



KY PEM 2022

Why Your Quarry Matters

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Introduction

- › At a cement operation, the plant is KING!
- › Quarries provide approximately 90% of the raw materials, but only account for 10% of the total costs
- › It is often seen that Quarry Managers have little to no experience with how a mine should operate.

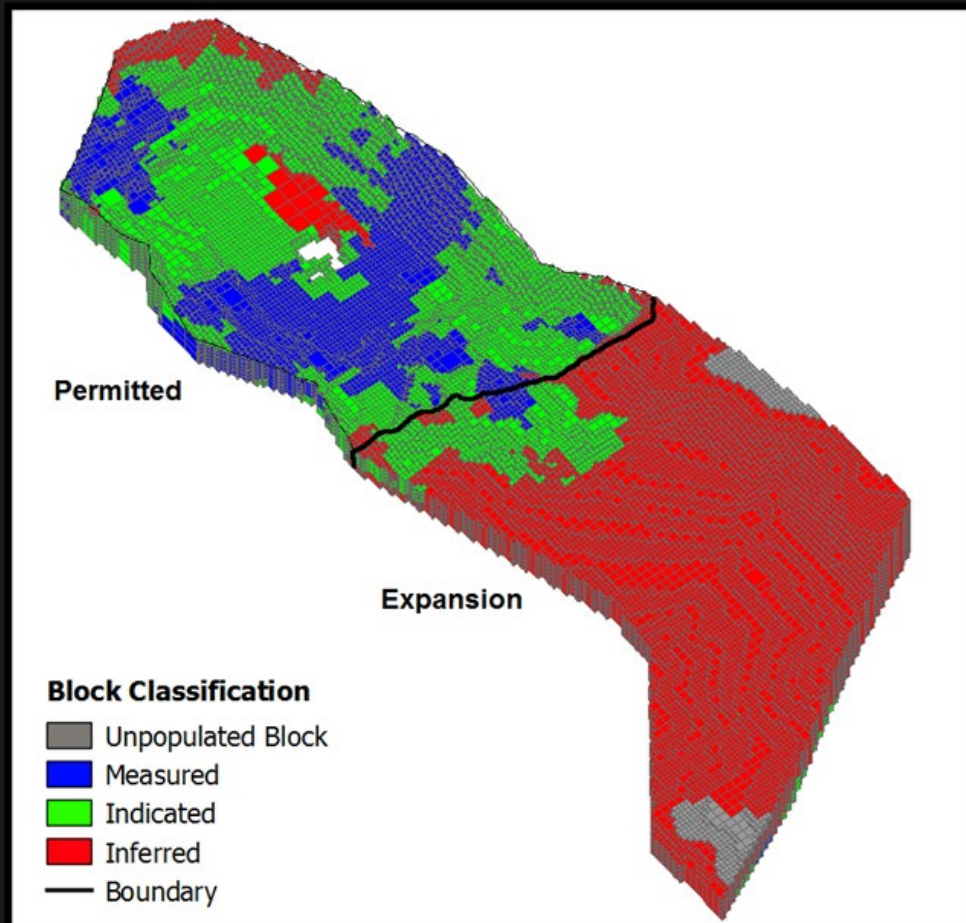
What we will cover

- › What is a block model
- › What information can you get out of a block model
- › What is a mine plan
- › What Information can you get out of a mine plan
- › Real life examples of how a block model and mine plan helped an operation

What is a Block Model

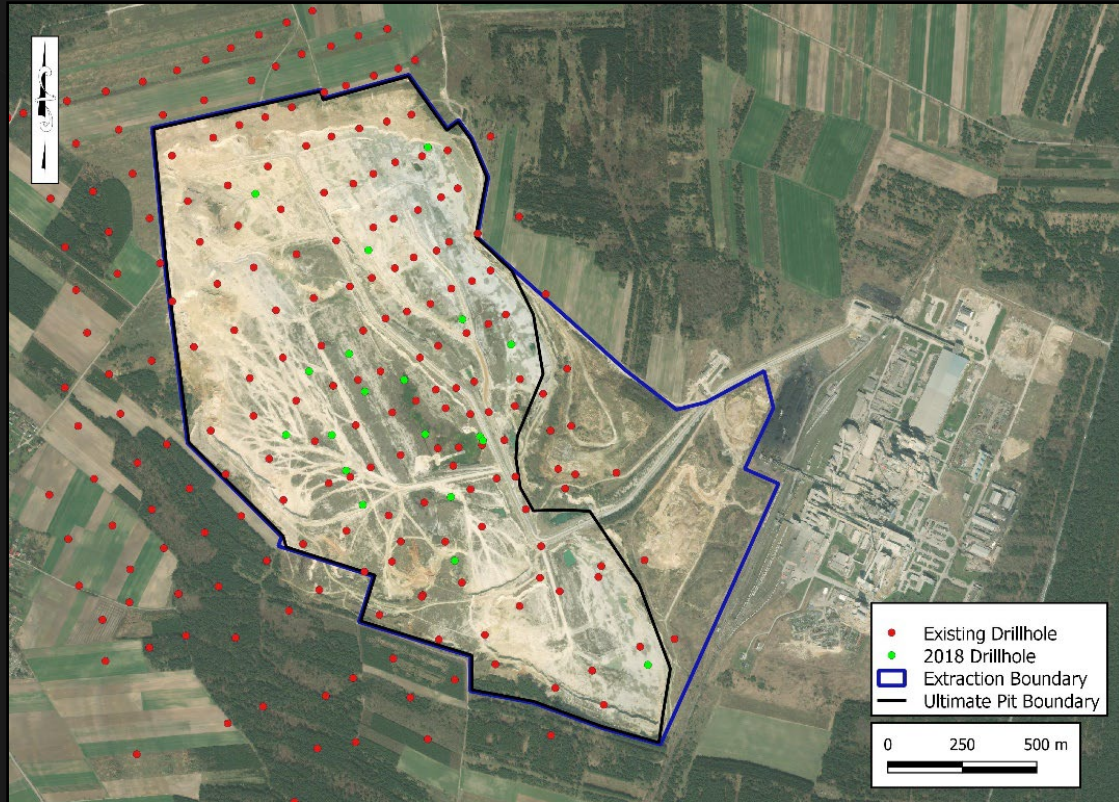


Model Estimation



Block Classification	Confidence Level	Description
Unpopulated	None	Blocks that were unable to be estimated using estimation procedures
Measured	High	Can be converted to "Proven" material with mining considerations
Indicated	Medium	Can be converted to "Probable" material with mining considerations
Inferred	Low	Can be converted to "Potential" material with mining considerations

