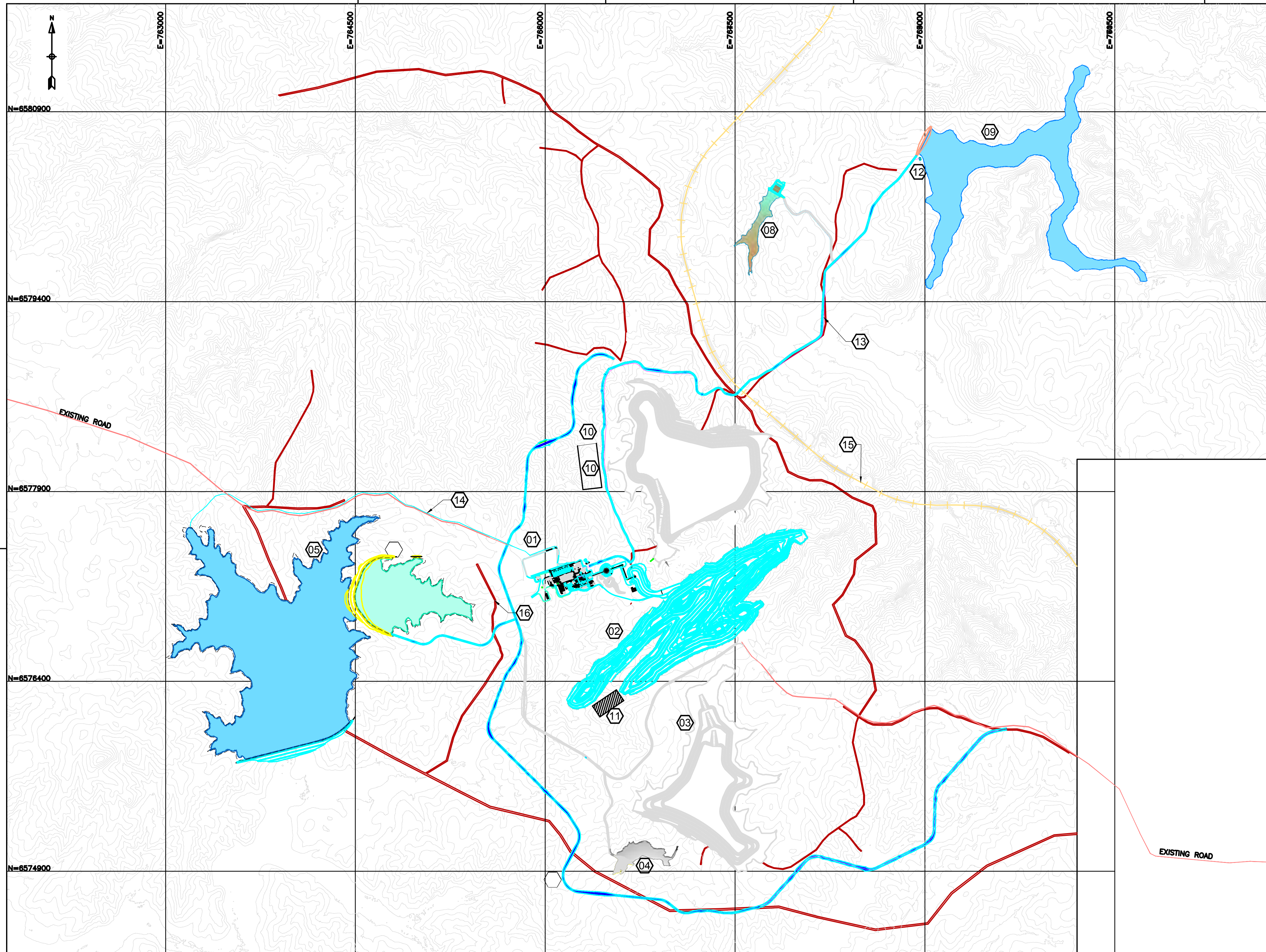
TRÊS ESTRADAS PROJECT

FEASIBILITY STUDY
GENERAL
PLOT PLAN – PHASE 1

SCALE	Nº ECM	Nº ÁGUIA RESOURCES	REVIEW
NTS	766-01-1000-C-M13-0002	1000-C-M13-0002	1

(A1)

Figure 11.2 Três Estradas Site Plan - Phase II (Carbonatite)



ITEM	DESCRIPTION
01	BENEFICIATION PLANT
02	MINE PIT
03	SOUTH WASTE STOCKPILE – PHASE 2
04	DIKE
05	AGLIME DAM SOUTH
06	AGLIME DAM EAST
07	STERIL STOCKPILE – PHASE 2
08	DIKE NORTH
09	WATER DAM
10	SANITARY FILL
11	BLASTING FACILITE
12	RAW WATER INTAKE
13	RAW WATER PIPELINE
14	TAILINGS DISPOSAL – PHASE 2
15	EXISTING RAIL WAY
16	AGLIME DISPOSAL – PHASE 1

1

LEGEND:

- EXISTING ROAD
- EXISTING RAILWAY
- NEW ROADS
- SECONDARY ROAD
- PIPELINE

1

OBJECTS ON GRAY COLOR REPRESENT PHASE 1 PROJECT

OBJECTS ON COLORS CYAN, GREEN OR WHITE REPRESENT PHASE 2 PROJECT

NOTES

1 – ALL DIMENSIONS ARE IN MILLIMETER, ELEVATION IN METER.
2 – COORDINATE SYSTEM, DATUM SAD-69
3 – TO BENEFICIATION PLANT – GENERAL ARRANGEMENT – PHASE 2 – SEE DWG AGUIA No. 1000-C-M13-0052 (ECM 766-01-1000-C-M13-0052).

REFERENCE DOCUMENTS

REV.	IT	DESCRIPTION	BY	DRAW.	VER.	APPR.	AUTH.	DATE
1	B	WHERE INDICATED	ICR	ICR	AXA	RAG	CAS	06/03/18
0	B	INITIAL ISSUE	ICR	ICR	RAG	CAS	CAS	29/12/17

REVIEWS

(IT) ISSUE TYPE: (A) PRELIMINARY (B) FOR APPROVAL (C) FOR INFORMATION (D) FOR QUOTATION (E) FOR CONSTRUCTION (F) AS BOUGHT (G) AS BUILT (H) CANCELLED

AGUIA — Millcreek Mining GROUP — ECM

TRÊS ESTRADAS PROJECT

FEASIBILITY STUDY
GENERAL
PLOT PLAN – PHASE 2

SCALE	Nº ECM	Nº ÁGUIA RESOURCES	REVIEW
NTS	766-01-1000-C-M13-0051	1000-C-M13-0051	1

(A1)

11.1 ECONOMIC PIT SHELL DEVELOPMENT AND PHASING

11.1.1 ECONOMIC OPTIMIZATION ANALYSIS

Prior to any pit shell optimization work, 'trade-off' studies were completed taking into consideration strip ratio, relative quantities of high grade saprolite to the fresh rock, and the impact of scheduling on Net Present Value (NPV). From this, it was determined that a production level of 300 Ktpy of concentrate targeting the optimal 45 – 50 million tonnes of ore in the deposit, would be a preferable scenario to those considered in earlier (i.e., PEA) studies.

Furthermore, the deposit was considered in terms of the overlying, high-grade and easily processed saprolite (the saprolite phase of the LOM), as separate from the remaining carbonatite phase.

By applying a Lerchs-Grossman algorithm to the block model, optimized economic pit shells were developed, one each for the saprolite and carbonatite phases, using the parameters shown below and targeting only Measured and Indicated resources. The inputs to the Lerchs-Grossman analysis, as summarized in Table 11.1, were based primarily on results from earlier economic PEA-level work on the project, with some adjustments to reflect later-stage and more relevant understanding (for example; foreign exchange rate, expected concentrate grades and recoveries, pricing, etc.).

Table 11.1 Summary of Pit Optimization Parameters

Parameters	Value
Mining Recovery/Mining Dilution	95%/5%
Process Recovery P_2O_5 Saprolite	81.4%
Process Recovery P_2O_5 Carbonatite	75.2%
Concentrate Grade Saprolite	32.7%
Concentrate Grade Carbonatite	30.1%
InterRamp Slope Angles Rock (by Sector)	51 and 55 degrees
InterRamp Slope Angles Weathered Material	34
Mining Cost Carbonatite (USD/t)	1.42
Mining Cost Saprolite (USD /t)	1.47
Mining Incremental Cost (USD /t)	0.01
Mining Rehabilitation Cost (USD /t)	0.17
Processing Cost Saprolite (USD /t)	6.10
Processing Cost Carbonatite (USD /t)	7.34
Selling Price (USD /t) Concentrate P_2O_5	146
Processing Cost (USD /t) Aglime	0
Selling Price (USD /t) Aglime	29
Marketing/Selling Costs (%)	2
Royalties (%)	2
Exchange Rate (USD to R$)	3.45

At the product prices provided, the resulting ultimate pit shell contained much more ore than required, suggesting much of the deposit is economically viable under reasonable assumptions. A series of pit shells were produced reporting potentially economic resources at increasing SR, with preliminary estimates of project NPV. The optimal pit shells were then selected that optimized the quantity of resource and project NPV, without incurring relatively large incremental increases in SR.

The pit shell provided the ultimate physical constraints of the economically optimal portion of the resource. Based on the pit shell, more detailed designs accounting for benches, ramping, etc., were developed which then served as the basis for annual scheduling.

The pit shell (by phase) selected as the basis for ultimate pit design is shown in Figure 11.3 and the ultimate pit design in Figure 11.4. The ultimate pit design contains 43.6 Mt of total ore and 68.0 Mt of waste, at an SR of 1.6: 1. The maximum pit depth is approximately 200m below the average elevation of the pit crest, and the pit is approximately 2300m long along its longest axis.

Figure 11.3 Ultimate LG Pit Shell

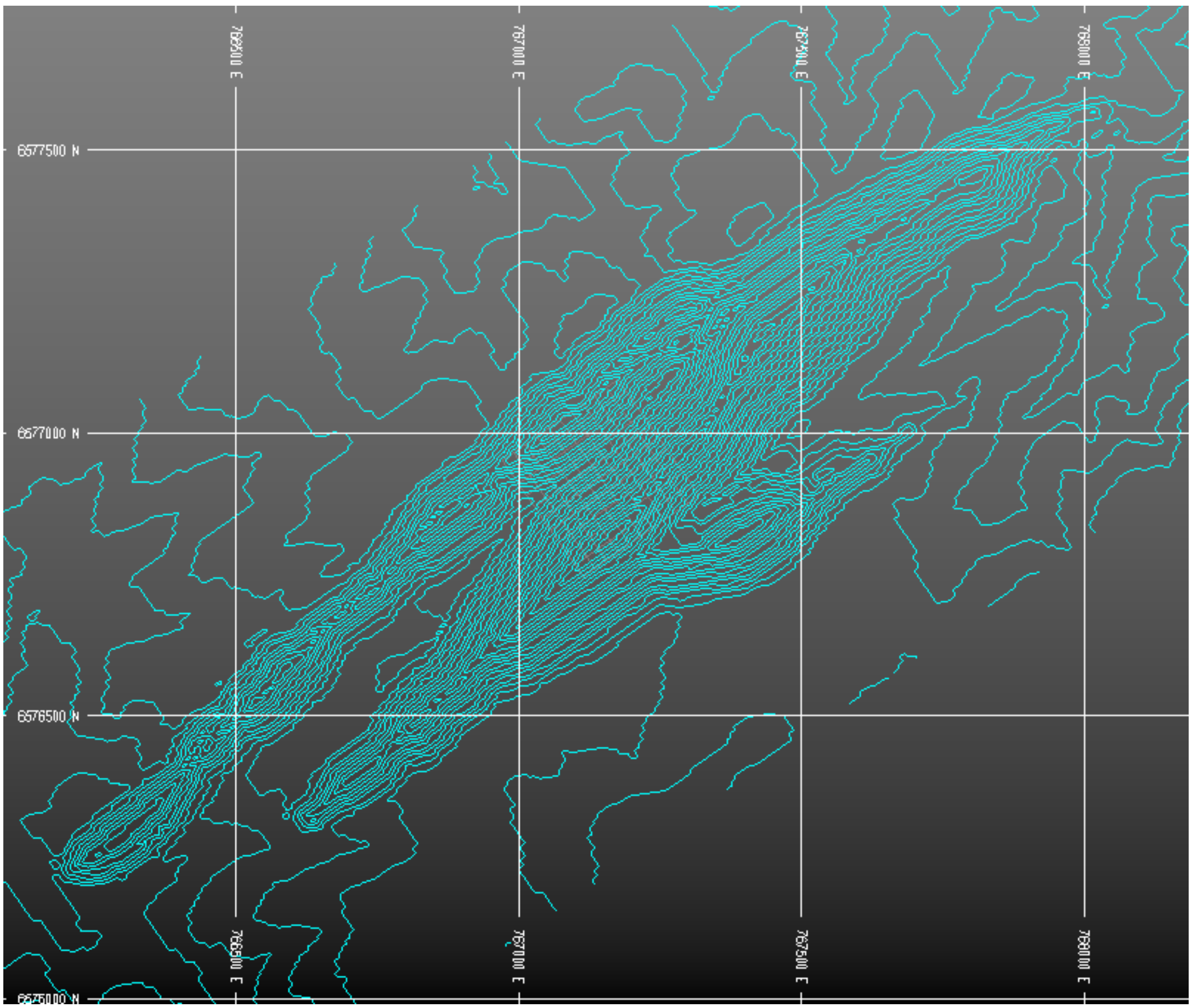
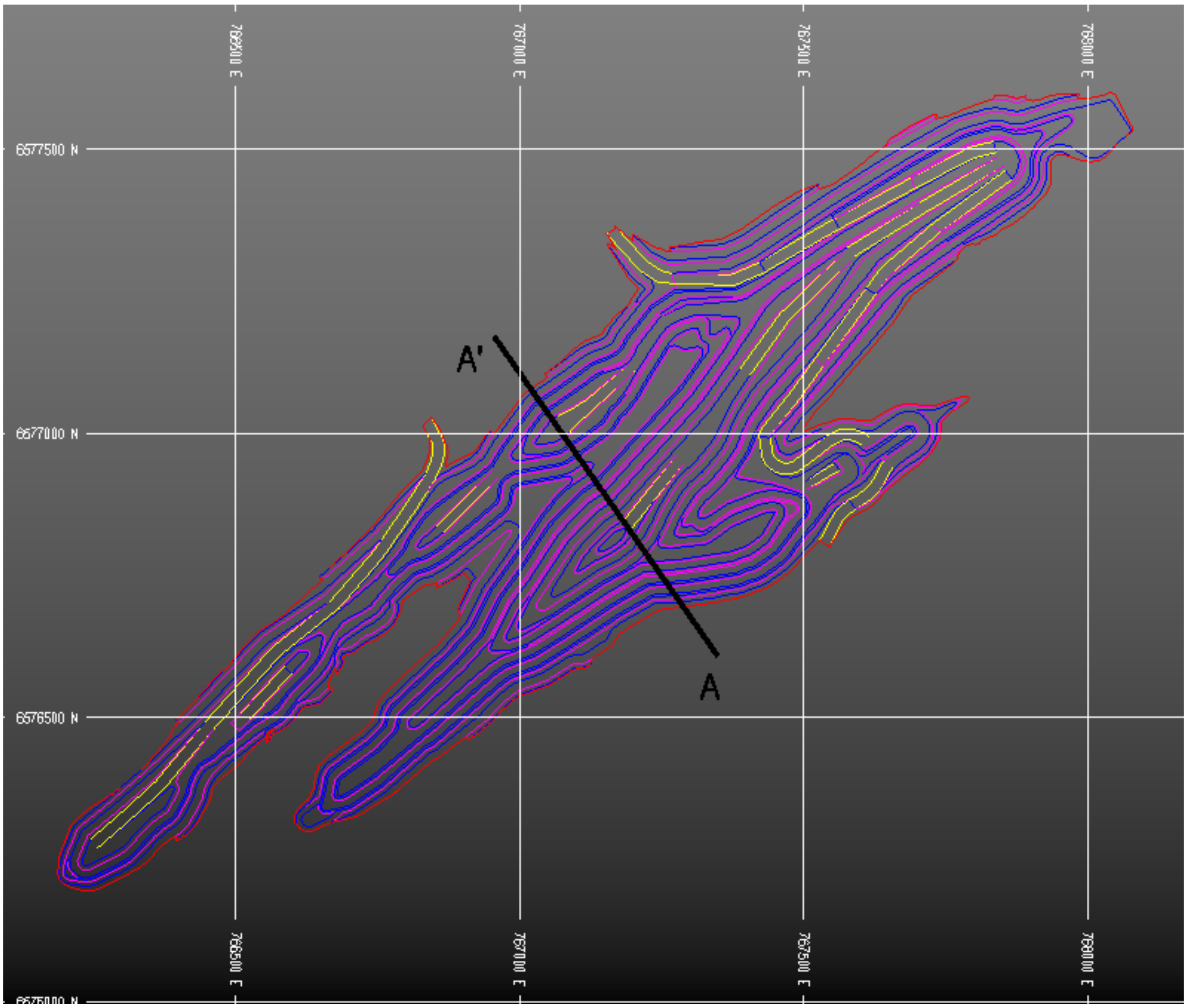


Figure 11.4 Ultimate Pit Design



11.1.2 ORE LOSS AND DILUTION

Any surface mining operation will incur ore loss as well as out-of-seam dilution. In addition, at Três Estradas Phosphate Project, the spatial layout of the orebody, the steeply dipping nature of the geologic structure, and sometimes narrow fingers of the ore blocks will likely lead to additional ore losses and dilution in the mine. Accounting for ore loss and dilution is required to provide a more realistic determination actual tonnes and grade of processed ore.

Based on prior experience of mid-scale hard-rock mining in steeper deposits, it was assumed that there would be a 5% ore loss in the mine, and a 5% out-of-seam dilution, by volume.

The transition from the ore to waste material types is abrupt (which should ease mining and grade-control operations). Therefore, the dilution grade is assumed to be null (devoid of all ore). The formula to calculate diluted grade is:

Diluted Grade = Undiluted Grade ÷ 1.05

To account for the quantity (tonnage) of ore losses and added dilution, an ore percent item was added to the 3D block model to properly calculate tonnage of ore and waste reporting to the mill and waste dumps, respectively. The formula to calculate the diluted ore percent is:

Diluted Ore Percent = 0.95 (Ore Loss) x 1.05 (Dilution) x 100

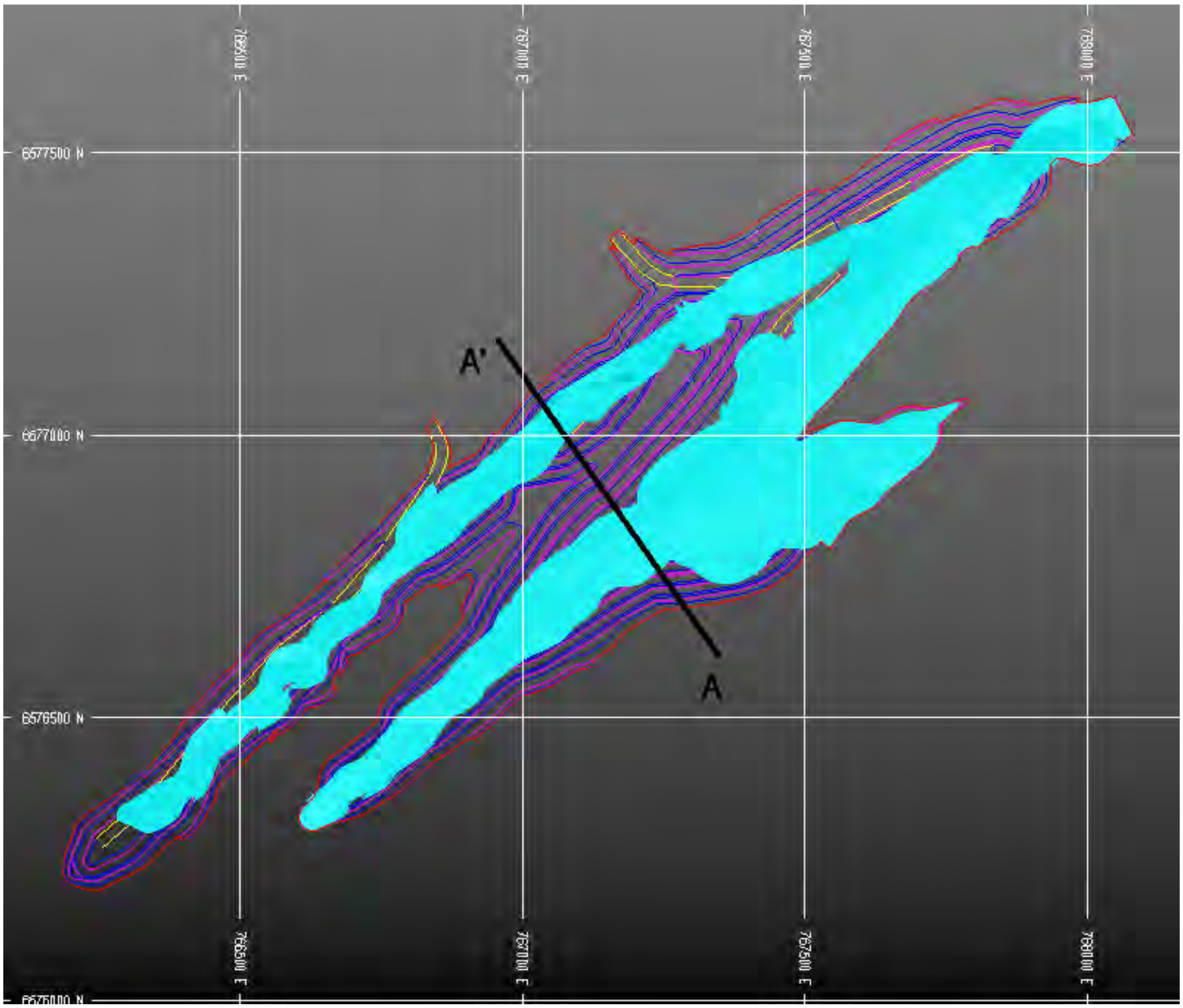
11.1.3 PIT PHASE DESIGN

Following the Lerch-Grossman analysis to predict an optimal economic pit-shell, the ultimate pit was partitioned into pit phases, which targeted the best ore at the lowest strip ratio on a declining basis to maximize the NPV of the project, i.e. starting with the lowest SR, highest grade and lowest cost to process.

