Other Modelling Examples

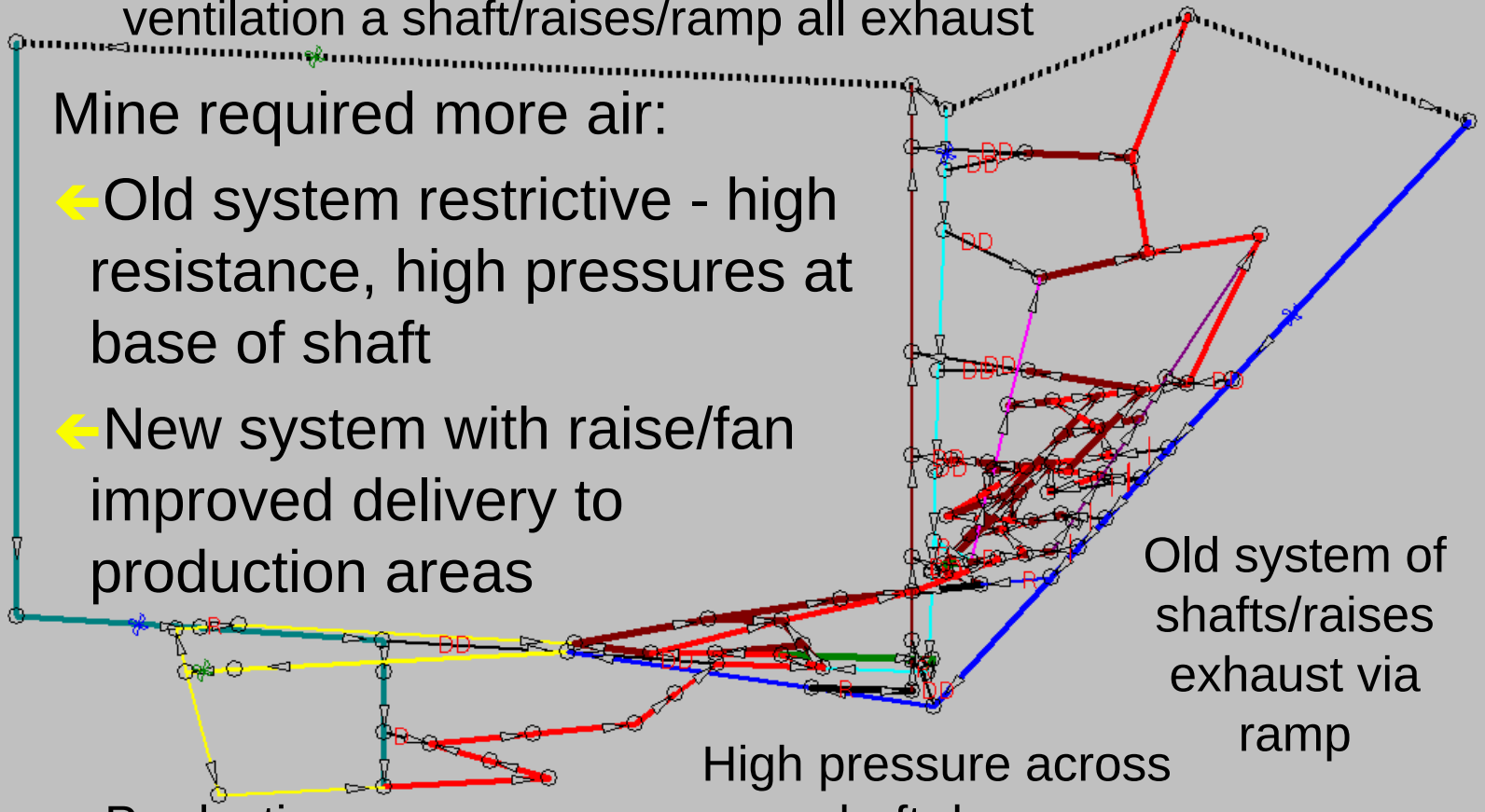
What else should be considered?