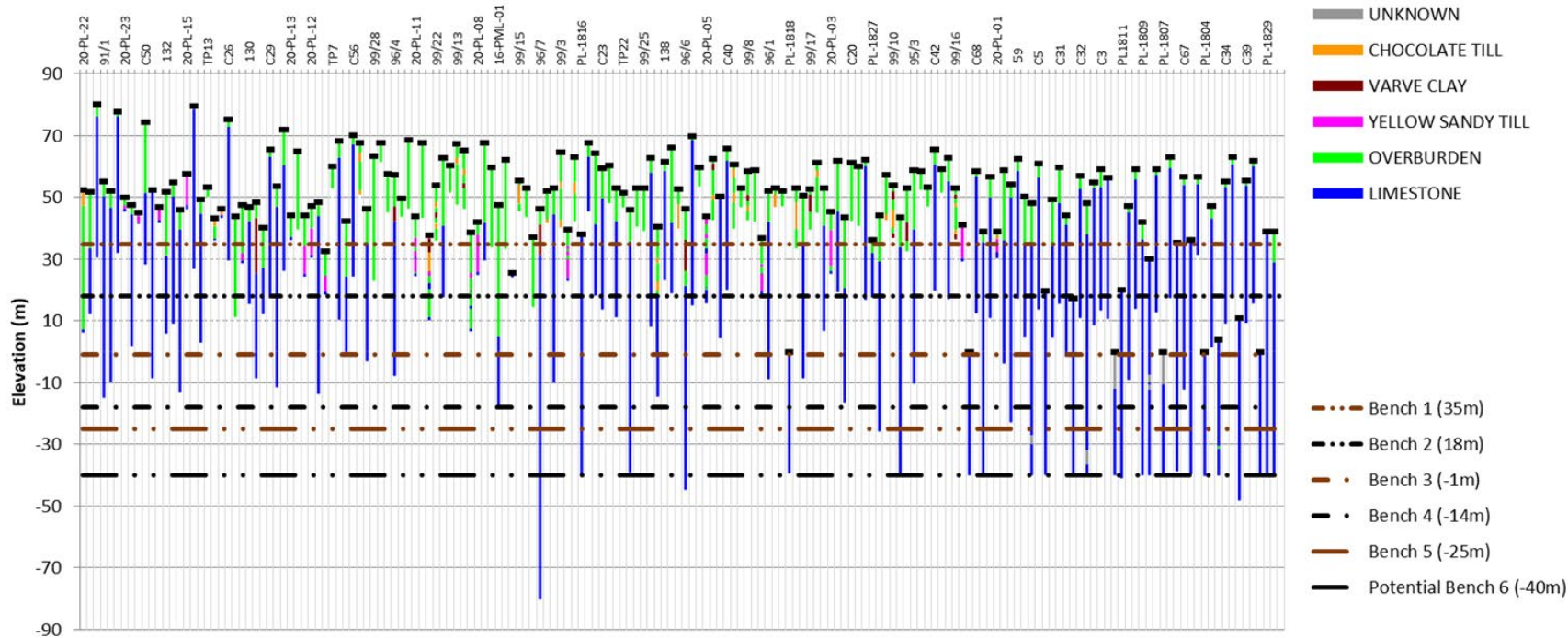
Exploration Drilling



- › The most critical element to understanding your quarry
- › Drilling in a grid is ideal but not necessary for development of a block model

Exploration Drilling Cont.

