BHP BILLITON
West Cliff Colliery

Gas Drainage Issues – West Cliff Area 5

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Introduction / Agenda

- Presentation on inseam gas drainage issues faced by West Cliff in the Bulli (#1) seam
- Mine History / Location
- Drilling / Equipment information
- Area 5 Gas Drainage Issues
- Drilling Techniques and Issues
- Summary

Mine Details

- BHP Billiton owned- formerly KCC
- Operate in Bulli seam in Southern NSW Coalfields
- Mining Lease granted 1969
- Commenced shaft sinking 1972
- Development commenced 1976
- Longwall Production commenced 1982
- Depth approximately 480m
- Production 2mtpa 2004
- Ongoing production budgets 2.7-4mtpa
- Mining area 5 which adjoins Appin area 1

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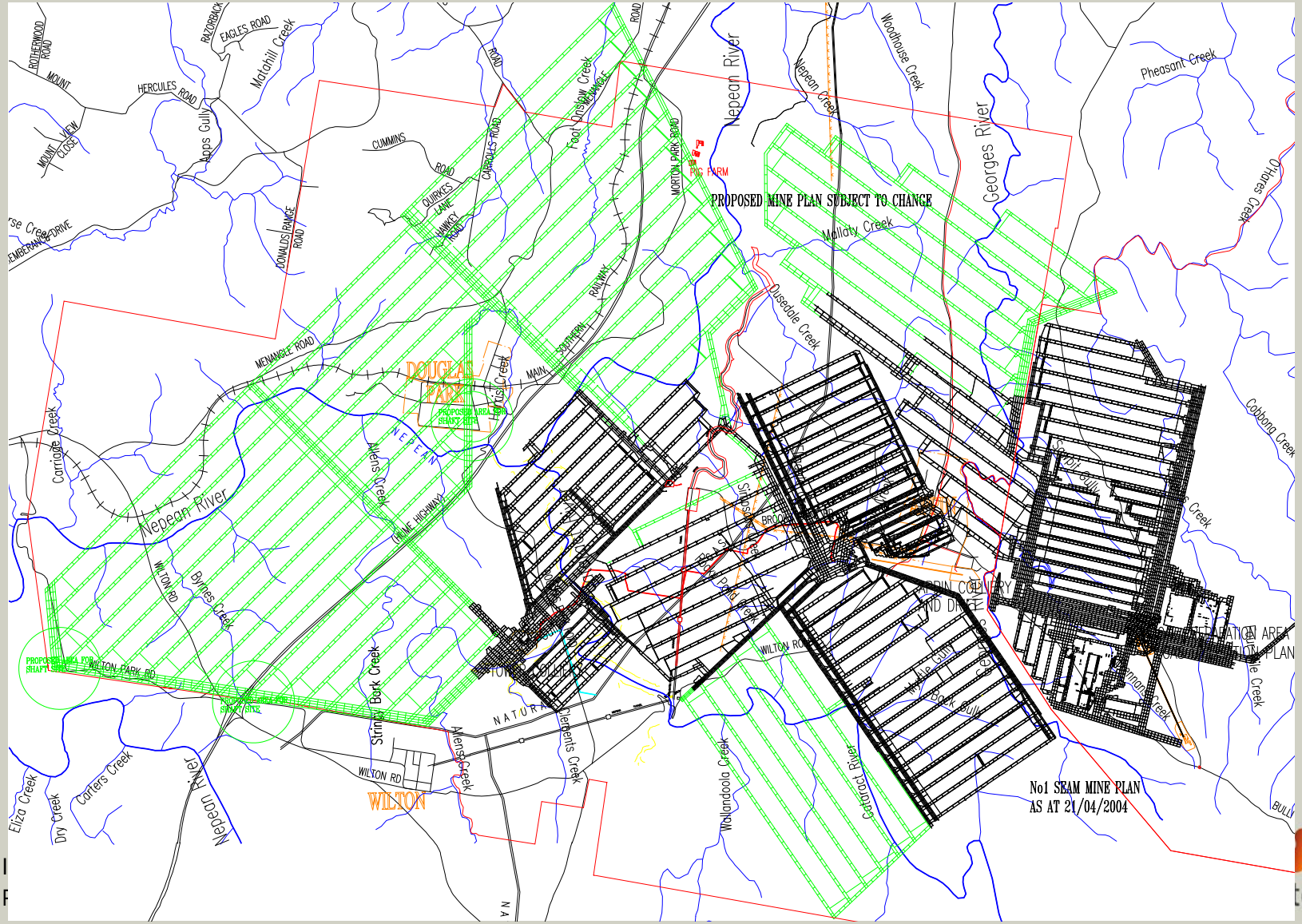
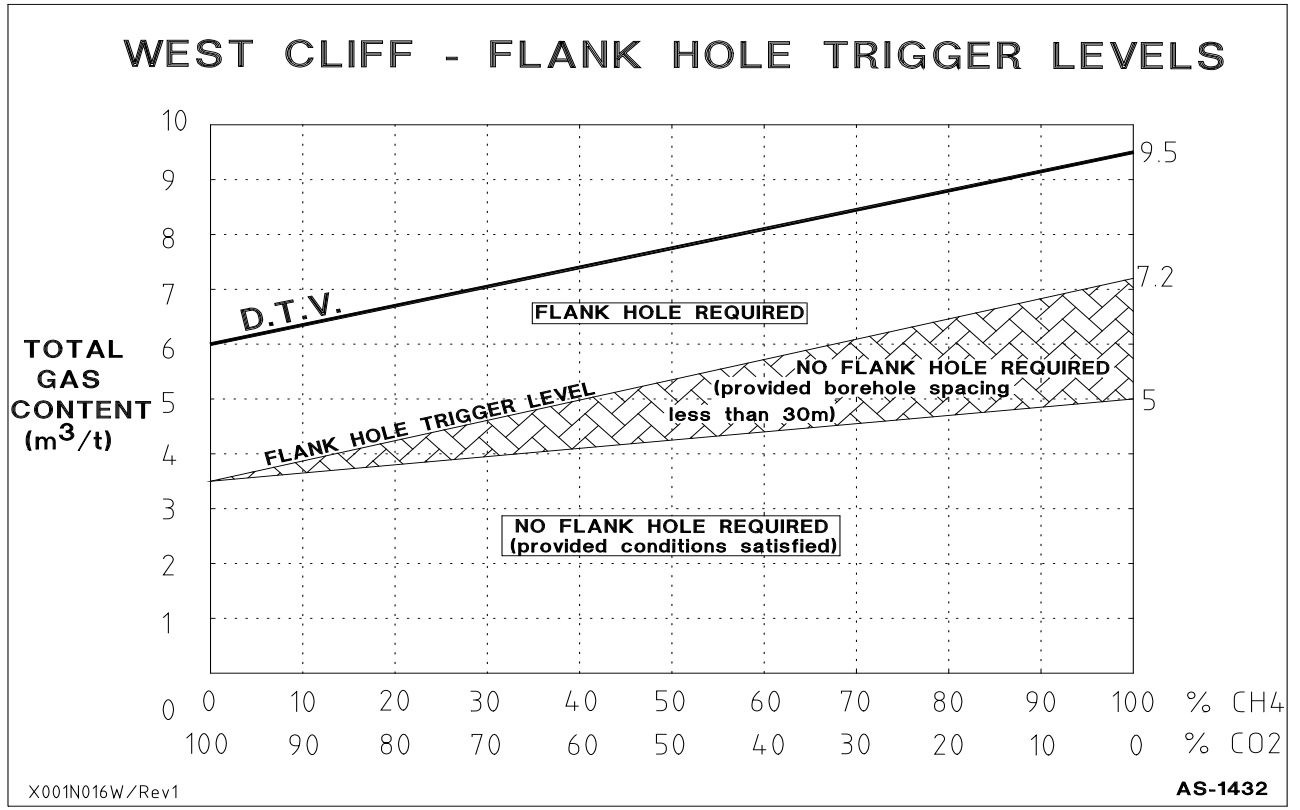
Mine Location



Drilling Information

- Develop approximately 15km per year
- 120km inseam drilling metres to support mine plan and OMP in 2004



