Use of Mine Planning Software in Mineral Resources and Reserves Estimation of the Lava Lignite Deposit in Servia – Greece

Ioannis Kapageridis[1], Athanasios Apostolikas[2], Efstratios Koundourellis[2]

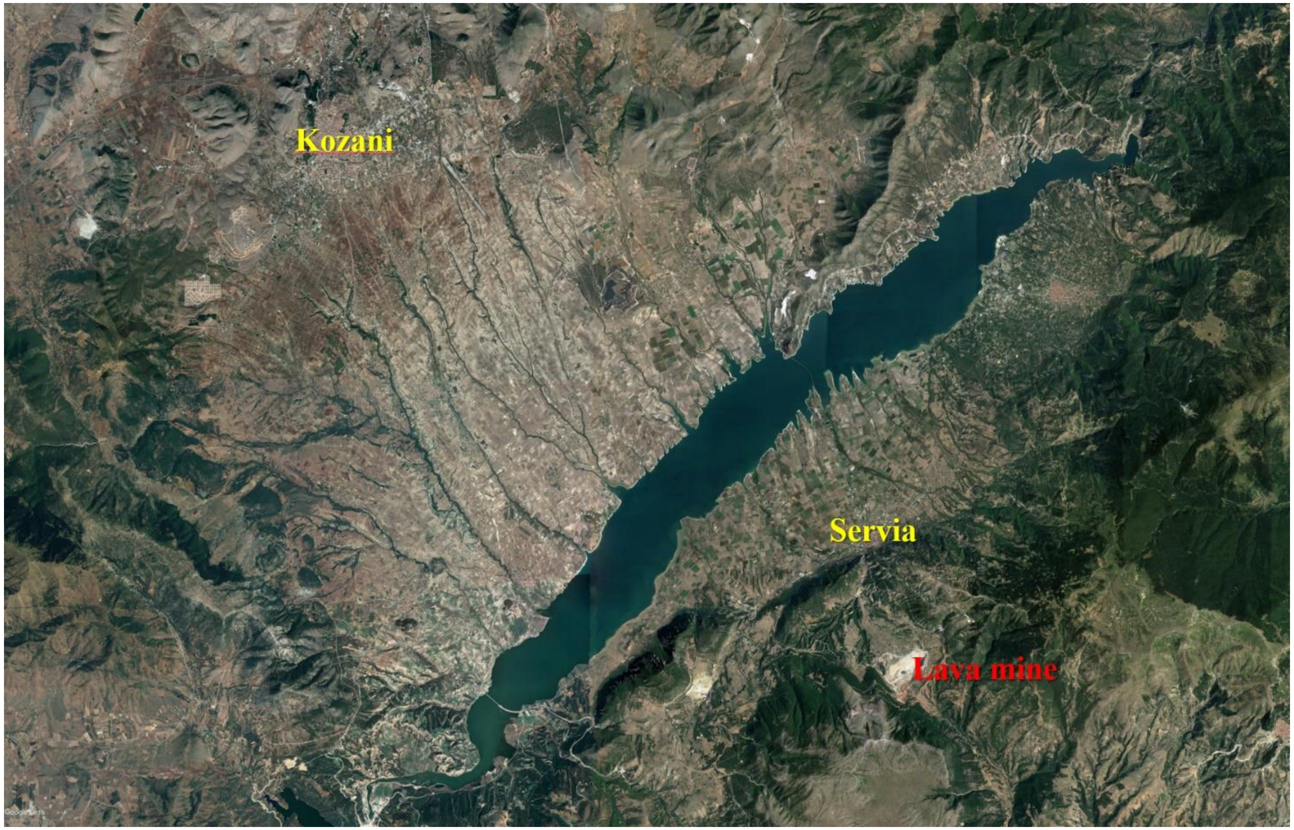
[1]Technological Educational Institute of Western Macedonia, Koila, Kozani, 52100, Greece
[2]LARCO GMMSA, 27 Fragkokklisias Street, Maroussi 15125, Athens, Greece

INTRODUCTION

The scope of the paper was to demonstrate the application of modern Geological Modelling and Mine Planning software such as Vulcan 3D to the Resource and Reserves evaluation, as well as the Mine Design & Development of Lava lignite mine.