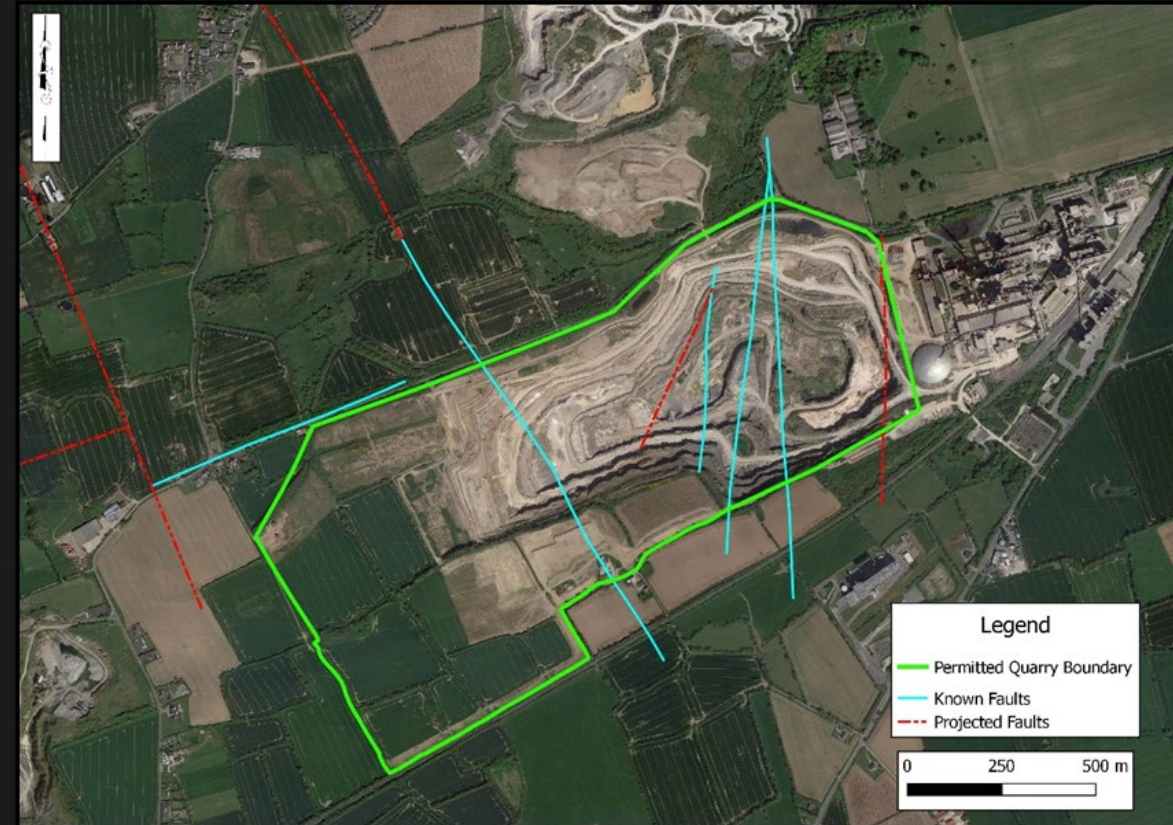
Drill Hole Penetration Chart



➤ Drilling needs to be deep enough to fully penetrate the pit floor

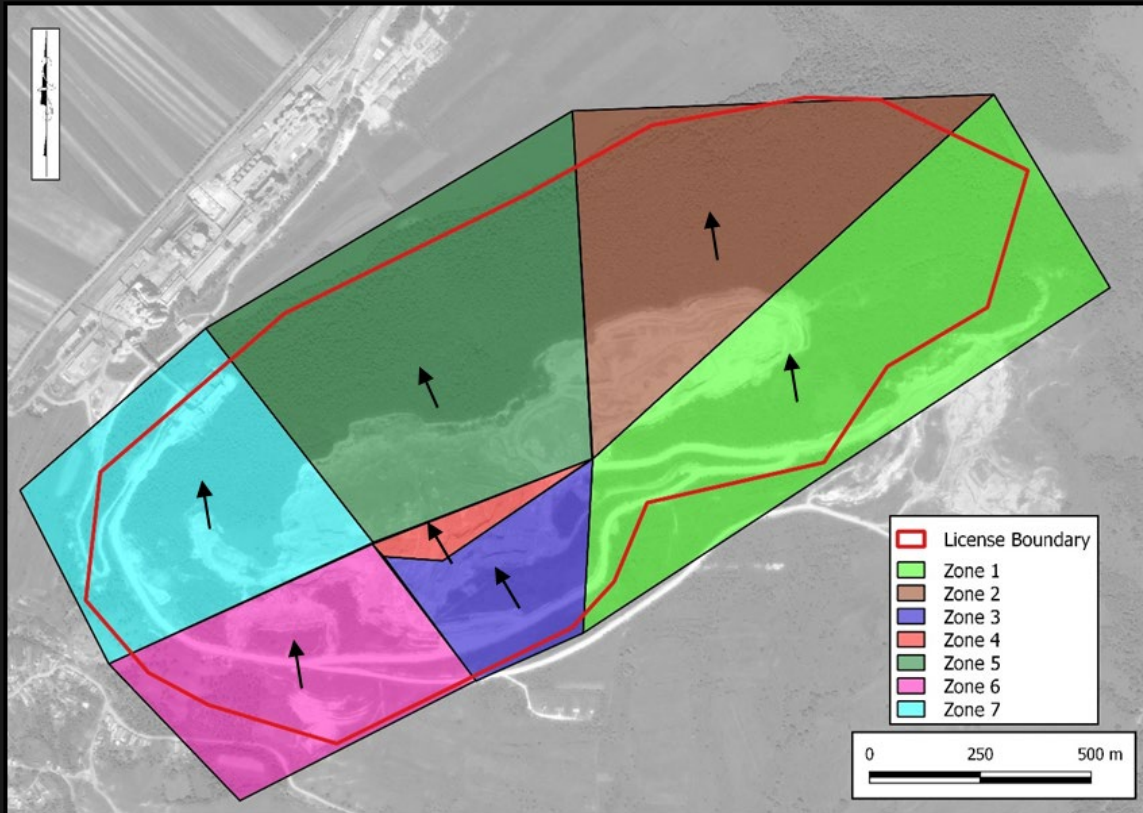
Faulting

- › Exploration drilling can identify any fault systems within your quarry
- › It is not uncommon to see material appear on one side of a fault but disappear entirely on the other side of the fault.



Faulting Cont.

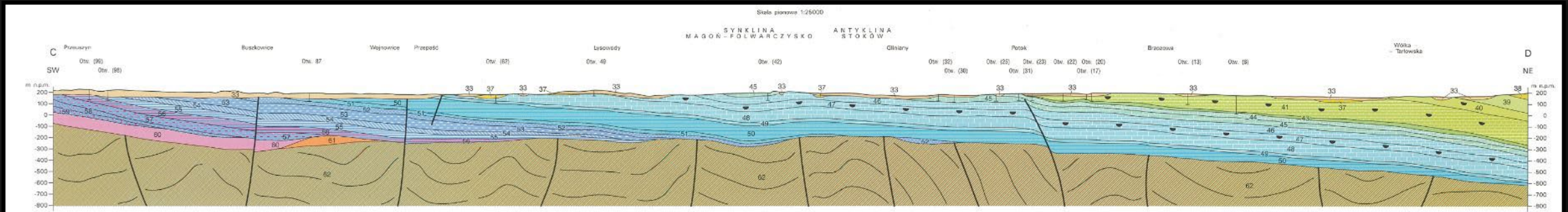
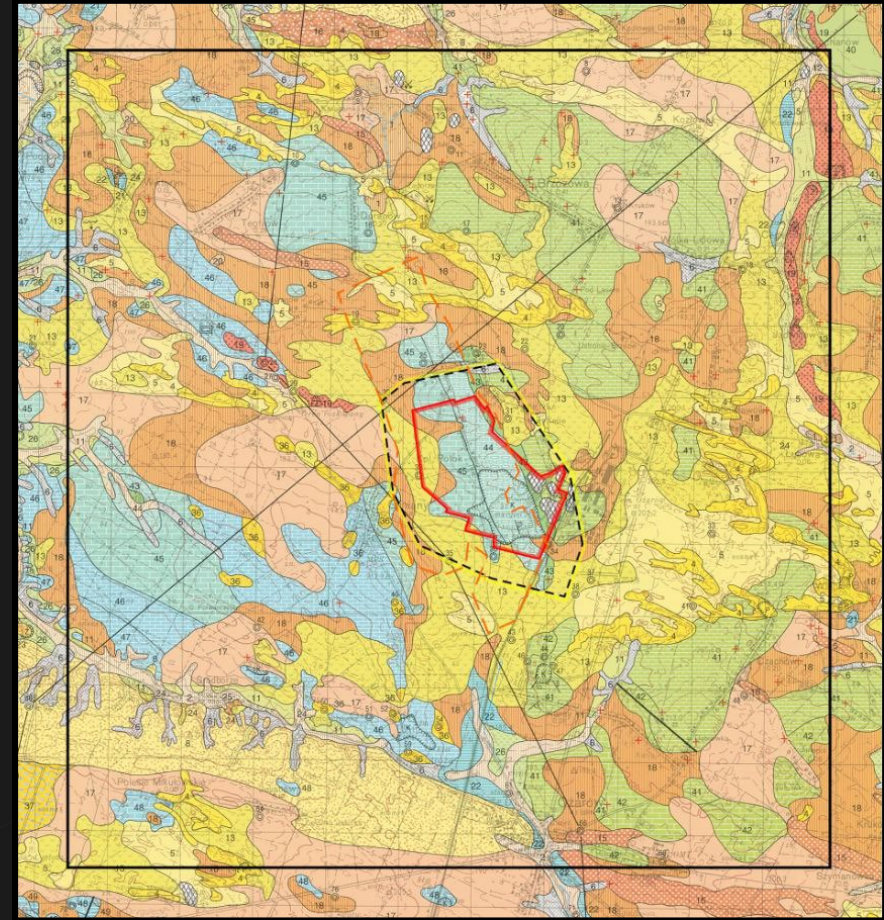
- › Quarries can be complex with many different fault blocks.
- › Each fault block is modeled independently



*Down-dip direction shown by black arrow

Geologic Bedding

- › Is a deposit “massive” or geologically bedded
- › If bedded, is there a strike and dip direction?



What Information can you get out of a Block Model?



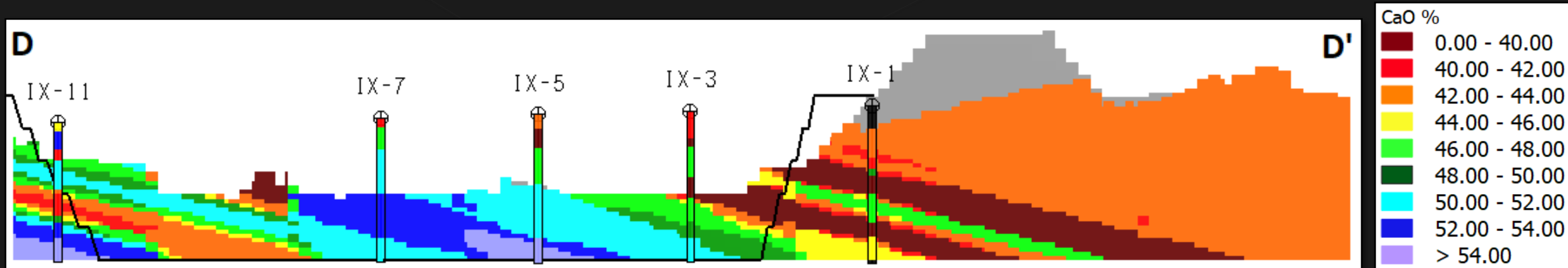
Resources and Reserves

Limestone						
Classification	Tonnes (Mt)	Al ₂ O ₃ (%)	CaO (%)	Fe ₂ O ₃ (%)	MgO (%)	SiO ₂ (%)
Measured	146.09	0.25	52.34	0.40	1.95	1.70
Indicated	3.19	0.66	50.38	0.48	1.99	4.07
Grand Total	149.28	0.26	52.30	0.41	1.95	1.75