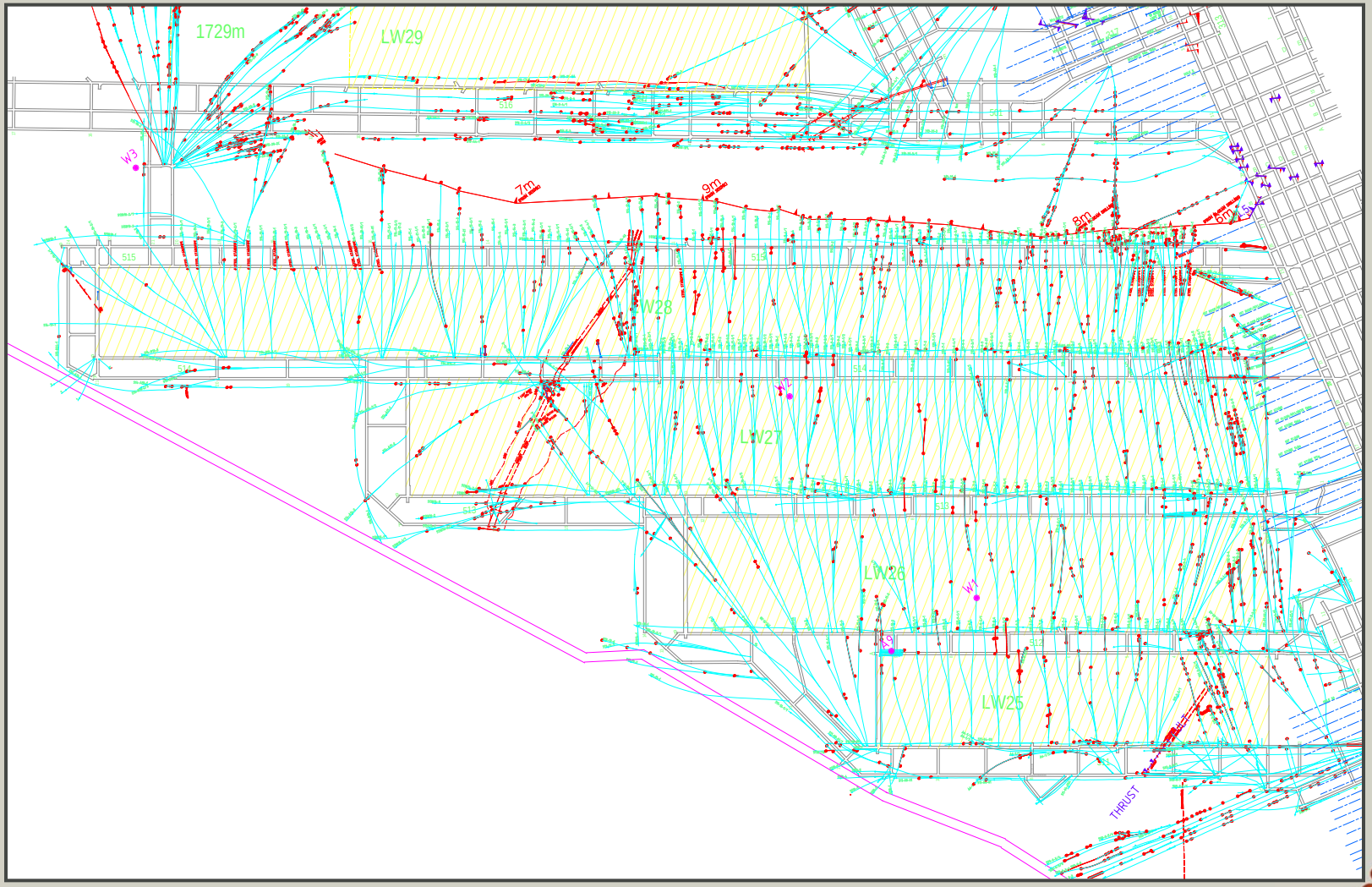
Gas Drainage Equipment

- Standard drilling / surveying equipment
- 3 Kempe drill rigs – 800m to1500m capacity
- 3 Longyear LM55 – 600m capacity
- 2 air machines
- Youngest machine 1994.
- 2 AMT acoustic survey tools- 1990 technology –superseded
- 2 AMT DDM mecca survey tools
- Introduce AMT Drilling Guidance System (DGS)- improved diagnostics
- Eastman single shot camera

Area 5 Gas Drainage Issues- Stage 1

- Area 5 stage 1 located in wedge of coal between original West Cliff Area 4 and Appin Area 1
- Advantage in this area of drainage via old workings
- Conventional inseam gas drainage practices in CH4 environment
- No structure of note except for a major fault 6-9m detected by seismic and later confirmed by underground drilling
- Mine plan change to step around fault

Area 5 – Stage 1



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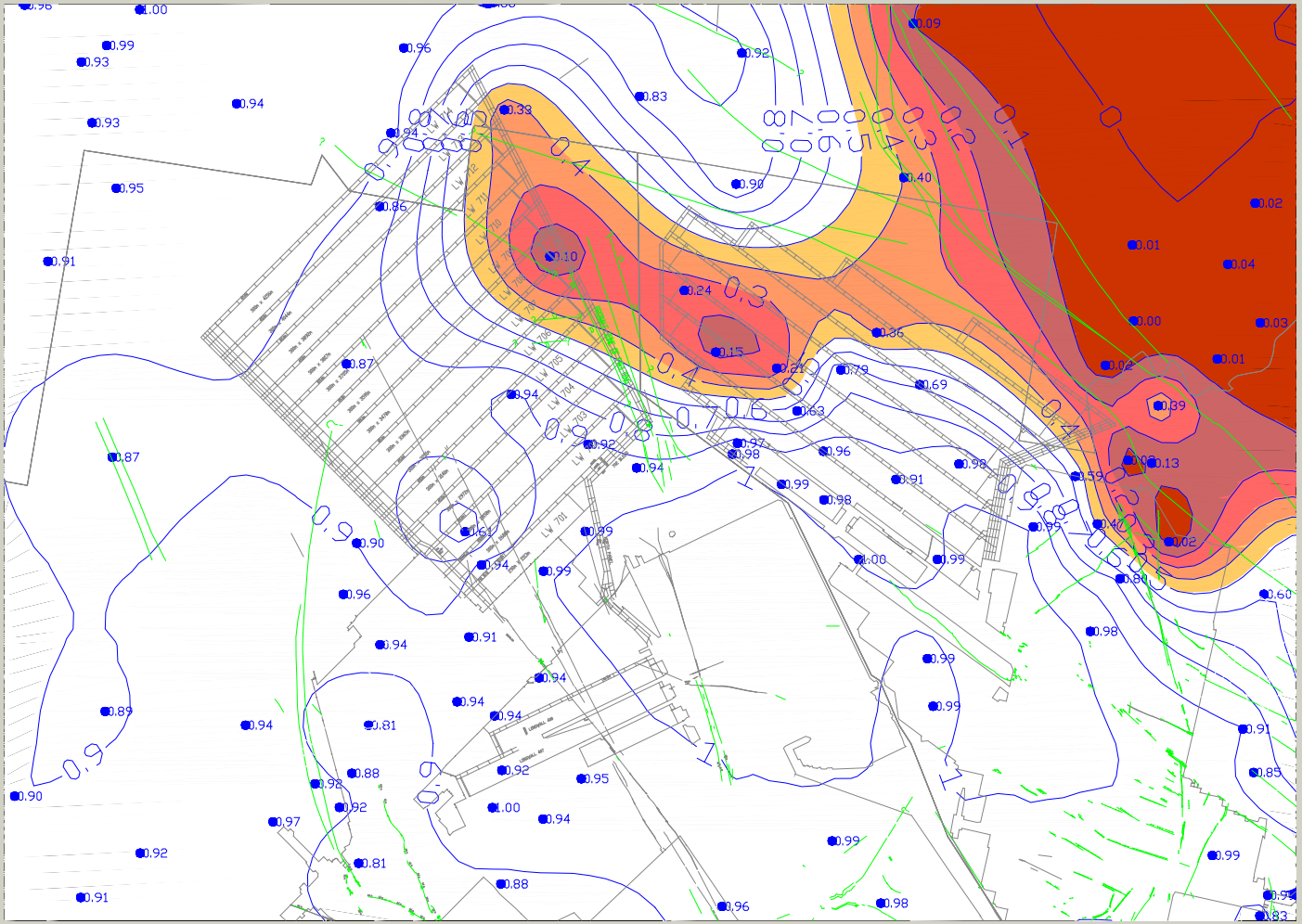
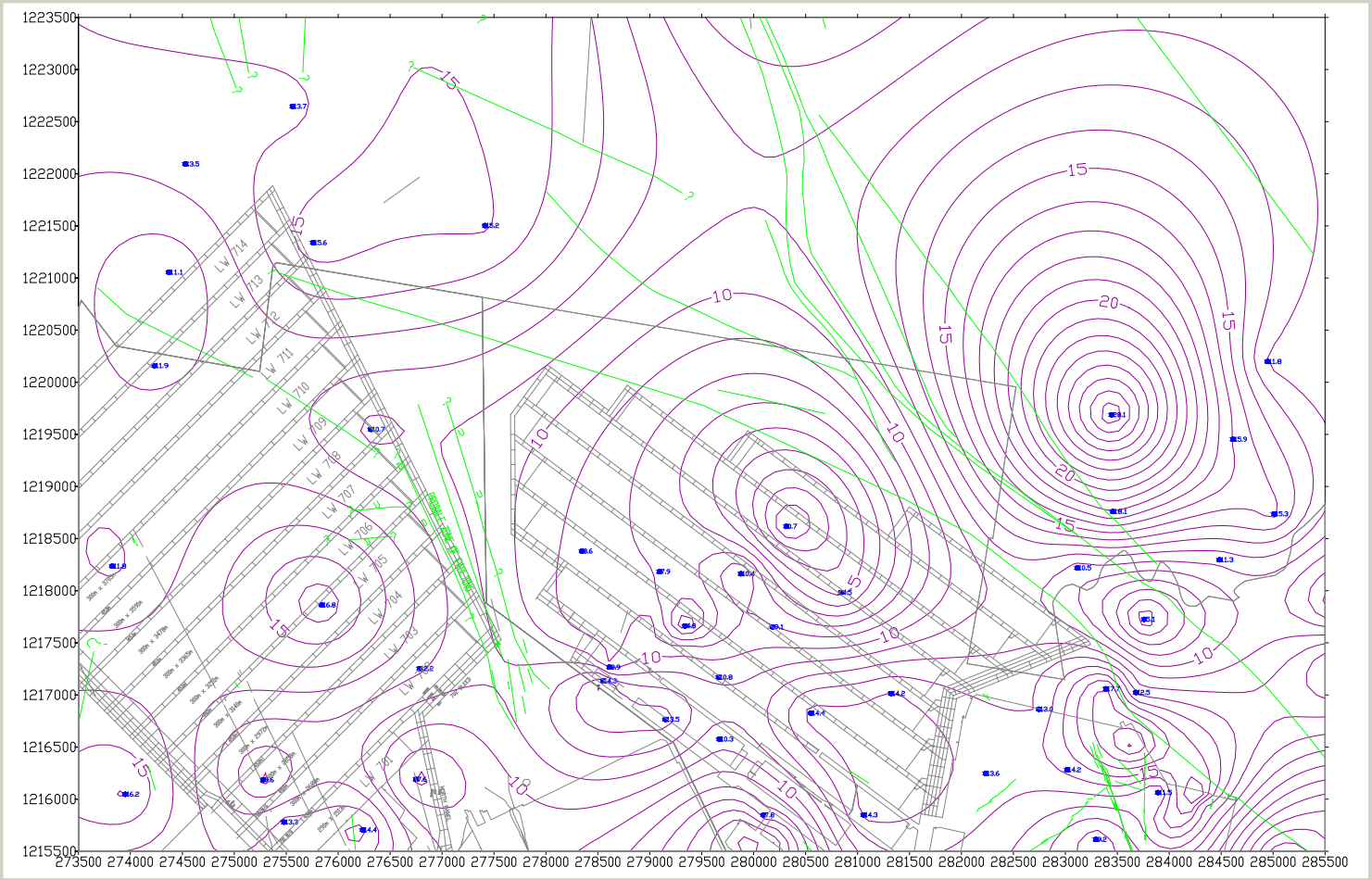
Gas Drainage Issues – Area 5 Stage 2

