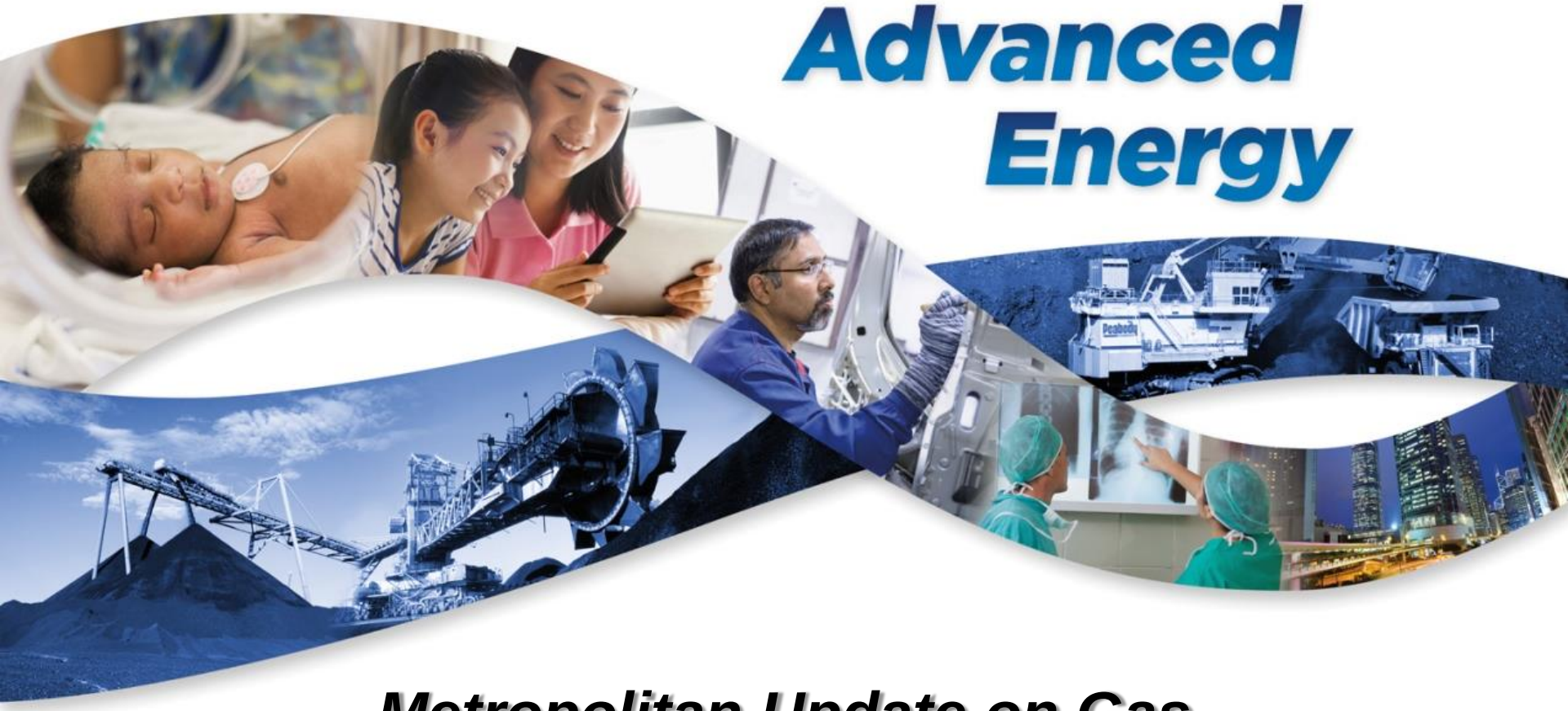


# *Metropolitan Update on Gas Drainage Operations*

***24th June 2015***

***Peter Jandzio***
***Gas Drainage Superintendent***

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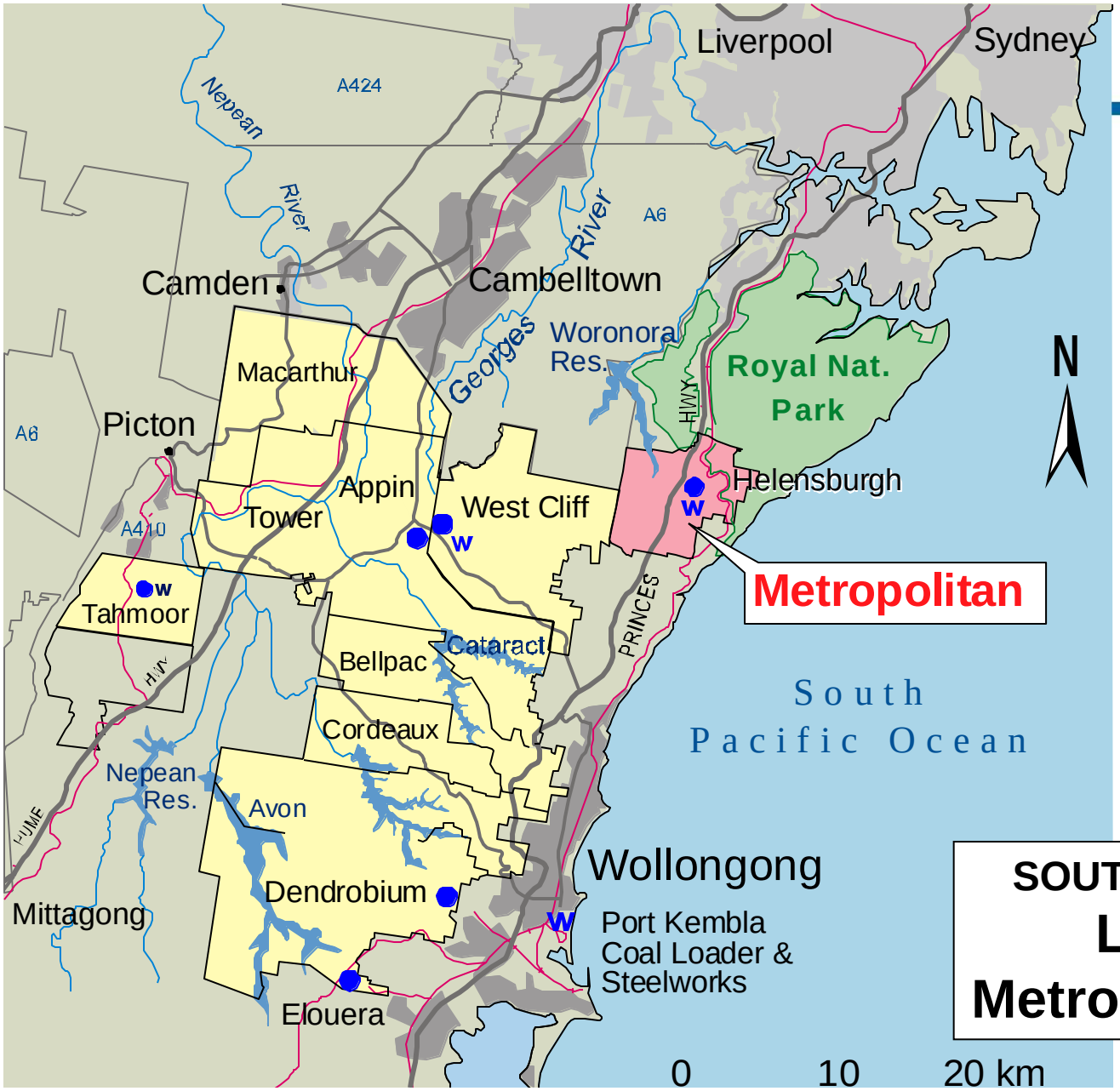
# Agenda

- Overview of Mine
- Mine plan and Seam overview
- Drilling Equipment Used
- Gas Drainage Process
- Challenges
- Further Work and Projects

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- Underground mine
- Open cut mine
- Proposed underground mine
- Proposed open cut mine
- w Washery

N

- Urban areas
- Railway
- Main Road
- Water reservoir
- Other collieries