Limestone						
Bench	Tonnes (Mt)	Al ₂ O ₃ (%)	CaO (%)	Fe ₂ O ₃ (%)	MgO (%)	SiO ₂ (%)
1	9.22	0.26	51.81	0.56	2.25	1.97
2	25.91	0.23	52.11	0.42	2.13	1.40
3	44.91	0.28	52.32	0.40	1.93	1.70
4	35.59	0.27	52.44	0.38	1.87	1.80
5	33.65	0.26	52.41	0.38	1.84	1.96
Grand Total	149.28	0.26	52.30	0.41	1.95	1.75

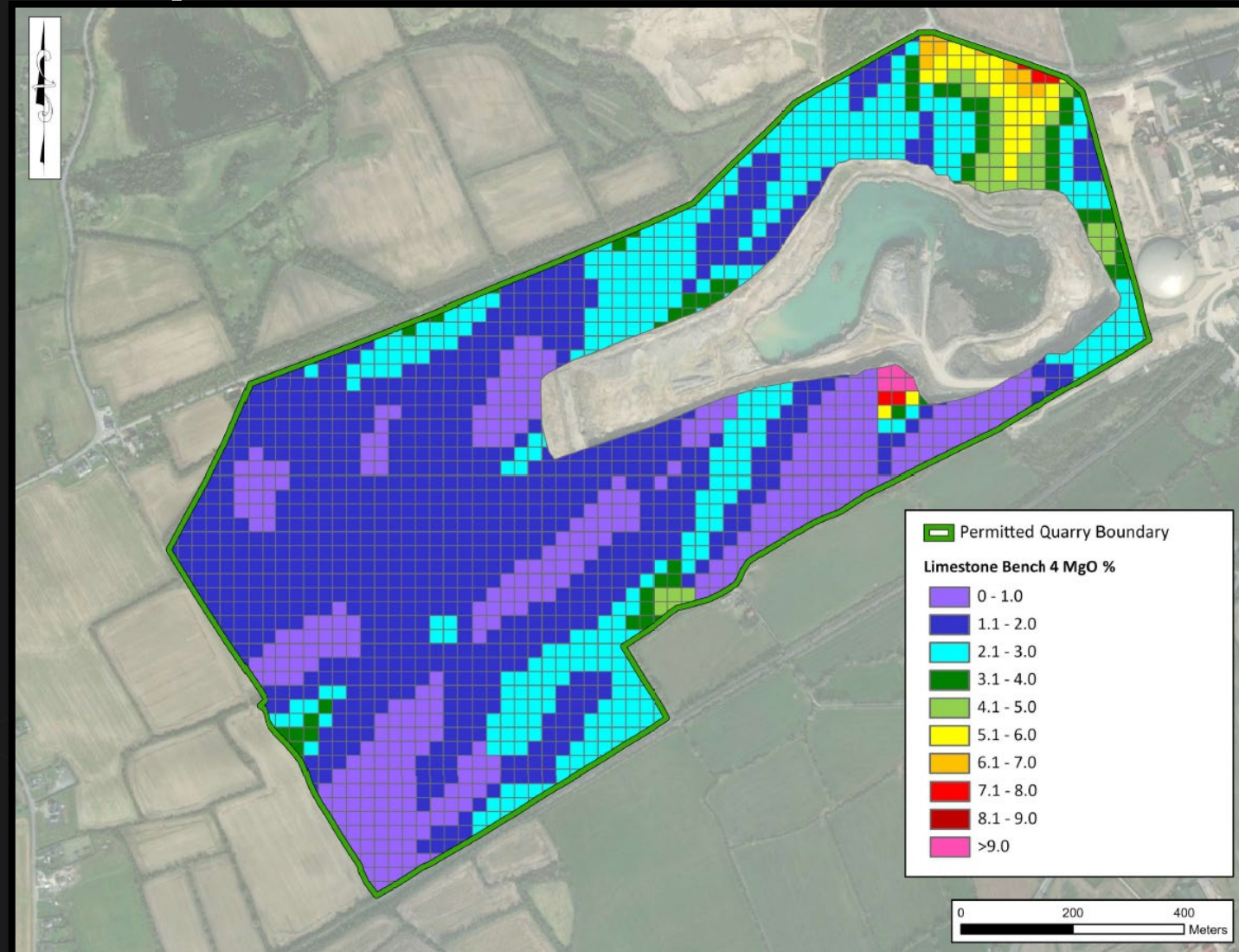
Cross Sections

- › Aslice across the block model
- › Can identify trends or hotspots within the quarry



Chemistry Grade Maps

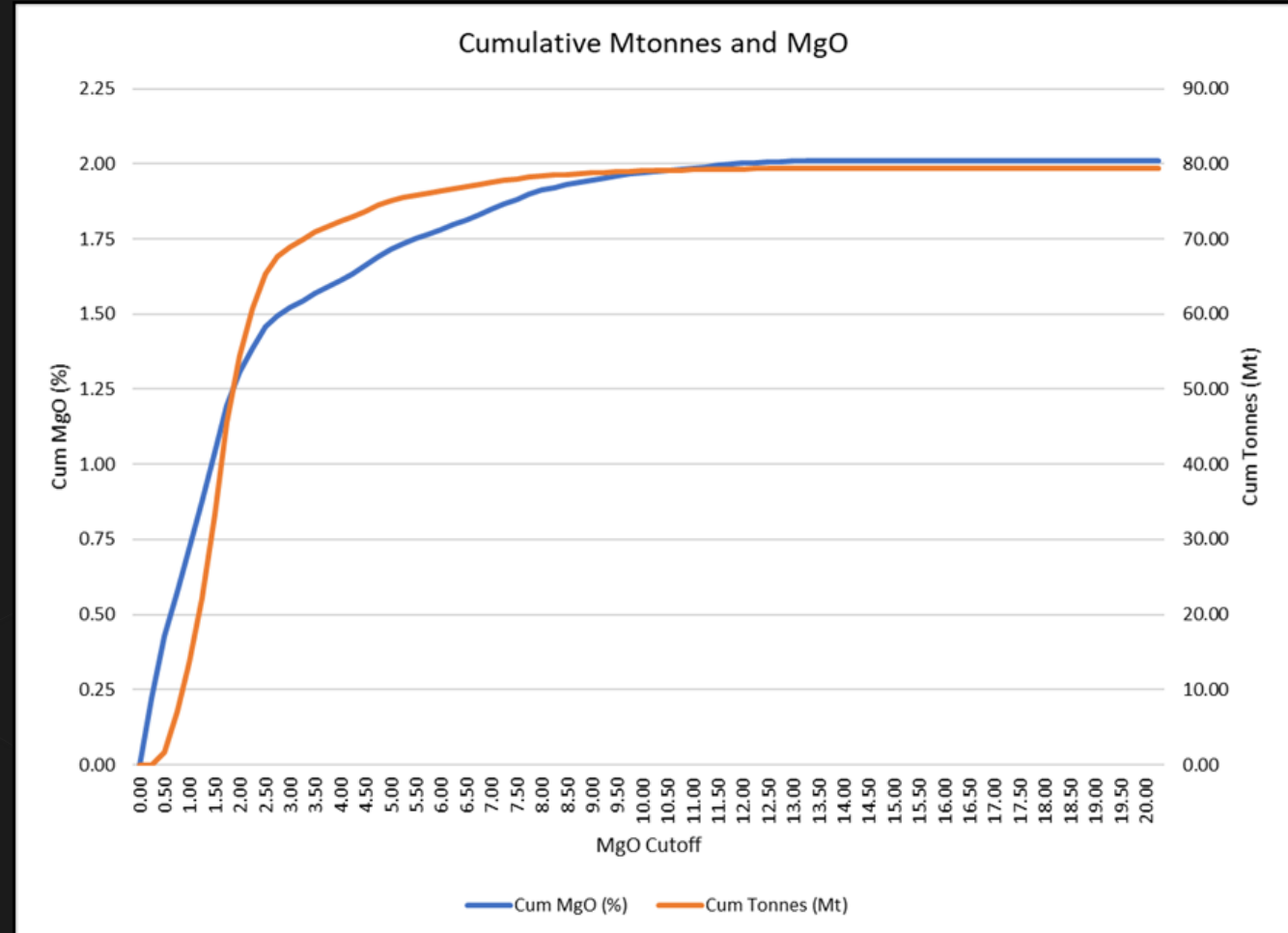
- › Concentrations for a specific chemistry
- › Can identify hotspots within the quarry



