

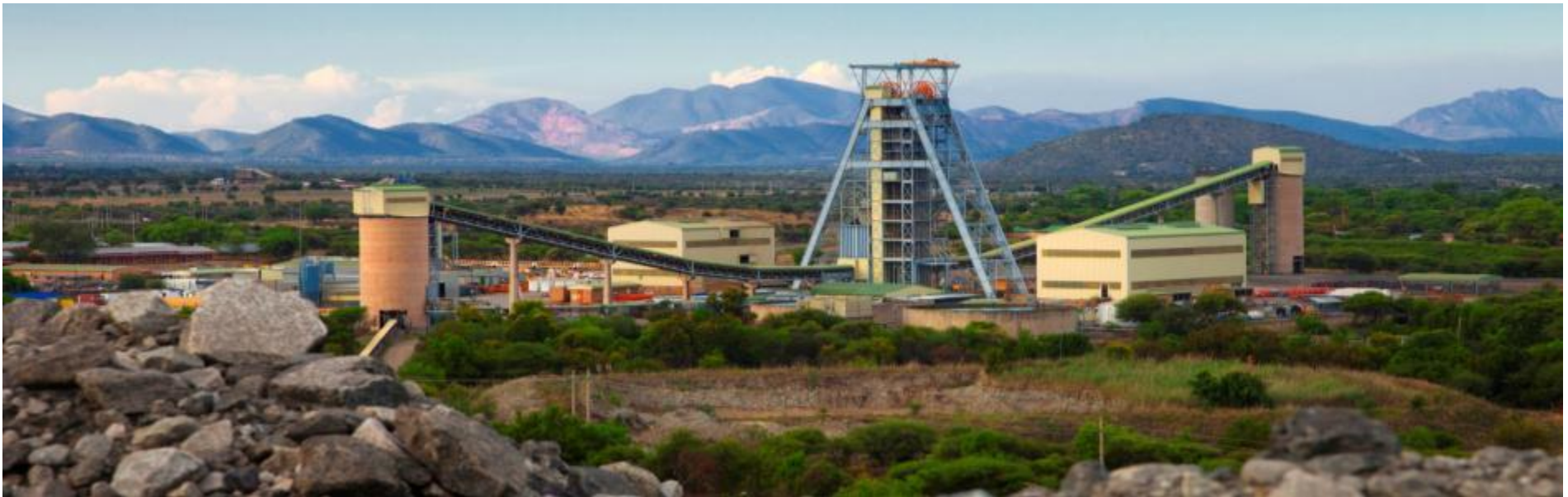
DAY OF LEARNING - LEDGING

GOOD LEDGING PLANNING PRACTICE AT TUMELA MINE

27th October 2015

Pierre Prinsloo

Anglo American - Platinum



Tumela 1# - Platinum

- History
- Macro Design
- Value Chain
- Micro Layout
- Pre-Ledge Visit
- Planning Process
- Future Improvement
- Questions

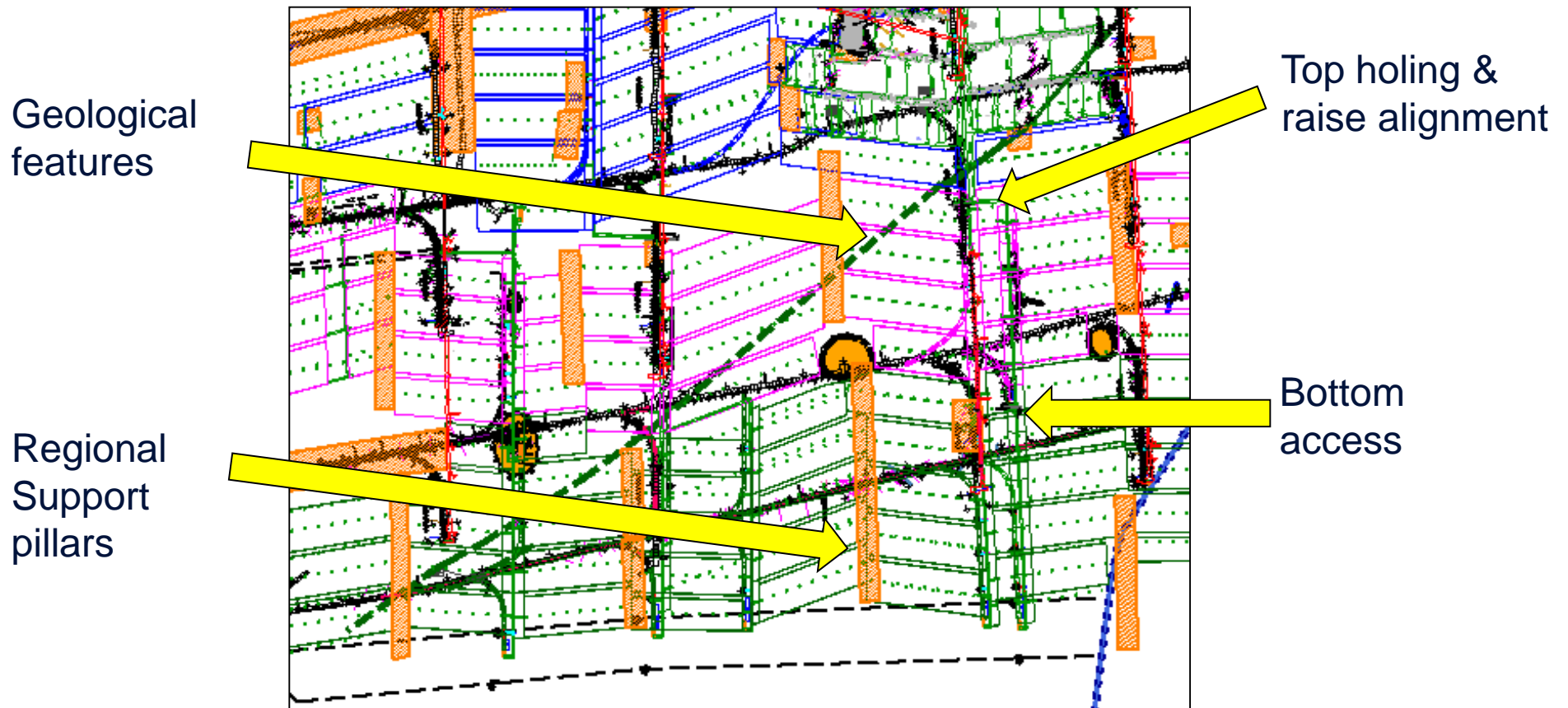


History - Planning Process

Year	Remedial Action (Ledging FOG Fatalities)
2009	Revised planning process - consider resources and infrastructure. Workplace to be visited by all relevant departments to issue <u>recommendations</u> .
2010	Revise planning process - pre ledge risk assessment signed off by all relevant parties. Multi-disciplinary team visit required. Ledging permit required before ledging commences.
2011	Pre ledge risk assessment revised with GO / NO GO scenarios.
2012	Revised planning process to ensure that only planned panels can be worked and prevent out of sequence ledging.
2013	Multi-disciplinary team to agree on and issue site-specific <u>instructions</u> during the pre-ledge inspection.