**SOUTHERN COALFIELD**

# Location of Metropolitan Colliery

# Metropolitan History

**Since being sold by BHP in 1988 the mine has passed through 5 small mining operators. With limited capital available the mine has been in 'survival' mode, unable to address a number of key limitations this has contributed to some of the restraints we have today.**

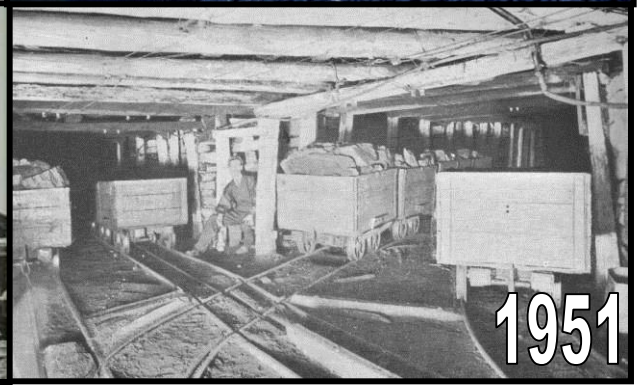
**Peabody acquired Metropolitan in 2006 when it recognised the potential of the operation and have owned the mine since.**

**In 2015 Metropolitan Mine turned 126 years old. It has a long and proud mining history.**

**This history unfortunately incudes outburst incidents both fatal and non fatal. It is this history which has shaped the way Metropolitan has evolved to safely mine coal in an outburst prone seam – 'The Bulli Seam'.**