Sensitivity Analysis

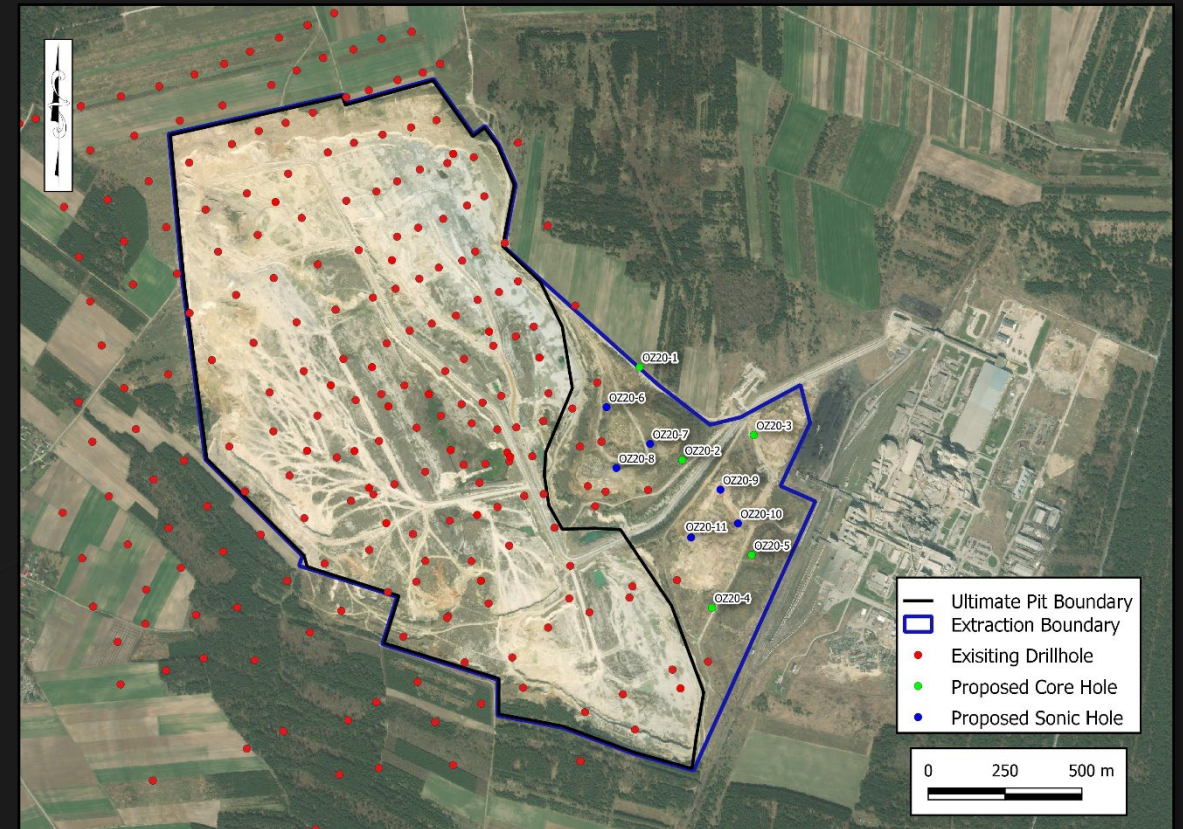
- › Can determine the sensitivity of the quarry's life for various chemical cutoff parameters
- › Shows the potential impact of high grading your quarry

Cumulative MgO Cutoff (%)	Incremental Mtonnes	Cumulative Mtonnes	Mtonnes above Average Grade	Quarry Life (1.9Mt/yr rate)
1.50	67.61	67.61	11.78	35.6 yrs
1.75	8.20	75.81	3.58	39.9 yrs
2.00	3.48	79.29	0.10	41.7 yrs



Future Exploration Drilling

- › A block model can identify areas that are of low confidence where additional drilling may be needed.



What is a Mine Plan?



What is a Mine Plan

- › It can be many different things:
 - / A sequential design
 - / A guidance for the total available material
 - / A valuation of property
 - ›› Lawsuits
 - ›› Investments
- › Understanding the clients needs and providing them is the MOST important thing in a mine plan
- › Must consider the Mining Method

Mining Methods

› Surface

- / Open Pit Truck and Shovel
- / Contour Mining
- / Dragline Strip Mining
- / Others

› Underground

- / Cut & Fill
- / Long-Hole Stoping
- / Vertical Crater and Retreat
- / Room and Pillar
- / Longwall
- / Others

Mine Planning

- › **Relates to mining of the deposit, but includes other disciplines and work**
 - / Geologists / Resource Estimation Specialists
 - / Hydrological and Geotechnical Engineers
 - / Environmental Scientists and Engineers
 - / Financial Analysis, Taxes, and Permitting
- › **Usually includes**
 - / Ultimate mining limits
 - / Access roads and ramps
 - / Quantity and quality of the deposit
 - / Mining / development of waste material
 - / Life-of-mine schedule
 - / OpEx and CapEx costs
 - / Cash-flow analysis (required for the statement of reserves)