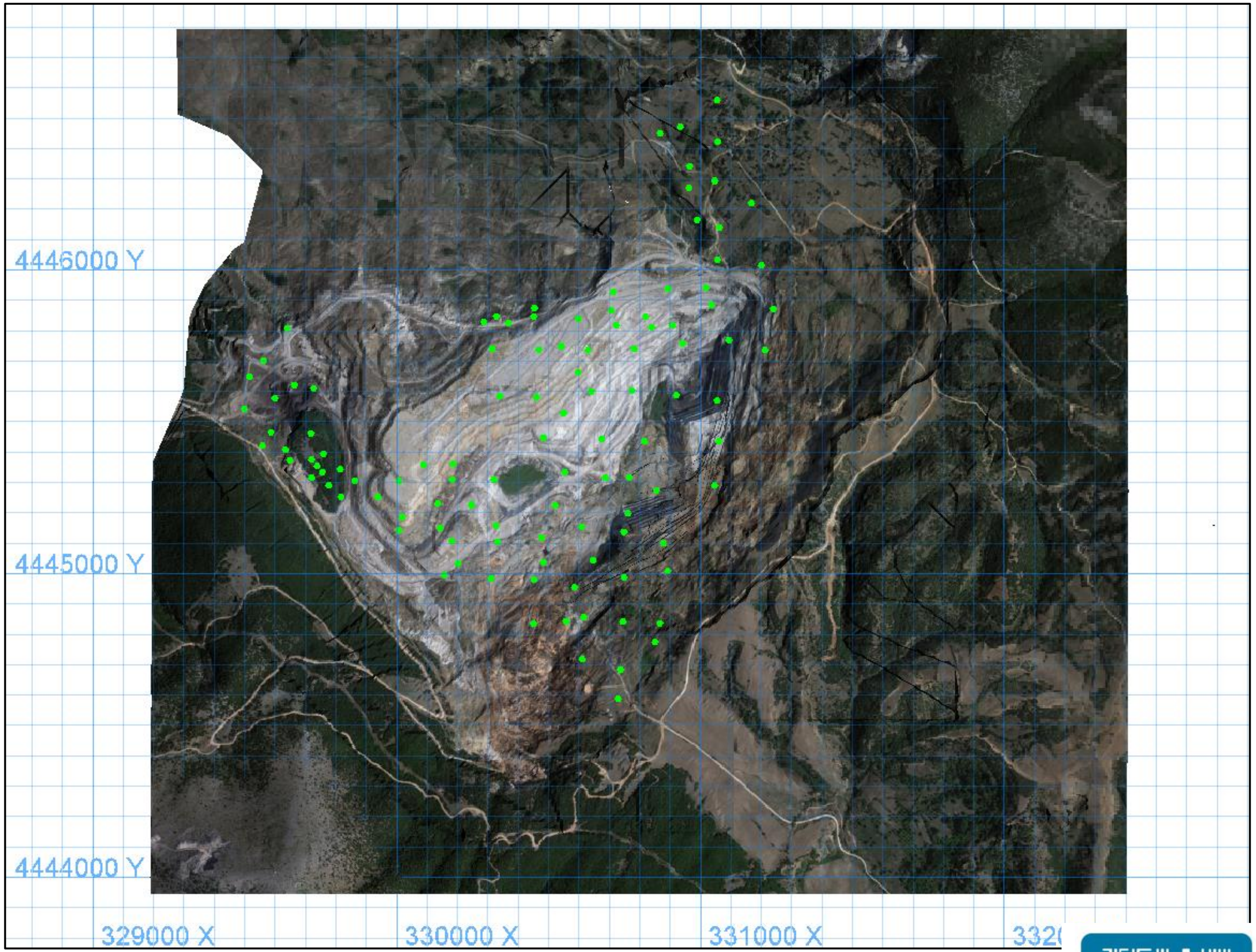
INTRODUCTION

The Lava lignite mine is located 12km from the town of Servia and 30km from the town of Kozani in the Kozani Prefecture



Available Data

- The data used in modelling and estimation of lignite resources and reserves of the Lava deposit included 120 drillholes and survey data of the original and current topography.
- All data were imported into appropriate Maptek Vulcan databases and validated.