- Area characterised by variability in base data
- Variable insitu content from 4 -14m3/t
- Trending away from CH4 to CO2 environment in northerly direction
- Need to understand the environment to effectively plan gas drainage and ventilation systems
- Surface borehole and seismic information complemented by underground drilling / exploration

CH4 Content



Seam Gas Content



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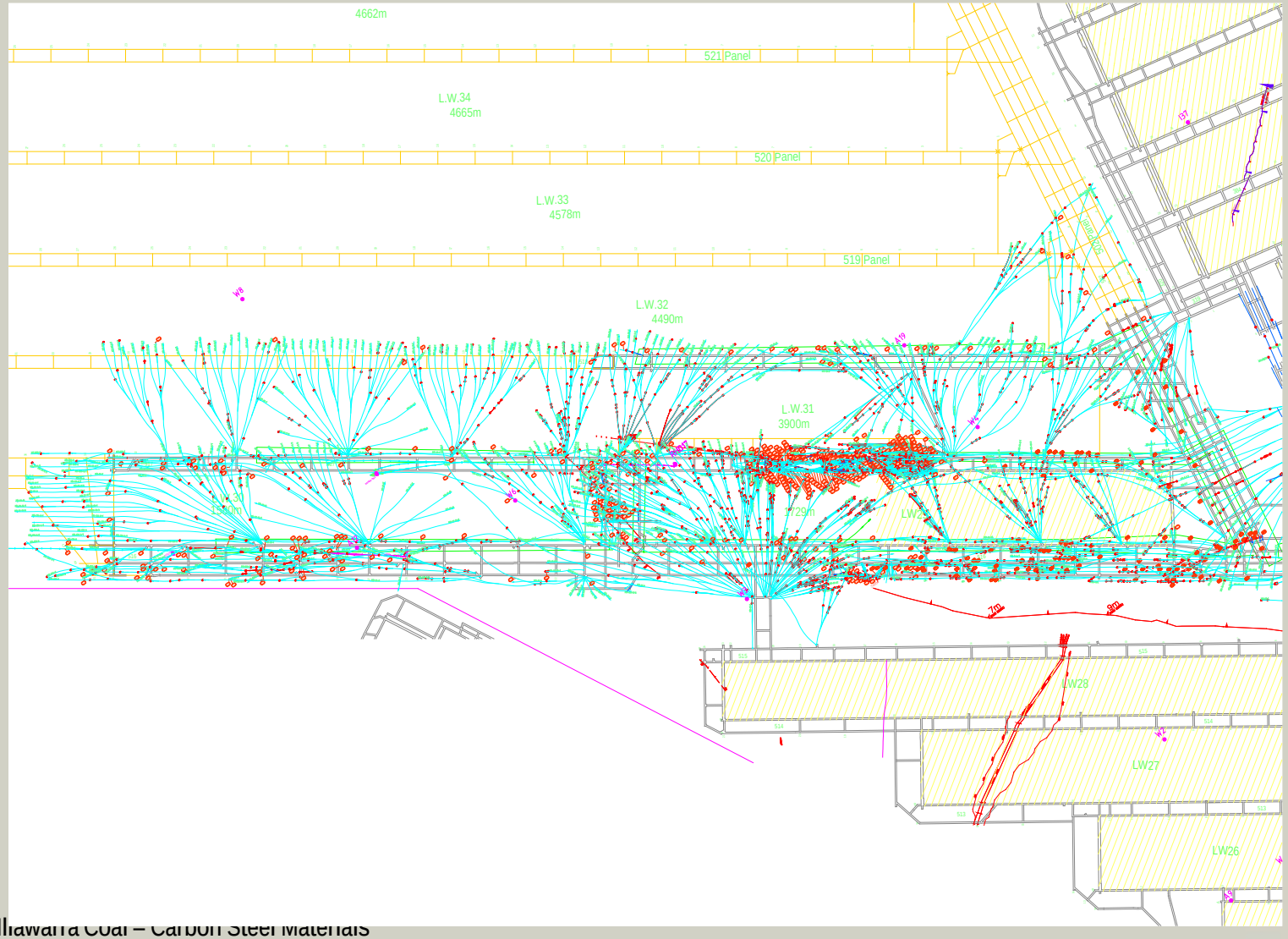
Gas Drainage Issues – Area 5 Stage 2

- Need to step around fault
- In effect starting a new mine for development
- No routine means to pre-drain ahead of 4 continuous miners
- Improvise drilling patterns
- Trial STIS holes
- Utilise longholes, old workings for drilling locations
- Drill around and parallel to the major fault for 516 panel
- Drill longholes across to 517 panel for pre-drainage
- Drilling towards 517 detected a potential major anomaly