Based on these criteria, saprolite ore is the obvious focus of early-stage development and is the initial target for the first four years of the LOM.

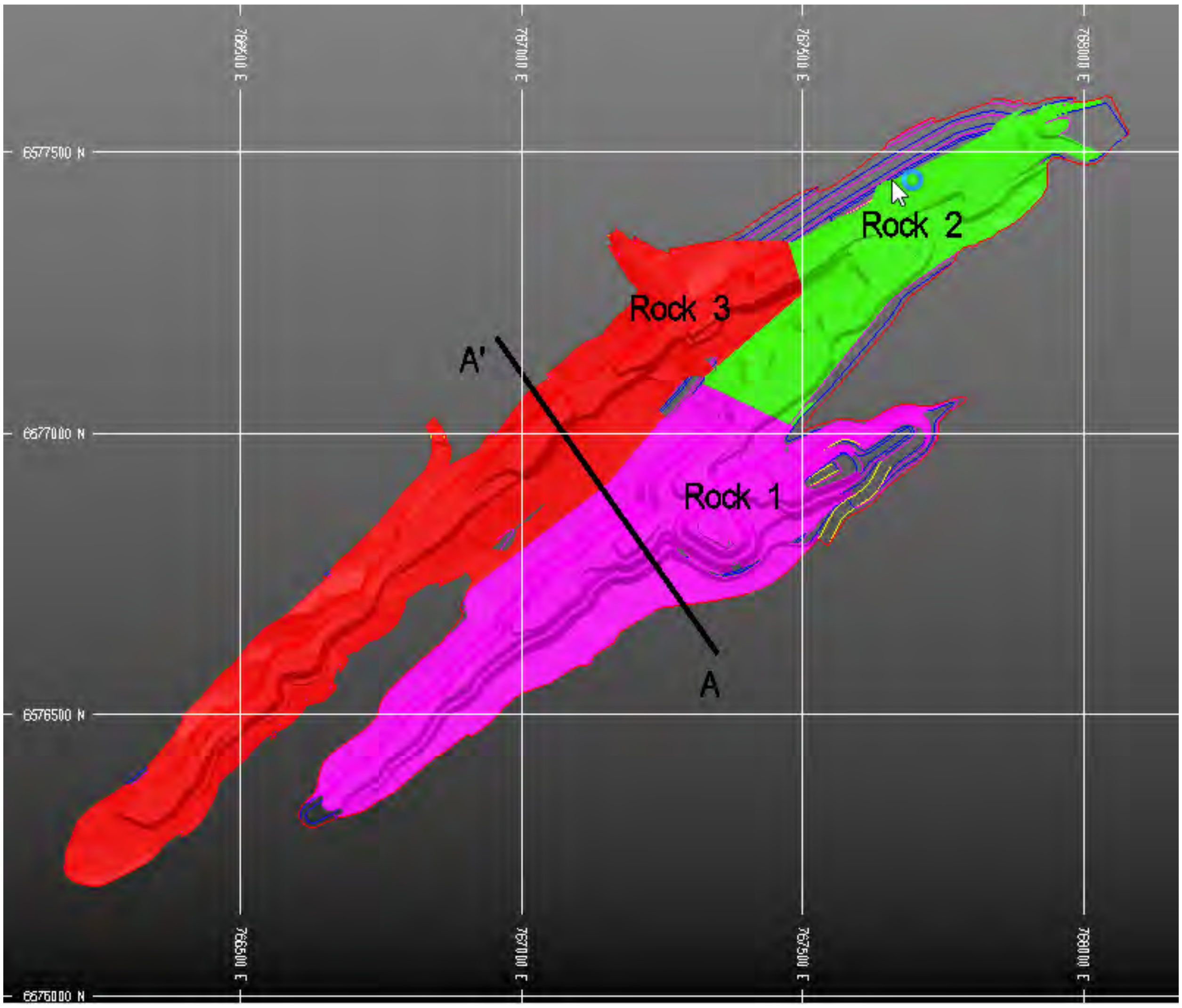
The saprolite-only phase solid is shown in Figure 11.5, below.

Figure 11.5 Saprolite Phase Solid



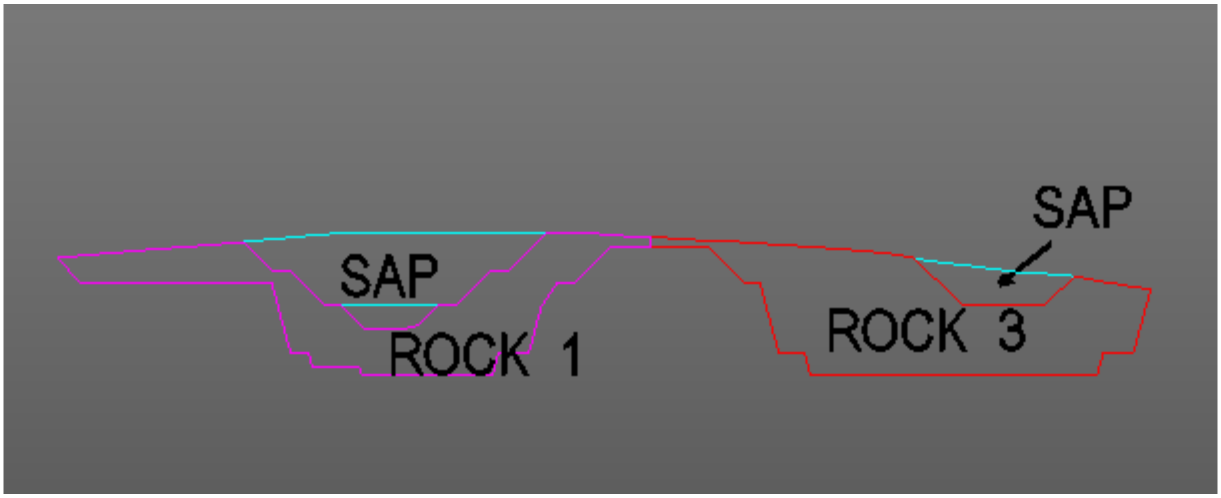
Following the saprolite phase, the carbonatite portion of the orebody was separated into three separate phases, referred to as Rock 1 – 3 (see Figure 11.6).

Figure 11.6 Carbonatite Phase Solids



Cross section A-A, the location of which is indicated on Figures 11.4 through 11.6, is shown in Figure 11.7 and illustrates the vertical relationship between the saprolite phases and the underlying 'rock' phases (looking southwest).

Figure 11.7 Phase Cross Section A – A



11.2 GEOTECHNICAL CONSIDERATIONS

A detailed geotechnical analysis of the proposed open pit area was completed by Walm Engenharia e Tecnologia Ambiental (Walm). This has guided assumptions concerning pit slope design, and the availability of suitable material from which to construct the tailings dam.

11.2.1 APPROACH

Walm conducted a detailed geotechnical appraisal of the project area based on a study of 33 drill holes and over 6,035m of core. This program provided information for 22 geologic – geotechnical cross-sections and various stability analyses, as well as sample material for laboratory testing.

In addition, a geologic characterization of the area was produced in order to better understand the geotechnical nature of each major rock and ore type.

Bieniawski's Rock Mass Rating (RMR) classification system was used to produce geotechnical descriptions of the various drill cores studied, taking into account strength to uniaxial compression of the intact rock, RQD (Rock Quality Designation), degree of fracturing, condition of the discontinuities, and water presence.

Following geotechnical descriptions and interpretation of geologic – geotechnical cross-sections, a geomechanical pattern was established in the various rock types (including; organic colluvial soil, saprolite, weathered rock and fresh rock) and failure mechanisms proposed for various regions of the proposed open-pit area.

Optical tele-viewing of drill holes in the north-west portion of the proposed main families of discontinuities for the pit area. They dip toward NW, SE, W, and E, respectively, with medium angles. While block falls are the most probable mode of failure in the northwestern slope, analysis indicates that planar and wedge failures would be the more likely failure mechanisms in the southeastern slope. The hydrostatic analysis of slopes considered them as partially drained, based on the well-drained nature of the deposit and relatively low projected flows (see Table 11.3 below, for hydrogeological considerations).

Results of a kinematic analysis are shown in Table 11.2, below, at various inter-ramp (i.e., overall slope) angles (IRAs).

Table 11.2 Results of Kinematic Analyses (by IRA)

DRILL HOLE	IRA	STRIKE AND DIP OF THE SLOPE	OCCURRENCE PERCENTAGE		
			PLANAR	WEDGE	BLOCK FALL
TEH-17-001	55°	165°	1.34%	3.43%	1.22% (intersections)
TEH-17-002	55°	135°	2.62%	3.33%	3.93% (basal plane)
TEH-17-003	51°	315°	6.87% (plane 1)	0.80%	0.00% (intersections)
TEH-17-004	55°	315°	1.95% (plane 1)	1.04%	0.00% (intersections)

In order to determine strength parameters of the rocks, 86 core samples were collected and submitted to Indirect Traction (IT), Uniaxial (U), and Triaxial (T) tests, as summarized in Table 11.3 below.

Table 11.3 Rock Strengths Summary

Rock type	Tensile Strength (MPa)	Average UCS (MPa)	UCS (from Triaxial Test)	Young's Modulus (E) (GPa)	Poisson's Ratio (*v*)
Gneiss	4.30	45.43	35.00	22.88	0.31
Sienite	6.37	76.30	88.00	29.87	0.25
Carbonatite	5.62	57.13	41.00	27.02	0.11
Amphibolite	4.63	24.94	63.00	36.73	0.34

11.2.2 RECOMMENDATIONS

Using the results of kinematic analyses and a limit-equilibrium approach, bench and IRA geometries by rock type were proposed, according to different slope directions. The bench height was assumed at 30m and, based on the low amount of groundwater, the hydrostatic analysis of the slopes assumed them to be partially drained.

These analyses returned a safety factor (S.F.) that exceeds the recommended value of 1.30. Walm's analysis indicated that that existing discontinuities are the main factor in failure, and resistance of the rock plays a secondary role in the stability of slopes of the ultimate pit.

Proposed slope geometries for fresh rock as well as soil / saprolite / weathered rock types are summarized below in Tables 11.4 and 11.5, respectively. These proposed geometries were used in pit phasing and mine design.

Table 11.4 Proposed Geometries for Rock Slopes

SECTOR	DRILL HOLE	DIP DIRECTION OF SLOPE	IRA TO BE CONSIDERED	BENCH GEOMETRY		
				Height (m)	Face angle	Width (m)
1 (North West)	TEH-17-001	165°	55°	30	75°	13.0
	TEH-17-002	135°	55°	30	75°	13.0
2 (North East)	TEH-17-003	315°	51°	30	70°	13.5
3 (South East)	TEH-17-004	315°	55°	30	75°	13.0

Table 11.5 Proposed Geometries for Soil / Saprolite Slopes

LITHOTYPE	BENCH GEOMETRY			IRA
	Height (m)	Face angle	Width (m)	
SOIL/SAPROLITE/CLASS IV	15	45°	7.2	34°

Geotechnical analyses were also performed on waste to propose appropriate designs for design of the waste dumps (see Table 11.7, below). Current dump designs have been shown to adequately contain the scheduled ex-pit and backfill waste production.

11.3 HYDROGEOLOGIC CONSIDERATIONS AND WATER MANAGEMENT

After examination of the drill hole data, the phreatic surface was found to be generally between 10m and 20m below drill hole collars and tending to a greater depth as it approaches the bottoms of the topographic drainage. This supports the concept that the water table is in the transition between the weathered rock and the low fractured rock. As the pit is located on a hilltop, the flow is radial from its center, and drains away from the location of the proposed pit.

In the weathering zone, the flow of water occurs through interstices and structural features. In fresh rock it is mainly controlled by discontinuities such as joints, fractures or faults.

The results show that the hydrogeological potentiality of these horizons varies from very low in the horizon of low fractured rock, to low in the horizon of weathering, and are considered to be poor aquifers.

Hydraulic conductivity values were obtained from infiltration and packer tests indicating low permeability of soil and rocks, according to Table 11.6.

Table 11.6 Hydrogeological Units and Hydraulic Conductivity

Typology	Geological Units		Hydrogeological Units	Estimated Depth (m)	Hydraulic Conductivity, K (cm/s)
POOR AQUIFER	Gneisses/ Granites	Weathered layer	Mixed aquifer	25	1.0 E -5 a 1.0 E -6
		Fractured rock	Fractured aquifer	180	1.0 E -6 a 1.0 E -7
		Fresh rock	Aquiclude	>180	1.0 E -7 a 1.0 E -8

From the water balance, a recharge rate of 124 mm / year (9%) was estimated for the area, mainly concentrated in the months of April to October. The recharge is more accentuated in the plateaus located in hilltops, since the discharge zones occur in the drainage channels of the valleys, with a significant variation of the spring's levels according to rainy and dry periods.

With the recharge estimation and the contribution area of the pit (~ 200ha), it is estimated that the groundwater contribution to the pit should be of the order of 10 to 20m³ / h.

Water management requirements have been estimated based on requirements for similar surface mining projects.

Cost estimates for surface and groundwater management are extrapolated from similar surface mining operations. It is assumed that, as necessary, a network of properly designed water diversions, channels, ponds and sumps will be established at the mine site which will divert the water away from active mining areas and pits.

Surface water that does come in contact with the active mining area will be managed with a series of adequately sized channels, sumps and settlement ponds. The captured water will serve the needs of the mine operations by providing a source for mine haul road watering, equipment wash water, etc. Excess water will likely be pumped to settlement ponds where it will be given time for suspended solids to settle out and ultimately discharged according to local environmental guidelines and standards.

Plant and process water will be supplied to the fresh water distribution system from the fresh 'water dam' storage facility.

11.4 GENERAL MINING METHOD

A truck-shovel mining approach is a common and well-accepted method in surface mining for steeply dipping mineralization. The truck-shovel approach takes advantage of the relative operational flexibility and agility of excavators / shovels (which can be particularly valuable in operations where there are potential complexities in selective mining of narrow to wide mineralized zones) as well as provides the ability to re-deploy equipment as needed to meet the waste removal requirements. For this project, contractors are assumed to be used during the start-up Phase 1 (mining saprolite), and 'self-mining' with employees (as opposed to contracted operators) beginning in Phase 2 (carbonatite mining). Given the nature of the project, there will be an economic advantage in leasing the primary mining equipment.

As described above, the optimal approach for this proposed operation was determined to include an initial phase in which the saprolite is targeted, thus taking advantage of low SR, higher-grade ore, and reduced processing costs. Once the saprolite is exhausted, the mine plan targets the underlying fresh rock ores (carbonatite / amphibolite). Mining of the pit in two phases as this will allow a logistically and economically efficient "ramp-up" of the plant and mining. Phase 1 pits will attain a depth of approximately 60m and the Phase 2 pit will attain an ultimate depth of 200m. The height of the waste rock dump will reach approximately 62m. As seen in Figures 11.1 - 2, the proposed plant location is relatively close to the pit to minimize the haulage of the phosphate. The Life-of-Mine (LOM) SR is approximately 1.6:1.

11.5 MINE DESIGN PARAMETERS

The basic assumptions and parameters used in mine design are summarized in Table 11.7, below. These parameters are determined according to several factors including current analyses and studies, prior operational experience in surface mining operations, or practical in-country experience related to the mining industry in the region.

Table 11.7 Mining Parameters

SG (waste)	2.85
SG (saprolite)	1.53
SG (carbonatite)	2.85
Swell Factor	1.3
Bench Width	15m
Bench Slope Angle	70-75
Pit Slope Angle	51 - 55
Ramp Width	20m
Ramp Slope (max.)	10%

11.6 MINING SCHEDULE

As described above, there will be three general phases to phosphate production at Três Estradas:

- Saprolite Mining Phase (Years 1 - 4): The overlying saprolite will be stripped and mined through Year 4, using conventional truck-shovel mining methods;
- Carbonatite Mining Phase (Years 4 - 16): The fresh rock ore (carbonatite and amphibolite) underlying the saprolite will be mined Year 4 through Year 16. Processing of carbonatite will produce a calcite by-product, which may be sold with no further processing as aglime. Market studies indicated that up to 1 Mtpy may be sold, while the remainder is to be transported and stored at on-site tailings dams (see Item 13).
- Aglime Reclaim Phase (Years 17 - 36): Following the end of mining, the stockpile of calcite tailings will be reclaimed at 1 Mtpy, until depletion.

11.6.1 MINE PRODUCTION PHASE

The mine schedule builds upon the pit phasing, which in turn was established after analyses indicating an economically and logistically optimal path forward, as described previosuly. As described below (Item 16.8), the mine plan schedule is based around mining and delivering to the plant the requisite saprolite or carbonatite ore, at varying grades, to produce 300 Ktpy of phosrock concentrate, with a +/- 15% (i.e., 45 Ktpy) design variance. The plant is initially configured to process the high-grade saprolite ore (see Figure 11.8), and then, in Years 3 - 4, is re-configured to accept lower-grade carbonatite.

The first 3.5 years of the sequence targeted the relatively high-grade and low SR saprolite phase of the resource. The higher grade of the saprolite (approximately 8.50% P_2O_5) has the additional advantage of reducing the required annual production in the initial years, which allows for a logistical 'ramp-up' period as well as provide lower operational costs in the early years and improving the project NPV.

During this initial saprolite phase (through Years 1 - 3.5), approximately 800 Kt of carbonatite ore is encountered. However, as the plant is configured to accept only saprolite for the initial phase of operations, the carbonatite rock is temporarily stockpiled until Year 4, at which point the plant is reconfigured to accept the more durable and lower-grade carbonatite ore. By depleting the stockpile entirely during Year 4, the reliance on production of carbonatite from the pit is reduced. Because of the lower grade of carbonatite (average of 3.74%) compared to saprolite, a significant increase in production is required to maintain production of 300 Ktpy of concentrate (see Figure 11.9, below).

From Year 4 through the LOM (Year 16) the mine produces only fresh rock (carbonite and amphibolite ores) which maintain a consistent head grade (See Figure 11.8). The SR, as shown in Figure 11.10, starts relatively low during the early years as the mine plan targets the overlying, high-grade, saprolite layer, with little cover. However, early on in the LOM, because of the steeply dipping nature of the deposit and the relatively small size of the mineable deposit, the pit must be established relatively quickly to it's full 'footprint' and final pit crests, which incurs significant stripping and a rapidly increasing SR during early years, reaching a maximum of 2.8 in Year 4. This need to strip and uncover ore drops off in the later years, as overlying material is removed and ore is uncovered with relatively little overlying waste, resulting in steadily reduced SR after Year 10.

Given the nature of the deposit and the relative importance of the impact of high grade and improved plant performance for the saprolite, the SR is not the driving factor for mine planning and scheduling.

The mine schedule is summarized in Table 11.8, and in Figures 11.8 - 10.