Result = No subsequent FOG on ledging to date

Critical considerations prior to Ledging?



First – We demolished Activity MO's

The “owner” has to understand & manage the full value chain!!



The Results:

- Ownership of the entire “factory”
- Improved quality of development
- Reduced delays in development construction
- Improved ledging efficiencies & conditions

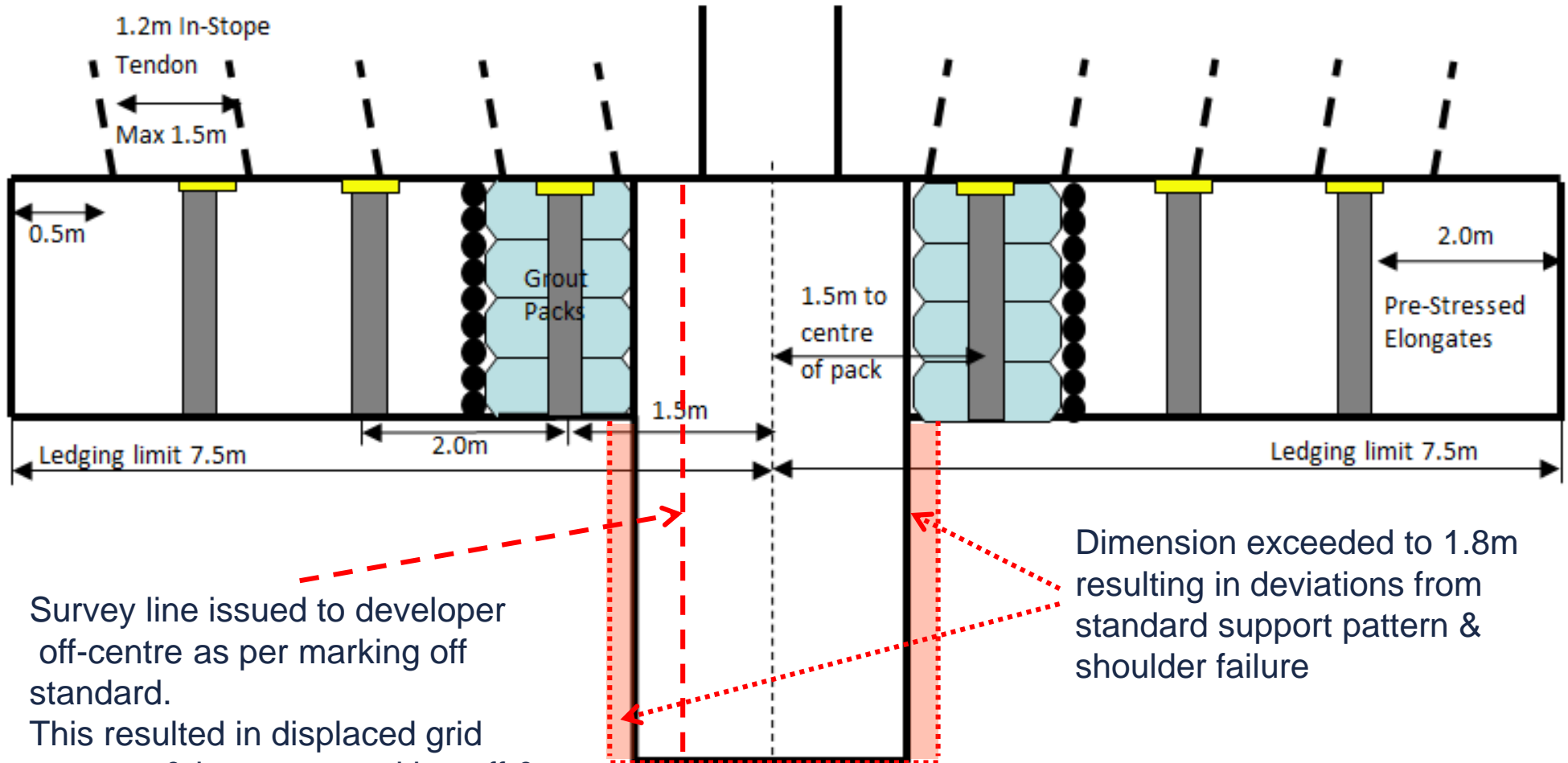
Micro Layout Key Success Factors

Off Line and Over-Breaking

- Air leg extensions
- Fixed excavation dimensions
- Fixed marking off standards
- Fixed standards on lines
- Training on marking off and taking lines
- Behaviour policy
- Geological mapping and sections