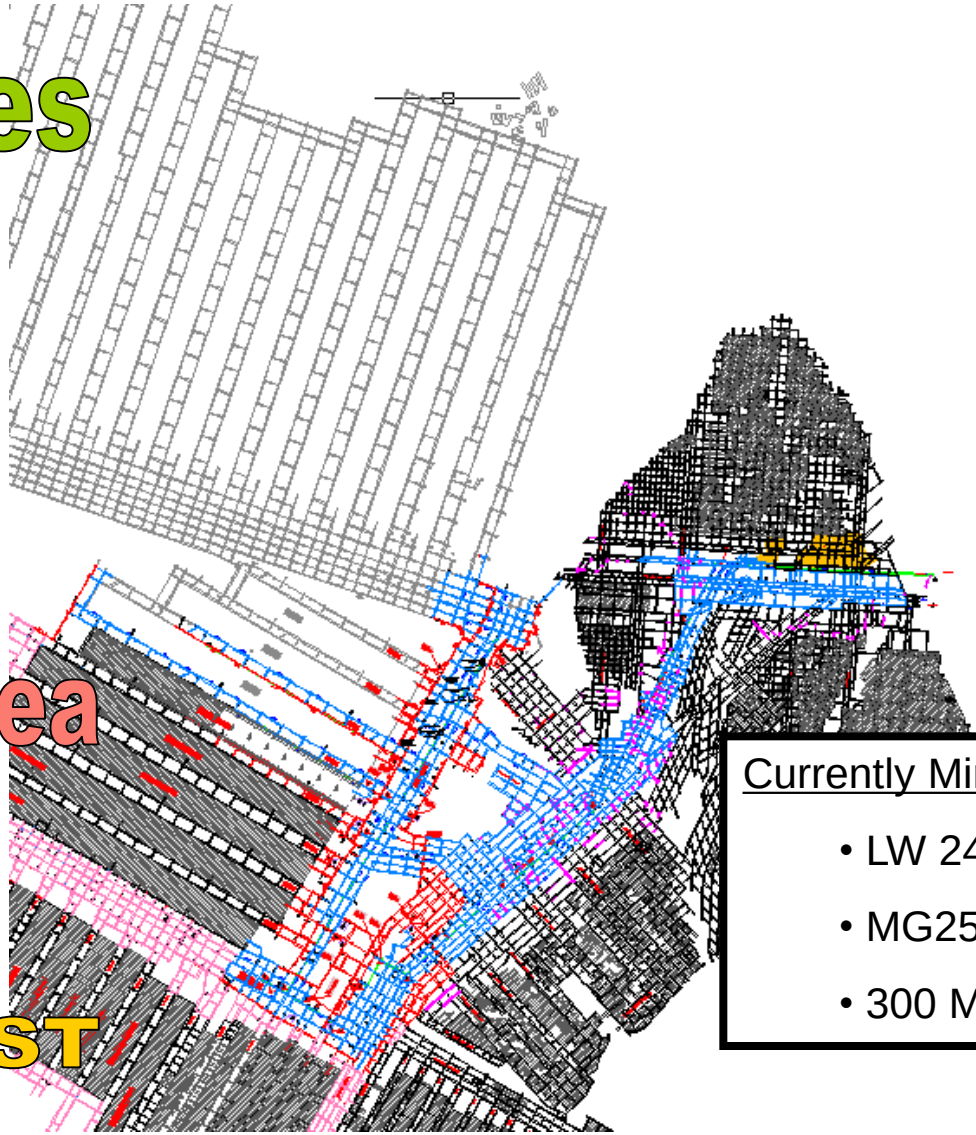


# Mine Plan

300 Series

Central Area

OLD B WEST AREA



Currently Mining

- LW 24 (Longwall)
- MG25 (Dev 1)
- 300 Mains (Dev 2 and 3)

# Gas Drainage Equipment

- 3 x Boart Longyear drill rigs
- DGS survey system
- 3 x Supavac units – Fines dewatering
- Fish tanks
- Fines pods
- Spa baths
- Gas / water separators
- Composite standpipes
- Pumps
- Pro Ram
- Various hoses and fittings