Figure 11.8 Mine Schedule – P_2O_5 Head Grade

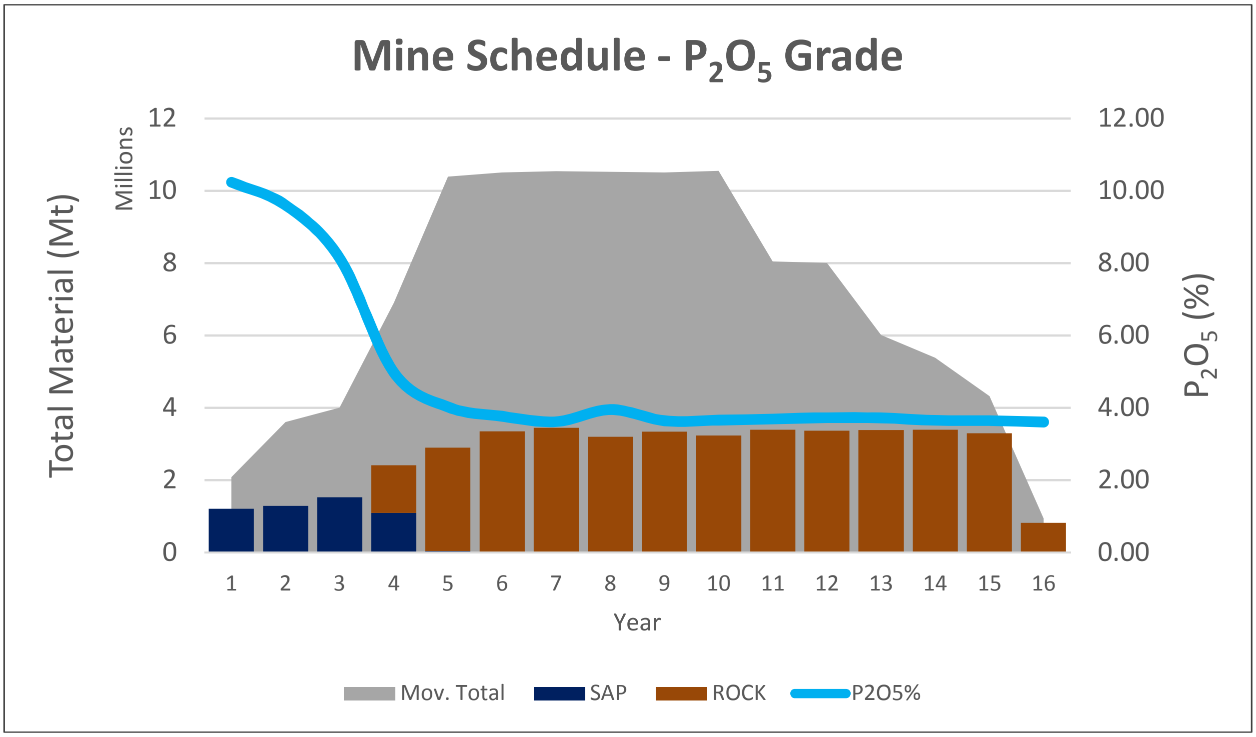


Figure 11.9 Mine Schedule – Quantities

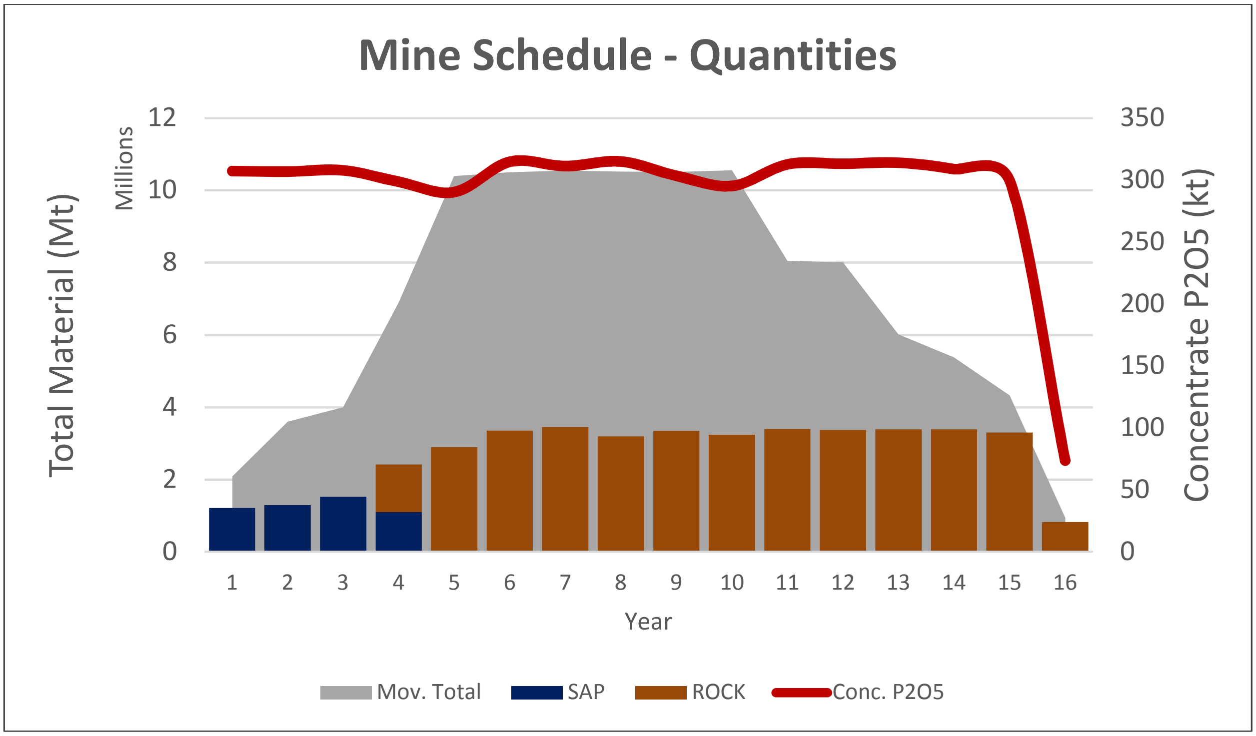


Figure 11.10 Mine Schedule – Strip Ratio

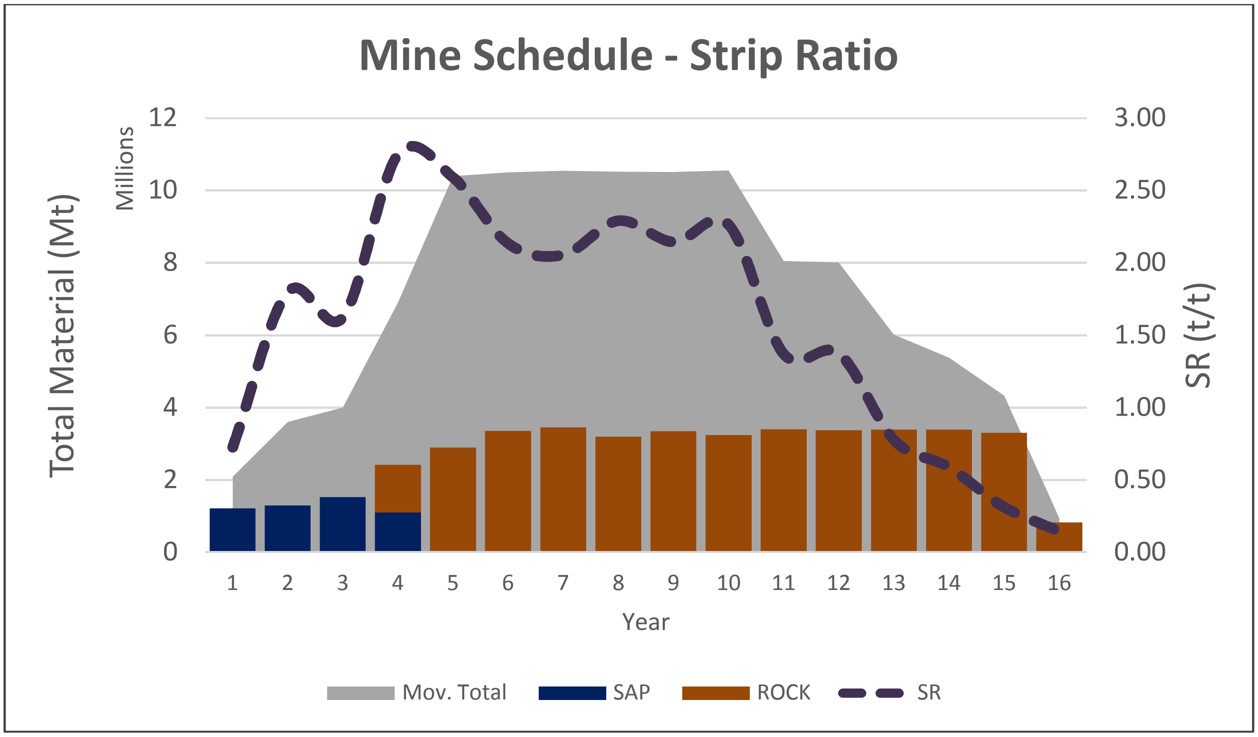
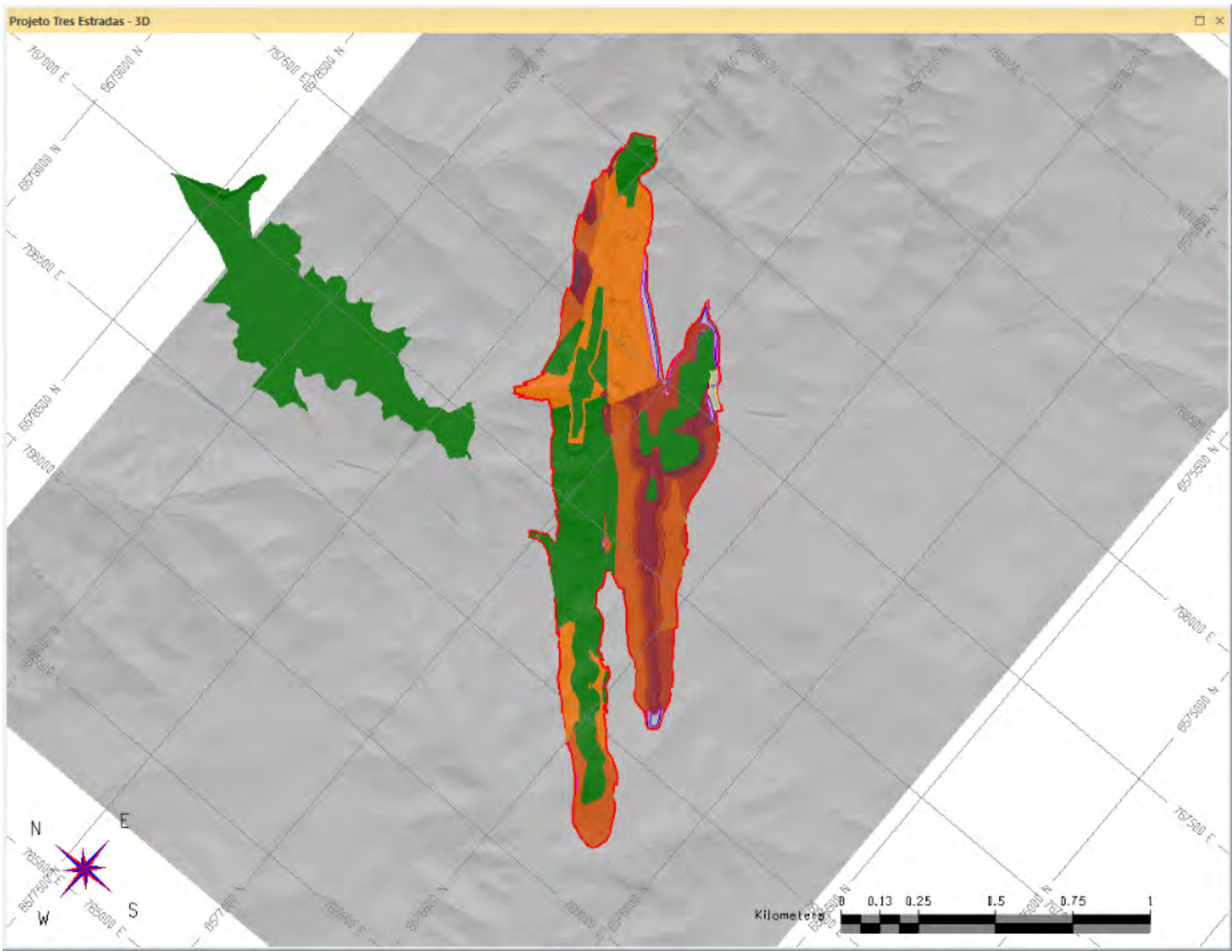


Table 11.8 Mine Schedule Summary

	ORE								ORE Total				STOCKPILE				WASTE	Grand Total	
	SAP				CARBONATITE								STK -		STK +				
YEAR	TONNES	DP2O5	P2O5_CONC	AGLIME	TONNES	DP2O5	P2O5_CONC	AGLIME	TONNES	DP2O5	P2O5_CONC	AGLIME	TONNES	DP2O5	TONNES	DP2O5	TONNES	TONNES	S/R
1	1,208,756	10.24	307,325	0					1,208,756	10.24	307,325	0			33,883	5.04	843,142	2,085,781	0.73
2	1,287,096	9.60	306,868	0					1,287,096	9.60	306,868	0			278,251	4.84	2,037,066	3,602,413	1.80
3	1,524,266	8.13	307,851	0					1,524,266	8.13	307,851	0			228,905	3.96	2,245,880	3,999,051	1.62
4	1,091,381	5.95	161,228	0	1,321,355	4.17	137,366	1,117,924	2,412,736	4.98	298,594	1,117,924	779,359	4.36	238,320	4.10	4,251,835	6,902,892	2.75
5	37,396	5.38	4,997	0	2,856,640	4.01	285,288	2,428,529	2,894,036	4.02	290,285	2,428,529					7,494,901	10,388,937	2.59
6	12,208	3.82	1,159	0	3,339,543	3.77	313,609	2,858,968	3,351,751	3.77	314,768	2,858,968					7,151,352	10,503,103	2.13
7	6,929	8.29	1,426	0	3,442,464	3.61	309,823	2,960,531	3,449,393	3.62	311,250	2,960,531					7,091,172	10,540,564	2.06
8	29,184	8.03	5,820	0	3,166,335	3.92	309,133	2,698,896	3,195,519	3.96	314,953	2,698,896					7,322,622	10,518,141	2.29
9					3,341,499	3.64	303,446	2,870,990	3,341,499	3.64	303,446	2,870,990					7,165,846	10,507,345	2.14
10					3,235,667	3.66	295,256	2,778,642	3,235,667	3.66	295,256	2,778,642					7,321,466	10,557,133	2.26
11					3,396,524	3.69	312,729	2,913,985	3,396,524	3.69	312,729	2,913,985					4,650,749	8,047,273	1.37
12					3,369,294	3.73	313,120	2,887,725	3,369,294	3.73	313,120	2,887,725					4,634,146	8,003,440	1.38
13					3,383,994	3.72	313,993	2,900,817	3,383,994	3.72	313,993	2,900,817					2,625,593	6,009,587	0.78
14					3,390,692	3.65	308,815	2,912,356	3,390,692	3.65	308,815	2,912,356					1,990,264	5,380,956	0.59
15					3,294,085	3.65	299,476	2,829,918	3,294,085	3.65	299,476	2,829,918					1,027,688	4,321,773	0.31
16					819,696	3.61	73,755	704,960	819,696	3.61	73,755	704,960					118,107	937,804	0.14
Grand Total	5,197,217	8.50	1,096,675	0	38,357,787	3.74	3,575,808	32,864,241	43,555,004	4.31	4,672,483	32,864,241	779,359	4.36	779,359	4.36	67,971,829	112,306,193	1.61

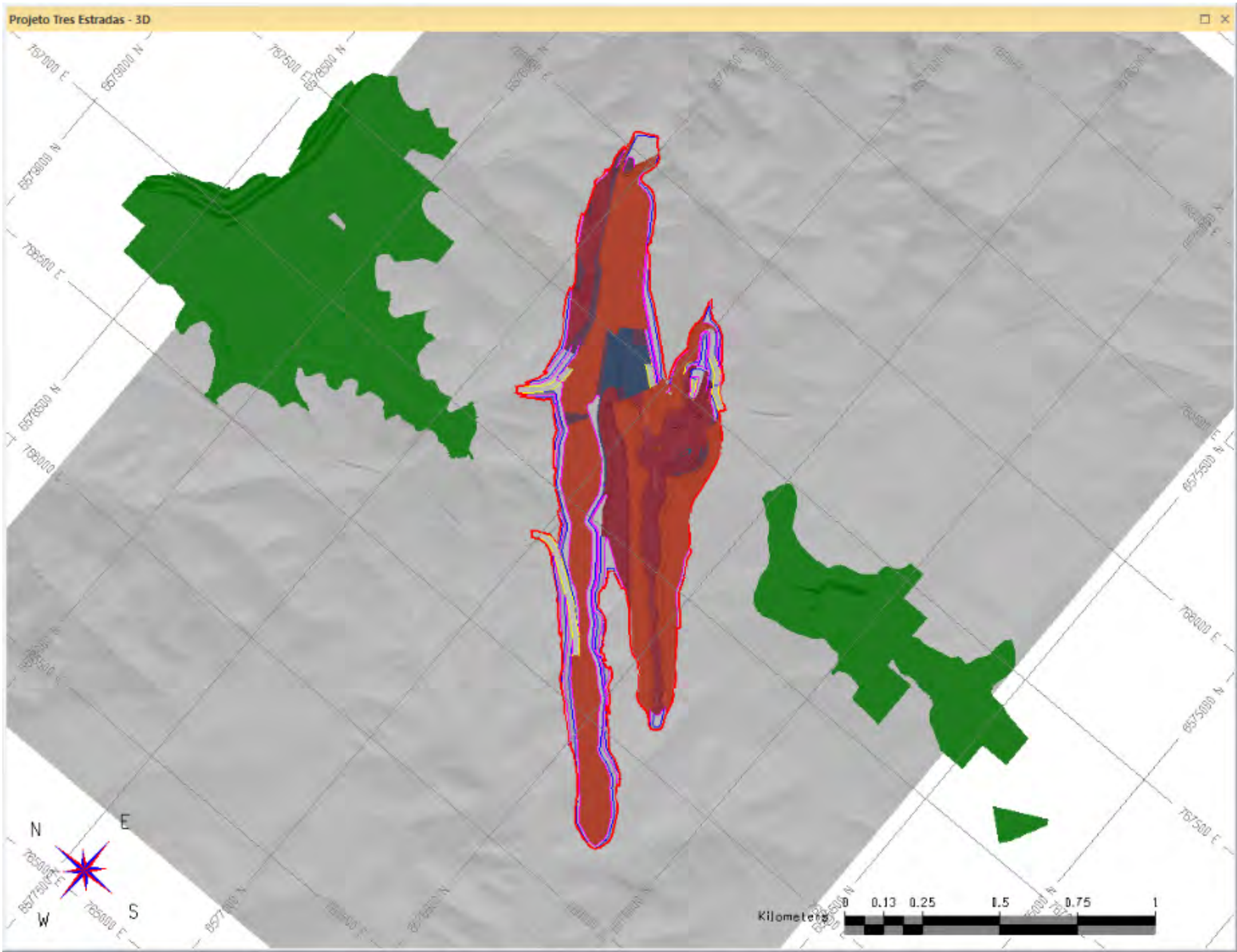
As seen in Figure 11.11, during Years 1 - 3 mining is limited to the saprolite phases and waste is taken to the North Waste Dump (note orientation of the figure).

Figure 11.11 Mine Plan, Year 3



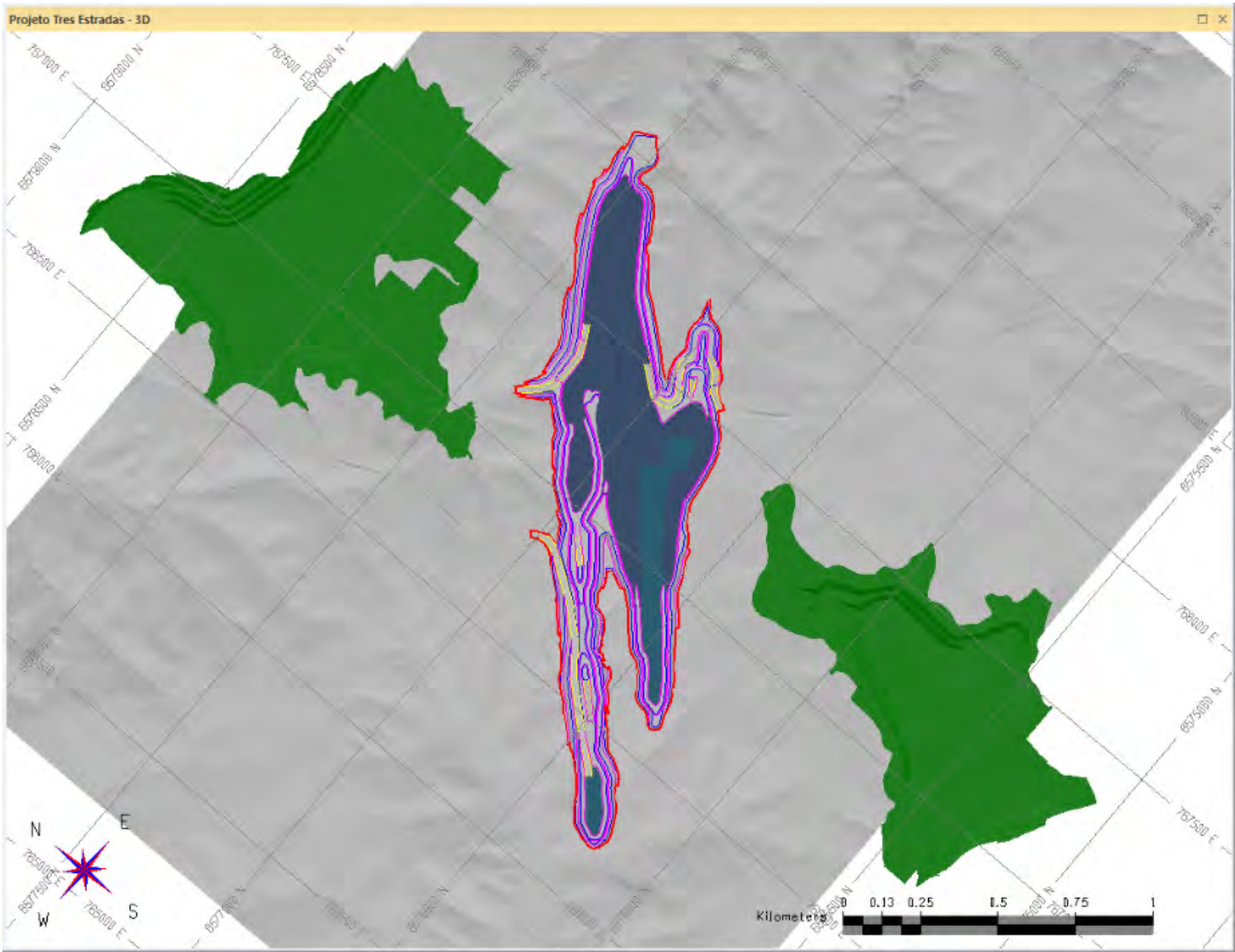
During Years 4 - 6 the Saprolite phases are depleted (during Year 4) and production of the initial carbonatite phase (Rock 1) begins. Construction of the South Waste Dump begins in Year 5. Mining from Rock 2 phase begins in Year 6.

Figure 11.12 Mine Plan, Year 6



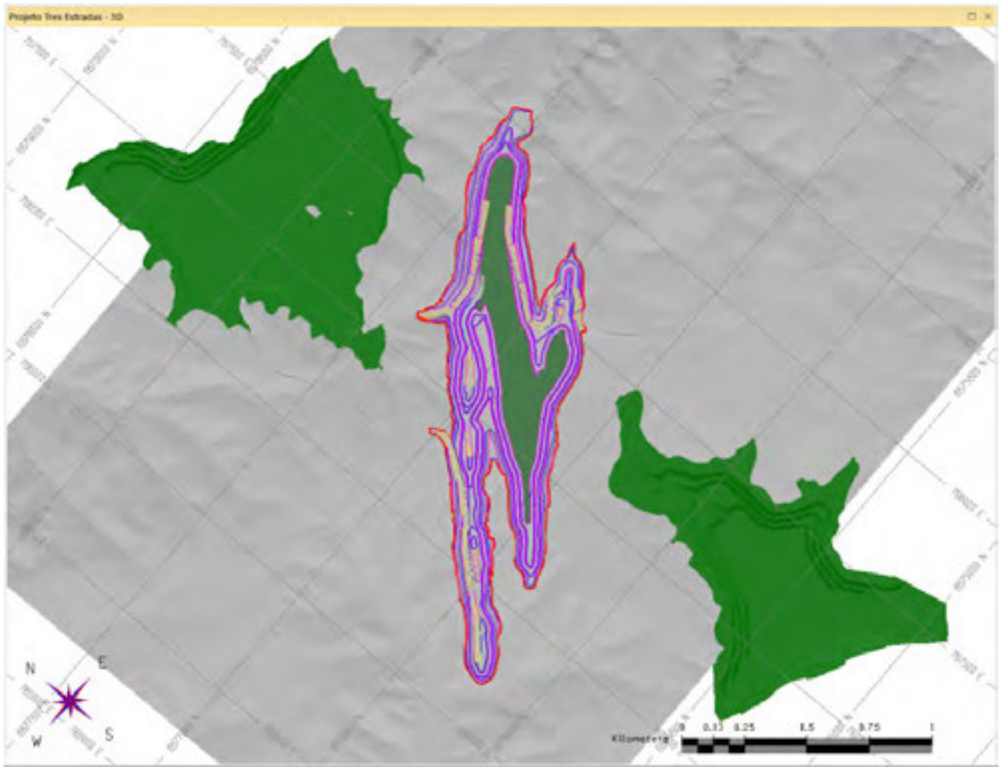
During Years 7 - 9, the Rock 1 phase is depleted (in Year 9) while development of the Rock 2 phase continues. During this period both the North and South Waste Dumps are utilized, depending on the location of the pit from which waste is produced.