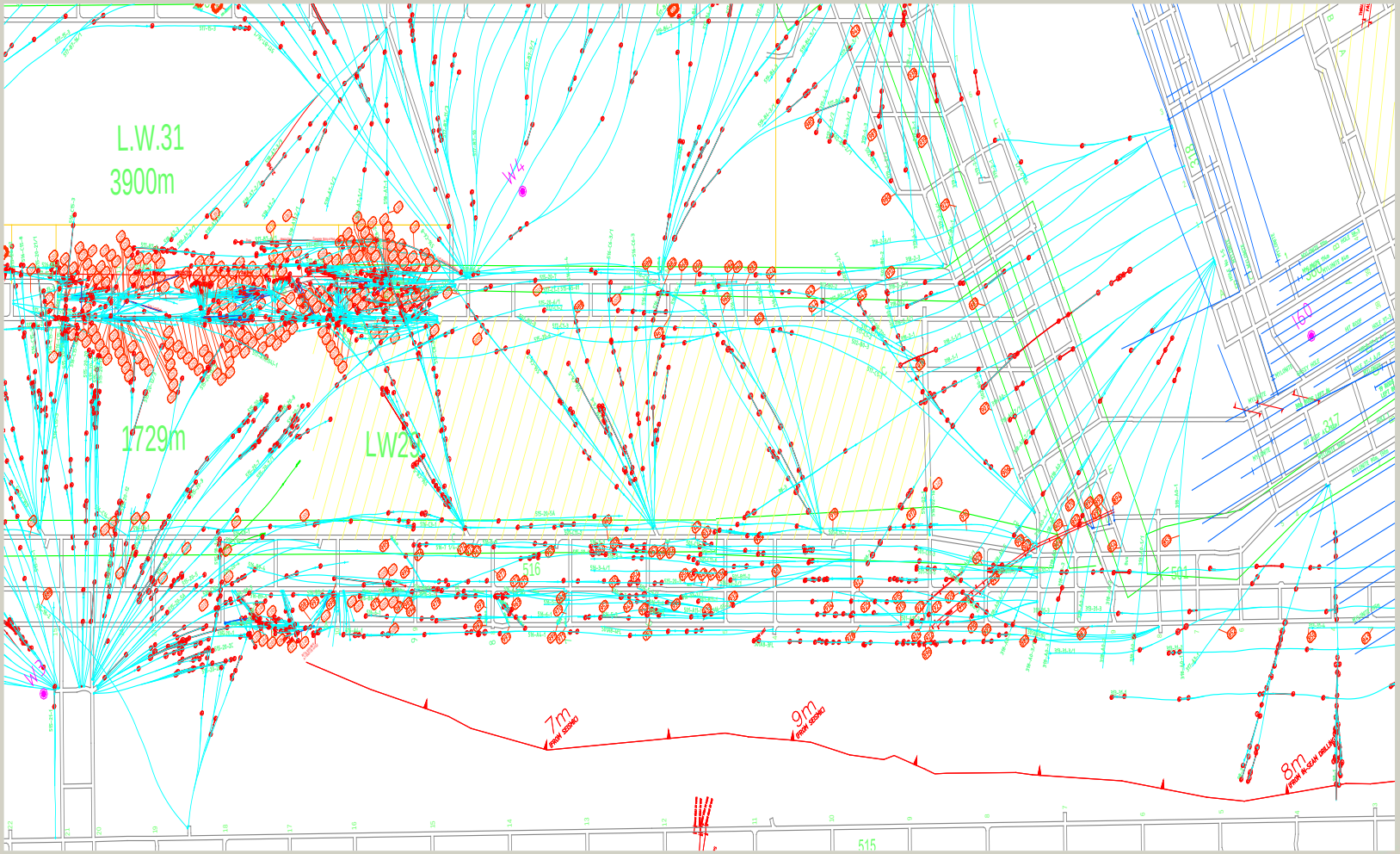
Area 5 – Stage 2



516 Panel Gas Drainage

- 3 heading development , 2 miners, 3 drill rigs
- Drainage achieved by means of drilling longholes around major fault from both ends
- Encountered minor areas of boggy ground at tail of the fault
- Scroll drilled boggy area
- Some temporary relief due to proximity to Appin workings
- Longholes drilled ahead of and around panel in advance of Appin workings
- STIS3 utilised in advance of Appin workings

Utilise Existing Workings for Drilling Locations -516 Panel



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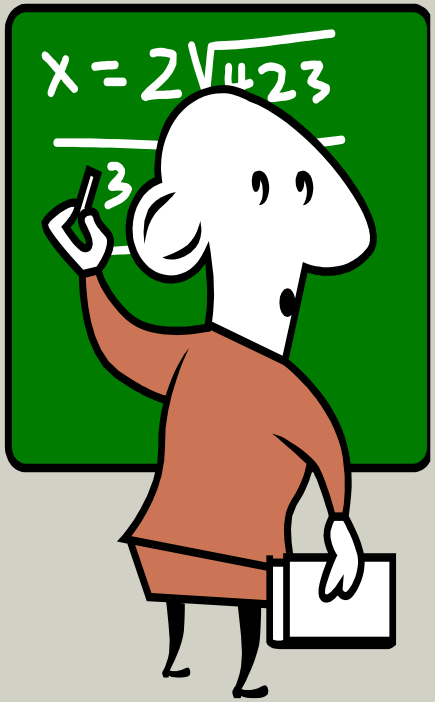
Gassy holes and their affect on development ventilation

- Intersecting “green or gassy holes” can be a major issue
- Development panel -10m3/s at face
- 0.4% CH4 as background
- Due to intersect hole with 100l/s
- Potential face general body
- Using l/s =10*Q*C (Q-quantity, C-concentration)
- C=10*10/100 + 0.4 = 1.4% general body



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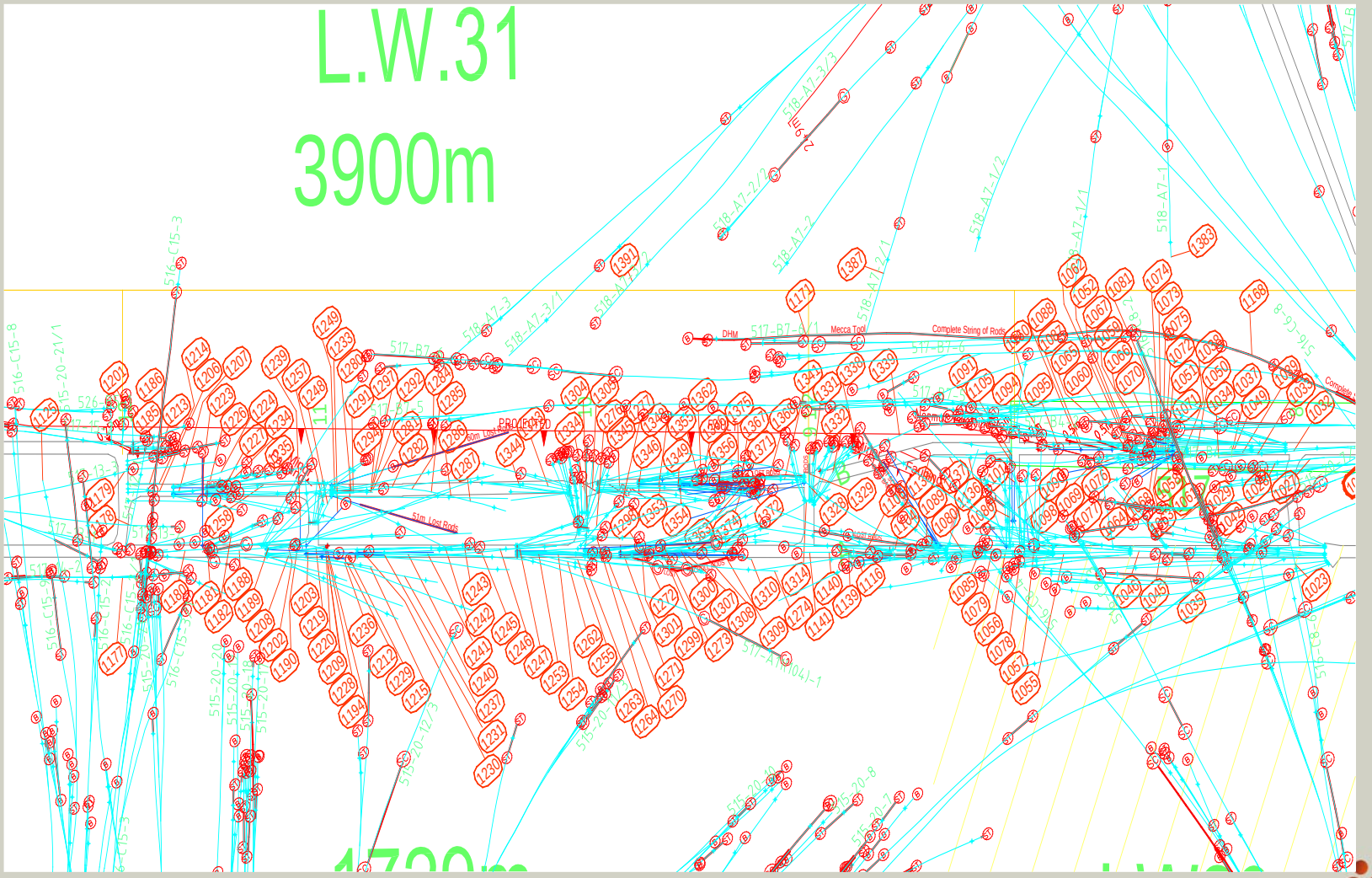
Methods of Dealing with Gassy Holes

- Risk based approach
- Monitor holes before intersection, flush as required
- Pre-cautionary zones as part of OMP process requiring vacuum, hoses etc available
- Maximise face ventilation through good standards (i.e. vent rubbers, short tube runs, large fans, venturi's)
- Intersect holes and deal with temporarily using hoses or inflatable gas bags
- Deal with permanently utilising standpipes
- Extreme cases alter mining sequence to provide full panel ventilation (eg STIS2 holing)