Example a - New Raise

New raise system creates “through” ventilation a shaft/raises/ramp all exhaust

Mine required more air:

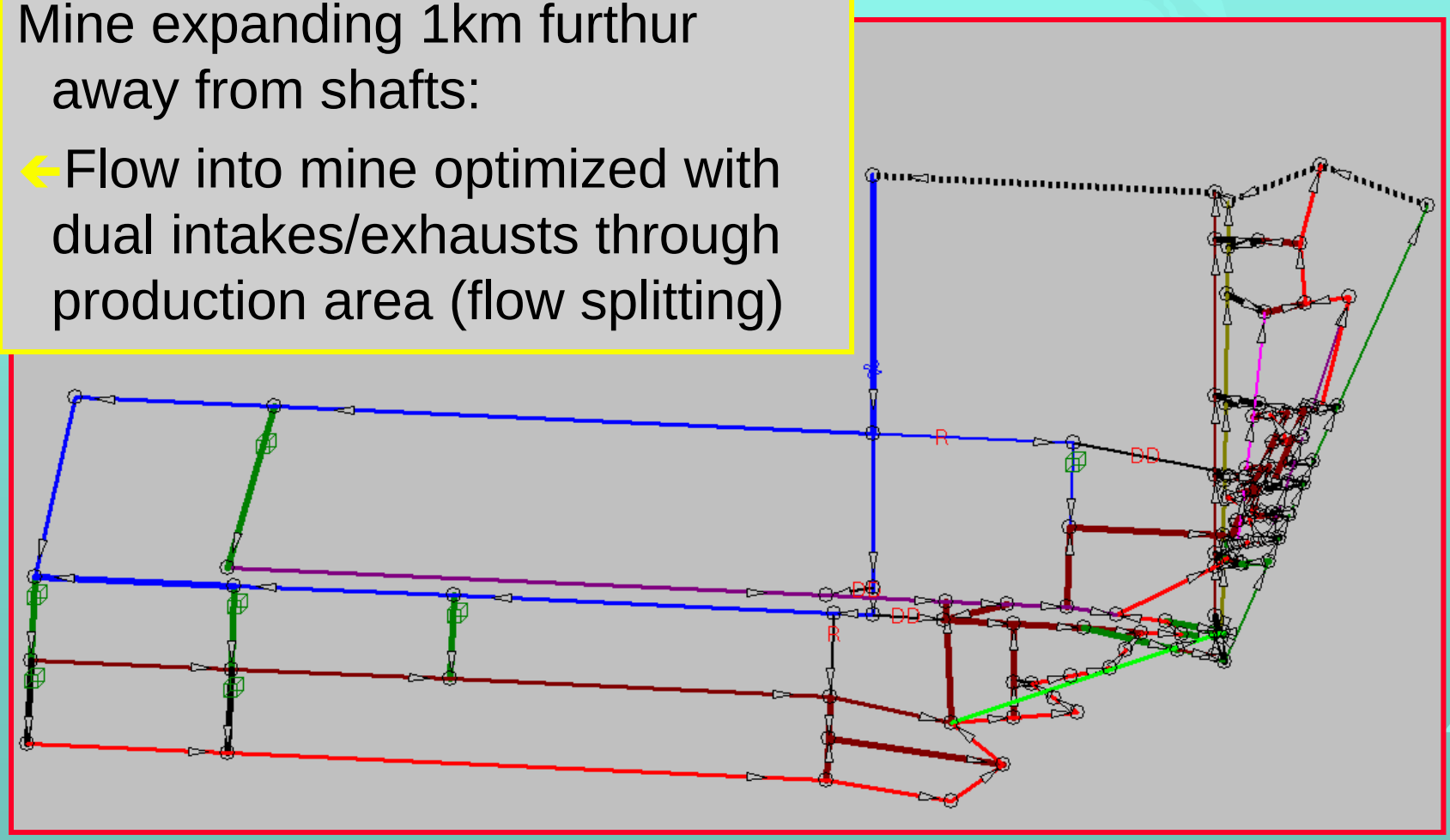
- Old system restrictive - high resistance, high pressures at base of shaft
- New system with raise/fan improved delivery to production areas