Figure 11.13 Mine Plan, Year 9



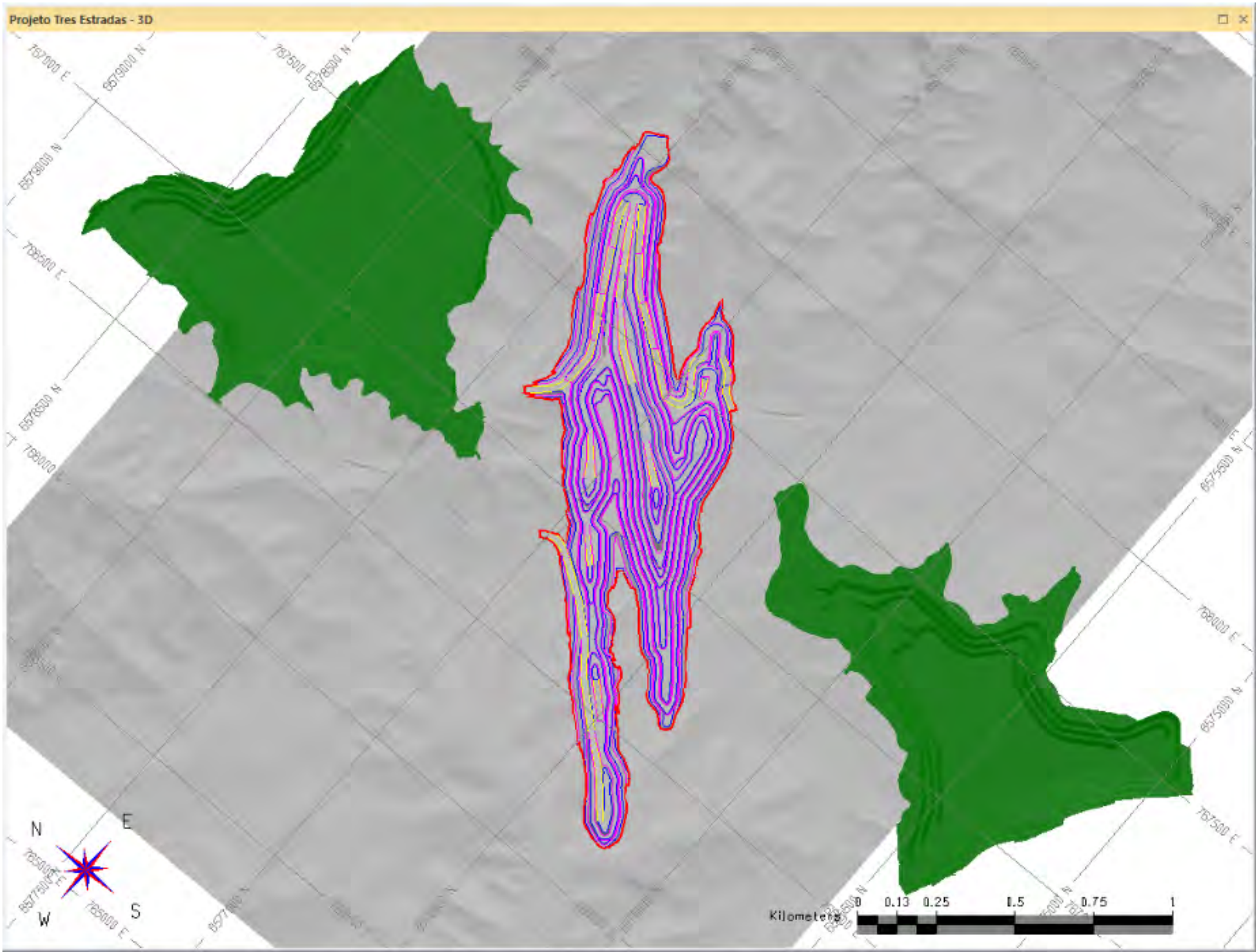
Primary production continues from Rock 2 during Years 9 - 10, with stripping of Rock 3 commencing in Year 11.

Figure 11.14 Mine Plan, Year 12



By Year 14 the Rock 2 phase is depleted, and Rock 3 continues to provide ore through the 2nd quarter of Year 16, the end of the LOM.

Figure 11.15 Mine Plan, Year 16



11.7 WASTE STORAGE

Waste generated through stripping of the saprolite and carbonatite ores will be disposed of in two waste dumps, located on the north and south sides of the pit. The use of two smaller dumps will minimize the impact on the surrounding region, while providing shorter and more effective haulage options for waste coming from mining operations.

For each waste dump, a dyke was designed to contain the sediments generated. In general, while the material to be deposited is essentially rocky, it will be heterogenous, particularly in the earlier years of mining.

The location of the waste dumps and dikes are shown on Figure 11.16, below.

Figure 11.16 Location of Waste Dumps

11.7.1 WASTE DUMPS

Based on stability analyses, and the strength parameters used from the previous experience with similar materials in the region, dump bench design geometries were proposed as described in Tables 11.9 – 11.10, for the South and North Waste Dumps, respectively.

Table 11.9 South Waste Dump, Design Criteria

Item	Description
Berms Width	7.0m
Bench Height	10.0m
Bench Slope Angle	2.0 H : 1.0 V (~26.56°)
Global Slope Angle	~20 °
Waste Pile Volume (Max. Cap.)	16Mm³
Area	75.84ha
Maximum Height	57.0m

.

Table 11.10 North Waste Dump, Design Criteria

Item	Description
Berms Width	7.0m
Bench Height	10.0m
Bench Slope Angle	2.0 H : 1.0 V (~26.56°)
Global Slope Angle	~20 °
Waste Pile Volume (Max. Cap.)	24.2Mm³
Area	93.83ha
Maximum Height	61.88m

It is noted that mine planning efforts fell slightly short of the maximum designed dump capacities, and these designs are therefore considered conservative.

At the proposed footprints of the South and North Dump areas, 23 percussive drillholes were drilled in order to establish the geotechnical stability and suitability of the locations. At the proposed South Dump location holes did not reach hard rock but did encounter weathered rock at approximately 3m in depth. There were some pockets of deeper topsoil noted. At the proposed location of the North Dump, drill holes were generally shallower, with the weathered rock surface being reached in under 3m. Based on this drilling it was concluded that the ground would be adequate to support the dumps, as designed.

11.7.2 WASTE SEDIMENT DYKES

For each of the waste dumps, a dyke is designed with the designed purpose of capturing sediment-laden run-off, for decantation and containment.

The dykes will be composed of rockfill (D_{50} = 500mm for the South Dyke, D_{50} = 700mm for the North Dyke) built with material available in the nearby borrow area (located within the confines of what will be the final pit), which is crushed and classified on-site. The structures are designed to account for overtopping, with spillways located in fill material above the existing topography (see Figures 11.17 and 11.18). This eliminates the need for surface drainage works and instrumentation and simplifies construction.

The dykes are designed to drain, while retaining the sediments and preventing sediment laden run-off. To this purpose, the dykes are designed with “sandwich” construction, using three different geotechnical transitional zones at the core of the dyke (see Tables 11.11 and 11.12).

Additional rockfill (with a D_{50} = 100mm for the South Dyke, and D_{50} = 150mm for the North Dyke) is used as fill material, and as an approximately 3m thick layer to protect the protect the transitional layers during annual dyke cleaning and maintenance. The combination of the transitional surfaces and protective rockfill is designed to allow water drainage while preventing transport of sediment through the dyke itself.

Tables 11.11 and 11.12 presents the summary of the main design characteristics of the South and North Dykes.

Table 11.11 Design Parameters, South Dyke

Item	Description
Upstream Slope Angle	2H:1V
Downstream Slope Angle	6H:1V
Massif Volume (M^3)	36,992
Reservoir Volume (M^3)	109,786
Dyke Area (M^2)	11,326
Reservoir Area (M^2)	44,405
Crest Width (M)	6.0
Crest Elevation (M)	314.0
Spillway Width (M)	60.0
Spillway Height (M)	2.0
Maximum Height (M)	9.0
Transition Zone 1	Gravel, D_{50} = 20mm
Transition Zone 2	Gravel, D_{50} = 5.5mm
Transition Zone 3	Sand, D_{50} = 0.775mm

Table 11.12 Design Parameters, North Dyke

Item	Description
Upstream slope angle	2H:1V
Downstream slope angle	6H:1V
Massif volume (m^3)	40,741
Reservoir volume (m^3)	152,785
Dyke area (m^2)	10,433
Reservoir area (m^2)	49,289
Crest width (m)	6.0
Crest elevation (m)	261.0
Spillway width (m)	60.0
Spillway height (m)	2.0
Maximum height (m)	11.0
Transition Zone 1	Gravel, D_{50} = 36mm
Transition Zone 2	Gravel, D_{50} = =6.45mm
Transition Zone 3	Sand, D_{50} = 0.775mm

Figure 11.17 South Dyke Design (Plan and Section Views)

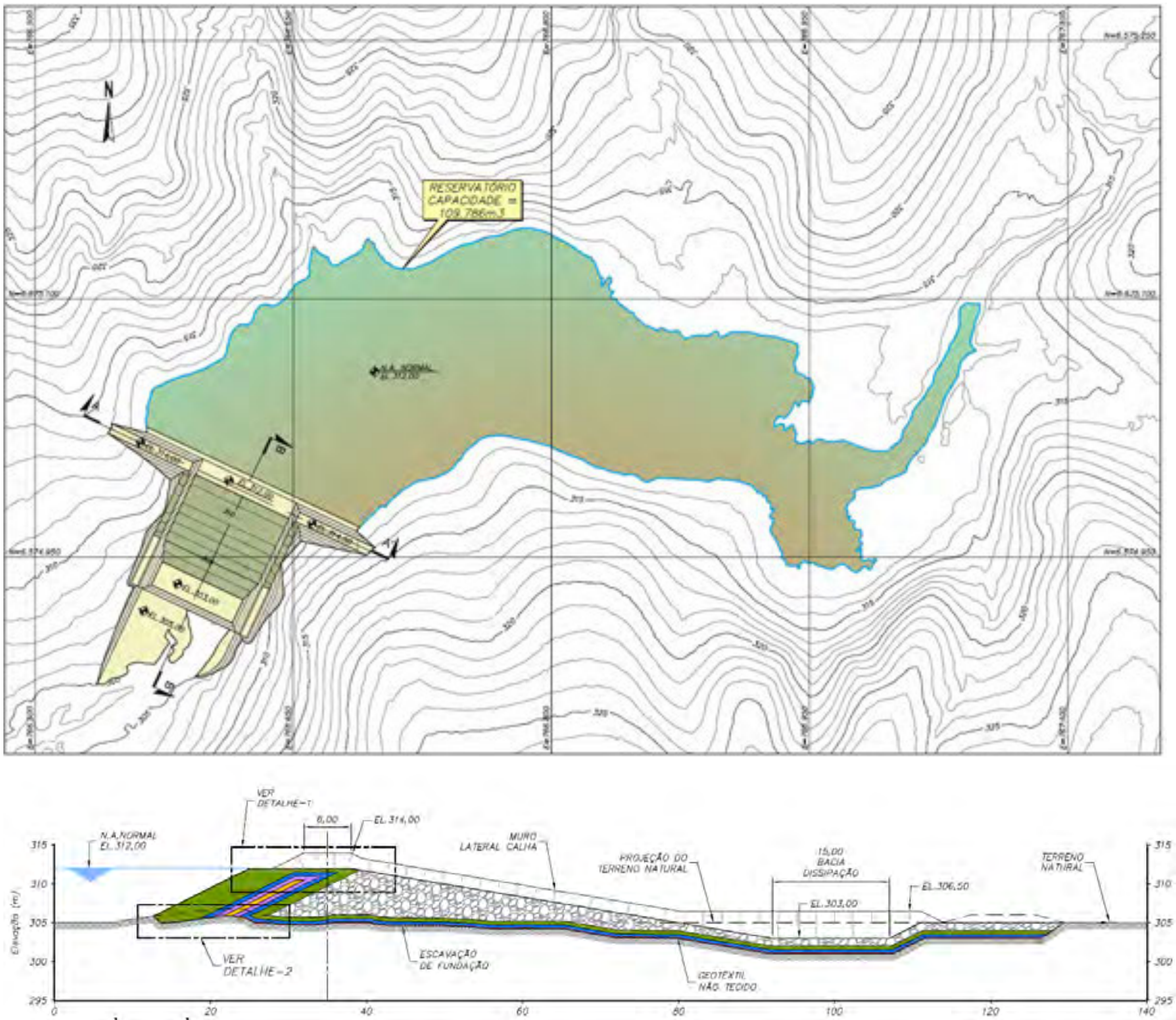
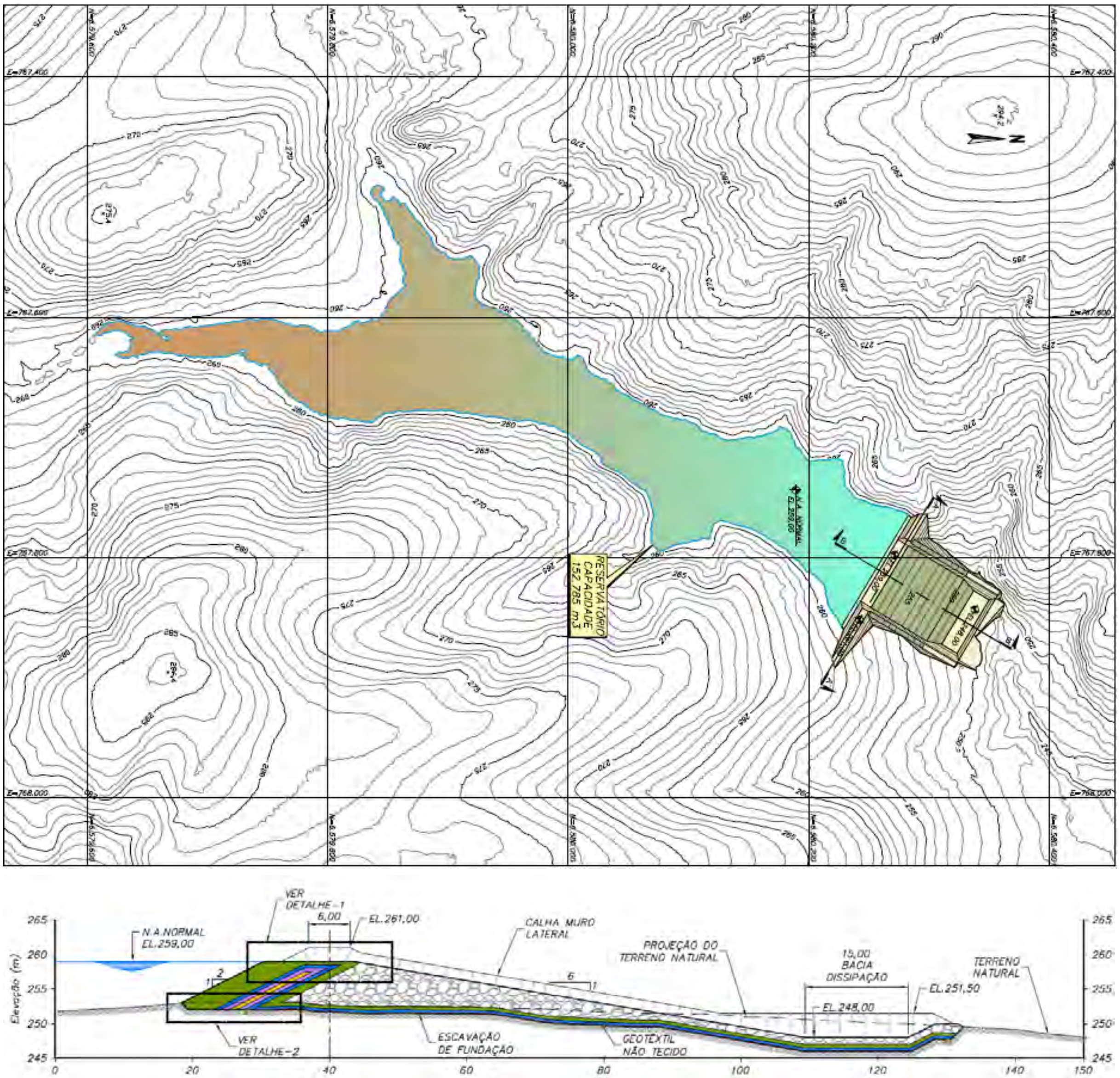


Figure 11.18 North Dyke Design (Plan and Section Views)



It is noted that due to restricted access by current landowners, no geotechnical surveys of the proposed dyke footprints were carried out.

11.8 MINING OPERATIONS

Prior to excavating the waste and phosphate, topsoil will be removed. This material will be salvaged and hauled to temporary storage piles. As the LOM advances, and reclamation is completed, the topsoil will be transported back onto reclaimed lands where it will be revegetated. If possible, topsoil will be stripped and hauled contemporaneously to avoid storage and reduce re-handling costs.

Mining at Três Estradas will utilize conventional truck and shovel mining techniques, with a combination of front-end loaders (FELs), and hydraulic excavators (backhoe configured) being used to load waste and ore into trucks. A combination of end-dump mining trucks or (during the saprolite phase) and over-the-highway transport trucks (during the carbonatite phase), will be used to haul waste and ore to the dumps and plant, respectively.

11.9 MINING EQUIPMENT AND PRODUCTIVITY

For the Três Estradas Phosphate Project multiple types of mining equipment will be needed to strip the required amount of topsoil and waste material, and mine the phosphate ores. As described above, a ‘truck-shovel’ mining method fleet of equipment is proposed that relies on mid-sized trucks to be matched with appropriately-sized mining shovels and front-end loader.

Prior to stripping and mining operations, non-saprolitic waste and fresh rock ore will be drilled and blasted utilizing a mid-sized down-the-hole hammer drill (saprolitic waste and ore will not require any blasting and may be excavated freely with a backhoe excavator).

During the saprolite phase, waste and ore will be mined using one mid-sized hydraulic excavator (Cat 374, or equivalent). Waste and ore will be loaded into over-the-highway (‘8X4’) transport trucks for haulage to the dumps, or to the processing plant. The truck fleet will consist of 3 – 6 trucks. These smaller trucks are considered flexible and cost-effective for shorter hauls with less vertical gain, and for smaller production scales.

As the saprolite phases ends (in Year 4) the scale of mining increases as the lower-grade carbonatite must be mined in greater volumes in order to maintain a production level of 300 Ktpy of phosphate concentrate. Waste will be stripped and fresh rock ores mined using two mid-sized FELs excavators (Cat 992, or equivalent) matched with a fleet of ’85 tonne’ trucks (Cat 775, or equivalent), with 8 – 9 trucks from Years 5 through 12, then steadily decreasing as the SR declines for the remainder of the LOM.

The main loading – haulage fleets will be supported with conventional equipment including a tractor dozer (Cat D8, or equivalent) and a smaller wheeled-dozer (Cat 824, or equivalent) for road maintenance and excavator support, a motor grader for road and working area preparation, small-scale excavators for finer work and to support loading operations, a water truck for road maintenance, field service trucks, and other light equipment. This support equipment is necessary to maintain efficient and safe working conditions, and to maximize equipment productivity of the primary equipment. The number of pieces of support equipment has been estimated based on applying experience-based factors to primary equipment.

Table 11.13 summarizes the type, size and maximum fleet quantity of equipment required to execute the mine plan. Fleet sizes for most equipment varies slightly throughout the mine life.

Table 11.13 Mining Equipment

Type	Purpose	Equivalent Model	Size	Productivity (Avg.)	Quantity (Max.)
Hydraulic Excavator	Waste / Ore, Sap. Phase	CAT 374F	4.4m^3 bucket	750 t/hr	1
Front End Loader	Waste / Ore, Carb. Phase	CAT 99 2K	12.2m^3 bucket	1092 t/hr	2
Transport Truck	Waste / Ore, Sap. Phase	Scania G440	Max Cap. 26mt	122 t/hr	6
End Dump Truck	Waste / Ore, Carb. Phase	CAT 775G	65mt	180 t/hr	9
Support Equipment					
Water Truck	Waste / Ore. LOM	CAT 775 Chassis	75,000 liters	N/A	1
Grader	Waste / Ore. LOM	CAT 14 M	14' (4.3m) blade	N/A	1
Track Dozer	Waste / Ore. LOM	CAT D8	231 kW	N/A	1
Wheeled Dozer	Waste / Ore. LOM	CAT 82 4K	264 kW	N/A	1
Large Blast Hole Drill	Waste / Ore. LOM	AtlasCopco - FlexiROC D60	354 kW	1500 t/hr	2

Equipment productivities have been developed based on first principles, industry standard assumptions and haulage route simulations.

Equipment hours for primary equipment were calculated by applying equipment productivities to quantities. In the case of support and auxiliary equipment, hours were estimated by factors (for example, one track dozer per excavator) or set at a fleet size for general use.

11.10 WORKFORCE

The production requirements discussed above require a 7 day per week schedule operating 365 days per year. The manpower estimate assumes four crews of hourly staff will work a revolving schedule of three-eight hour shifts per day. Table 11.14 presents the hourly manpower requirements at full production levels.

Mine salaried staff and management are considered to be part of Águia's management team.

11.10.1 SCHEDULE

The production requirements discussed above require a 7 day/week, 3 shift/day schedule operating 365 days per year, with the following discounts for operating time:

- Machine Scheduled hrs = Total Annual hrs – Off Time Loss – Utilization Loss = 7665 hrs

Estimated effective utilization is therefore calculated as follows:

- Machine Mechanical Availability = 85%
- Usage = 70%
- Efficiency = 85% X 70% = 59.5%
- Machine Operating hrs = Machine Scheduled Hrs X Mech. Availability = 6515 hrs
- Effective Operating hrs = Machine Sched. Hrs X Efficiency = 4561 hrs
- Effective Utilization = 4561 hrs / 8760 hrs = 52%

The manpower estimate assumes four crews of hourly staff will work a revolving schedule of three-eight hour shifts per day. Table 11.14 presents the hourly manpower requirements at full production levels. Infrastructure, offices etc., have accounted for additional maintenance staff while, while maintenance costs account for labor.