517 Panel Gas Drainage

- 2 heading gate road panel for LW29 & 30
- Potential anomaly identified from previous drilling
- Panel advanced to 7 line by longhole drilling from 516 panel and from within 517 panel
- Fault detected at 8 line with associated boggy ground
- Scroll drilling implemented for approximately 700m of panel advance to 12 line
- Trial large diameter auger drilling
- STIS2 utilised for pre-drainage from 19 to 28 line
- Fan drainage and longholes utilised to drain to extent of panel

517 Panel Scroll Drilling



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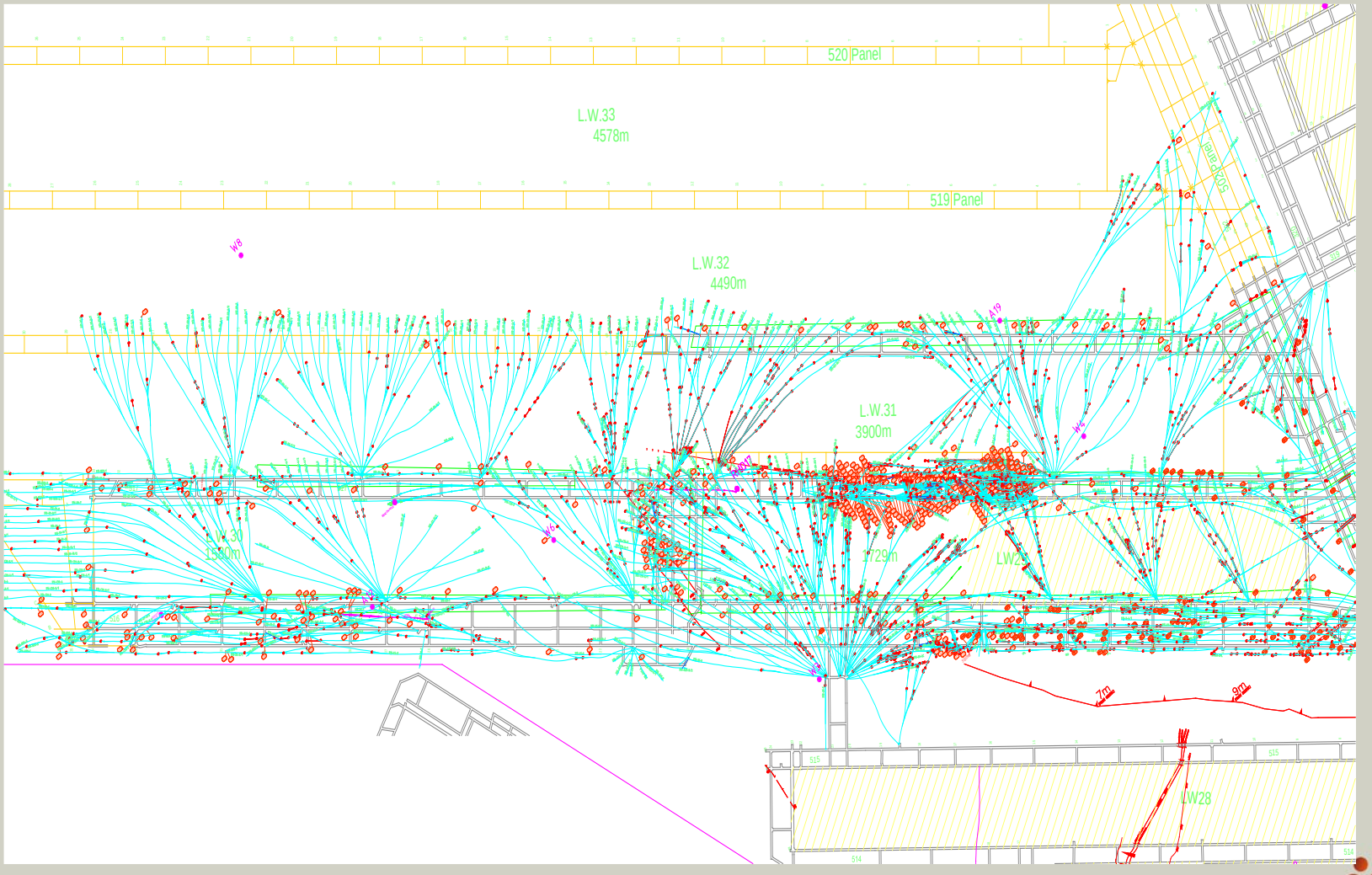
517 Panel Drilling Patterns



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517 Panel and it's affect on the mine plan

- 18 months to negotiate 7-12 line through faulted area
- Result was a contingent change to the mine plan
- Led to minor intake gas contamination issues with 516 panel on flood intake (due to mining contents just below threshold)
- Intake gas issues resolved by means of locating intersected holes and placing on vacuum
- Implemented an advancing / retreating longwall for LW29
- Longwall downhill, belts inbye then outbye
- Compromised longwall and overall mine ventilation
- Stepped tailgate for LW31

Scroll Drillling

- Standard BWJ drill rods with custom designed scroll pattern welded to rods to enable rod handling
- 90m holes possible without steering control
- Best results achieved when drilling uphill into boggy ground to enable fines to clear.
- Typical 7 hole pattern – 10 days
- Drainage Lead time 2-3 weeks
- Core area and authorise for normal mining
- Remove rig and mine
- Shunt miner, flit in drill rig and do it all again
- And again….
- And again….
- And again!!!!!

Scroll Drilling

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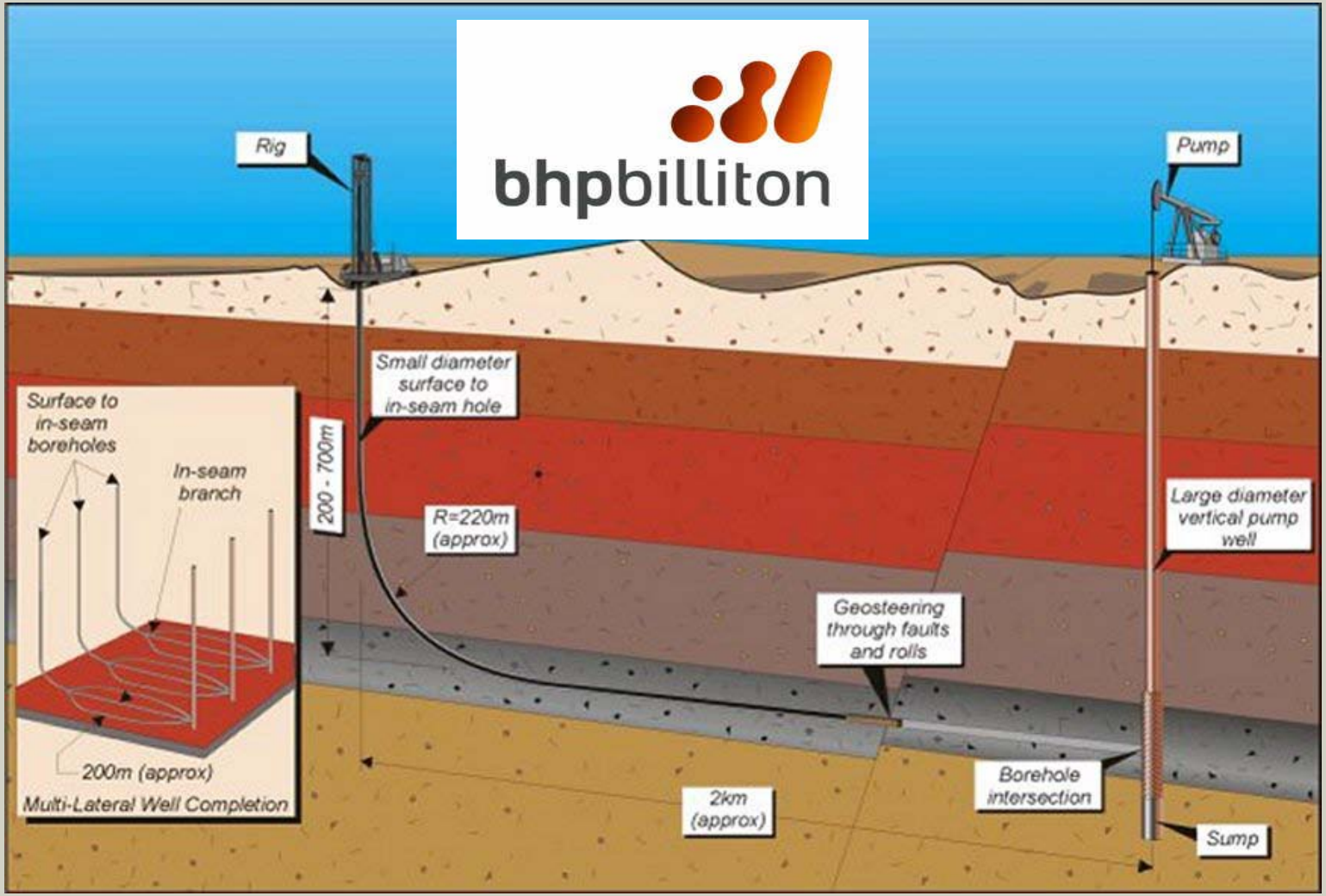
Surface to Inseam Drilling Concept