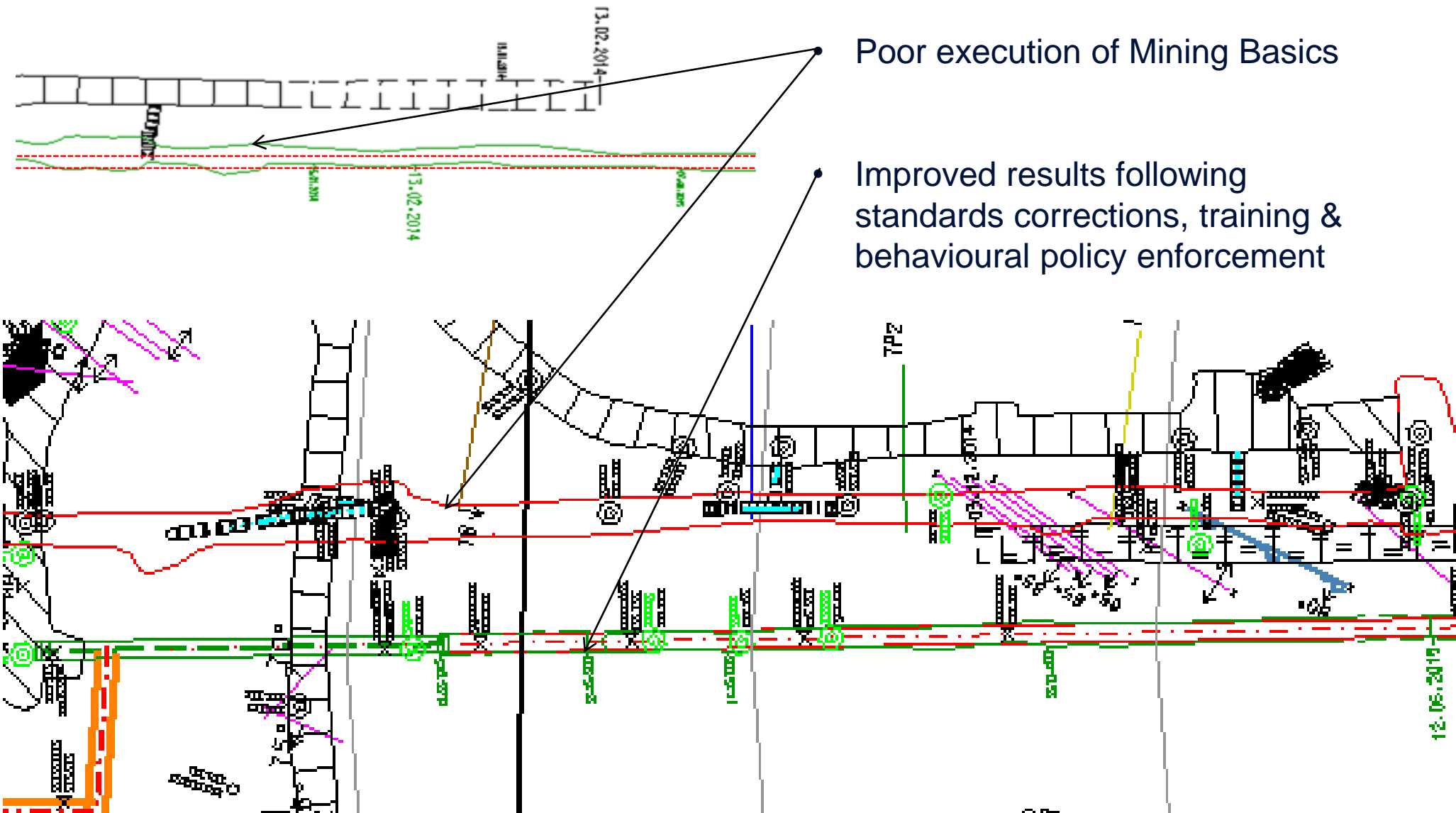


Micro Layout Continued

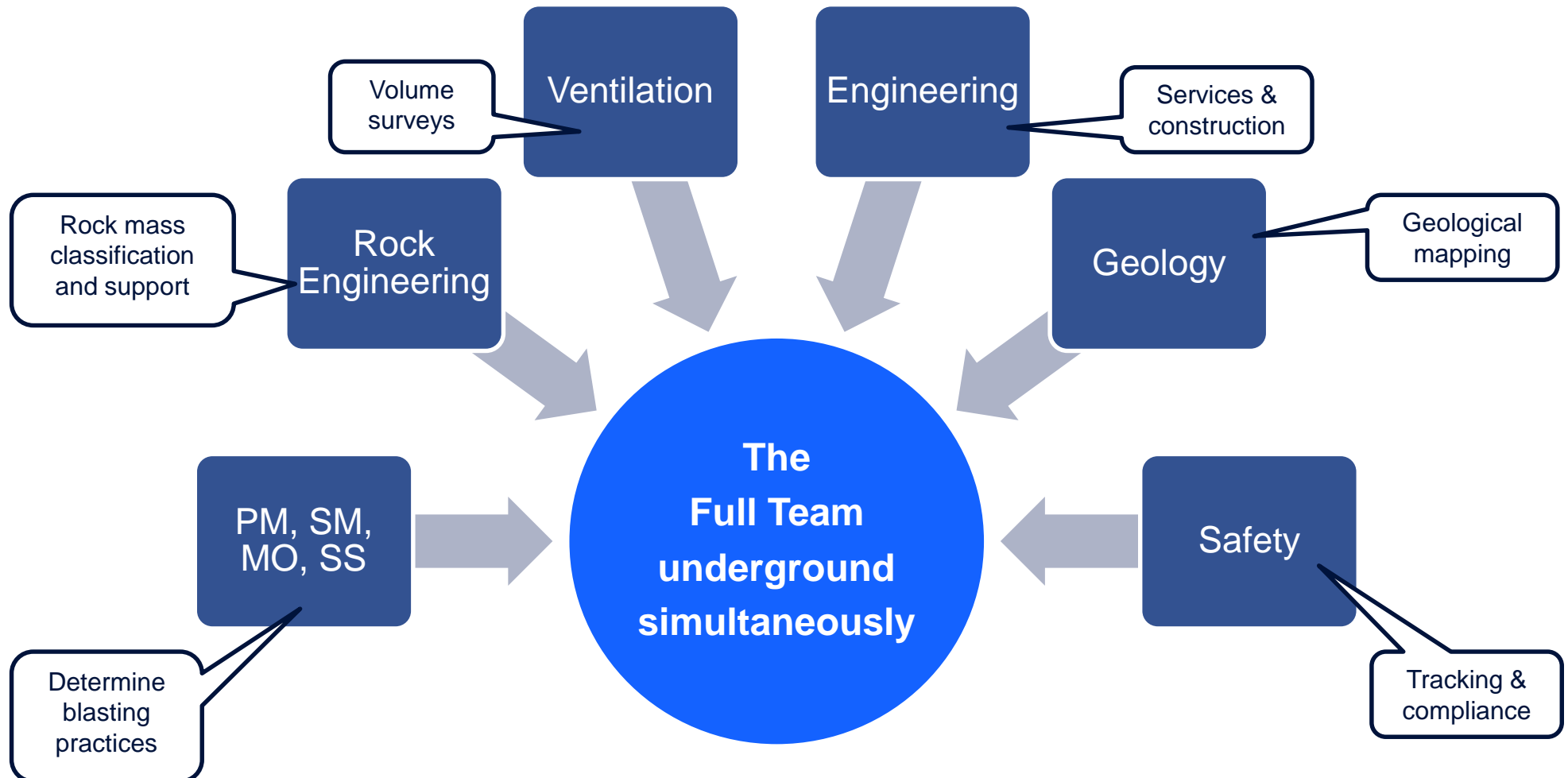


Survey line issued to developer off-centre as per marking off standard. This resulted in displaced grid patterns & incorrect marking off & consequently over-breaking