Example a - Future (1)

Mine expanding 1km furthur away from shafts:

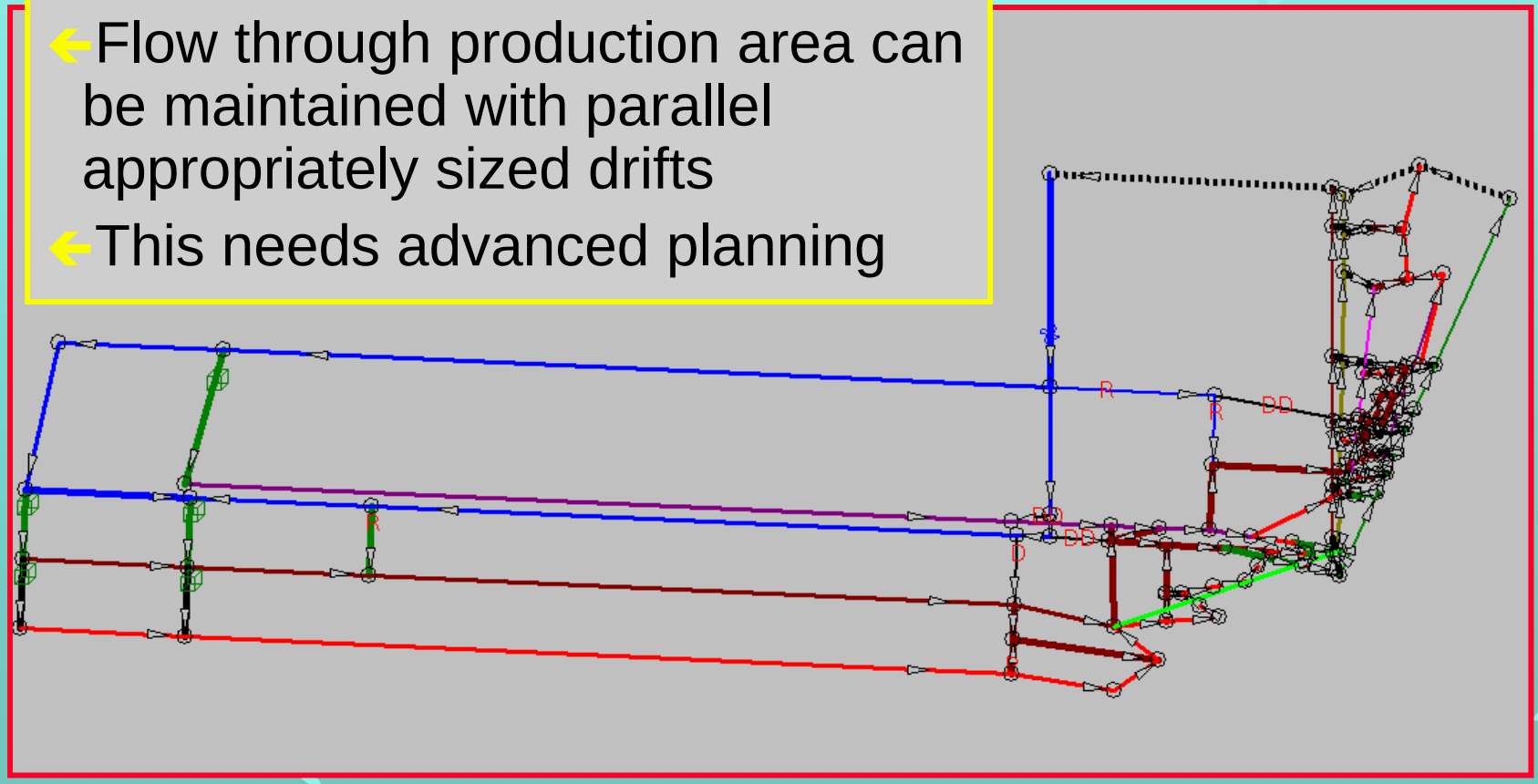
- Flow into mine optimized with dual intakes/exhausts through production area (flow splitting)



Example a - Future (2)