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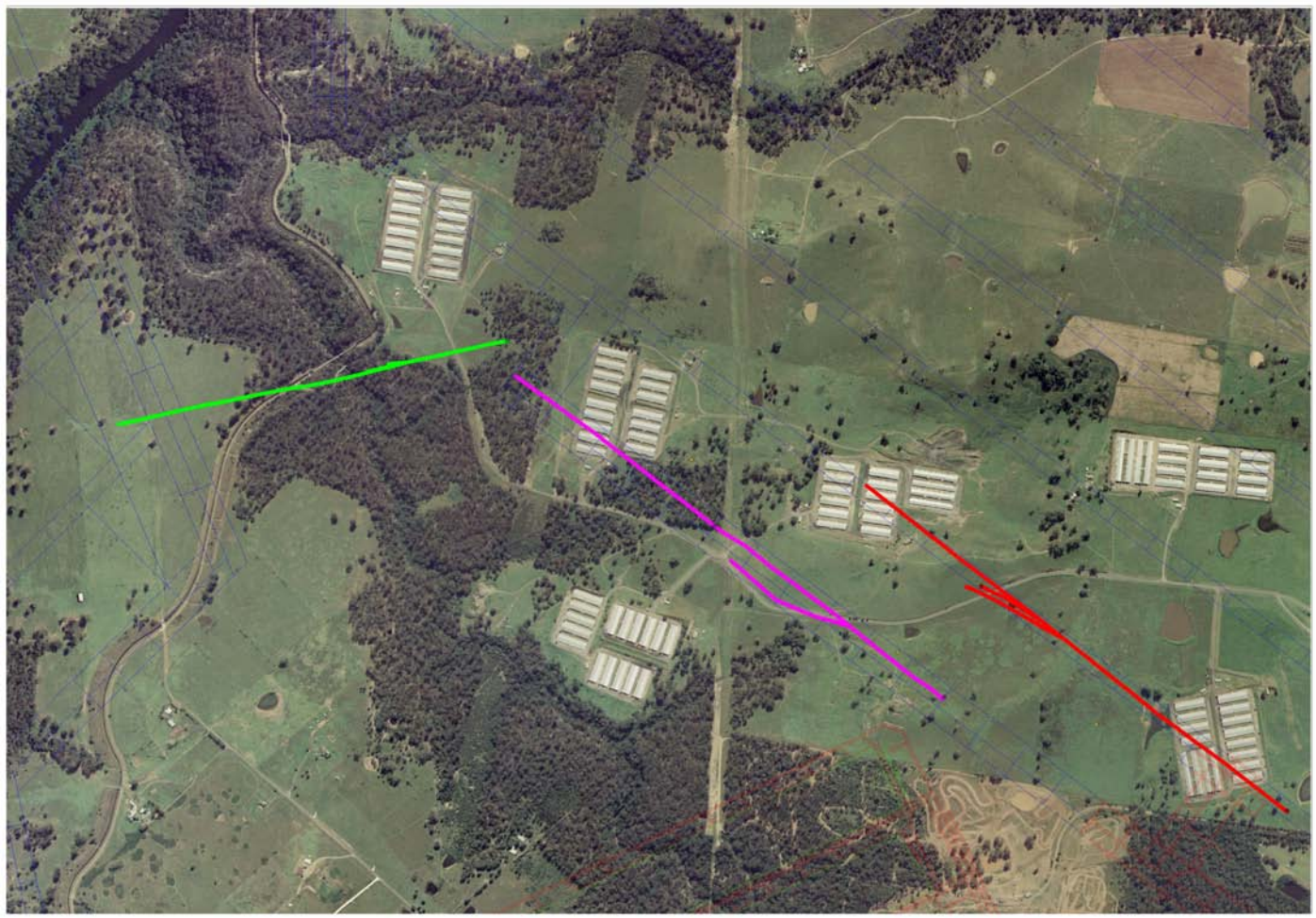
STIS2 & 3

- STIS2 drilled for 517 panel due to inability to drain area with conventional underground drilling
- Drilled down the middle of the gate roads to provide maximum drainage
- Peak flows of 250l/s
- Average flow 80l/s
- Successfully drained 19-28 line from virgin to 8m3/t over 6 month timeframe.
- STIS3 for 516 panel less successful
- Peak flows 100l/s & less leadtime

STIS 1,2,3



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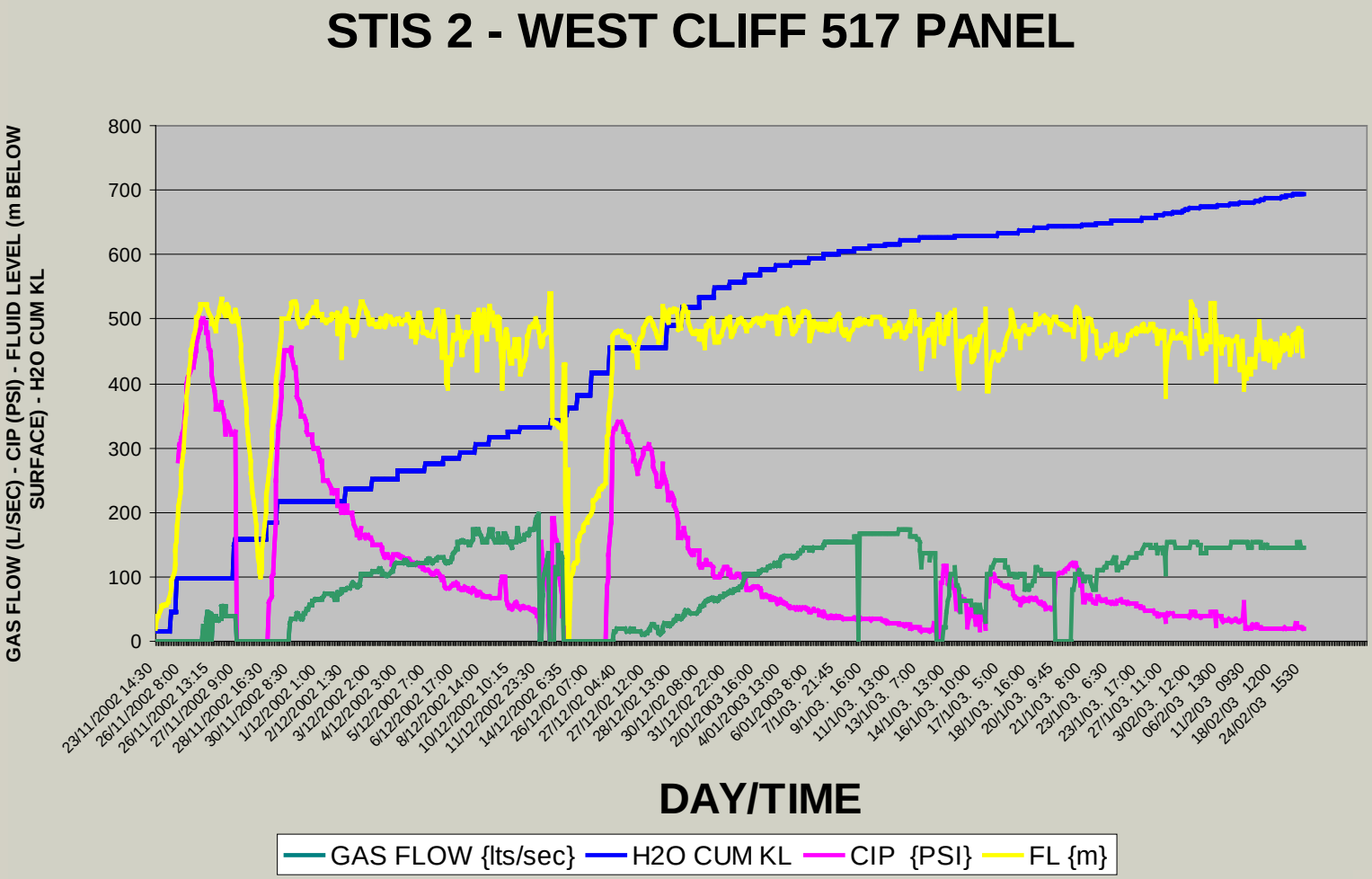
STIS 2 Hole Flows