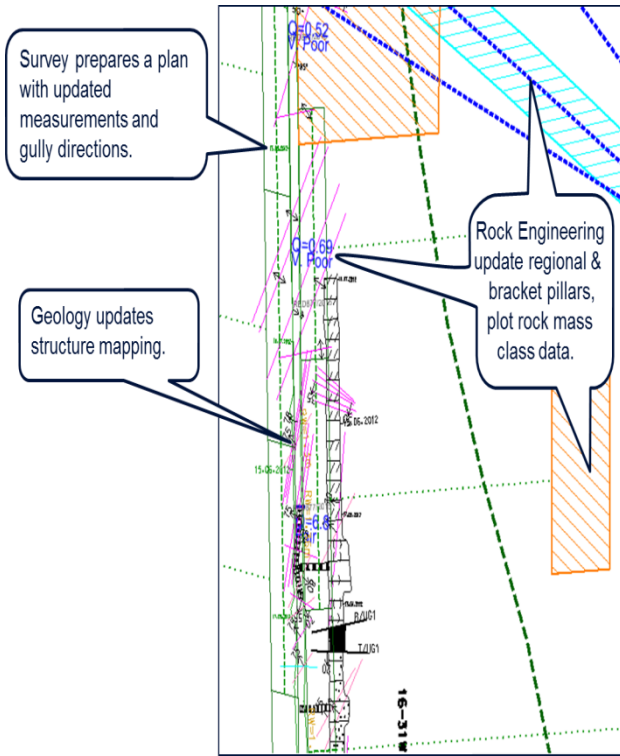
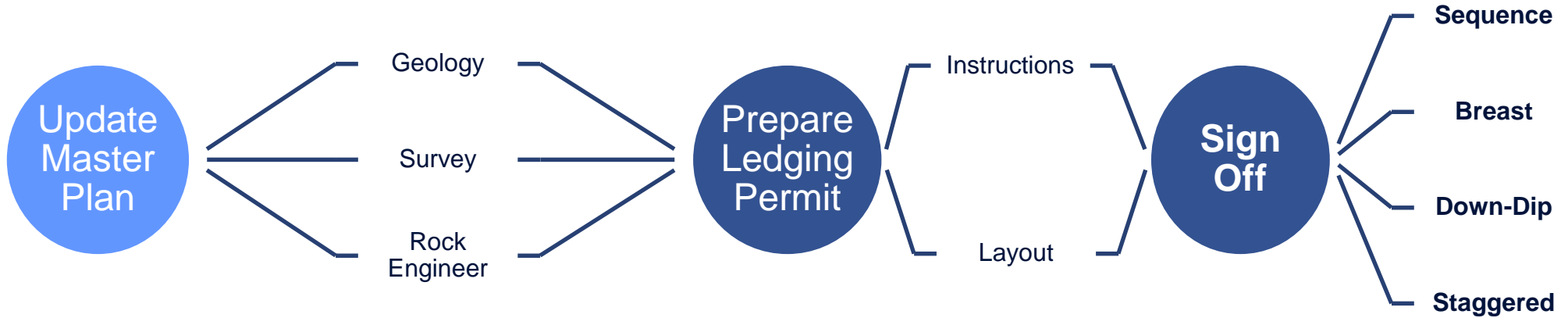
Micro Layout Continued



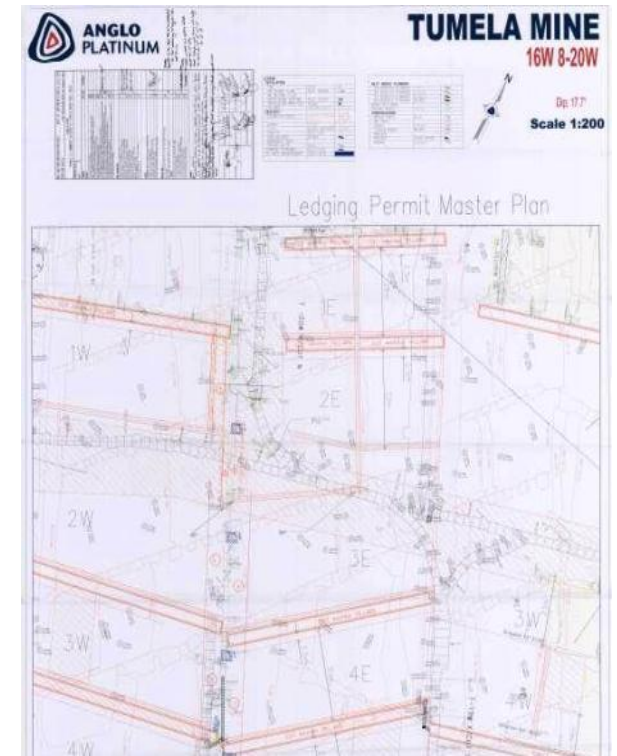
No ledging unless...



Planning Process - Surface




This is a 'PERMIT TO COMMENCE LEDGING OF A RAISE/WINZEL/REFR DRIVE' form for the TUMELA MINE. It contains a table with columns for 'NO.', 'DESCRIPTION', and 'REMARKS'. The table is filled with handwritten entries and signatures. At the bottom, there are several signatures and dates.