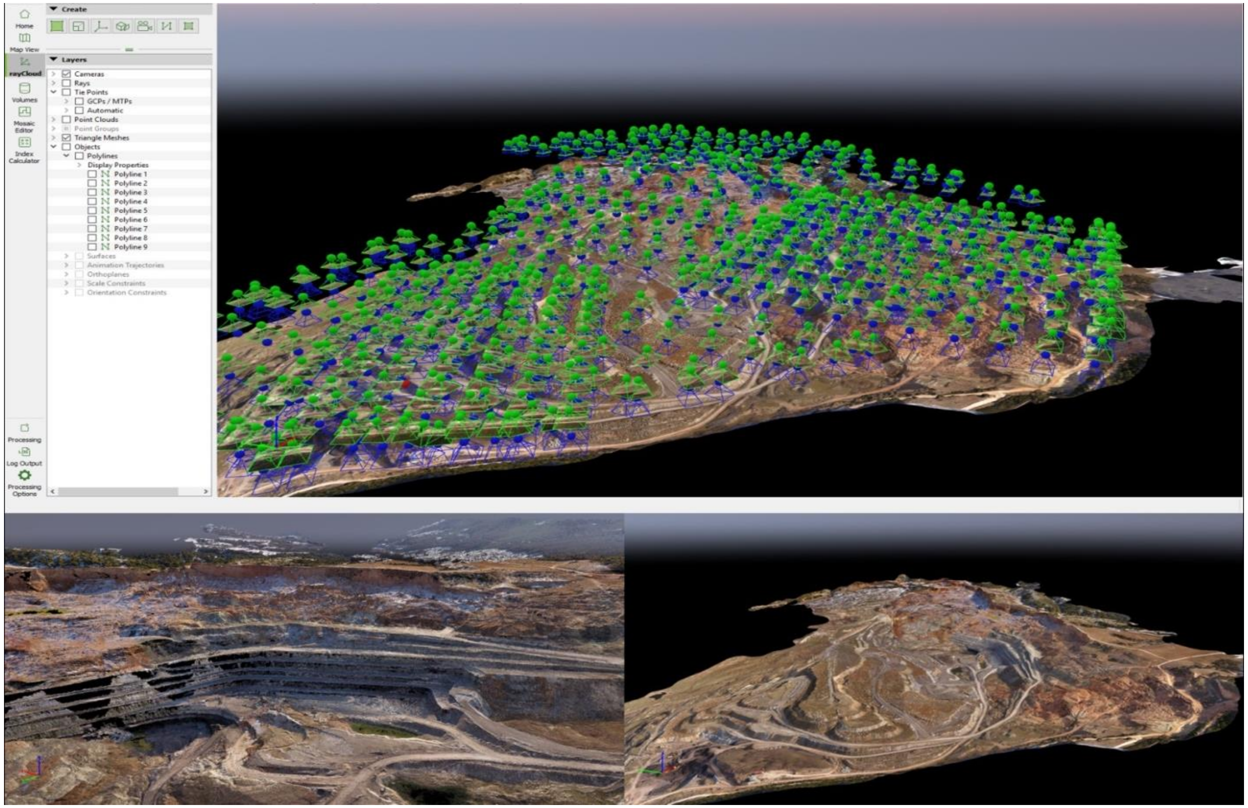
Software Implementation

- LARCO GMMSA has been using Maptek Vulcan since 2007 for mine planning in all of its mining operations including the nickel mines in Kastoria, Agios Ioannis and Evia.

- Vulcan 3D is also used for mine planning of the lignite operation in Servia

- Current topography was surveyed by drone and modelled using the photogrammetry software Pix4Dmapper Pro (Pix4D SA)

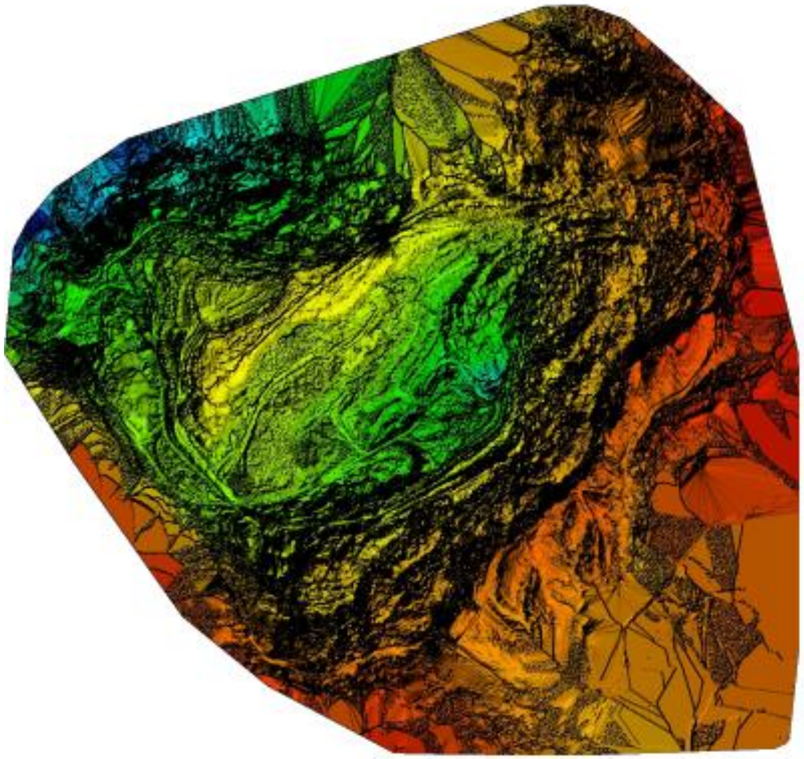
Software Implementation



The triangulation surface model was produced by the specialized photogrammetry software Pix4Dmapper Pro using **590** aerial pictures acquired by a drone covering **5.5 Km^2**.