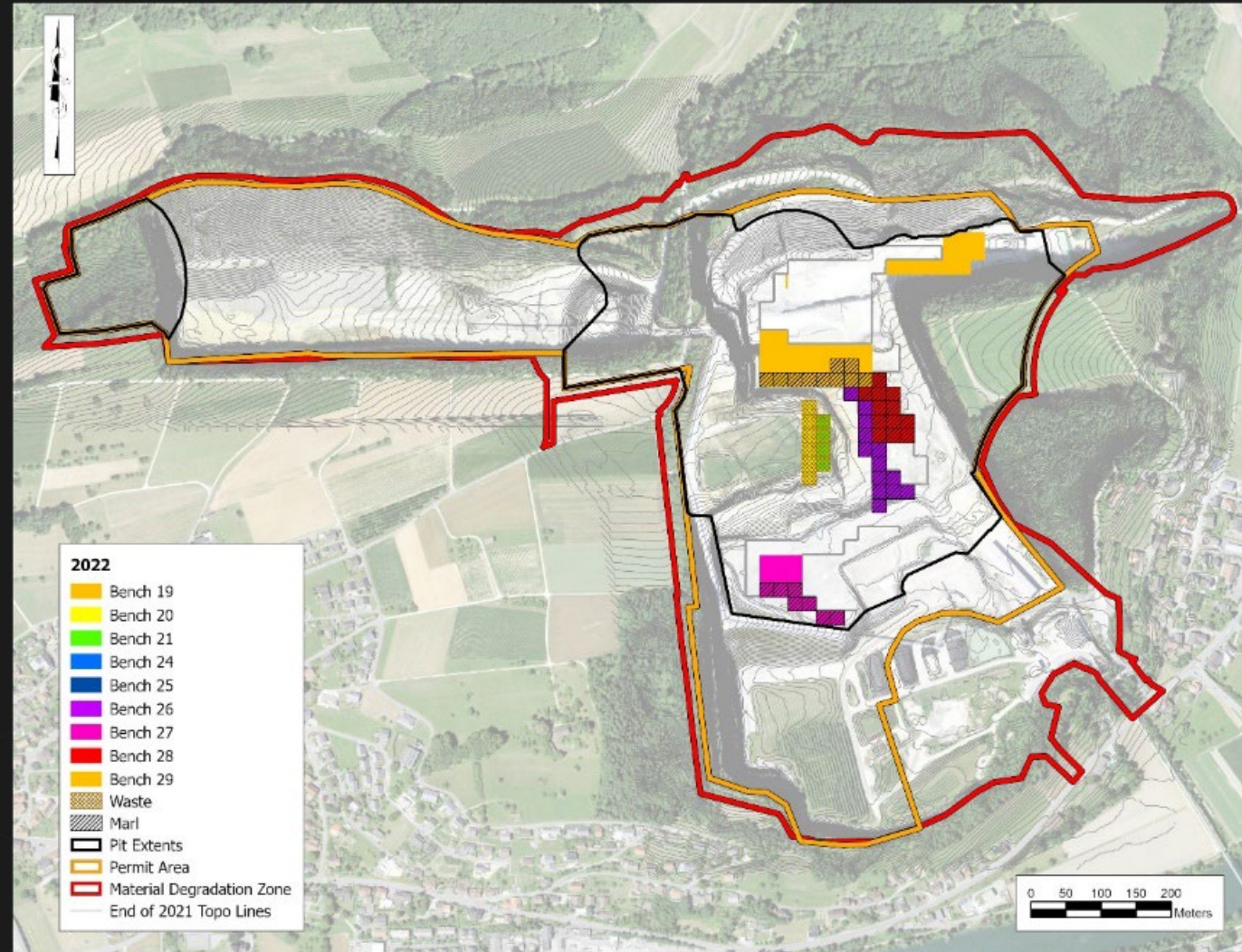
What Information can you get out of a Mine Plan?



Annual Progression Maps

End of Year 2022

- › Shows where and how much of each bench will be mined
- › Helpful in planning a transition into a new phase of quarry development

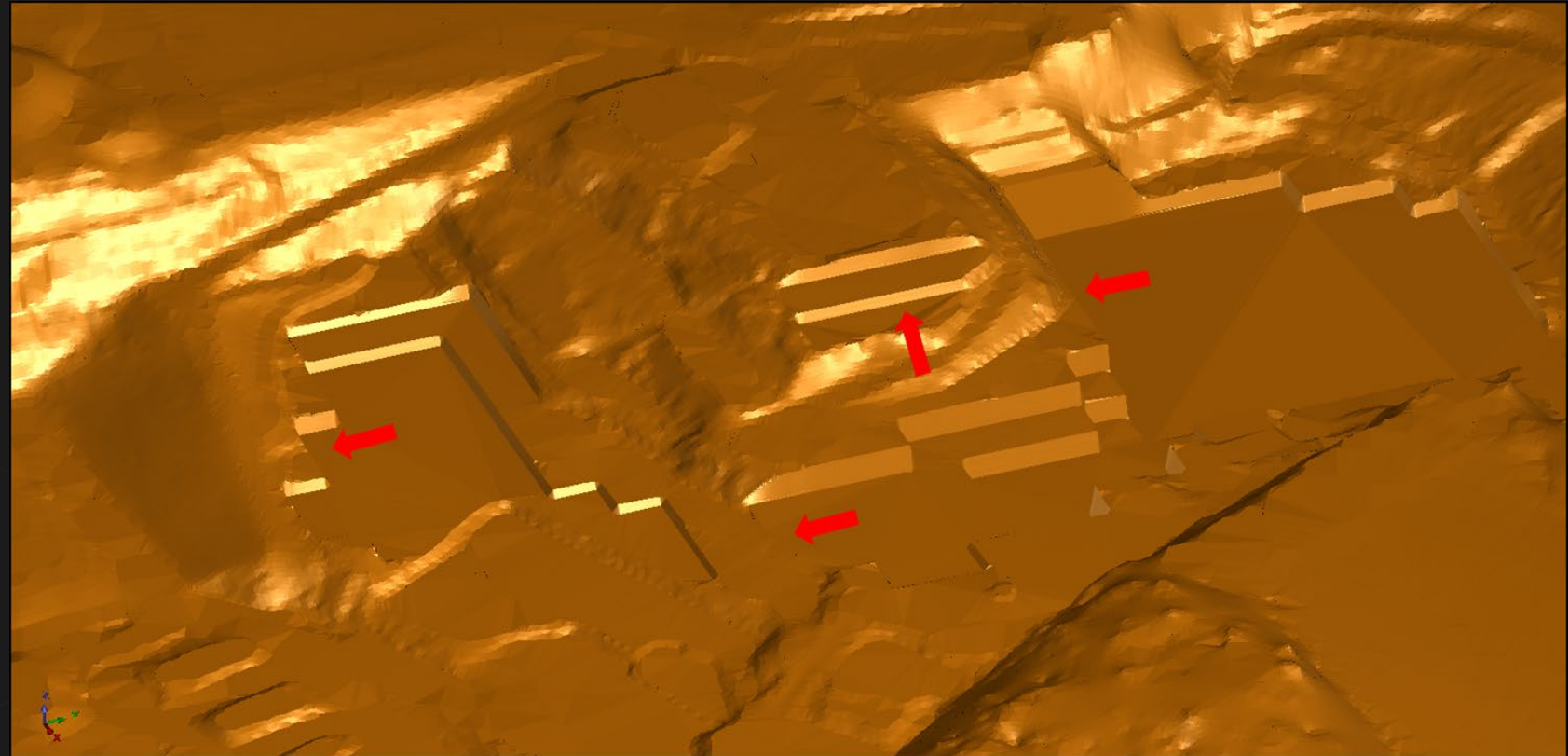


Annual Progression Maps Cont.