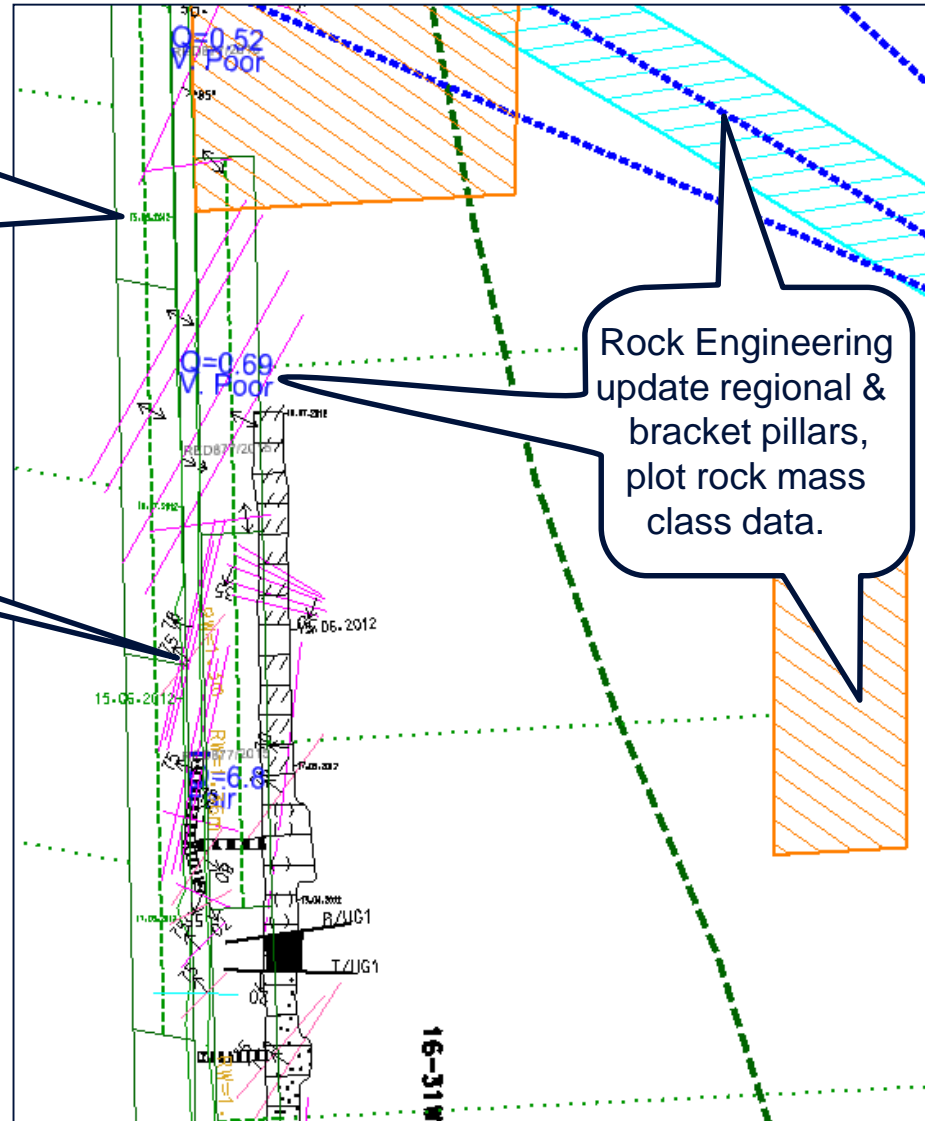


Preparing the Ledging Master Plan

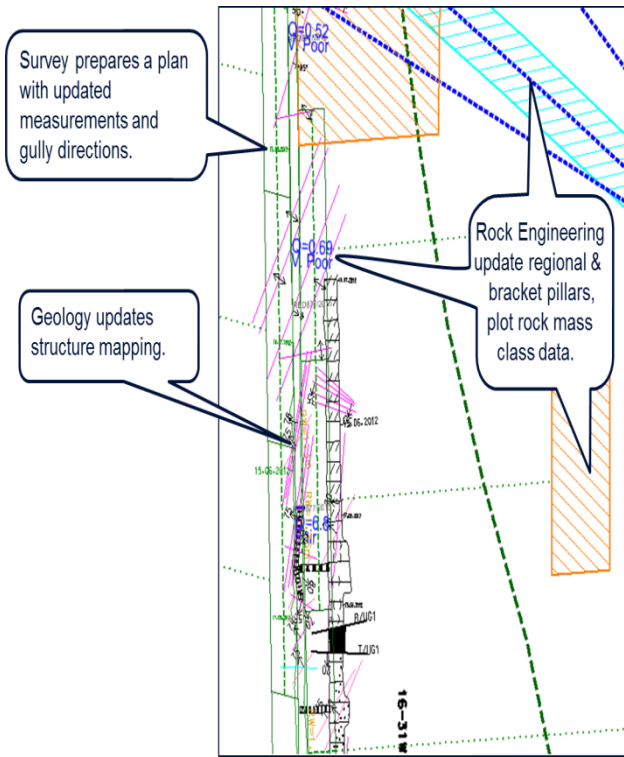
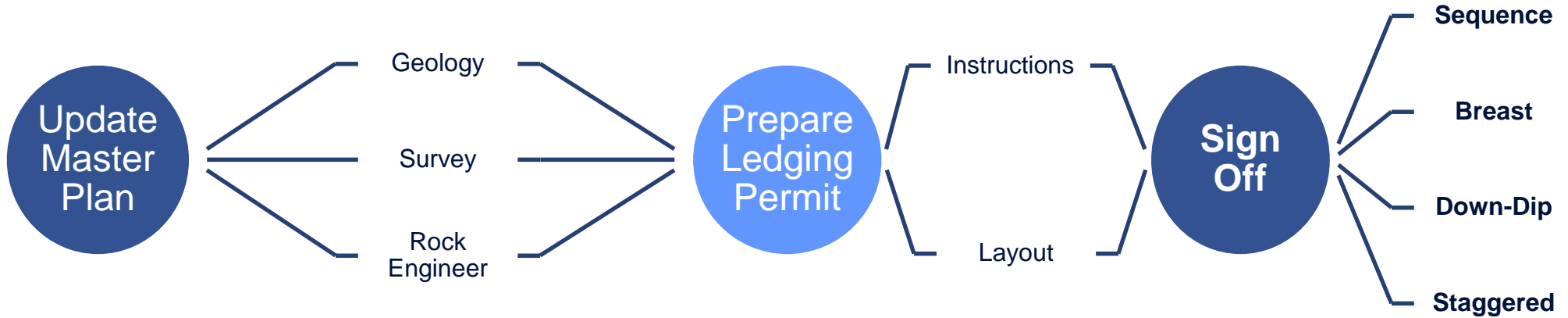
Survey prepares a plan with updated measurements and gully directions.