The average Ground sampling Distance of the produced model was **7.29cm /pixel** and it was georeferenced using 7 Ground Control Points.

Software Implementation



This triangulation model by Pix4Dmapper Pro was imported in Maptek Vulcan3D as the surface of current topography, to be used for lignite resources and reserves modelling and calculation.

Drillhole Database Development and Validation

- Data from the 120 drillholes were imported to a drillhole database in Maptek Vulcan through CSV files containing collar information (hole ID, collar XYZ) and sample intervals (top and bottom depth, length, lithology, ash content, etc.)

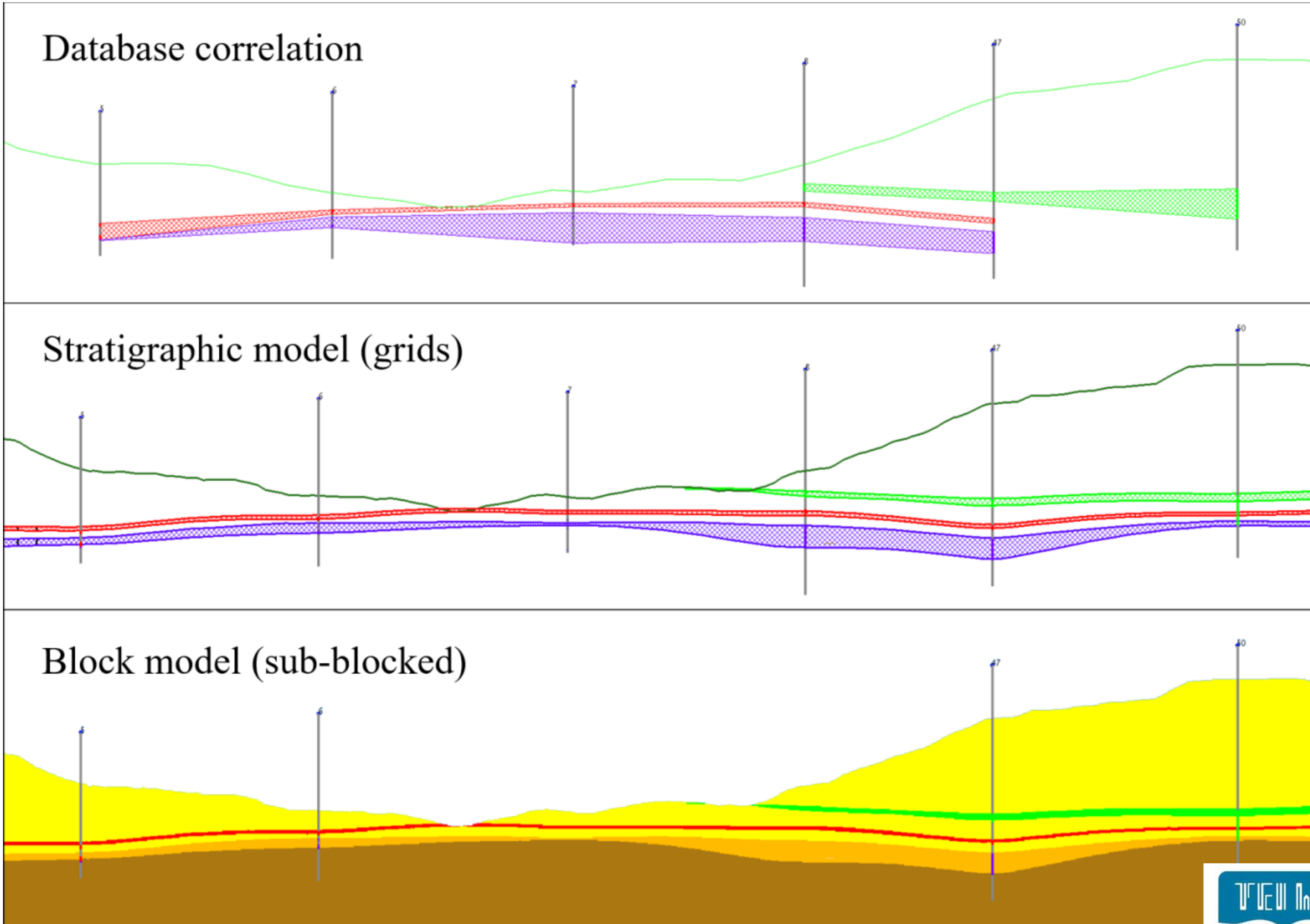
- The database was checked and validated both visually and through a number of tests related to collar coordinates and overlapping intervals.

- Sample intervals were composited to a standard length of 0.5m as they were originally of varying length, thus not suitable for block model estimation.

- The choice of composite length was based on the mining method used.