# Gas reticulation

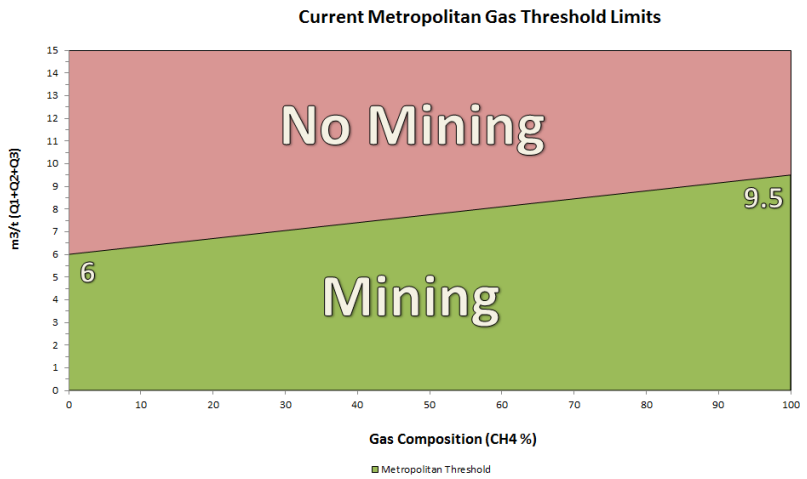
- Metropolitan does not operate a gas drainage vacuum plant, this can be both beneficial and challenging
  - Benefit of a less complicated system
  - Challenge of maintaining and balancing gas flow around the mine – Force / Suction System with a moving operating point depending on drainage sites

- Gas drainage ranges used
  - 18” steel range in mains – Main arteries
  - 12” steel ranges in gate roads – Capillaries
  - 4” hosing and jewellery used on holes

- 2 x driving forces for drainage
  - Vented to bottom of upcast shaft – Suction
  - Seam gas pressure – Forcing

# Metropolitan Bulli Seam Characteristics

- Change in composition from Methane to Carbon Dioxide
  - Longer drainage lead times
  - Drainage effectiveness sensitive to cleat direction
- Predominant geological structure – strike slip faulting
- Current area content and composition ranges:
  - 12 $m^3/t$ - 25 $m^3/t$
  - Typically around 15 $m^3/t$
  - Some passes have also been obtained in some virgin areas
  - Generally 95+% $CO_2$