Geology updates structure mapping.

Rock Engineering update regional & bracket pillars, plot rock mass class data.

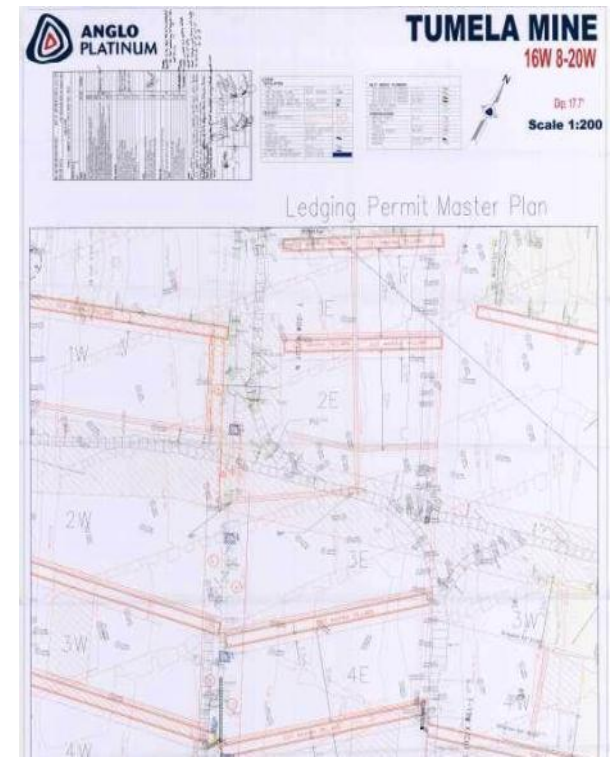


Planning Process - Surface



TUMELA MINE
PERMIT TO COMMENCE LEDGING OF A RAISE/WINZE/REEF DRIVE

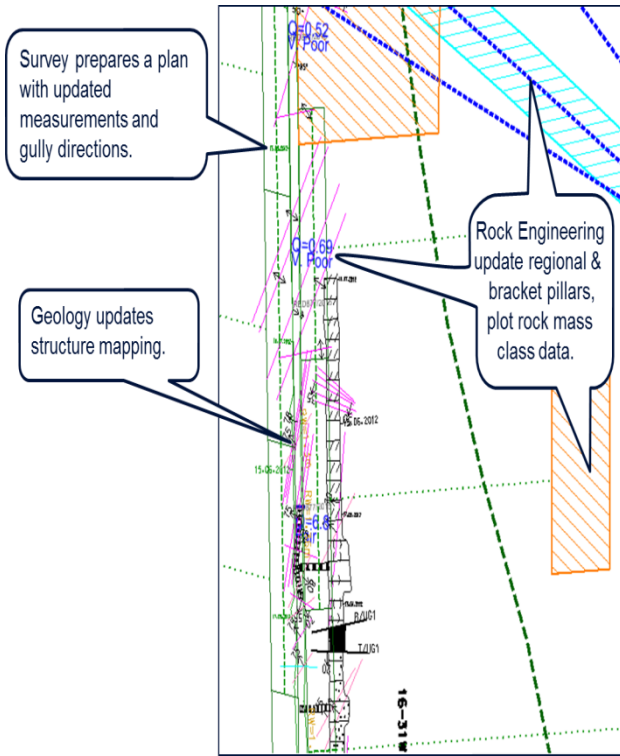
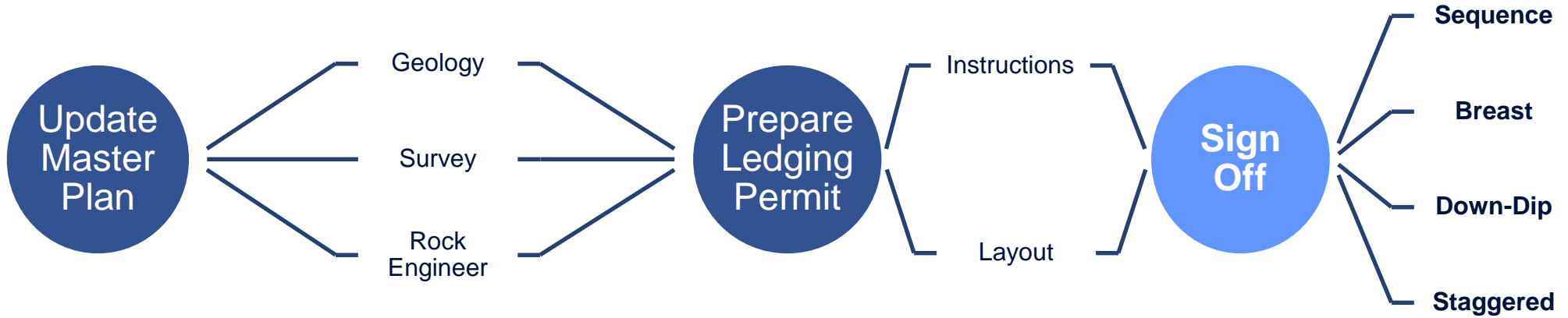
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Ledging Permit

PERMIT TO COMMENCE LEDGING OF A RAISE/WINZE/REEF DRIVE			
Department	Yes	No	Comments
GEOLOGY			
Is the whole raise line mapped?			
Has all mapping been transferred from the development sheet to the stope sheet?			
All known geological features indicated on the plan?			
Has harzburgite been exposed?			
Are there any borehole intersections expected in the excavations ahead and demarcated on the plan?			
ROCK ENGINEERING			
Rock engineering risk rating / RMC on plan?			
Primary support in place and to standard?			
Geological features and brows demarcated?			
Geological features and brows supported?			
Has harzburgite been exposed?			
Additional support required?			
Change in mine layout required?			
Mine sequence given?			
UG2 & Merensky Pillars and remnants indicated on plan?			
SURVEY			
Breakaway note of strike gullies approved and signed off by Section Manager?			
Strike gully positions indicated on plan?			
Abutments indicated on plan?			
Pillars on plan (approved by Rock Engineering)?			
VENTILATION			
Is the available quantity of air sufficient for mining the raise?			
Are there any restrictions in the raise?			
MINING			
Have the strike gullies been broken away?			
Is the X/cut pumped?			
Is all the primary development completed?			
Is there a minimum of two winches installed?			
Is all construction completed?			