GEOLOGICAL MODELLING

- The lignite layer intervals were correlated and used to build grid models of the roof and floor of each layer.
- The grid models were cropped by the current topography surface and were checked against drillholes in sections.
- Minor layers of low lignite quality (waste) within the three main lignite layers were also modelled separately.
- Blocks inside these waste layers were to be excluded from estimation, as were the composites that came from these layers to minimise dilution.



LARCO GENERAL MINING & METALLURGICAL COMPANY

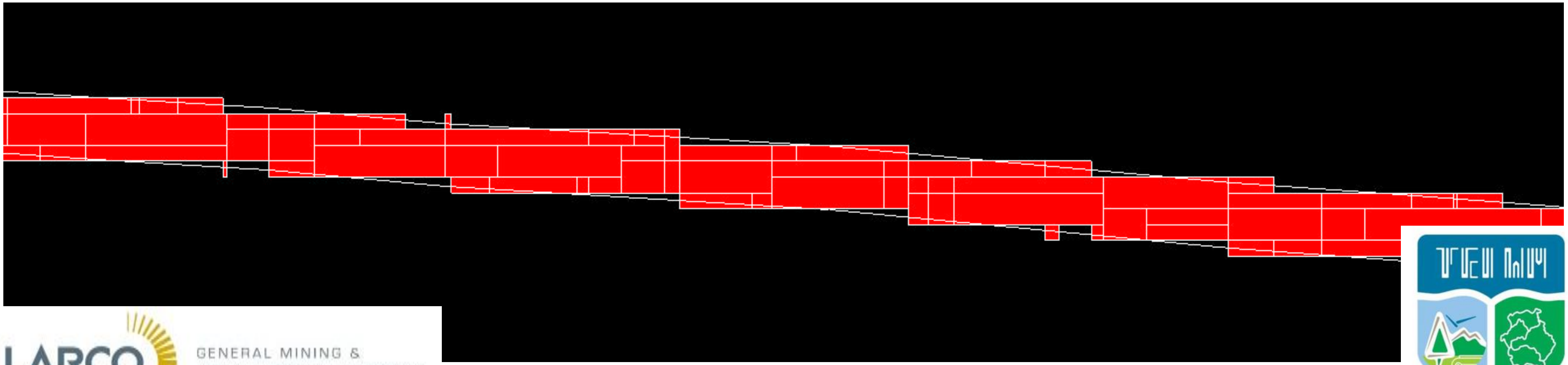
LIGNITE RESOURCES ESTIMATION

The structural grid models of stratigraphy and the current topography triangulation model were used to create a sub-blocked block model.

The main block size was set to 10x10x10m while the sub-block size ranged from 1x1x0.5m up to the main block size.

Sub-blocking occurs only in cases where a main block intersects one of the surfaces included in the model, i.e. lignite and waste layers roof and floor surface, and the current topography surface.

The aim of this process is to reduce the number of sub-blocks down to the absolutely necessary while still following the controlling surface to the greatest resolution possible.