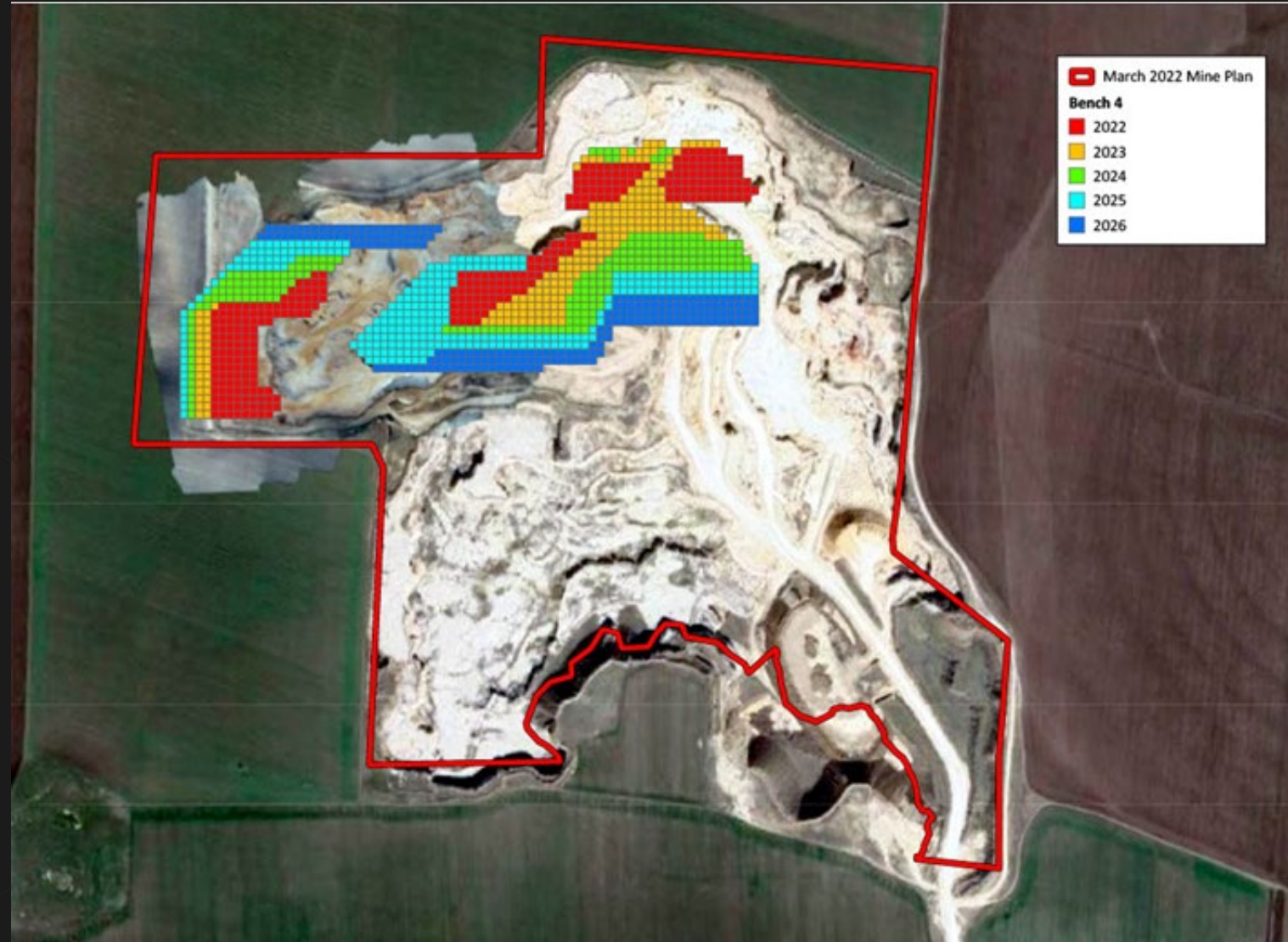
→ = Mining Direction

End of Year 2022

- › Shows the development of the operation over a given period of time



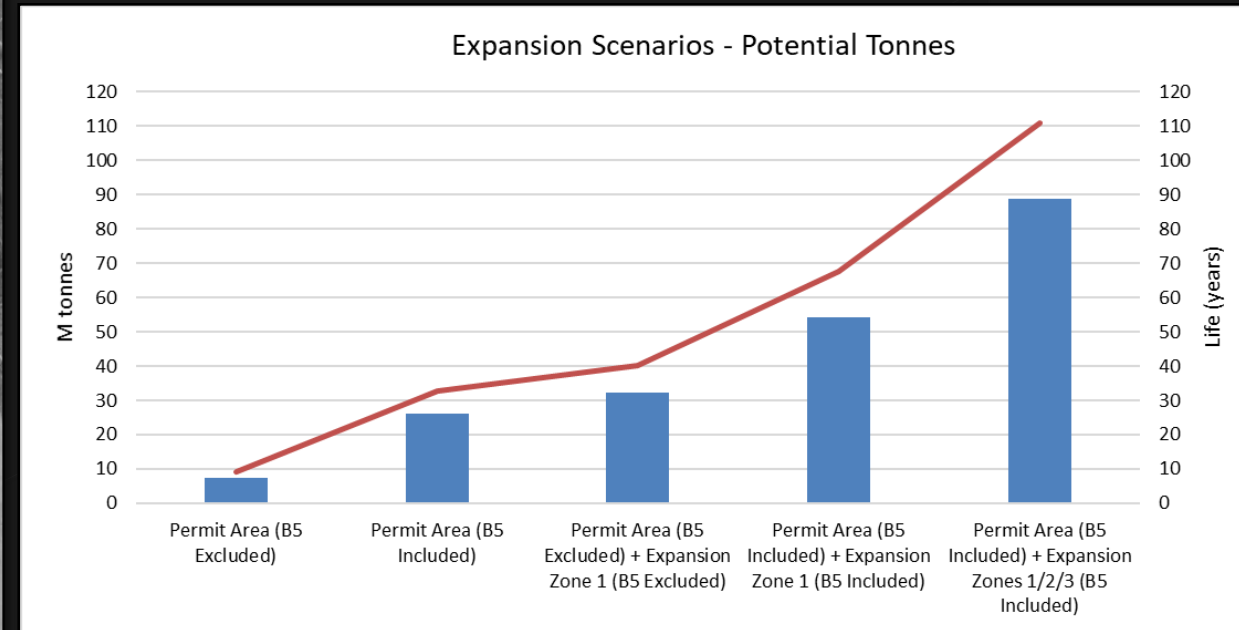
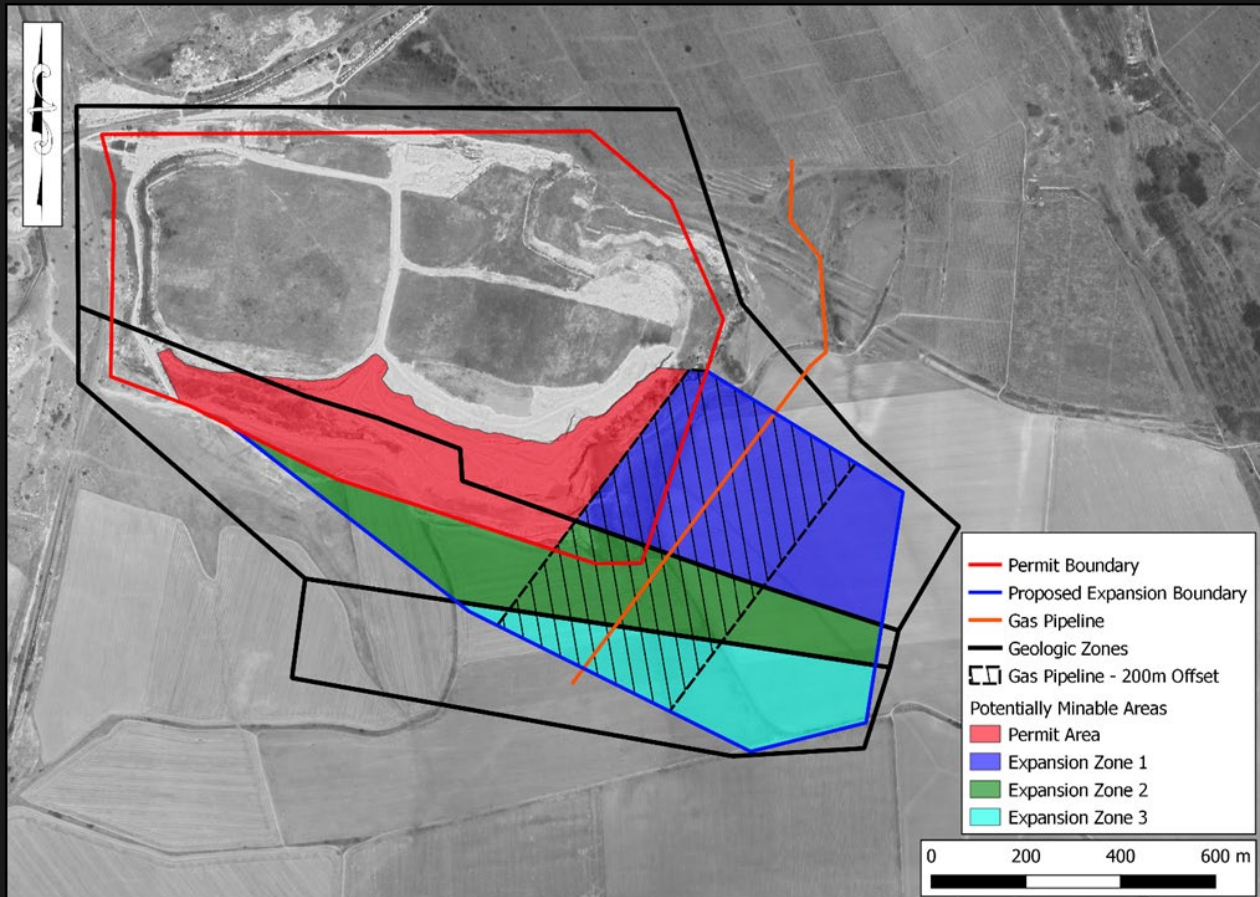
By Bench Annual Progression