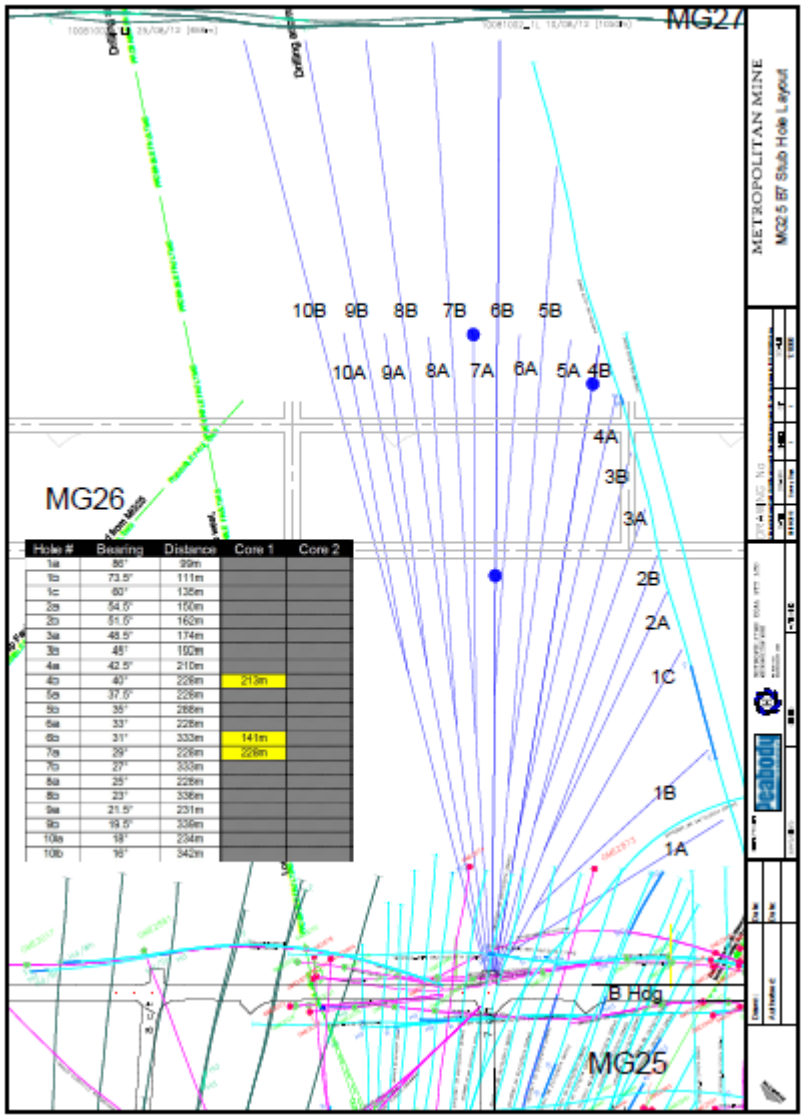
# Metropolitans Gas Drainage Process

Outburst Control Plan

| | |
|---|---|
| Design | • Preliminary Gas Drainage Design Based on Mine plan requirements |
| Gather Data | • Take an initial core for a representative sample of area to be drained |
| Review | • Review preliminary drainage pattern against time restraints from mine schedule and develop revised drainage plan if required |
| Implement | • Drill holes for drainage |
| Monitor / Maintain | • Monitor flows from holes, calculate gas reservoir, extrapolate required drainage time<br>• Maintenance of gas ranges to maximise efficiency |
| Verify Effectiveness | • Implement a coring regime which aligns with the outburst control plan<br>• Closing the grid to identify missed structures |
| Review / Authorise | • Review data and authorise a permit to mine<br>• ORC to review all data against compliance with the mines Control Plan |
| Mine Coal | • Gathering data and Monitoring mining conditions as mining advances – Check and Act |

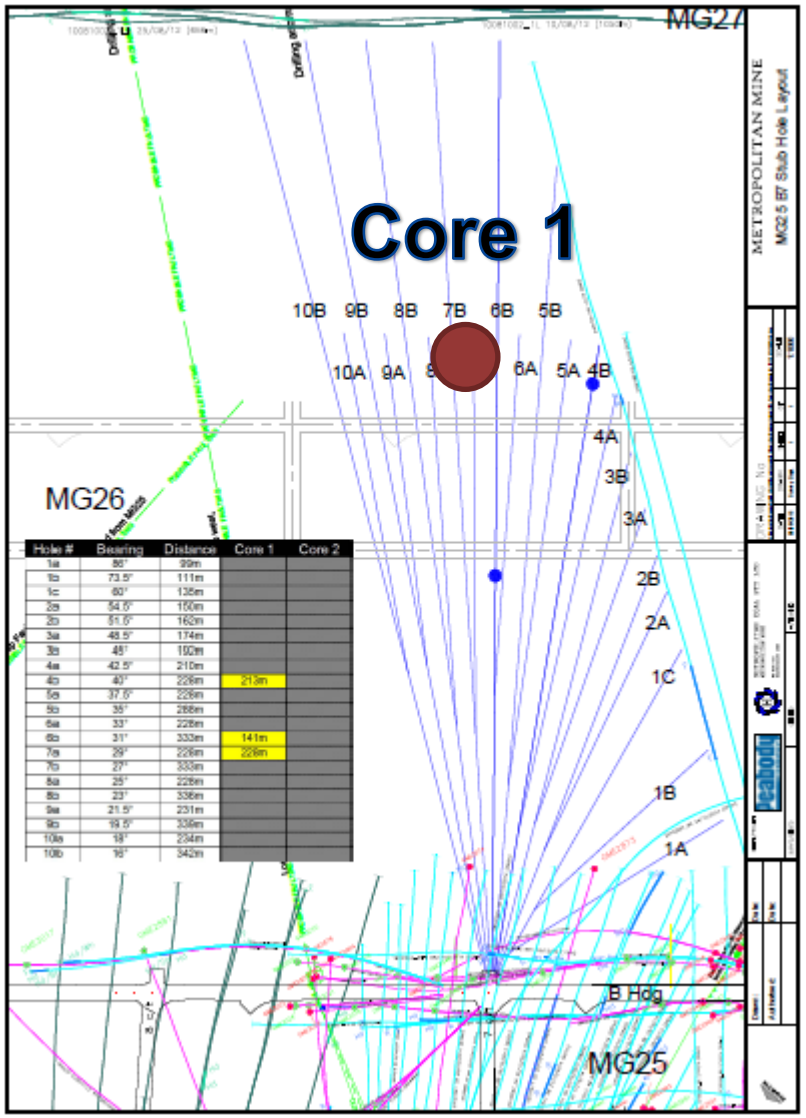
# Design

- Initial design covers requirements of developing roadways and LW block drainage.
- Any Known geological features
- Design includes location to be drilled from and services available etc
- Favourable drainage hole direction
- Generally aim for 20m hole spacing initially
- Where possible drill across 2 blocks due to short LW face width
- Saves setup time and can increase drainage time for adjacent panels
- Each site is also used as an in situ permeability test and previous success drives future patterns



# Gather Data

- First hole and core location is determined by Gas Drainage Superintendent and Mine Manager to determine best location for a representative sample or area to be drained.
- Core is taken and analysed.
- Gas reservoir is calculated.