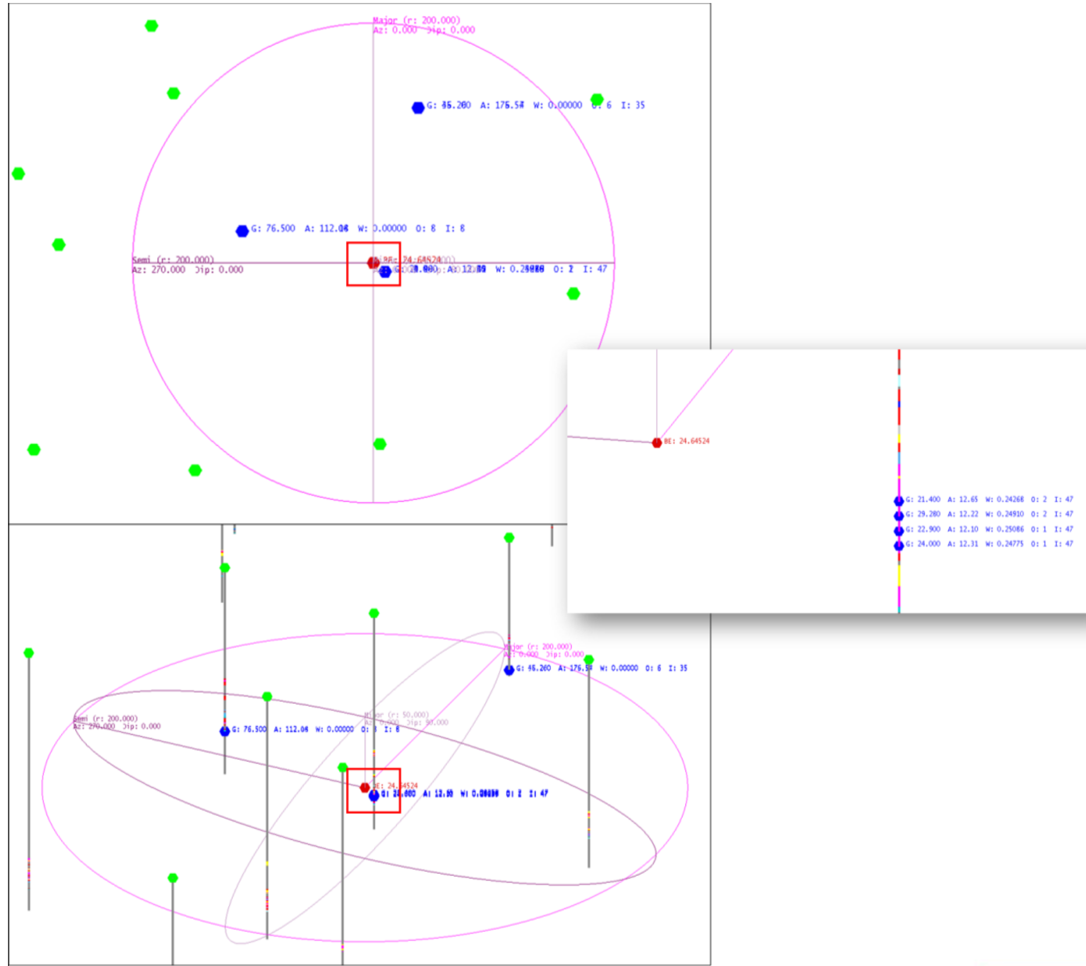


LIGNITE RESOURCES ESTIMATION

Multiple estimation runs were defined targeting the blocks of each lignite layer (block model zone).

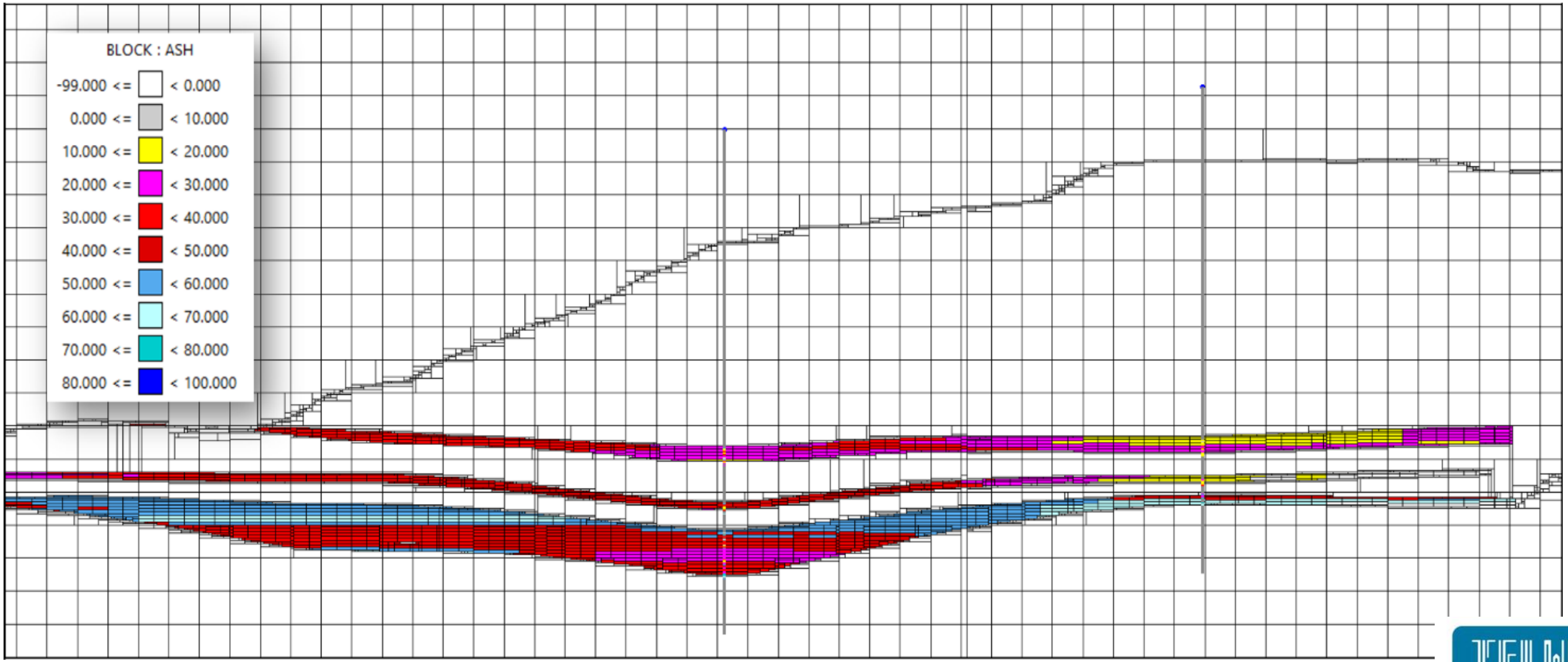
Octant based search was used to ensure sample selection from surrounding drillholes to the block being estimated.