Mining continues 2km away from shafts:

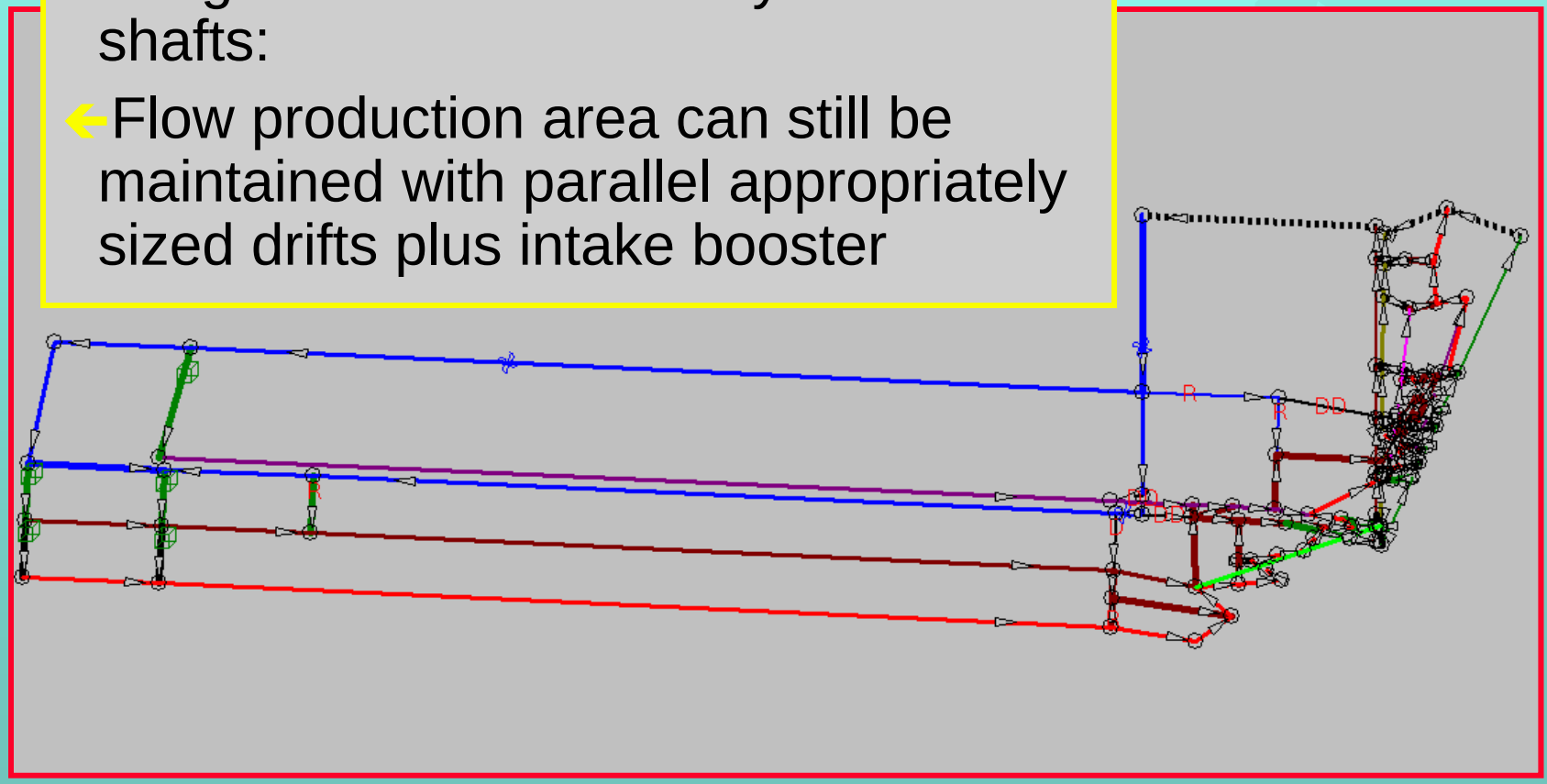
- Flow through production area can be maintained with parallel appropriately sized drifts
- This needs advanced planning