Planning Process - Surface

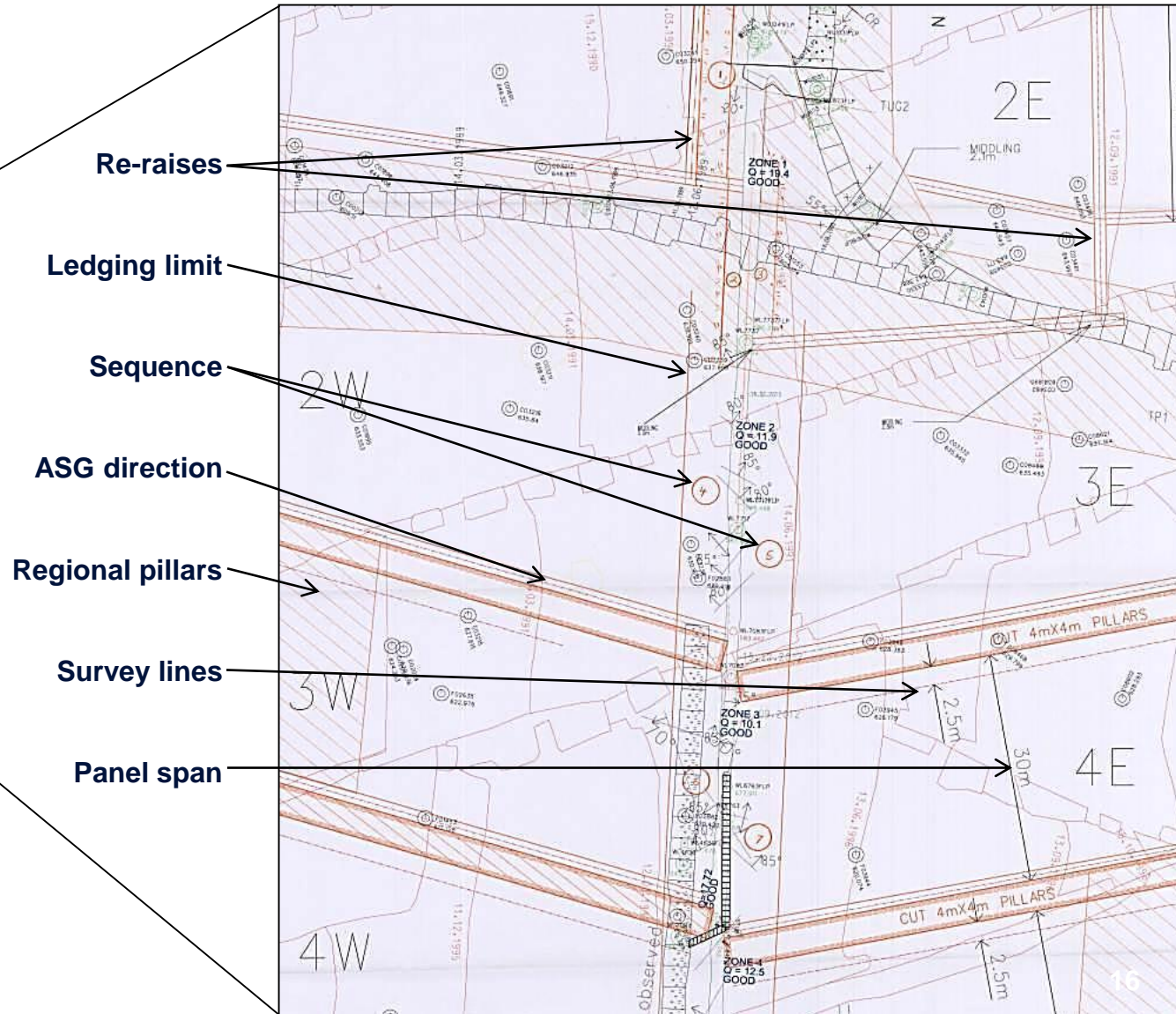
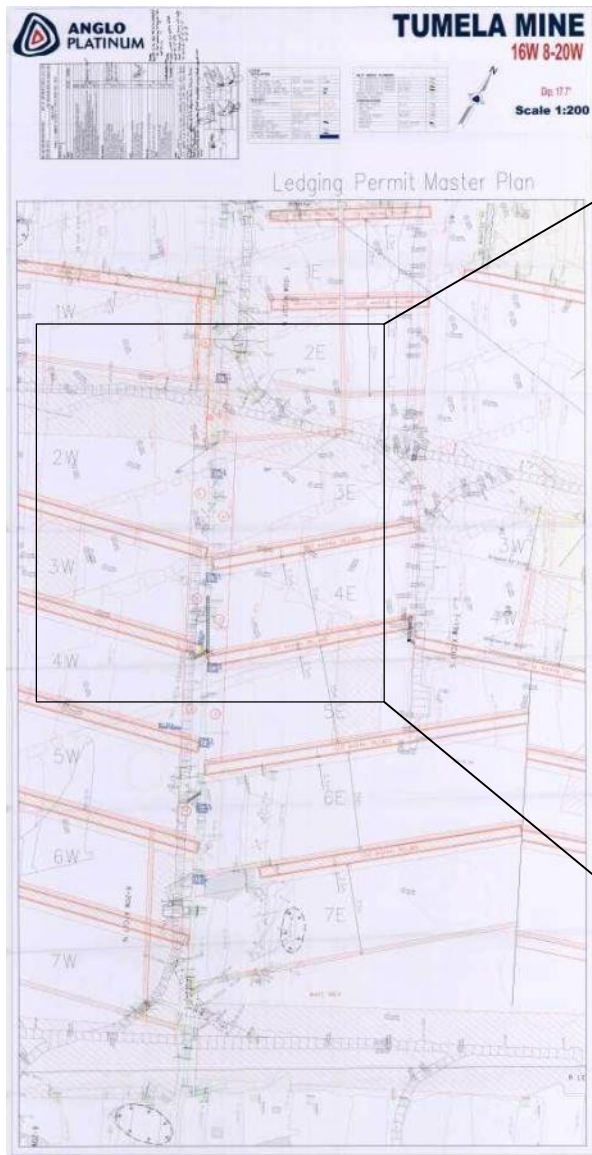