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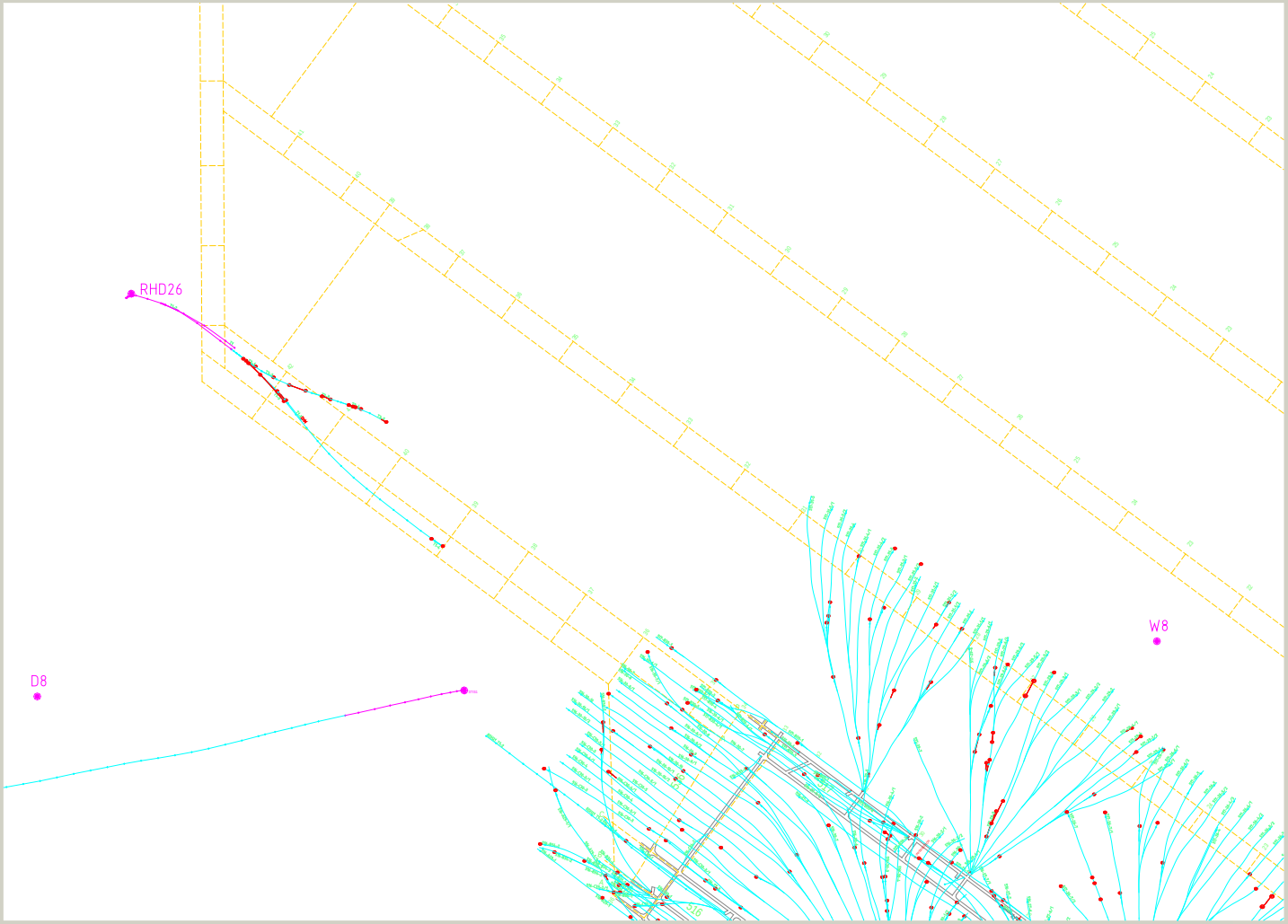
STIS4

- Designed as a quad lateral hole for the extension of 517 panel to accommodate LW30
- Design to increase drainage time by approx. 10-12 weeks in comparison to underground drilling capabilities
- Designed without a beacon (vertical) hole due to timing
- Designed to be intersected by underground drilling
- Achieved a single hole and partial branch due to drilling, budgetary and timing issues

STIS4



Auger Drilling

- Trial of large diameter auger drilling to enhance gas drainage and improve lead times
- Attempted both 1.5m and 0.9m diameter holes up the centre of the roadways
- Issues with rig set up time, hole stability, hole length (30m holes achieved)
- Complemented existing gas drainage patterns
- Further development of technique required away from production environment.

Large Diameter Auger Holes

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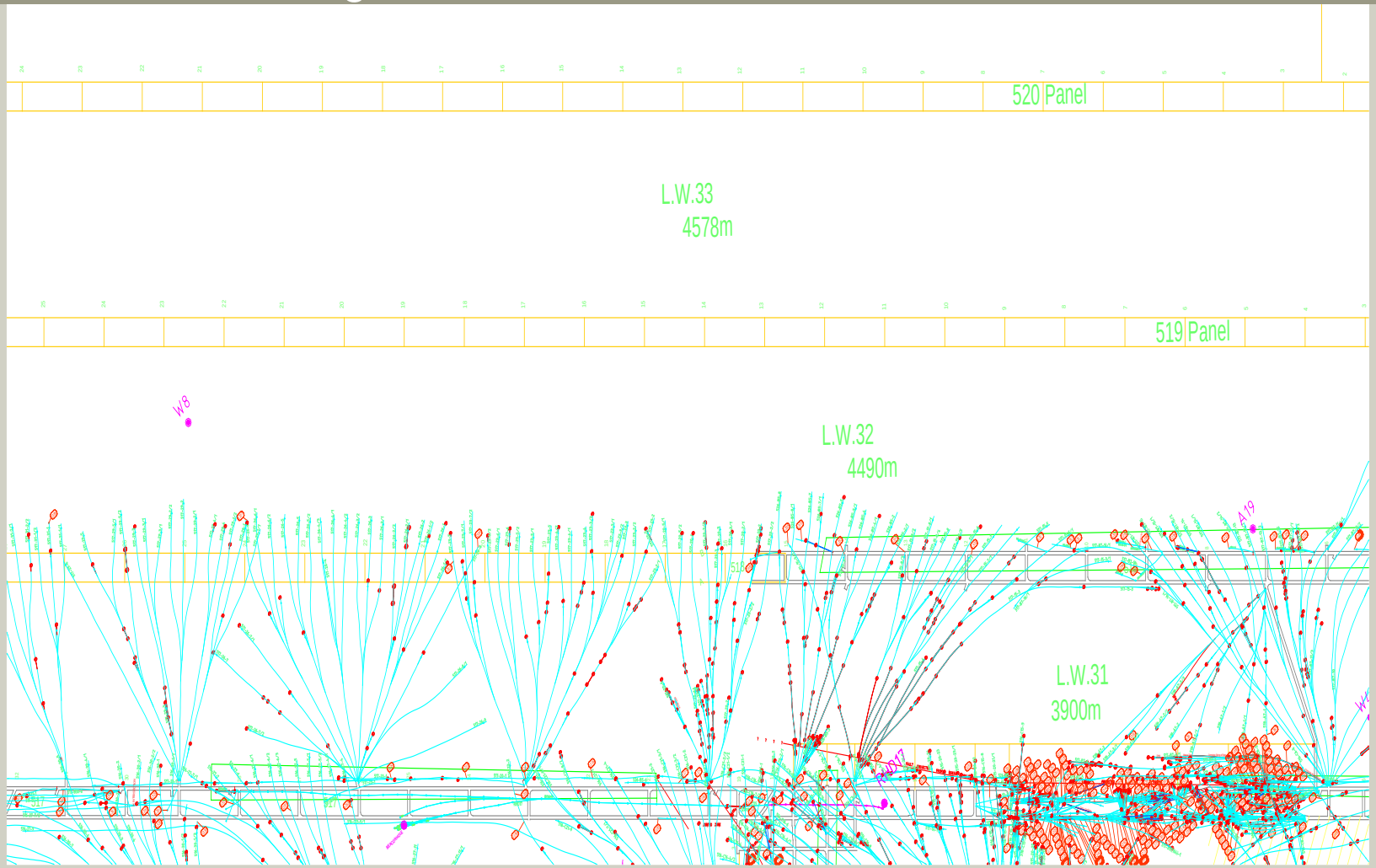
518 Panel Drainage

- 2 heading gate road development -4km
- Potential for intake gas issues if poorly drained
- Gas drainage achieved by fan holes from 517 panel
- Fan holes affected by non development of 517 panel and location of fault
- Harbour bridge drilled to effectively drain 7-13 line
- Drilling required up to 150m of stone drilling to negotiate the fault in LW31 block