After estimation, it was possible to check how the sample selection strategy worked showing estimation related information (applied distance, applied weight, octant number, etc.)

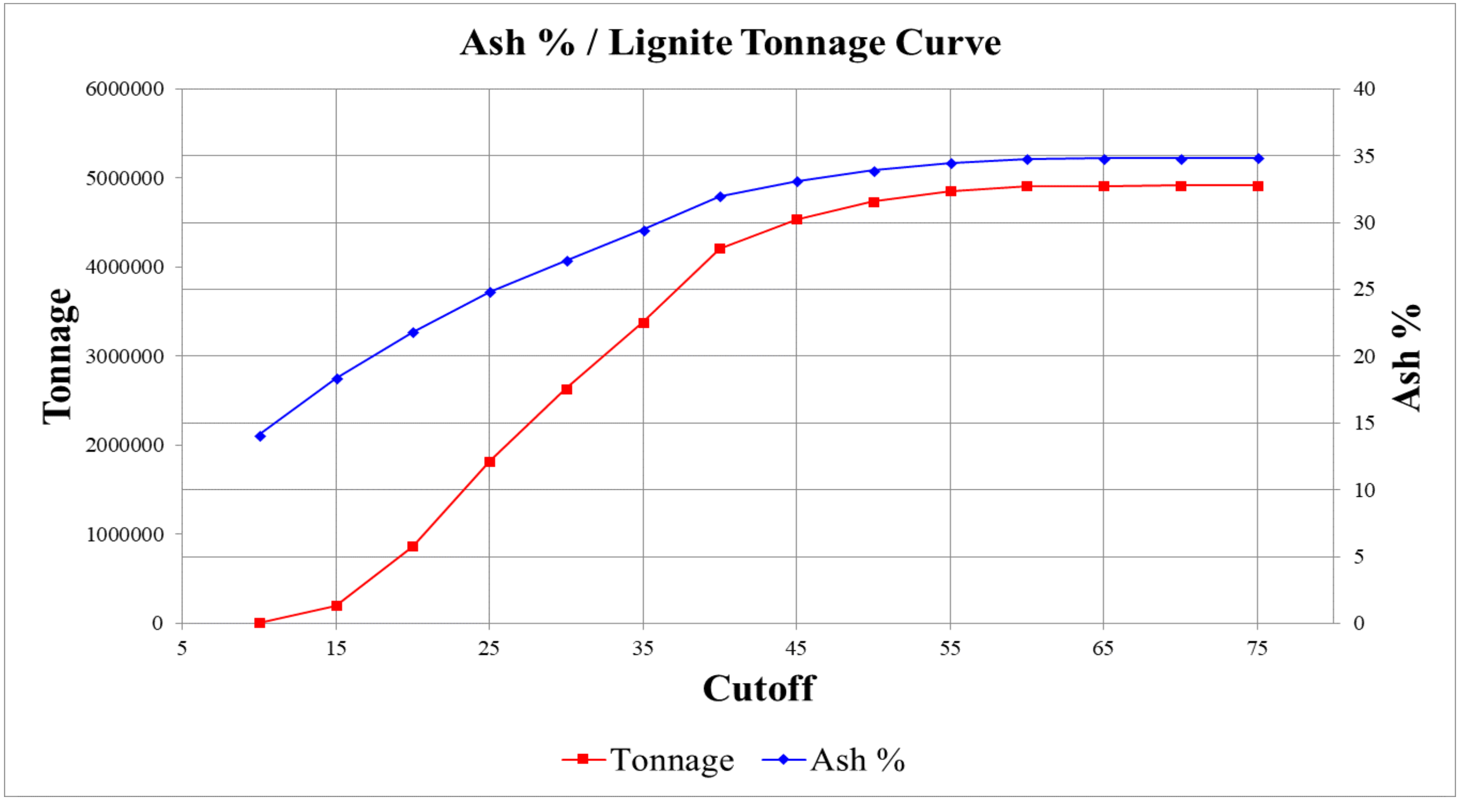


LIGNITE RESOURCES ESTIMATION

- After the estimation, each block of the model inside the lignite layers has a defined ash content.
- Estimates presented good agreement with the drillhole interval values.