TUMELA MINE
PERMIT TO COMMENCE LEDGING OF A RAISE/WINZEL/REEF DRIVE

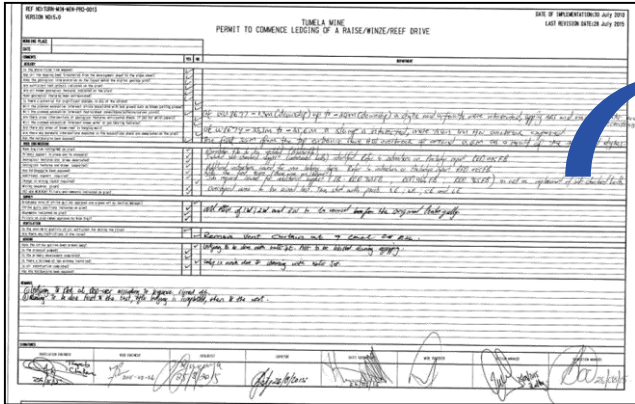
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Master Ledging Layout and Sign Off



Planning Process - Monthly



PERMIT TO COMMENCE LEADING OF A RAISE/WIND/SHEEF DRIVE

DATE OF IMPLEMENTATION: July 2015
LAST REVISION DATE: July 2015

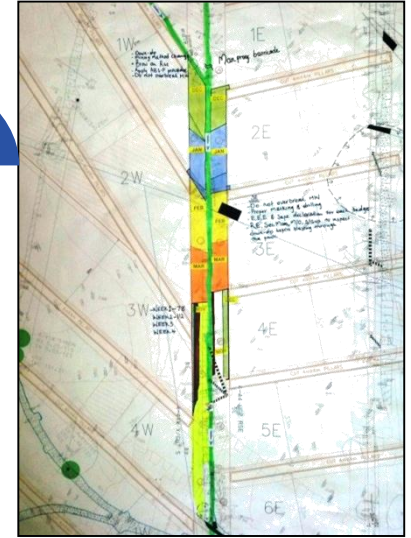
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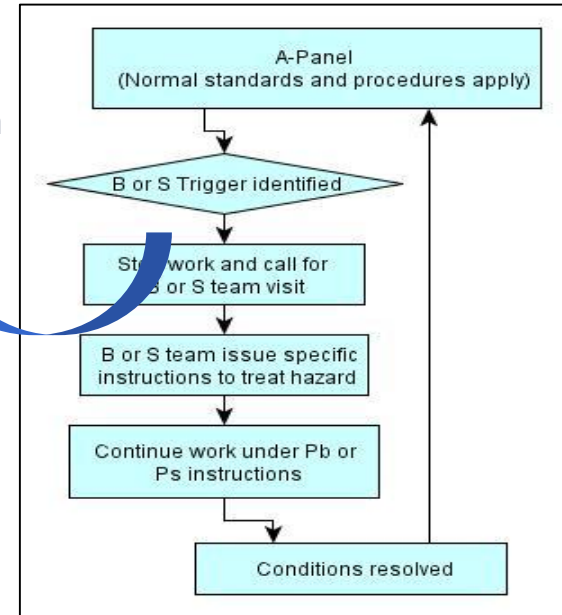
APPROVED BY: [Signatures]

Monthly referral to Ledging Master Plan

Execute the Plan



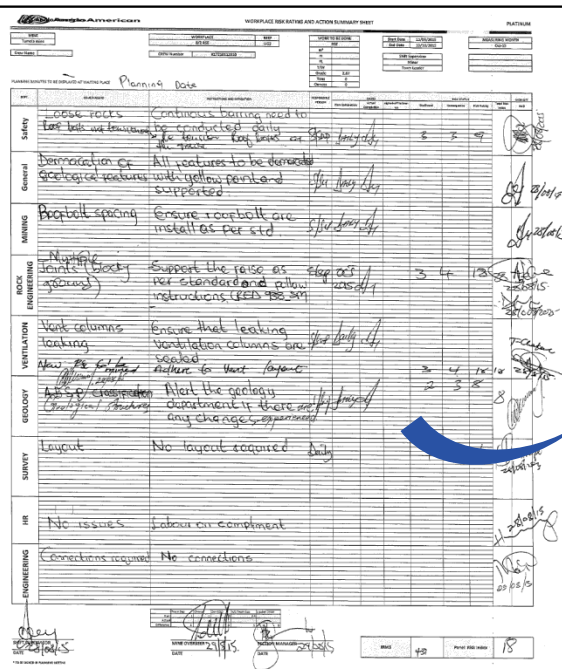
Daily Safe Declaration & ABS-P HITS



Update the Plan

Measure the Actual

Continuous Improvement



Workplace Risk Rating and Action Summary Sheet

PLANT/AREA: [Handwritten]

DATE: [Handwritten]

HAZARD	RISK RATING	CONTROL MEASURES	STATUS	RESPONSIBLE	COMPLETION DATE
Continuous bearing need to be conducted	High	Ensure continuous bearing is conducted	Open	[Signature]	[Date]
Ensure rockfall are metal as per std	Medium	Ensure rockfall are metal as per std	Open	[Signature]	[Date]
Support the raise as per standard and follow instructions (REFS 780-301)	Medium	Support the raise as per standard and follow instructions (REFS 780-301)	Open	[Signature]	[Date]
Ensure that leading ventilation columns are sealed	Medium	Ensure that leading ventilation columns are sealed	Open	[Signature]	[Date]
Alert the geology department if there are any changes	Medium	Alert the geology department if there are any changes	Open	[Signature]	[Date]
No layout required	Low	No layout required	Open	[Signature]	[Date]
Labour on compliment	Low	Labour on compliment	Open	[Signature]	[Date]
No connections	Low	No connections	Open	[Signature]	[Date]



...Safe Profitable Mining

Ore Reserve Conversion

- Combining certain activities in the value chain to optimise face length availability

Water Jetting

- No face winch, no odd rigging
- Increased production and clean mining
- Improved support installation quality

Wide Raise Rig

- Mechanisation
- Combine development and ledging into single activity

QUESTIONS ?