# Review

- Simple review process (reviewed against historical performance)
  - High gas / Low Lead Time

    Increase hole density
  - Low gas / Long Lead Time

    Decrease hole density
- Other factors around the design review are:
  - Known geological features
  - Any Outburst prone structures
  - Reservoir volume (content)
  - Lead time available to meet mine scheduling restraints

# Implement

- Drilling of the revised pattern
- During the drilling process more monitoring is conducted by the drill rig operators:
  - Return water colour
  - Hardness of drilling
  - Size and shape of fines through returns
  - Increase / Decrease of gas make
- Findings noted on drillers report and logs are review by Gas Drainage superintendent
- Samples of cuttings are taken if required to be analysed

# Monitor/Maintenance

## Monitoring

- Following the completion of a hole it is connected to the gas drainage reticulation system.
- Each hole is then measured for gas flow on a regular basis – Aim is twice per week.
- Gas range gas composition is constantly monitored by tube bundle system and flow measurements are taken
- Regular gas bags taken for gas ranges to verify tube readings
- Pressure monitoring of gas range – Suction location and strength

## Maintaining

- Inspections of gas drainage sites, gas drainage ranges for any damages
- Empty water along gas ranges regularly

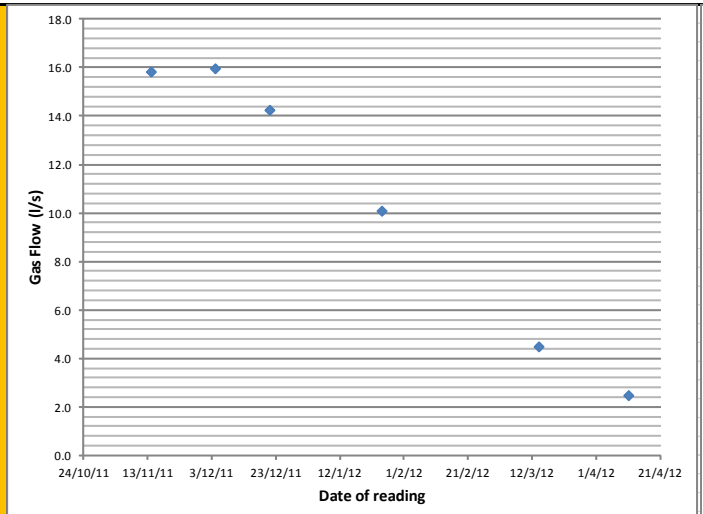
# *Individual Hole Monitoring*

- Hole flow monitoring is analysed and is used as a predictive tool and is then fed back into the mine scheduling

## Individual Standpipes

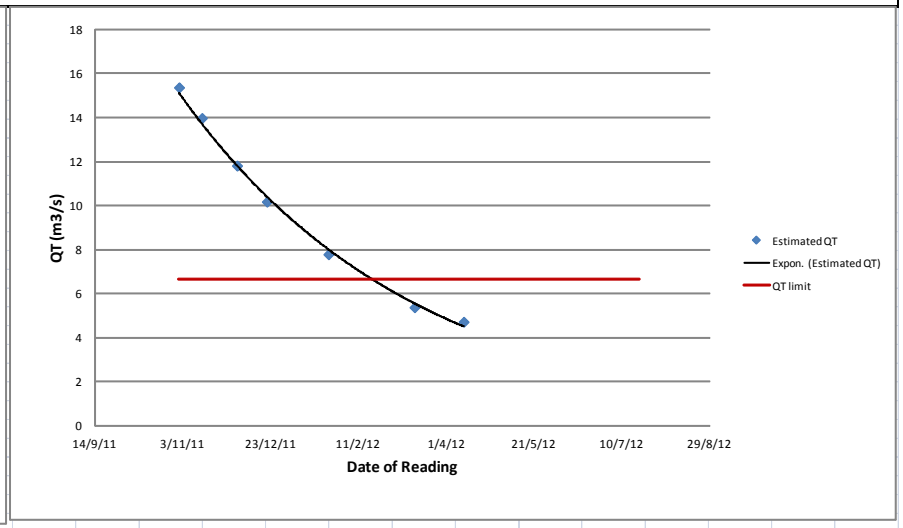
Hole 1

### Gas Flow Reading (l/s)




### Estimated Trends of QT (m3/t)

the first point represents the virgin core, the second point represents the first reading



# Verify Effectiveness

- Once we believe the coal has been drained below threshold levels and the area of coal needs to be mined we need to verify that the controls implemented has been effective.

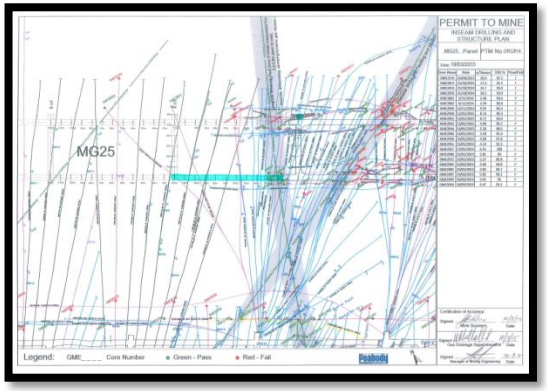
We do this by:

  - Compliance coring at a maximum spacing of 60m in normal unstructured coal
  - Compliance coring within 10m of any structure identified as outburst prone by the mines Outburst review committee, this determines the pressure gradient across the structure and potential risk of outburst.