Table 11.14 Hourly Manpower Summary - Full Production

Category	Subtotal
Mine Operation	
Drill	9
Blast	3
Load	16
Haul	41
Support	12
Auxiliary	10
Total Mine Operation	**91**

11.11 RECLAMATION

As mining progresses, waste dumps will become available for final reclamation. Growth media (topsoil) will be placed directly onto reclaimed surfaces and the land revegetated. To the extent possible, any regrading that must occur on the waste dumps prior to growth media placement will occur in tandem with waste dumping activities. This effort will ensure that reclamation practices remain concurrent with active mining operations and will reduce material re-handling expenses.

At the conclusion of mining, the final pit void that is remaining will be bermed-off to prevent access. Other final reclamation will be completed upon cessation of Phase 3 (Aglime).

12 MINERALS PROCESSING

The mineral processing facilities for the Três Estradas Phosphate Project are designed in three phases:

Phase 1: treat the saprolite ore during the first years of operation. The primary product will be a phosphate concentrate (or phosrock), which will be sold for fertilizer manufactory. The tailings of the saprolite ore phosphate circuit will be disposed in a tailings dam.

Phase 2*:* treat the fresh carbonatite ore during the remaining years of the mine life. The primary product will be a phosphate concentrate (or phosrock). The tailings of the carbonatite ore flotation circuit may be sold as agricultural limestone (Aglime), without any further treatment other than dewatering/drying. The expected production rate of Aglime will be higher than the potential market. Thus, part of it will be dewatered and sold and the remaining will be disposed for reclaiming and commercialization after the mine depletion.

Phase 3*:* recover, dewater, and sell the aglime disposed during the Carbonatite treatment.

Other by-products such as lime product for use in cement manufacture or flue gas desulphurization may also be produced, but to achieve the market specification some additional treatment of the phosphate circuit tailings (magnetic separation and/or flotation) will be needed.

The process design is based on the metallurgical testing programs presented in this report in Chapter 13. The most favourable results for phosphate recovery and concentrate production utilized column flotation technology to treat the whole material, without fines removal (minus 20 µm, or “slimes” fraction). The fine fraction is typically removed as it has an adverse effect on the conventional flotation process. The volume of the fine fraction is very significant and the phosphate grade of the fines is similar to the coarse fraction. The potential losses in removing the fines range from 20% to 45% in the saprolite and 40% to 50% in the fresh carbonatite.

The carbonatite mineralization contains approximately 40% CaO or approximately 71.4% $CaCO_3$, which remains in the phosphate flotation tailings.

The unit operations included in this process are:

- Primary crushing;
- Stockpiling of crushed material and reclaiming system;
- Grinding (two stages, closed circuit with hydrocyclones);
- Flotation;
- Phosrock concentrate thickening, filtration, drying, storage and load out;
- Aglime concentrate thickening, filtration, drying, storage and load out (Carbonatite phase);
- Tailings disposal.

12.1 PROCESS DESIGN CRITERIA

The beneficiation plant has a nominal capacity to produce 300,000 t/y of Phosrock product and 1,000,000 t/y of aglime from its deposit. The nominal capacity is based on the following:

- Saprolite ore with average 8.5% P_2O_5 grade during the first years, 7446 operating hours per year and average mining rate of 1.35 million t/y (wet basis);
- Carbonatite ore with average 3.7% P_2O_5 grade during the remaining years, 7884 operating hours per year and average mining rate of 3.18 million t/y (wet basis).

The beneficiation plant design criteria of the Três Estradas Phosphate Project are based on the following parameters:

- The process design is engineered as inherently safe and compliant with standard industry practices and legal, regulatory, health and safety requirements established by local authorities to maintain a sustainable operation and minimize the risk to the environment, employees, health and safety and the community;
- Safety features in the beneficiation plant design include dust control systems and a fire protection system;
- The comminution and flotation circuits are based on proven experience with widely accepted phosphate processing methods and proven equipment selection;
- Equipment selection is based on achieving nominal processing plant capacity, consistent product quality and low capital and operating costs;
- The metallurgical plant was designed for a phased implementation:

- The first phase comprises the facilities to treat the saprolite ore (higher grade and naturally finer and softer ore when compared to the carbonatite ore). The concentration plant will produce phosphate (P_2O_5) concentrate (300,000 t/year, dry basis);
- The second phase comprises the facilities to treat the carbonatite ore (lower grade, harder ore). The transition from first to second phase will consist, essentially, on the installation of new mills, new flotation columns and the aglime dewatering facilities. The process equipment of the saprolite phase (except the primary grinding) will be used to treat the carbonatite phase. The phosrock production will remain constant (300,000 t/y, dry basis) and a portion of the flotation tailings will be dewatered (through thickening and filtering) and sold as aglime (1,000,000 t/y, dry basis). The excess of the thickened flotation tailings will be pumped to the aglime storage dam;
- And the third phase comprises to reclaim, dewater and sell the aglime. The aglime production will remain constant (1,000,000t/y dry basis) until the exhaustion of aglime dam;

- The phosphate milling circuit (final configuration of Phase 2 of implementation) will be comprised of two parallel operating trains to accommodate the feed rate and hardness, and to maximize plant utilization;
- Test work for comminution, flotation and liquid-solid separation has been completed; test results are detailed in Chapter 13;
- Sufficient buffer capacity between the mine and beneficiation plant has been provided by utilizing emergency run of mine (ROM) and crushed material stockpiles, with provisions for future increase in ROM material storage capacity;
- Standardized equipment selections have been made, where possible, to minimize the spare parts inventory;
- Equipment selection, plant layout and design are based on “fit for purpose” approach with low capital expense (capex) and operating expense (opex).

The process plant design and equipment selection is based on the parameters summarized in Table 12.1.

Table 12.1 Design Criteria

Description	Unit	Phase 1	Phase 2	Phase 3
Average P_2O_5 Feed Grade	%	8.5%	3.7%	-
Annual ROM Feed Rate	t/y	1,348,488	3,183,024	-
P_2O_5 Concentrate Production (dry basis)	t/y	300,000	300,000	-
Aglime Production (dry basis)	t/y	-	1,000,000	1,000,000
Thickened Tailings to Dam (dry basis)	t/y	980,514	1,828,062	-
Magnetic Product (dry basis)	t/h	67,974	54,962	-
Operational Efficiency (grinding/ concentration)	%	85%	90%	-
Effective Hours Per Year	h/y	7,446	7,884	-
ROM Feed Rate (dry basis)	t/h	181	404	-
P_2O_5 Concentrate/phosrock (dry basis)	t/h	40.3	38.0	-
Aglime Production (dry basis)	t/h	-	127	-
Thickened Tailings to Dam (dry basis)	t/h	132	232	-
Magnetic Product (dry basis)	t/h	9.1	7.0	-
P_2O_5 Recovery	%	81.4%	75.3%	-
P_2O_5 Yield	%	22.2%	9.4%	-
P_2O_5 Grade - Concentrate	%	32.7%	30.1%	-

12.2 PRODUCTS CHARACTERISTICS

The following figures and tables show the characteristics of the products (phosphate concentrate and aglime).

Phosphate Concentrate (Phosrock)

The following tables show the physical/chemical characteristics of the phosrock produced from both saprolite and Carbonatite ores, according to pilot column flotation testing results (ERIEZ, 2017).

Table 12.2 Saprolite Phosrock

Item	Unit	Value
Before Magnetic Separation (Cleaner Flotation Concentrate)		
% P_2O_5	%	33.3%
% MgO	%	0.76%
% Al_2O_3	%	0.51%
% SiO_2	%	3.03%
% Fe_2O_3	%	3.08%
% CaO	%	44.05%
After Magnetic Separation		
% P_2O_5	%	32.7%

Figure 12.1 Phosrock (Saprolite) – Size Distribution

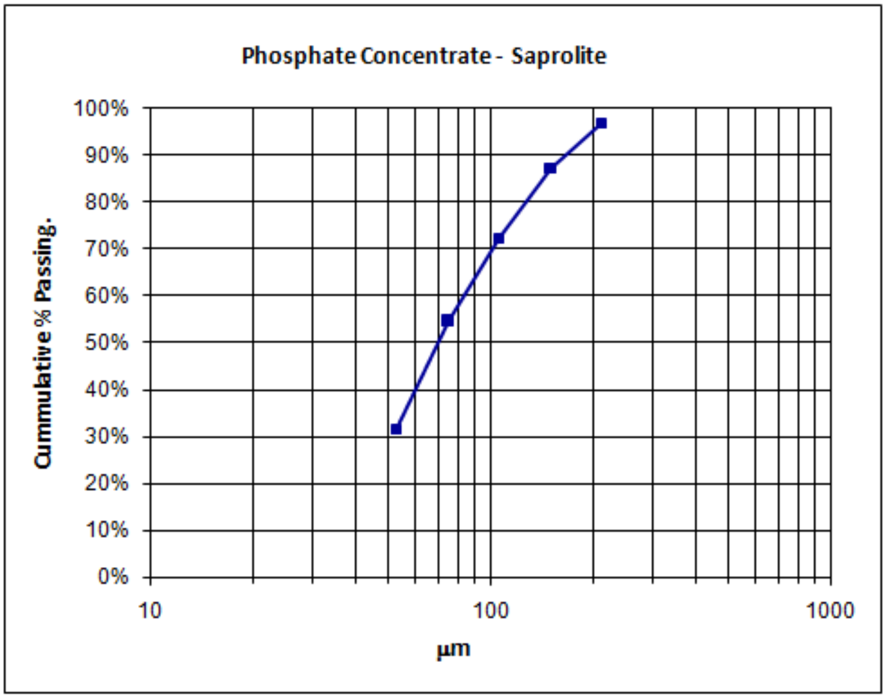
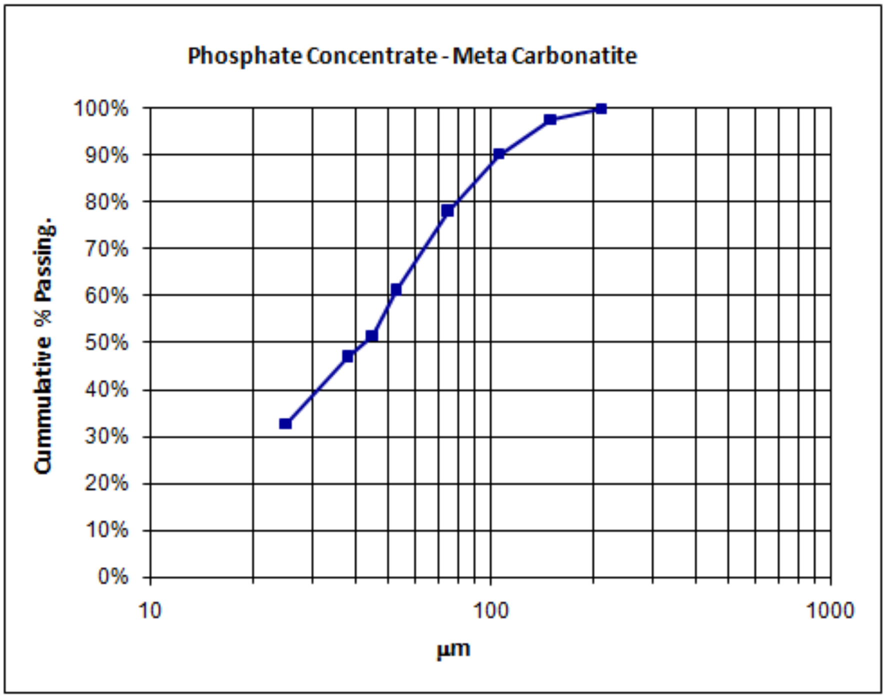


Table 12.3 Carbonatite Phosrock

Item	Unit	Value
Before Magnetic Separation (Cleaner 3 Flotation Concentrate)		
% P_2O_5	%	31.1%
% MgO	%	48.3%
% Al_2O_3	%	3.50%
% SiO_2	%	2.30%
% Fe_2O_3	%	0.70%
% CaO	%	4.50%
P95	µm	150
P80	µm	53
After Magnetic Separation		
P_2O_5 Grade	%	30.1%

Figure 12.2 Phosrock (Carbonatite) – Size Distribution



Agricultural Lime (Aglime)

The carbonatite tailings generated in pilot column flotation testing developed during 2016 (Eriez) were evaluated to be sold as aglime and compared with market specifications established by MAPA (Brazilian Agriculture Ministry) (Lobo Engenharia, 2015). The following table shows that the carbonatite flotation tailings meet the specifications for aglime commercialization.

Table 12.4 Aglime

Parameter	Unit	Aglime (MAPA Specification)	Aglime (Testing Flotation Tailings)
1. Size Distribution			
Minus 2.0mm	%	> 100%	100%
Minus 0.84mm	%	> 70%	100%
Minus 0.30mm	%	> 50%	98%
2. CaO + MgO	%	> 38.0%	45.5%
3. PN	%	> 67%	84.7
4. PRTN	-	> 45	84.1
5. RE			99.2
6. Moisture - Max.	%	10%	Slurry 20% solids
7. Moisture - Normal	%	5%	-

12.3 PROCESS PLANT DESCRIPTION

The following description outlines the major unit operations of Três Estradas Phosphate Project, based on the results of the mineralogical test work, design criteria, and assumptions presented in this report:

The following table summarizes the list of areas of the processing plant.

Table 12.5 List of Areas

NUMBER	DESCRIPTION
1300	**PHOSPHATE AND CALCITE BENEFICIATION**
1310	**Crushing**
1311	Primary Crushing – Saprolite
1312	Primary Crushing – Carbonatite
1313	Secondary crushing – Carbonatite
1320	**Stockpile and Reclaim System**
1321	Stacking and Reclaiming System – Saprolite
1322	Stacking System – Carbonatite
1323	Reclaiming System – Carbonatite
1330	**Grinding**
1331	Grinding
1332	Grinding Media Storage
1340	**Phosphate Processing**
1341	Phosphate Flotation
1342	Phosrock Thickening and Filtration
1343	Phosphate Drying
1344	Phosphate Stockpiling and Shipping
1350	**Agricultural Lime (Aglime) Processing**
1353	Aglime Thickening and Filtration
1355	Aglime Stockpiling and Shipping
1360	**Aglime Disposal Facilities**
1361	Infra-Structure and Accesses
1362	Aglime Pumping System
1363	Aglime Pipeline
1364	Aglime Recovery System
1370	**Hot Gas Generation**
1371	Coal Receiving and Storage
1372	Limestone Receiving and Storage
1373	Coal Crushing
1374	Hot Gas Generation
1374	Ash/ Gypsum Storage/ Shipment

The figures presented in the following pages show the summarized process flow diagrams and the general arrangements for the processing plant, for Phases 1 and 2.

Plant PFD´s are presented in Appendix D.

Figure 12.3 Process Route - Block Diagram

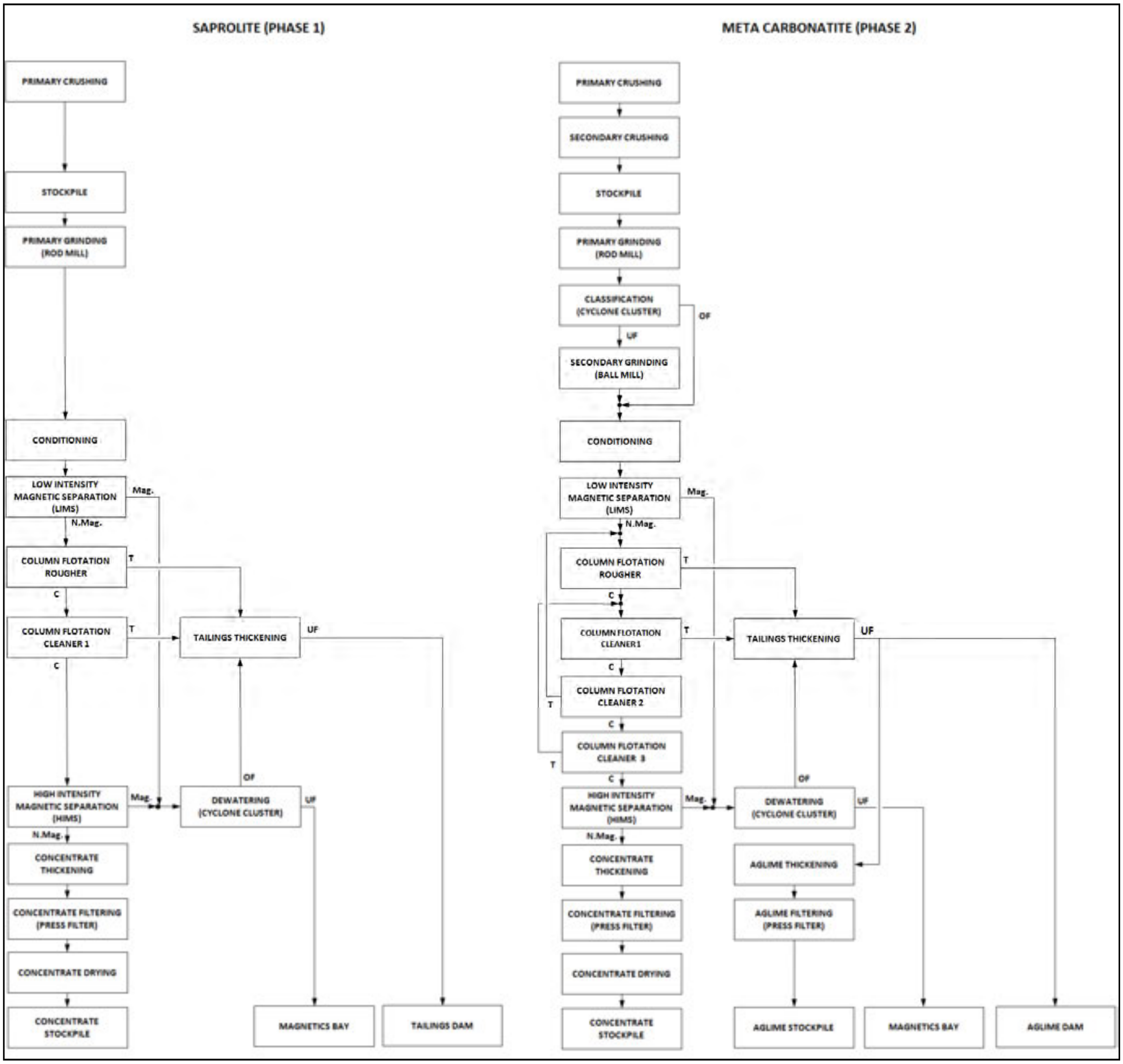


Figure 12.4 Comminution Circuit – Saprolite (Phase 1)

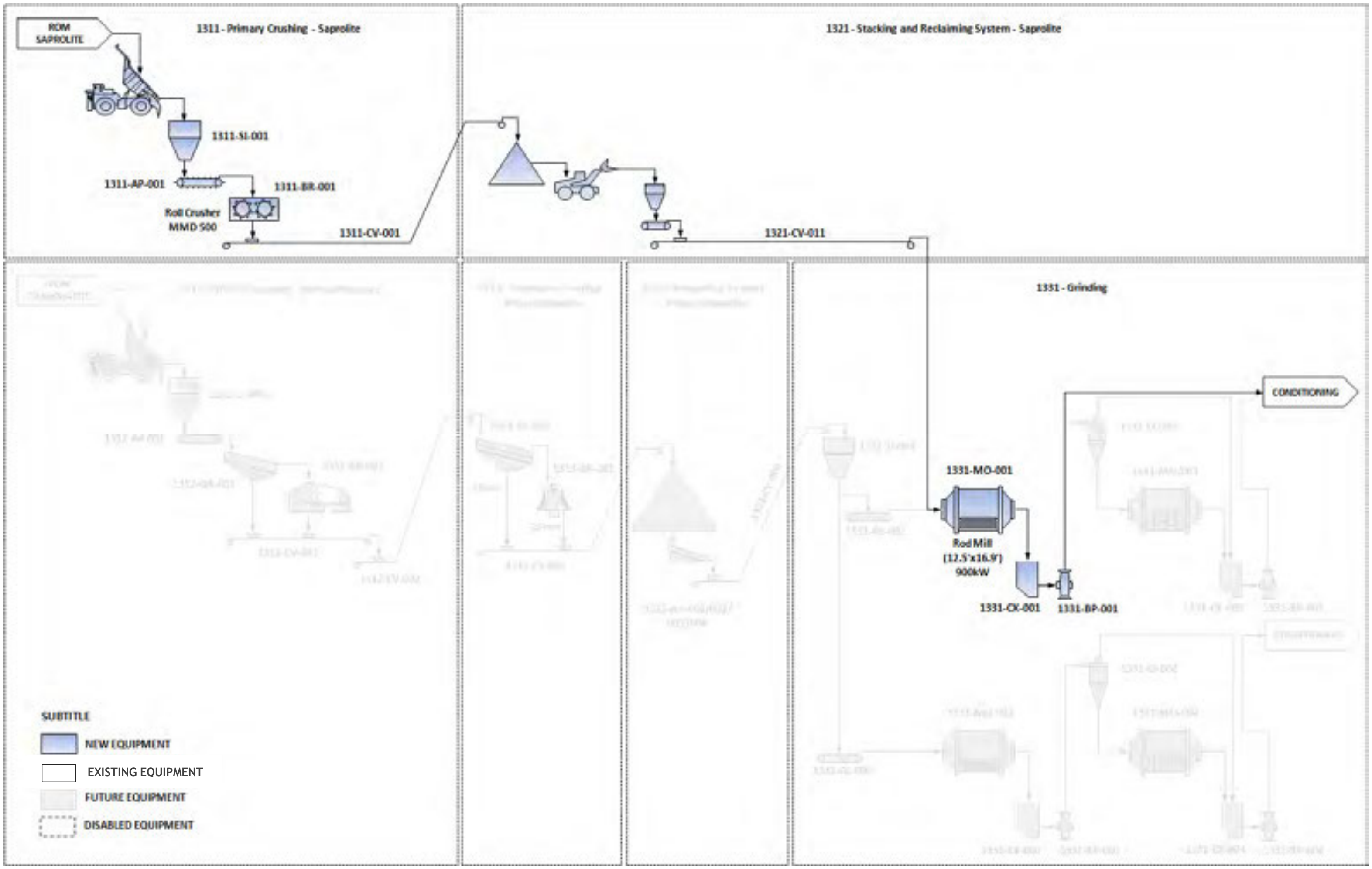


Figure 12.5 Comminution Circuit – Carbonatite (Phase 2)