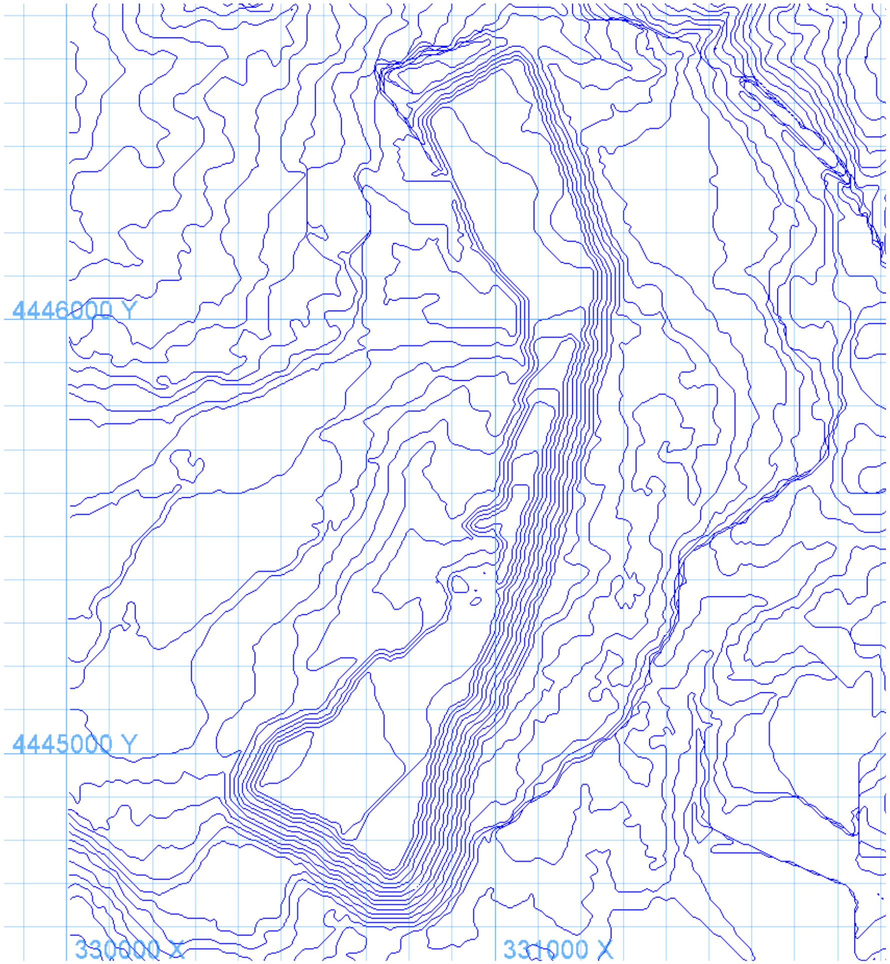


LIGNITE RESOURCES ESTIMATION



- The curves show the sensitivity of lignite ash content and tonnage to the ash upper limit applied.
- It seems that after 60% there is little or no change on lignite ash and tonnage.

LIGNITE RESERVES CALCULATION



- For the lignite reserves calculation, a solid triangulation of the conceptual final pit was used to limit the considered volume.
- The final pit was derived using Lerchs-Grossman pit optimisation with standard financial and pit slope parameters

LARCO GENERAL MINING & METALLURGICAL COMPANY

LIGNITE RESOURCES CALCULATION

Ash 50%								
Lignite kTonnes	**Ash** %	**Waste** m^3 x1000	**SR** m^3/t	**Sector**	**Lignite** kTonnes	**Ash** %	**Waste** m^3 x1000	**SR** m^3/t
2,420	34.89	26,623	11.00	North	986	34.35	8,749	8.88
				Central	643	37.01	5,372	8.36
				South	792	33.84	12,503	15.79
Ash 60%								
Lignite kTonnes	**Ash** %	**Waste** m^3 x1000	**SR** m^3/t	**Sector**	**Lignite** kTonnes	**Ash** %	**Waste** m^3 x1000	**SR** m^3/t
3,040	38.85	26,107	8.59	North	1,056	35.59	8,690	8.23
				Central	962	42.67	5,105	5.30
				South	1,022	38.62	12,311	12.05

- Using Lerchs-Grossman pit optimisation the above lignite reserves were estimated.
- Two scenarios are presented based on a different upper limit for ash (50 or 60%), at three separate sectors (North, Central and South).

CONCLUSION

- Most aspects of the application of mine planning software to the evaluation of lignite resources and reserves of the Lava lignite deposit were discussed

- The implementation of mine planning software produces results that increase confidence as to the available resources, and helps in planning future mining operations by developing different mining scenarios with speed and clarity

- The use of a pit optimization tool helps convert resources to reserves with more confidence and in a more standardized fashion that is widely accepted by the mining industry

Thank you for your attention!

LARCO GENERAL MINING & METALLURGICAL COMPANY