518 Panel Drilling



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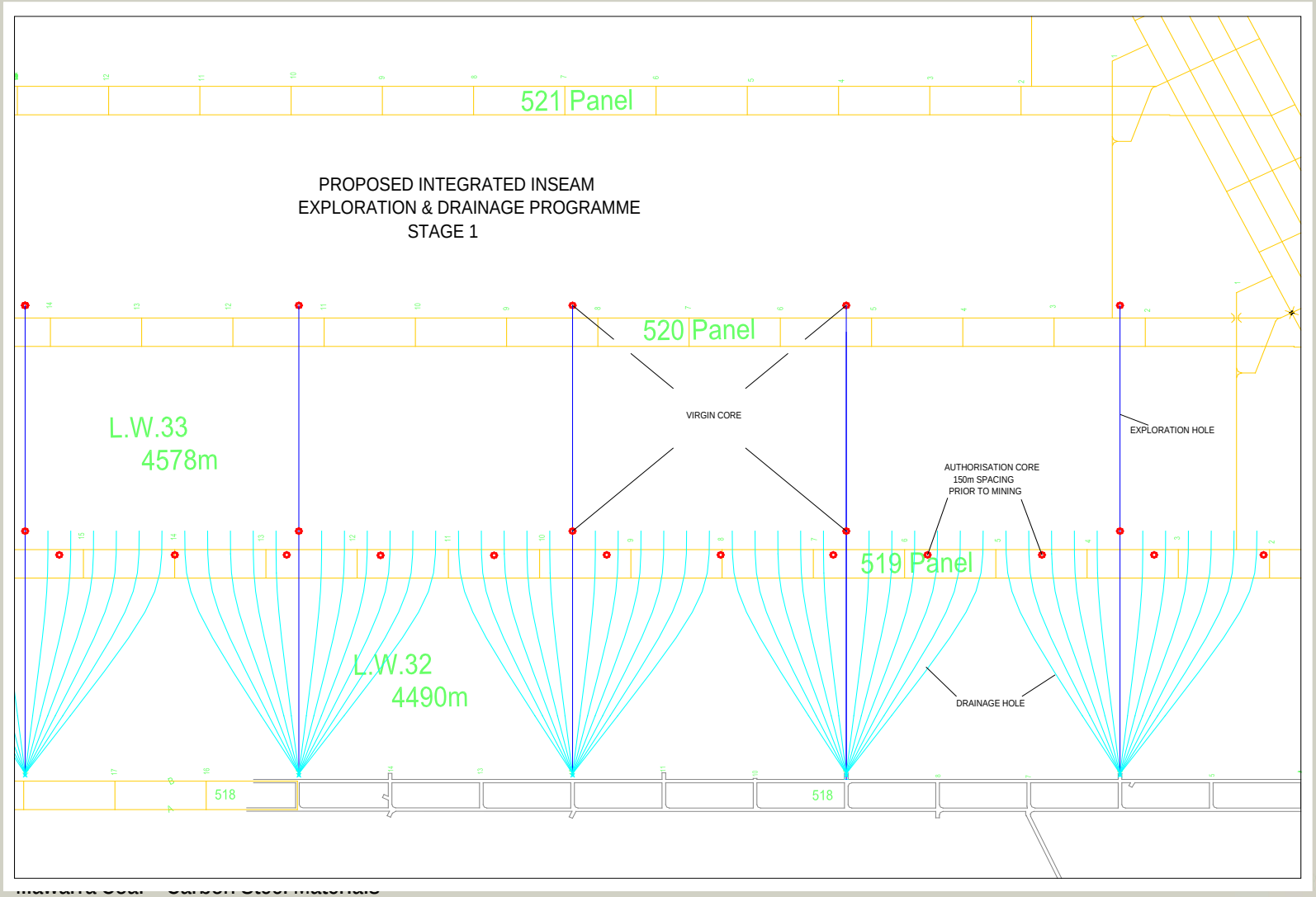
519 Panel and Beyond– “The Ideal”

- Pre-drainage to be achieved by means of either conventional fan holes or by STIS holes
- Operating Excellence Project on Gas Delays to Development
- Project Goals
- No gas delays to development due to seam gas content by June 2006
- 80% confidence we have full knowledge of geology 3 years in advance i.e. 2 longwall blocks
- 95% confidence that we have full knowledge that the gas drainage system is draining gas satisfactorily 1 year in advance of mining

“The Ideal” – Stage 1



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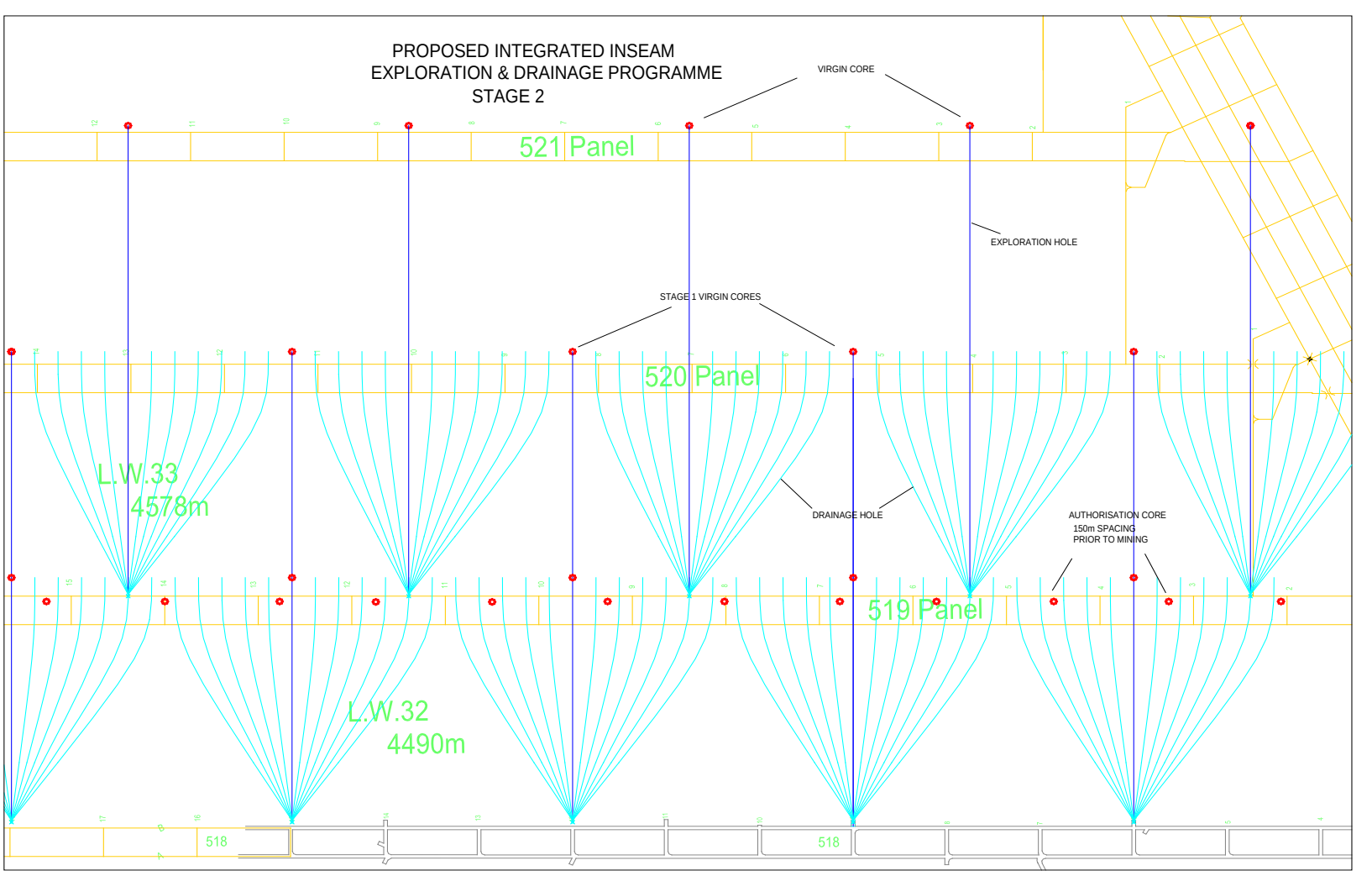
“The Ideal” – Stage 2



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“The Alternative Ideal” – STIS

- Possible expansion of STIS drilling program
- STIS has potential to open up mining areas well in advance of mining
- Issues with STIS holes:-
- STIS holes don’t remove the requirement for underground drilling
- At 500m depth STIS holes can be costly
- STIS holes are not without risk
- For example second leg of STIS3, STIS4
- Potential loss of drilling gear
- Potential issues with underground intersection

Summary

- Ultimately the success of inseam gas drainage lies in removing it from the critical path of mining
- Routine drilling patterns and equipment haven't significantly changed over the last 15 years.
- The appropriate techniques and tools to deal with boggy or difficult to drain areas are still in their infancy, resulting in huge financial impacts to any operation encountering them
- Creative application of gas drainage techniques have been required to achieve threshold gas levels for normal mining at West Cliff Colliery
- The opportunity to remove the geological element of surprise, as well as the interaction between development and drilling, is a major goal that is actively being pursued

The End

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