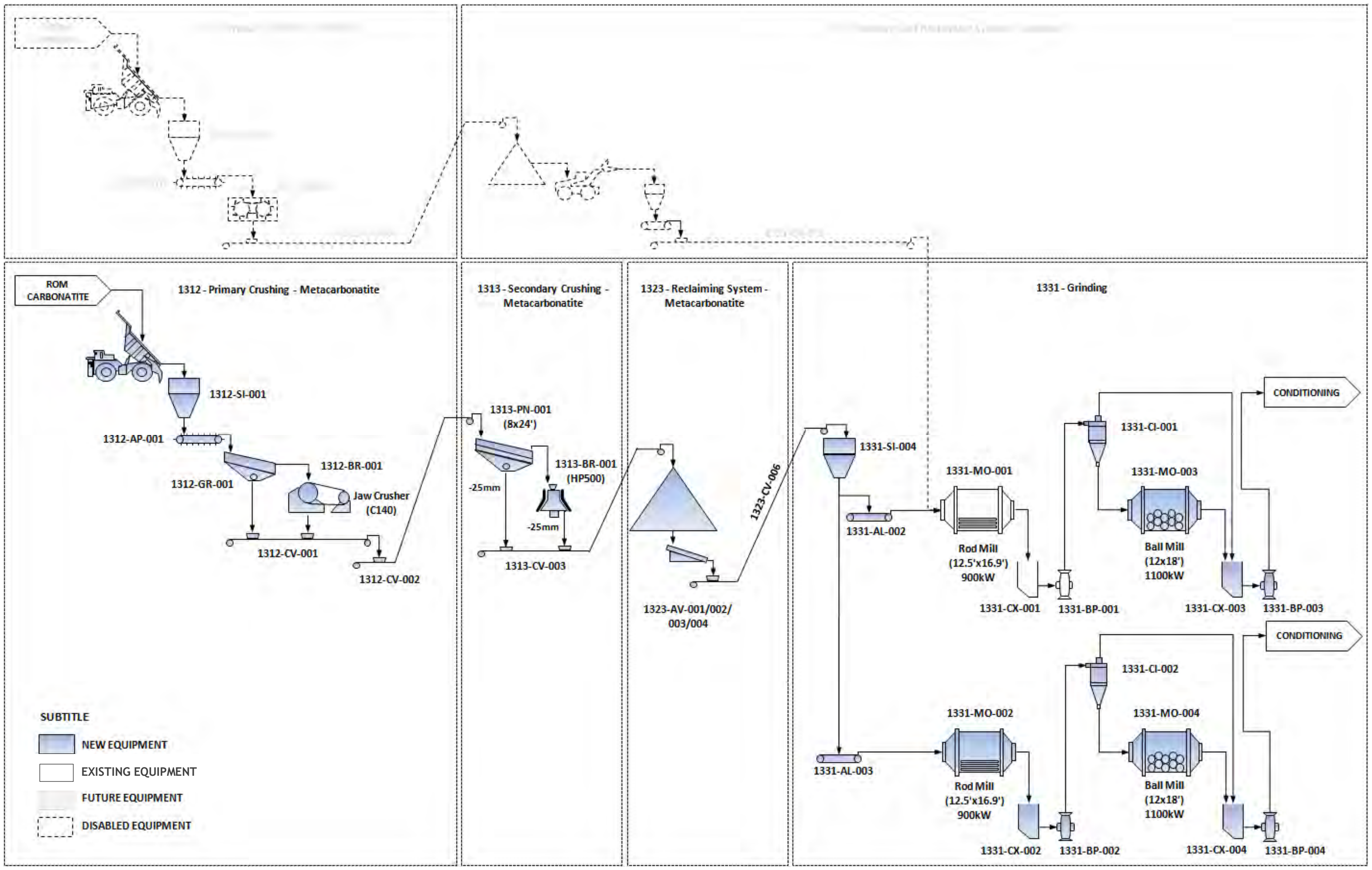


Figure 12.6 Flotation and Dewatering Circuit – Saprolite (Phase 1)

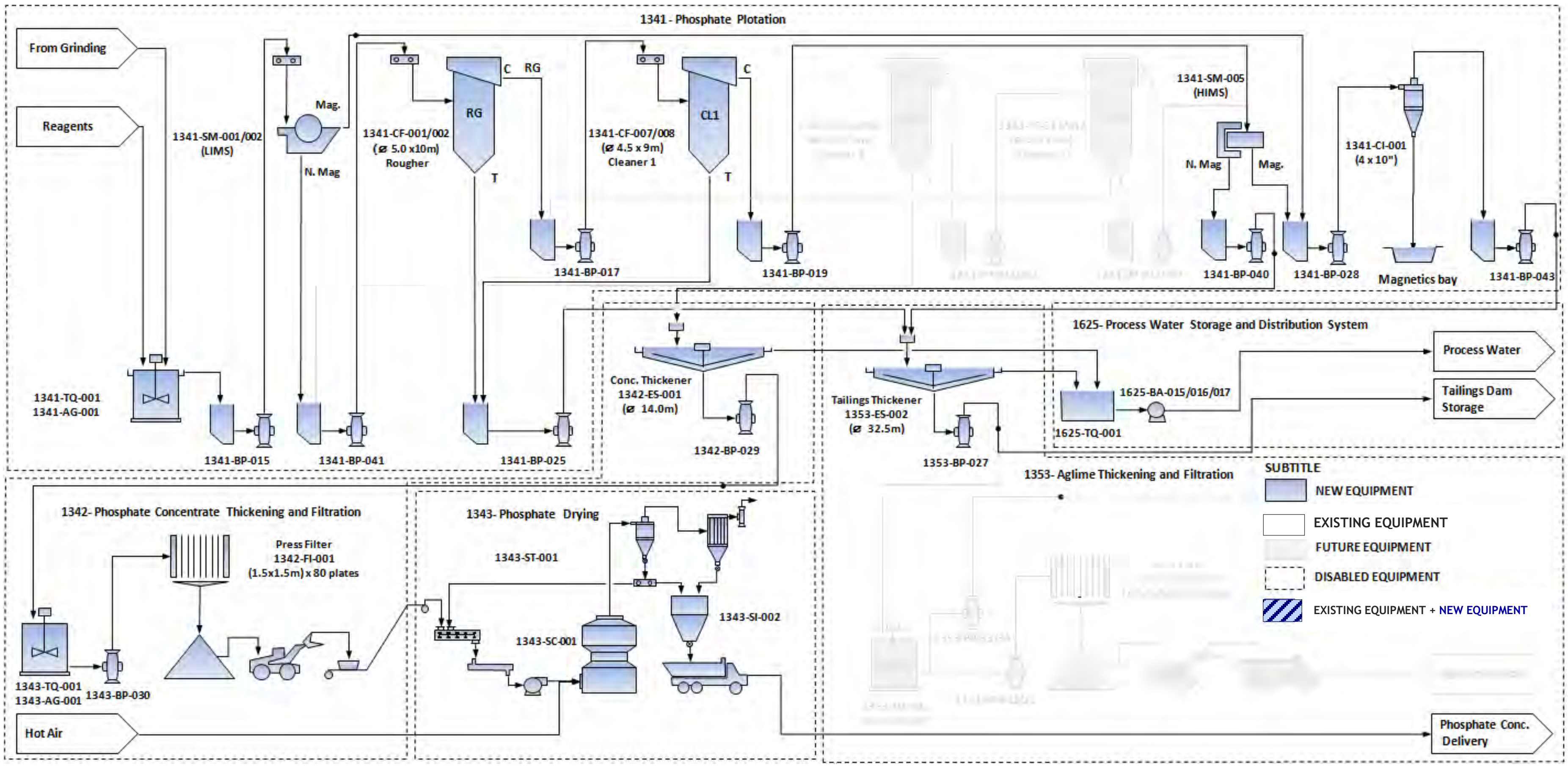


Figure 12.7 Flotation and Dewatering Circuit – Carbonatite (Phase 2)

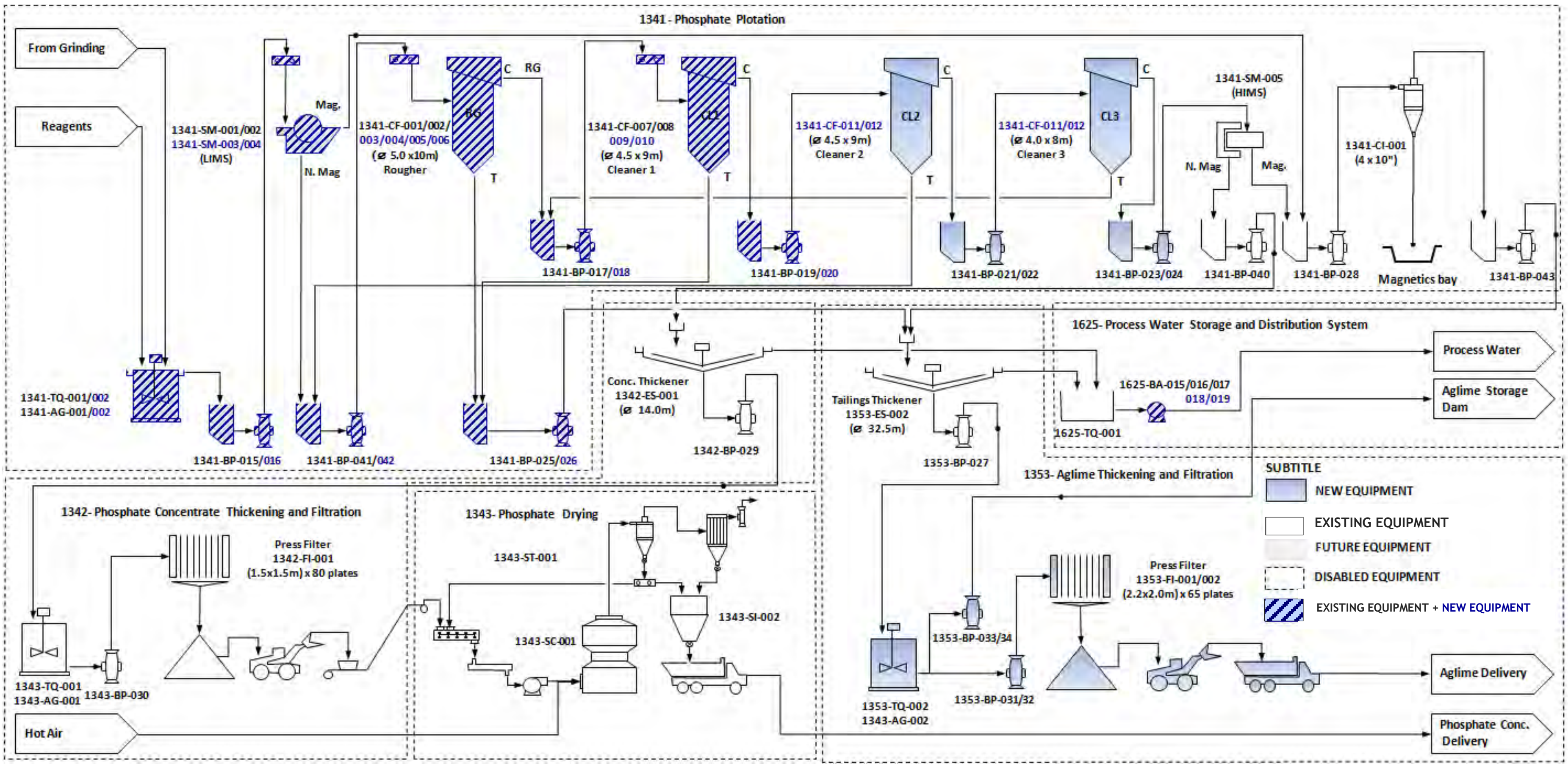


Figure 12.8 Hot Gas Generation System (Common to Phases 1 and 2)

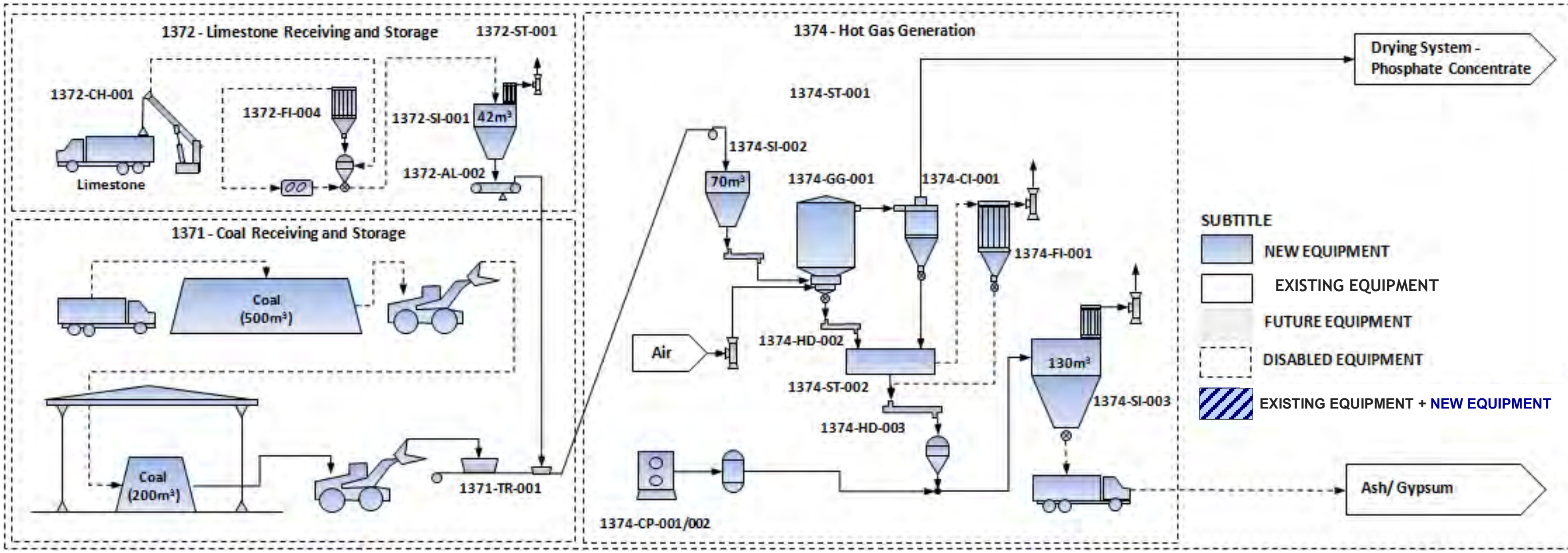


Figure 12.9 General Arrangement for Phase 1

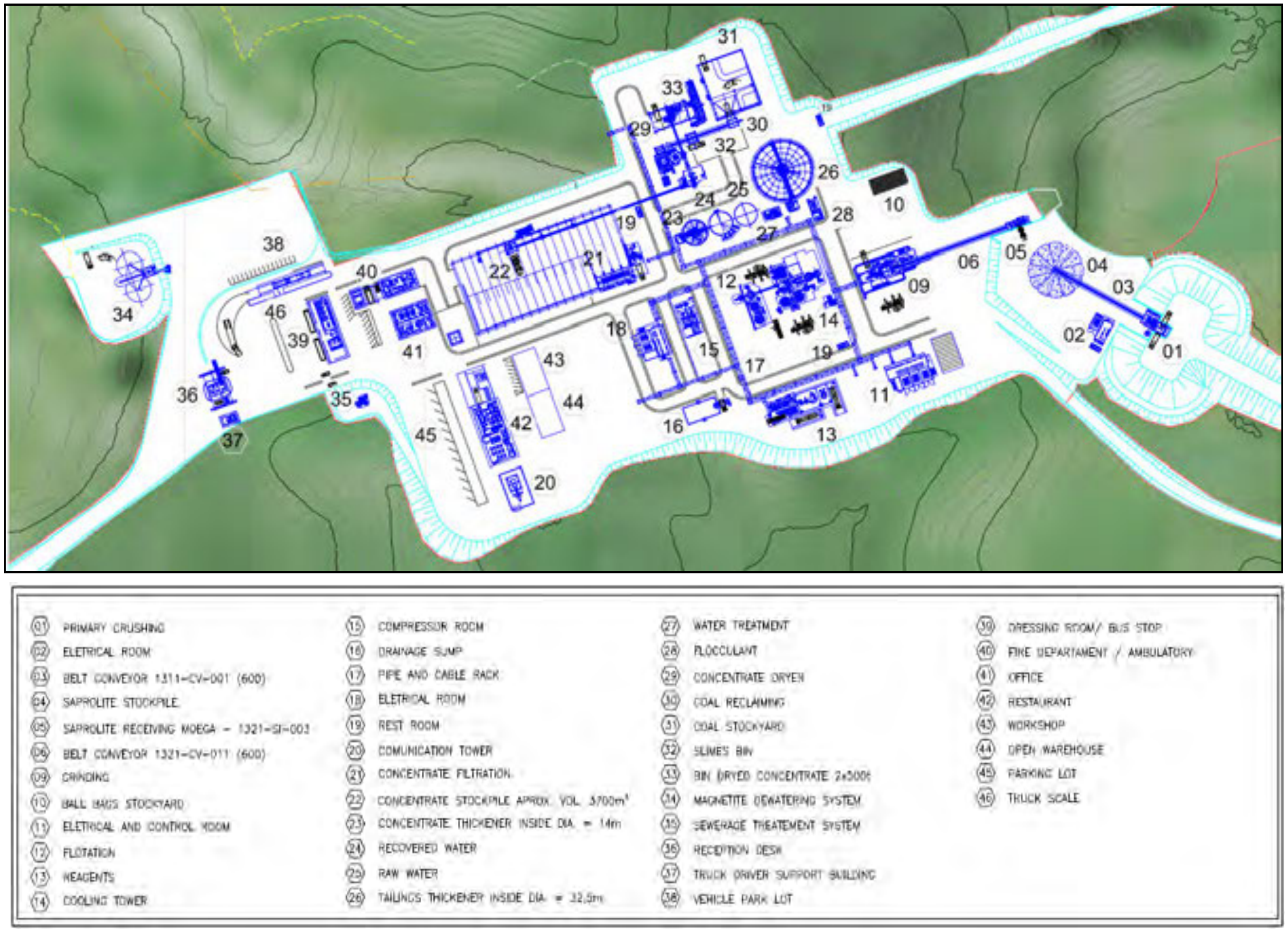
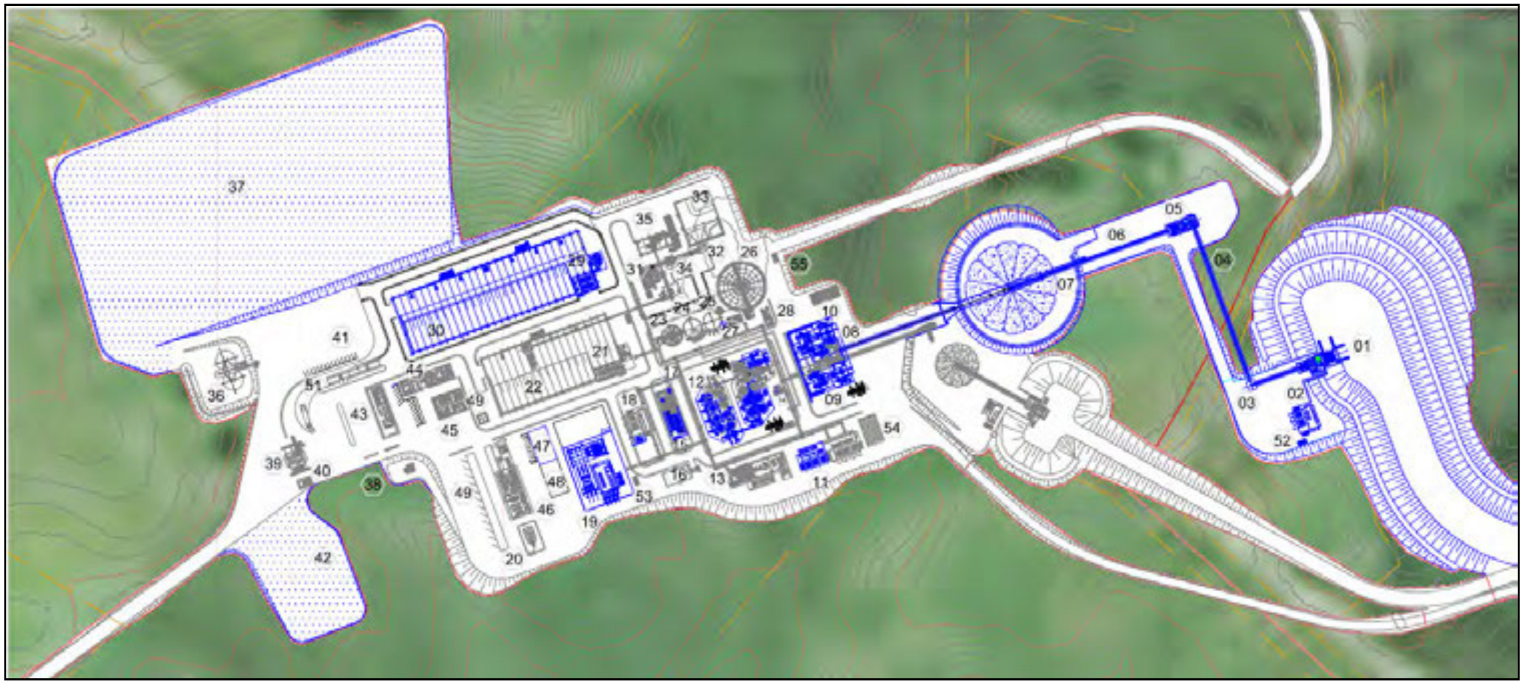


Figure 12.10 General arrangement for Phase 2



01	PRIMARY CRUSHING	12	FLOTATION	23	CONCENTRATE THICKENER INSIDE DIA. = 14m	34	SLIMES BIN	45	OFFICE
02	CONVEYOR BELT 1312–CV–001(800)	13	REAGENTS	24	RECOVERED WATER	35	BIN DRYED CONCENTRATE 2x500t	46	RESTAURANT
03	TRANSFER HOUSE	14	COOLING TOWER	25	RAW WATER	36	MAGNETITE DEWATERING SYSTEM	47	WORKSHOP
04	CONVEYOR BELT 1312–CV–002(800)	15	COMPRESSOR ROOM	26	TAILINGS THICKENER INSIDE DIA. = 32,5m.	37	AG LIME STOCKYARD	48	OPEN WAREHOUSE
05	SECUNDARY CRUSHER	16	DRAINAGE SUMP	27	WATER TREATMENT	38	SEWERAGE TREATEMENT SYSTEM	49	LIVING SPACE
06	CONVEYOR BELT 1313–CV–003(600)	17	PIPE AND CABLE RACK	28	FLOCCULANT	39	RECEPTION DESK	50	PARKING LOT
07	CRUSHED ROM STOCKPILE LIVE VOLUME–5000m³	18	ELETRICAL ROOM	29	AG LIME FILTRATION	40	TRUCK DRIVER SUPPORT BUILDING	51	TRUCK SCALE
08	CONVEYOR BELT 1323–CV–006 (600)	19	MAIN SUBSTATION	30	AG LIME STOCKPILE APROX. VOL. 8500m³	41	VEHICLE PARK LOT	52	ELETRIC ROOM
09	GRINDING	20	COMUNICATION TOWER	31	CONCENTRATE DRYER	42	TRUCK PARK LOT	53	ENERGY METERING CABINET
10	BALL BAGS STOCKYARD	21	CONCENTRATE FILTRATION	32	COAL RECLAIMING	43	DRESSING ROOM/ BUS STOP	54	LABORATORY
11	ELETRICAL AND CONTROL ROOM	22	CONCENTRATE STOCKPILE APROX. VOL. 3700m³	33	COAL STOCKYARD	44	FIREFIGHTER/AMBULANCE	55	REST ROOM

The area for each of the facilities Phase 1 (Saprolite) and Phase 2 (Carbonatite) is presented at table below.