- A hole is also drilled which ‘closes the grid’ to prove that there are no structures which are entering the proposed workings parallel to previous drainage holes and have gone undetected.

# Review / Authorise

- Surveyors plot holes, core results and any other relevant information onto mine plan
- These plans are then used to authorise a block of coal to be mined safely under the PTM system
- All gathered data relating to the area is now reviewed in a PTM meeting before issuing a PTM
- The major items reviewed are:
  - Location and Core results
  - Location and number of boreholes
  - Gas flows from the drainage sites
  - Geological features within permit area

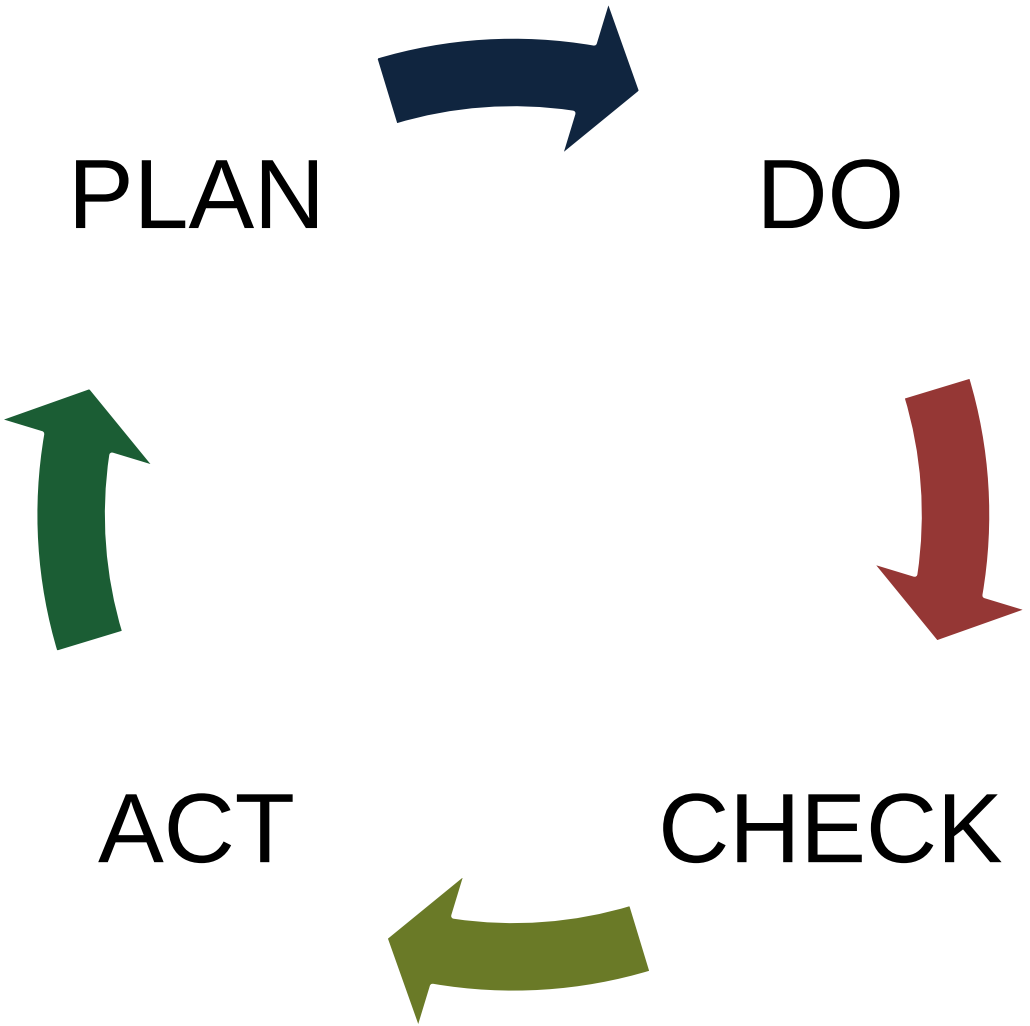



- Once satisfied that we can safely mine an area a PTM can be issued and signed off by the ORC

# Mine Coal

- During the mining process the deputies and operators are constantly monitoring their work environment for change. In particular outburst indicators
- The PTM is constantly being reviewed shiftly and mining conditions monitored
- The mine operates a Outburst TARP which is based around outburst indicators
- Operators annually undergo refresher training in outburst awareness
- Geologist regularly inspects roadways mined
- Return gas monitoring system
- The PTM is the most important document in a panel and without it no mining can take place