Example a - Future (3)

Mining continues 3km away from shafts:

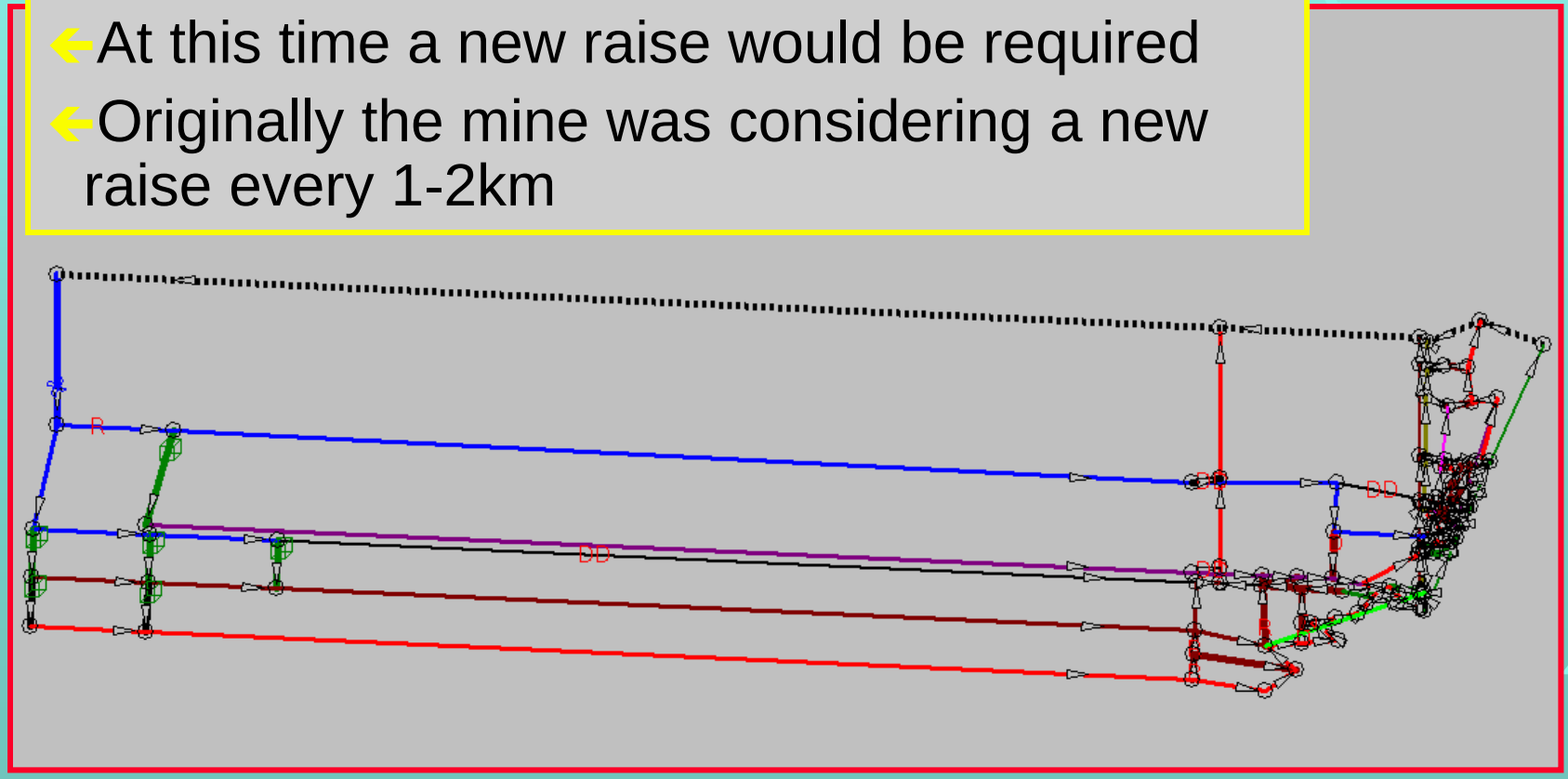
- Flow production area can still be maintained with parallel appropriately sized drifts plus intake booster