Table 12.6 Process Facilities Area (m^2)

Facilities (m^2)	Phase 1 (Saprolite)	Phase 2 (Carbonatite) Final Configuration
Primary Crushing	105	250
Secondary Crushing and Screening	-	200
Stockpile and Reclaim System	765	3,340
Grinding	520	1,620
Flotation	960	1,150
Thickening and Water Tanks	2,750	2,750
Phosrock Filtration and Shed	4,070	4,070
Aglime Filtration and Shed	-	6,020
Coal Stockyard	840	840
Drying	470	470

Most of the process buildings do not have a roof or siding. Adequate rigging plans to guarantee access and space for parking were foreseen, to enable the operation of mobile cranes, truck mounted cranes or other mobile equipment, to provide processing plant maintenance, wherever required.

The buildings for Reagents, Filtration and Stockpiles and Compressors, due to their specific function, will be covered with lateral siding (the coal stockpile will have a large uncovered pile and a smaller covered one). The maintenance at these buildings will be carried out by cranes, hoists or fork-lift.

12.4 PROCESSING PLANT DESCRIPTION

12.4.1 COMMINUTION CIRCUIT

Phase 1 - Saprolite

During Phase 1 (Saprolite), ROM will be transported by 30 t trucks from the mine to the beneficiation plant. ROM will be dumped into a hopper and passed through an apron feeder underneath the hopper. The material is then transported via the apron feeder to a toothed roll crusher, model MMD 500 or similar (mobile system, over crawlers).

The toothed roll crusher product (size less than 25 mm) will be transported by a conveyor belt to a stockpile. The crushed ore will be reclaimed from the stockpile and transported to a hopper by a front-end loader. The material will pass from the hopper through a belt feeder and finally directed onto a conveyor belt that will lead the crushed material to a primary 12.5’ x 16’ rod mill with 900 kW drive.

The rod mill discharge will be directed to a pump box where dilution water and a solution of NaOH will be added. The slurry from the box will then be pumped to the conditioning stage.

Phase 2 - Carbonatite

With the exhaustion of the Saprolite ore reserves, the comminution circuit will be modified and complemented according to the following:

- Installation of a primary/secondary crushing system consisting of a primary jaw crusher and a secondary cone crusher operating in open circuit. The existing primary sizer crushing of the Saprolite circuit will be disabled;
- Installation of a new conical surge pile with reclaim system using vibratory feeders located underneath the pile. The saprolite surge pile circuit will be disabled;
- Installation of an additional rod and two ball mills, which will operate in two parallel lines (one rod mill and one ball mill each line).

ROM will be transported by 70 ton trucks from the mine to the beneficiation plant and then dumped into a hopper with a fixed grizzly. A mobile rock breaker will be used to break rocks bigger than 750mm. The ore will be reclaimed by an apron feeder to a vibrating grizzly (3 m x 5.6 m) equipped with 100mm openings. The oversize material (-750 mm +100 mm) will be the primary crusher feed (C140 Metso or similar). The grizzly undersize, together with primary crusher discharge will be collected by a conveyor belt system which will direct the material to the secondary crushing.

The material from the primary crushing will be transported to the secondary crusher feed silo. From the silo, the material will be reclaimed by a belt feeder to an 8' x 24' banana vibratory screen. The ore will be classified in 25 mm with oversize feeding the secondary cone crusher (HP 400 Metso or similar). The screen undersize together with the secondary crushing product will be transported by a conveyor belt to the crushed ROM stockpile.

The crushed ore will be reclaimed from the crushed ROM stockpile using vibratory feeders and transported by a conveyor belt to the rod milling feed silo. The material will be fed by belt feeders into the two primary 12.5' x16' rod mills equipped with 900 kW drives. The rod mills will operate in open circuit in which one rod mill will be from the saprolite phase and a new one from the carbonatite phase.

In the carbonatite phase, the primary grinding circuit will also comprise a secondary grinding stage with two ball mills operating in closed circuit. The primary grinding product will be discharged in two pump boxes and pumped to two classification hydrocyclones batteries. The cyclones underflow will feed the two 12' x18' ball mills with 1,100 kW drives. The secondary grinding product will be collected in a pump box and pumped to the conditioning tanks before feeding the Low Intensity Magnetic Separator (LIMS).

The following tables detail the main features of the comminution equipment and installations of the Phases 1 and 2 of the project.

Primary Crushing

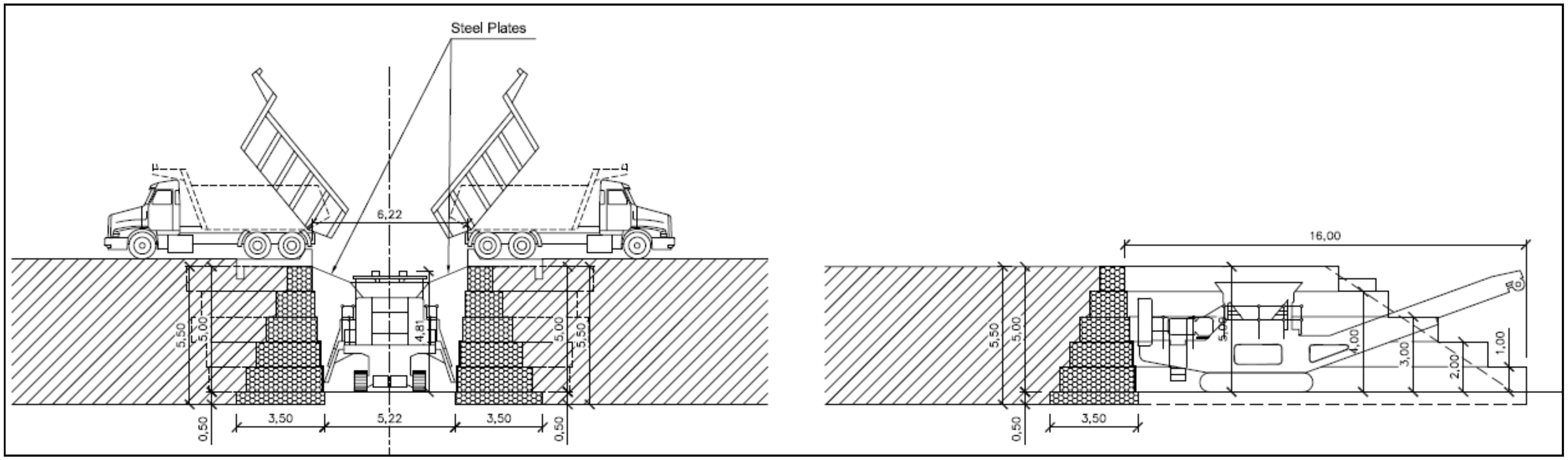
The following table shows the crushing system basic data.

Table 12.7 Primary and Secondary Crushing Basic Data

Item	Unit	Saprolite	Meta Carbonatite
Feed top size	mm	100	750
Nominal feed rate	t/h	205	281
Design factor	%	35%	35%
Design feed rate	t/h	277	379
Primary Crushing			
Feed system	-	30 trucks, 2 discharging points	70 trucks, 2 discharging points
Hopper reclaiming system	-	Apron feeder	Apron feeder
Equipment type/ model	-	Roll crusher (sizer), MMD 500	Jaw crusher (C140) with scalping grizzly (2.5 x 4.0m)
Product size	mm	minus 50	minus 200
Secondary Crushing			
Feed system	-	-	Silo with
Silo reclaiming system	-	-	belt feeder
Equipment type/ model	-	-	Cone crusher (HP500) with scalping screen (8'x24', banana type)
Product size	mm	-	minus 25mm

The following figure shows the saprolite primary crushing system lay-out. A 5.5 m high gabion containment wall will be constructed, to facilitate the trucks discharge in the feed hopper.

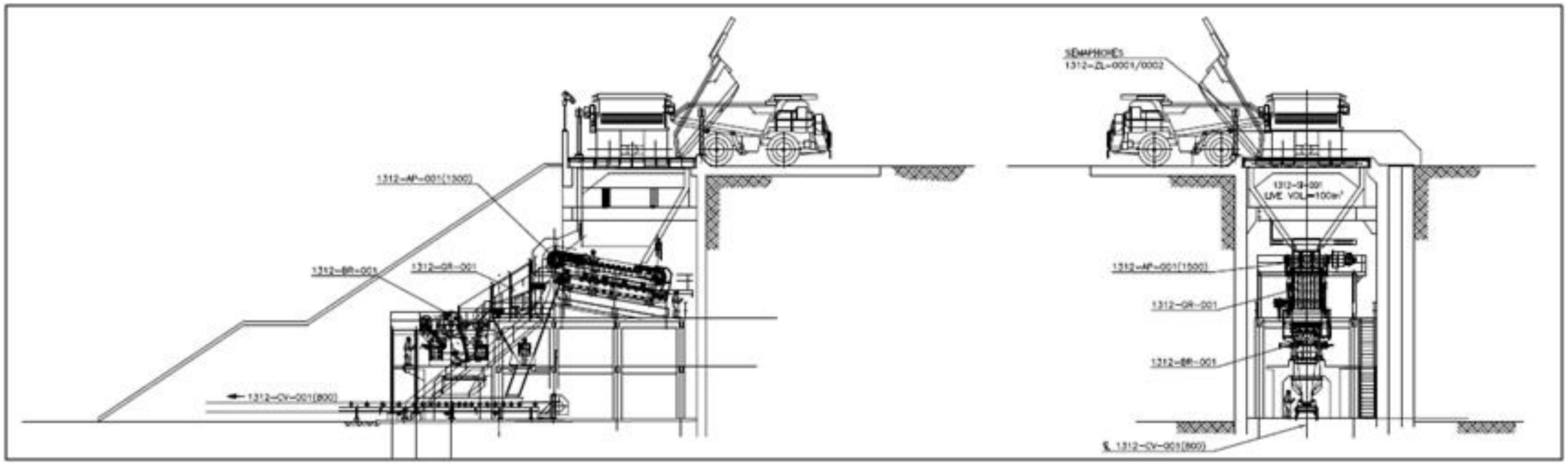
Figure 12.11 Primary Crushing – Phase 1



The primary crushing building for Phase 2 will be a steel structure (columns, beams and bracing in rolled or welded structural steel profiles) and will be supported by shallow foundations on piers and isolated footings. Its installation will require a 16.75 m high reinforced earth containment wall and transitional concrete slabs at the truck discharge area.

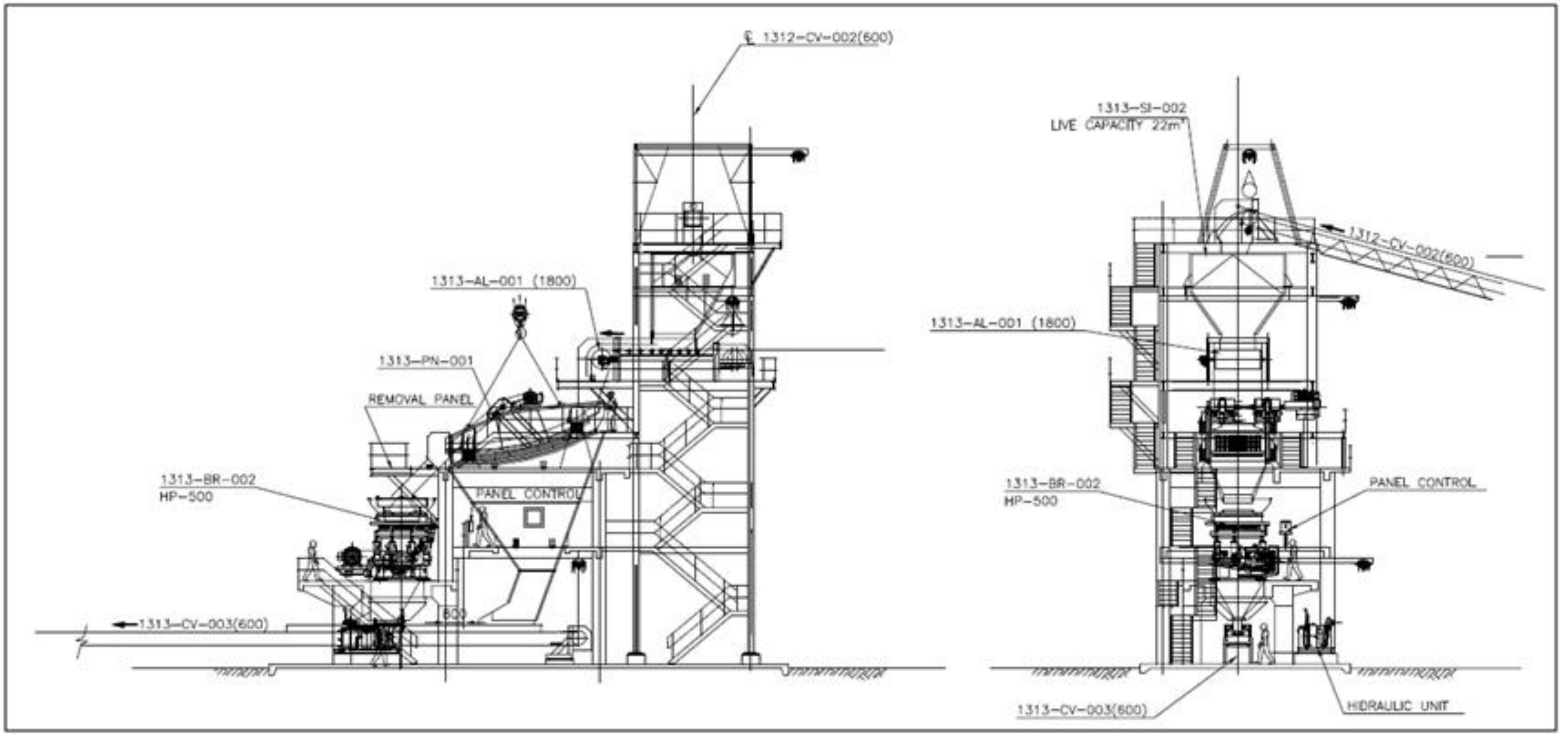
The Phase 2 primary crushing lay-out is shown on the following figure.

Figure 12.12 Primary Crushing – Phase 2



The Secondary Crushing and Screening building will be a steel structure, with isolated footings.

Figure 12.13 Secondary Crushing – Phase 2



Surge Stockpile (Crushed Material) and Reclaiming System

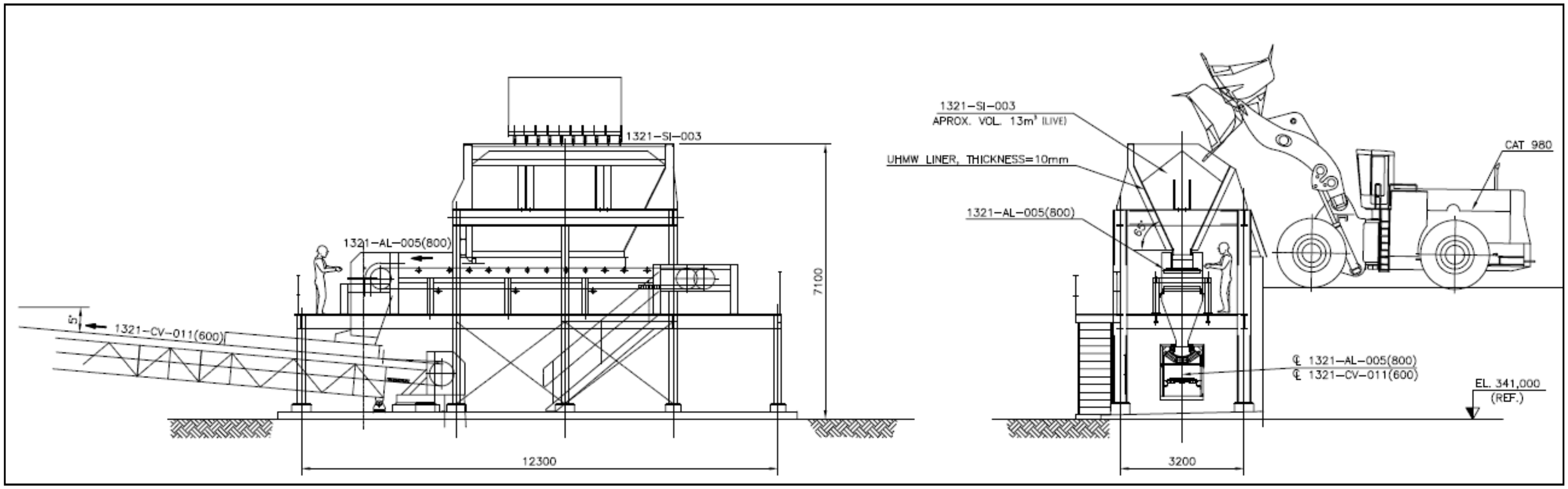
The following table show surge stockpile basic data.

Table 12.8 Surge Stockpile Basic Data (Crushed Material)

Item	Unit	Saprolite	Meta Carbonatite
Pile type	-	conical	conical
Stockpile Capacity (live)	h	12	20
Repose angle	º	35-38%	35-38%
Total capacity	m^3	1,222	approx. 25,000
Total capacity	t	2,200	45,000
Live capacity	m^3	1,222	approx. 5,000
Total capacity	t	2,200	9,000

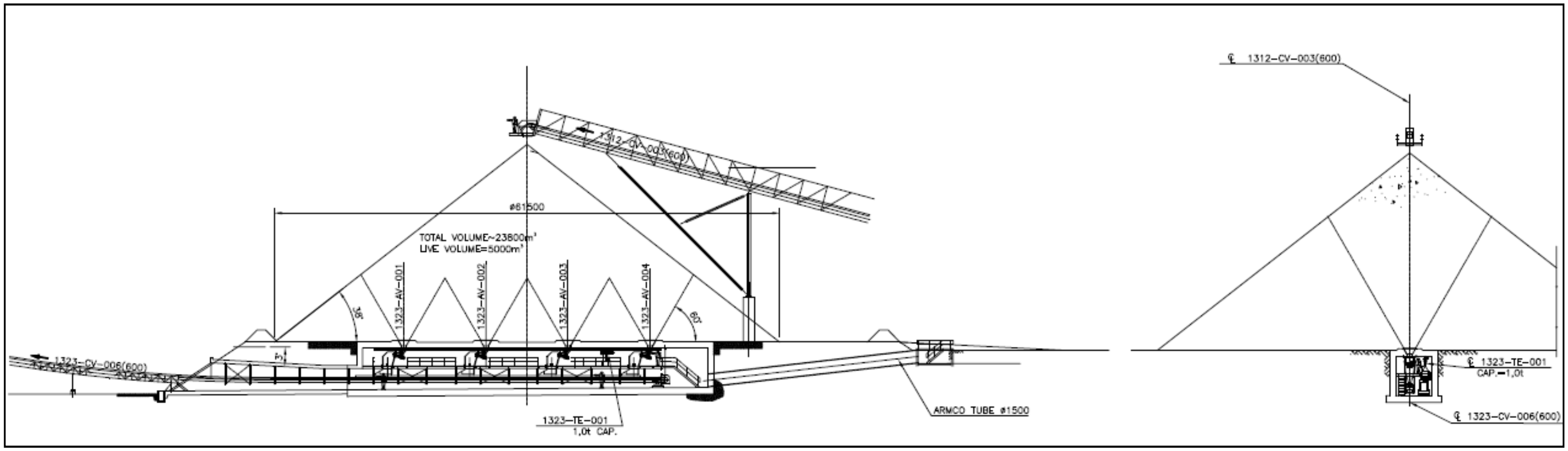
The reclaiming system (hopper and feeder mounted in a steel structure building) arrangement for Phase 1 is shown on the following figure. This system will operate only during 3.5 years, handling a low feed rate.

Figure 12.14 Reclaiming System – Phase 1



For Phase 2, the reclaiming of crushed material from stockpile will be by means of four vibrating feeders, installed in line, underneath the ore pile, on a concrete tunnel. A safety tunnel for emergency situations was considered, as shown in the following figure.

Figure 12.15 Stockpile and Reclaiming System – Phase 2



Grinding

The following table show the basic data for the grinding circuit, for both phases.

Table 12.9 Grinding Basic Data

Item	Unit	Saprolite	Meta Carbonatite
Grinding Circuit			
Circuit Configuration	-	Rod Mill	Rod Mill + Classification Cyclone Cluster + Ball Mill
Number of operating lines in parallel	-	1	2
Number of equipment	-	1	4
Primary Grinding			
F80 Fresh Feed	-	1250 µm	19 mm
P80 Fresh Feed	-	150 µm	3.5 - 4 mm
Nominal feed rate (dry basis)	t/h	181	404
Mill type	-	Rod Mill	Rod Mill
WI	kWh/t	4.85-6.23 (Rod Mill)	13.64
Circuit type	-	Open circuit	Open circuit
Mill size	-	12.5'x16' (3.81x4.9m) 900 kW	12.5'x16' (3.81x4.9m) 900 kW
Number of equipment	-	1 New	1 Existing + 1 New (2 Total)
Grinding media consumption	g/t	60	100
Secondary Grinding			
F80 Fresh Feed	-	-	19 mm
P80 Fresh Feed	-	-	150 µm
Mill type	-	-	Ball Mill
WI	kWh/t	-	10.68
Circuit type	-	-	Open circuit
Mill size	-	-	12'x18' (3.6x5.5m) 1100 kW
Number of equipment	-	-	2 New (2 Total)
Grinding media consumption	g/t	-	120

The following figures show a plan view for reference (Figure 12.16) and detailed section views of the grinding building (Figure 12.17 – 18), where the two operational phases can be seen. The Phase 1 will require only one rod mill and, for the Phase 2, a second rod mill and two ball mills will be installed to provide two independent operational lines. The grinding building will house the mills, feed bin, belt feeders, sumps and pumps and cyclones. The building is surrounded by industrial drainage gutters to collect the spillage and route it to a catchment sump.