# Throughout all processes



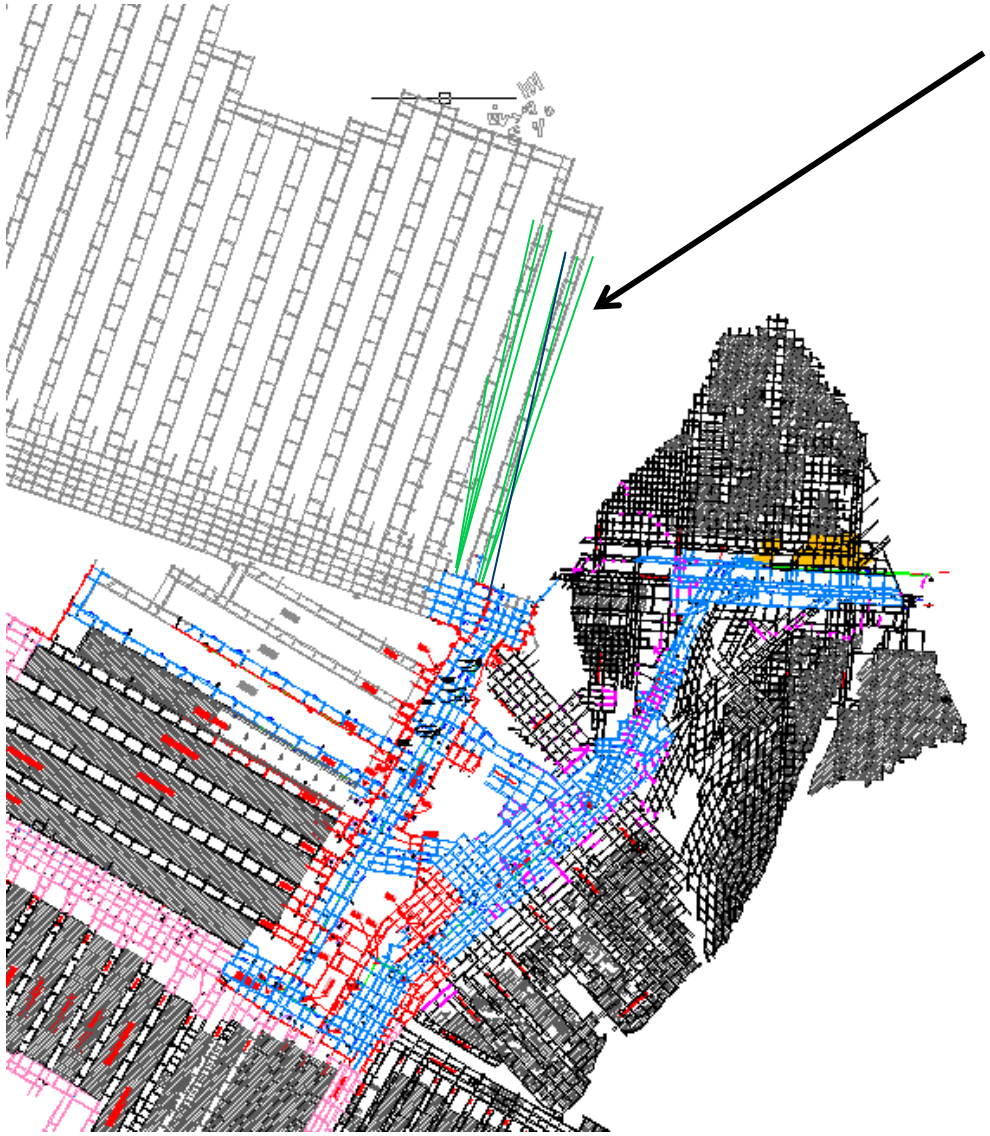
# Other checks and balances

- Monthly ORC meeting
  - Review of current permit and permit limits against production
  - Review of flow and gas data for all areas of the mine which are being monitored
  - Review of drilling and coring for previous month
  - Identify future areas for drilling as per mine schedule
  - Includes local check inspector
  - Review any actions from PTM process

# Current challenges

- Change in mining direction – New set of mains
  - VLI engaged to drill long holes to drain the first 2 gate roads aiming for 1800m holes
  - Needs to be completed in seam as there are number of surface constraints which eliminate surface to seam options
- Short lead times for drainage
  - As little as 4 months drainage time in some areas
- Gas drainage range efficiency
  - Maintaining suction at drill sites without a vacuum plant
- Limited reserve gas content definition

# Challenges



## Gas Draining First Blocks

- Generally use cross block drainage, this is not possible for the first gate road in 300 series
  - VLI engaged to drill long holes to drain the first 2 gate roads aiming for 1800m holes
  - Needs to be completed in seam as there are number of surface constraints which limit surface to seam options

# Future Projects

- Vacuum Gas Plant to improve gas reticulation efficiency
- Nitrogen Injection trial with ACARP and UOW to ‘Speed up’ drainage time

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