Real Life Examples of How a Block Model and Mine Plan Helped an operation



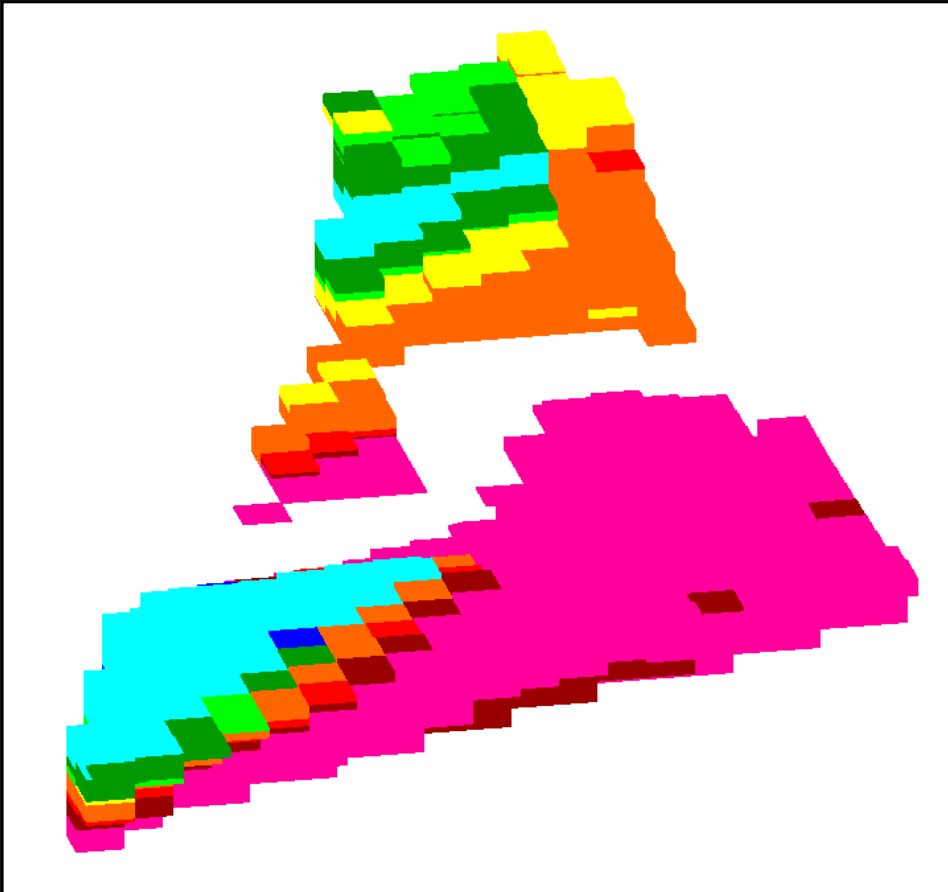
Identified Additional Reserve Areas and Faulting



“Unblendable” Material Left in the Quarry

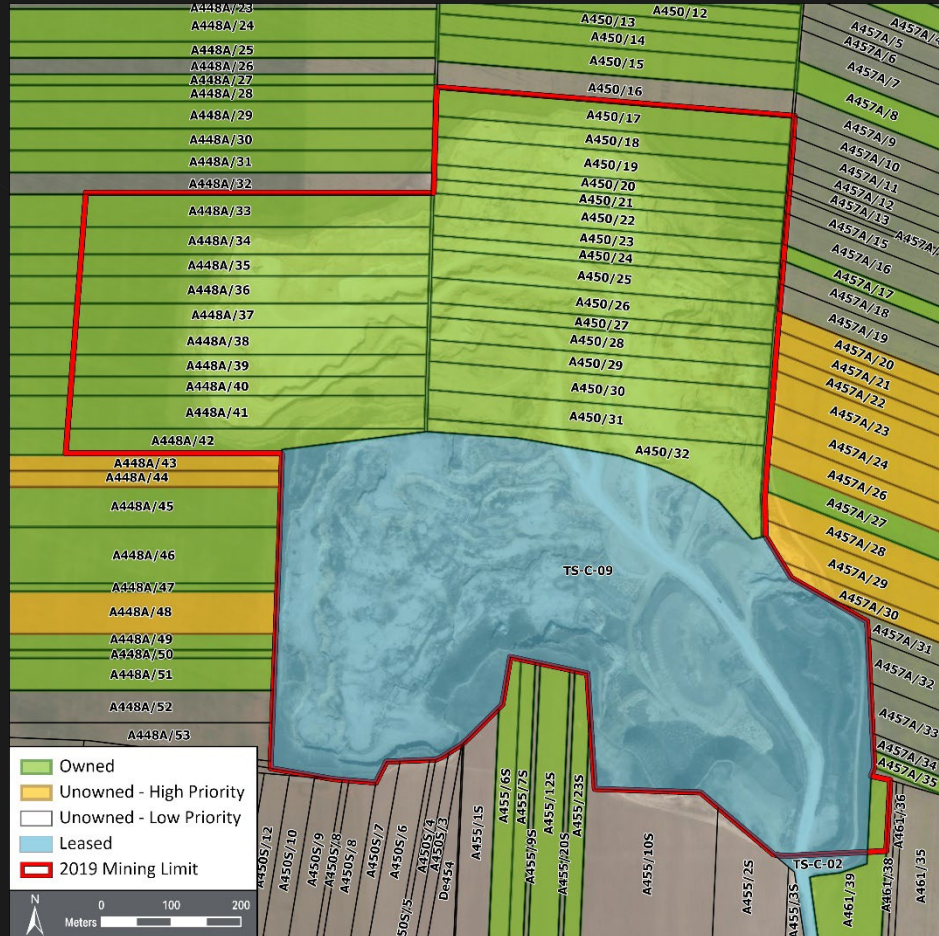


Quantified Unusable Material



- › 8.09 Mtonnes of Chert material represents approximately 3.67 years of mine life.

Avoided Hard to Handle Material Historically



Questions?

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