Figure 12.16 Grinding Building Plan – Final Configuration

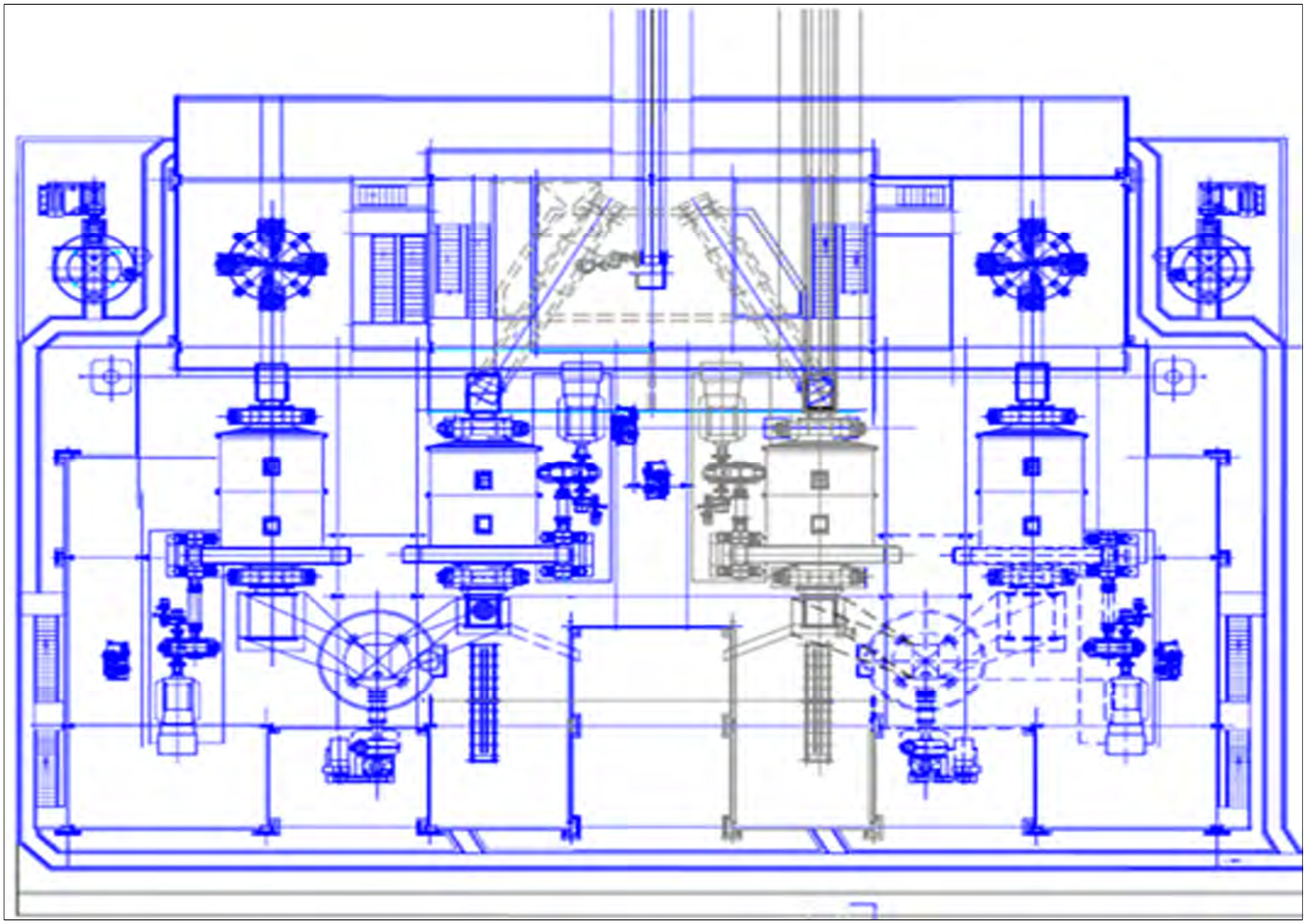


Figure 12.17 Grinding Building Section

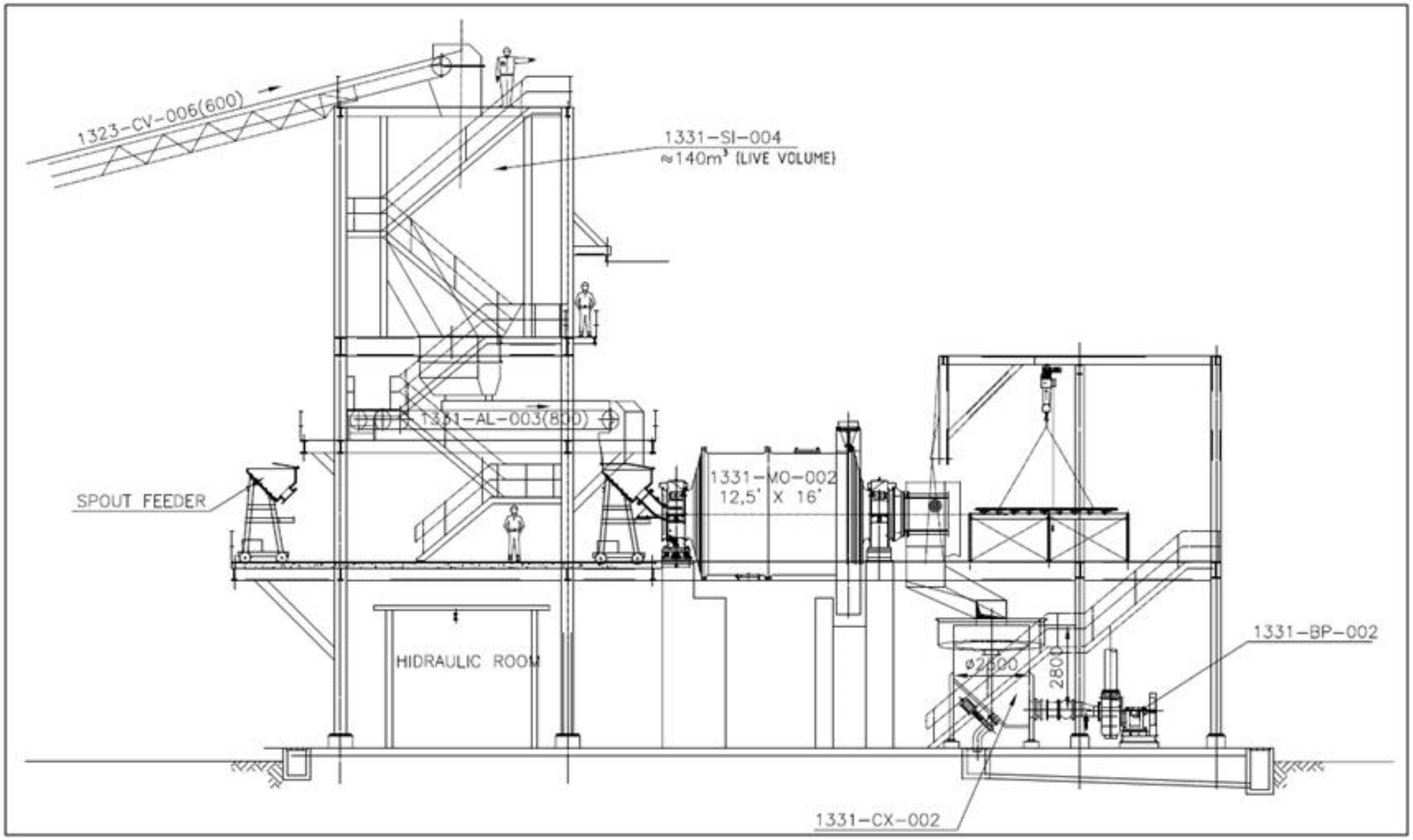
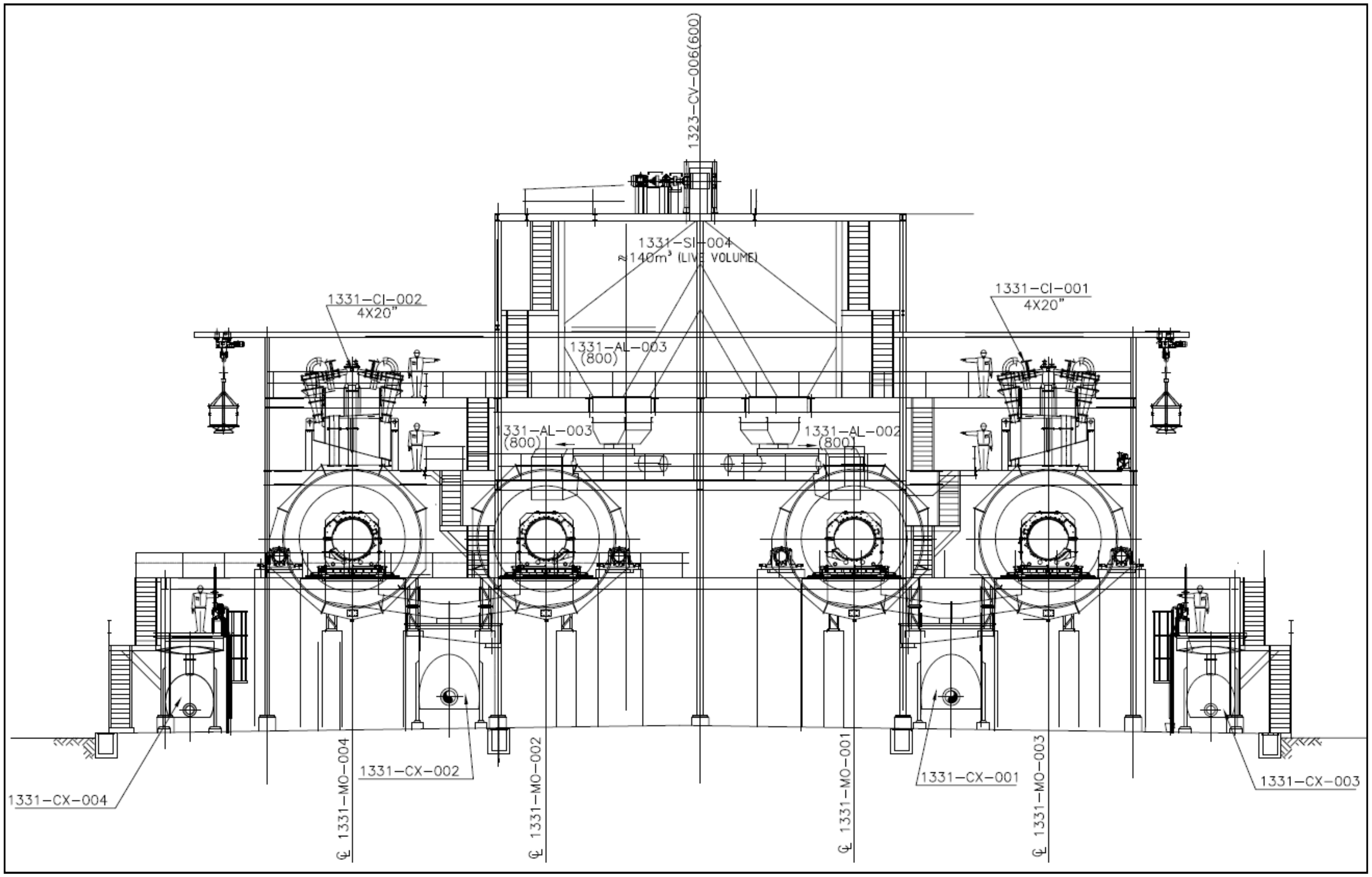
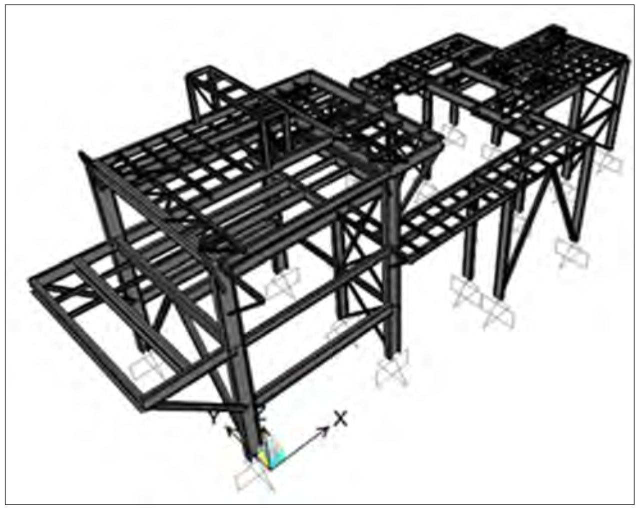


Figure 12.18 Grinding Building Section – Final Configuration



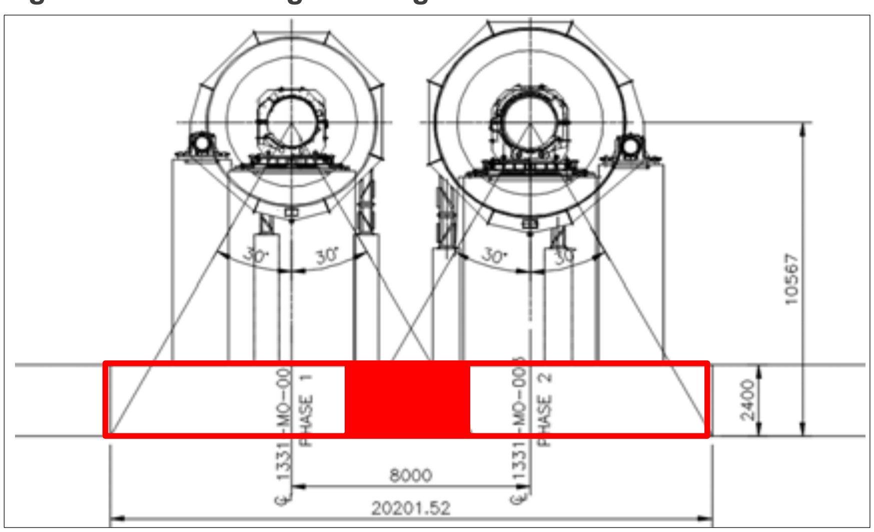
The grinding building will be constructed of steel structures, as per the figure below, with isolated concrete footings.

Figure 12.19 Grinding Building – Steel Structures Model – Phase 1



The mills supporting structure will be independent from the building foundation. However, the mills, in the final configuration of the building, will be close to each other and some overlapping of contiguous mills foundation will occur as shown in the figure below. So, the second mill foundation (not the superstructures) will have to be constructed during Phase 1 implementation.

Figure 12.20 Grinding Building – Concrete – Mills Foundations



12.4.2 FLOTATION CIRCUIT

Phase 1 – Saprolite

In the Phase 1 (Saprolite ore), the flotation circuit will include the following components:

- Conditioning Tank;
- Low Intensity Magnetic Separation;
- Rougher (RG) and Cleaner 1 (CL1) direct column flotation stages;
- High Intensity Magnetic Separation (WHIMS) of the Cleaner 1 concentrate;
- Classification by hydrocyclones of the WHIMS tailings (to remove the magnetic material and storing it in a bay).

Conditioning Tank

The slurry directed to the conditioning tanks will be treated with a collector and a depressant (corn starch) prior to magnetic separation. After conditioning, the conditioned slurry will be directed to a pump box, where dilution water will be added, and then pumped into a slurry distributor that will feed the low intensity magnetic separation stage.

Low Intensity Magnetic Separation

The conditioned slurry will be fed into two low intensity magnetic separators (LIMS). The magnetic separator produces a magnetic fraction and a non-magnetic fraction.

The non-magnetic fraction will be subjected to flotation in order to concentrate the phosphate content.

The magnetic fraction, which constitutes the tailings, will go through a dewatering stage in order to recover process water. The slurry will flow into a pump box and then pumped to a battery of dewatering cyclones. The cyclones will produce a dewatered magnetic-rich underflow that will be disposed in a magnetic bay. The overflow, with low solids content, will be directed into a pump box and then pumped into a thickener feed box, which will feed the tailings thickener.

Flotation

The flotation will be a two-stage process with a rougher stage followed by a cleaner stage.

The non-magnetic fraction from the low intensity magnetic separation stage will be directed to a pump box, where dilution water will be added, and then pumped into a slurry distributor, where frother (butyl glycol ether) will be added, before entering the two rougher flotation columns with diameter of 5 m and height of 10 m.

The rougher concentrate will flow into a pump box and then pumped into a slurry distributor that will feed the two flotation columns of the cleaner stage with a diameter of 5.0 m and height of 10 m. The rougher tailings will flow into a pump box and then pumped into a thickener feed box that will feed a tailings thickener.

The cleaner concentrate will flow into a pump box and then pumped to a high intensity magnetic separation (HIMS) stage. The cleaner tailings will follow the same path as the rougher tailings up to the tailings thickener.

The following flows will be sampled: rougher feed, cleaner concentrate and tailings (rougher + cleaner flow).

High Intensity Magnetic Separation

The final flotation concentrate (cleaner concentrate) will be fed into a high intensity magnetic separator. The magnetic separator produces a magnetic fraction and a non-magnetic product.

The magnetic fraction, which constitutes the tailings, will go through a dewatering stage in order to recover process water.

The non-magnetic fraction, which constitutes the concentrate, will flow into a pump box and then pumped into a thickener feed box that will feed the concentrate thickener.

Phase 2 – Carbonatite

In the Phase 2 (Carbonatite), additional column flotation stages will be installed, according to the following:

- Installation of Cleaner 2 and Cleaner 3 flotation columns and the respective slurry pumping systems.

Flotation

The non-magnetic fraction from the low intensity magnetic separation stage, after condition will be directed to a pump box, where dilution water will be added, and then pumped into a slurry distributor, where frother will be added, before entering the six rougher flotation columns with diameter of 5 m and height of 10m (in the Carbonatite phase, a second line of rougher flotation columns with four columns will be installed).

The rougher concentrate will flow into pump boxes and then pumped into slurry distributors that will feed the four flotation columns of the cleaner 1 stage. The cleaner 1 stage columns will have 4.5 m diameter and height of 9 m (in the Carbonatite phase, a second line of cleaner 1 flotation columns with two columns will be installed). The rougher tailings will flow into pump boxes and then pumped to the tailings thickener.

The cleaner 1 concentrate will flow into pump boxes and then pumped to cleaner 2 stage. The cleaner 1 tailings will follow the same path as the rougher tailings up to the tailings thickener.

The cleaner 2 stage will comprise two 4.5 m diameter and 9 m height flotation columns. The cleaner 2 concentrate will be pumped to the cleaner 3 stage feed. The cleaner 2 tailings will be directed to the rougher feed as a circulating load.

The cleaner 3 stage will comprise two 4 m diameter and 8 m height flotation columns. The cleaner 3 concentrate will be pumped to a high intensity magnetic separation (HIMS) stage. The cleaner 3 tailings will be directed to the cleaner 1 feed as a circulating load.

The following flows will be sampled: rougher feed, cleaner 3 concentrate and tailings (rougher + cleaner 1 flow).

The following items show the main features of the concentration equipment and/or installations of both phases of the project.

Table 12.10 Flotation Basic Data

Item	Unit	Saprolite	Carbonatite
Flotation Circuit			
Flotation Cell Type	-	Column (with retrofit pumping system)	Column (with retrofit pumping system)
Flotation Stages	-	RG, CL1 (direct flotation)	RG, CL1, CL2, CL3 (direct flotation)
Feed Material	-	Conditioned grinding product, after Low Intensity magnetic separation	Conditioned grinding product, after Low Intensity magnetic separation
Final Concentrate	-	Cleaner 1 concentrate	Cleaner 3 concentrate
Final Tailings	-	RG + CL1 Tailings	RG + CL1 Tailings
Conditioning			
Slurry Solids %	%	55-60	35-40
Conditioning Residence Time	min.	5	5
pH	-	10.5	10.5
Rougher Column Flotation (RG)			
Number of Cells	-	2 (New)	2 Existing + 4 New (6 total)
Flotation Column Diameter	m	5.0	5.0
Flotation Column Height	m	10.0	10.0
Carrying Capacity	$t/(h.m^2)$	1.33	1.59
Retention Time	min	23.81	32
Feed Rate (dry basis)	t/h	186	426
Overflow (dry basis)	t/h	52.25	179
Underflow (dry basis)	t/h	134	246
Cleaner 1 Column Flotation (CL1)			
Number of Cells	-	2 (New)	2 Existing + 2 New (4 total)
Flotation Column Diameter	m	4.5	4.5
Flotation Column Height	m	9.0	9.0
Carrying Capacity	$t/(h.m^2)$	1.36	1.32
Retention Time	min	28.19	32
Feed Rate (dry basis)	t/h	52.25	186
Overflow (dry basis)	t/h	43.51	74

Item	Unit	Saprolite	Carbonatite
Underflow (dry basis)	t/h	8.74	111
Cleaner 2 Column Flotation (CL2)			
Number of Cells	-	-	2 (New)
Flotation Column Diameter	m	-	4.5
Flotation Column Height	m	-	9.0
Carrying Capacity	$t/(h.m^2)$	-	1.47
Retention Time	min	-	32
Feed Rate (dry basis)	t/h	-	74
Overflow (dry basis)	t/h	-	48
Underflow (dry basis)	t/h	-	26
Cleaner 3 Column Flotation (CL3)			
Number of Cells	-	-	2 (New)
Flotation Column Diameter	m	-	4.0
Flotation Column Height	m	-	8.0
Carrying Capacity	$t/(h.m^2)$	-	1.56
Retention Time	min	-	32
Feed Rate (dry basis)	t/h	-	48
Overflow (dry basis)	t/h	-	42
Underflow (dry basis)	t/h	-	6

The following table shows the basic criteria related to the magnetic separation.