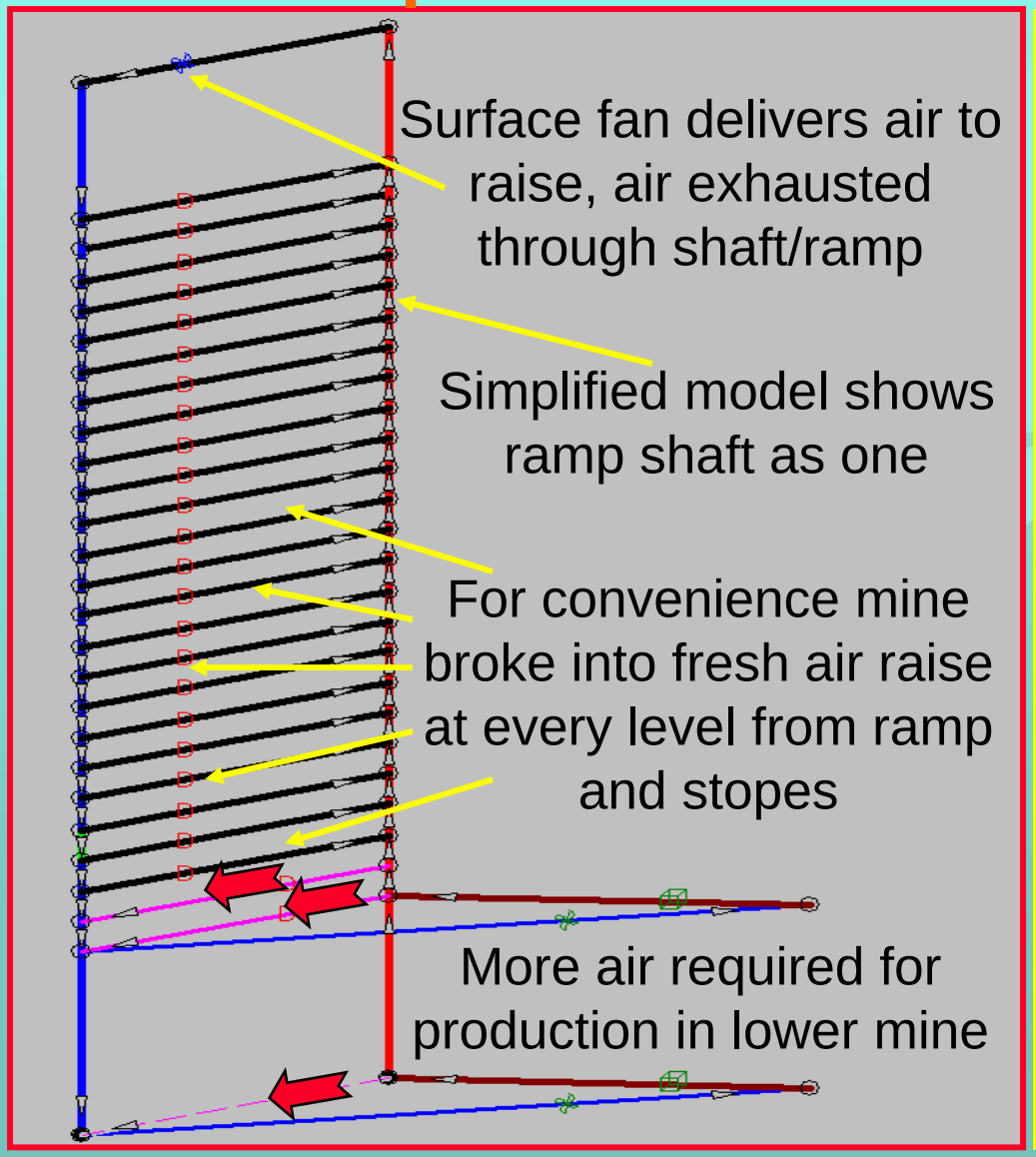
Example a - Future (4)

Mining continues now additional 4km away from shafts:

- At this time a new raise would be required
- Originally the mine was considering a new raise every 1-2km



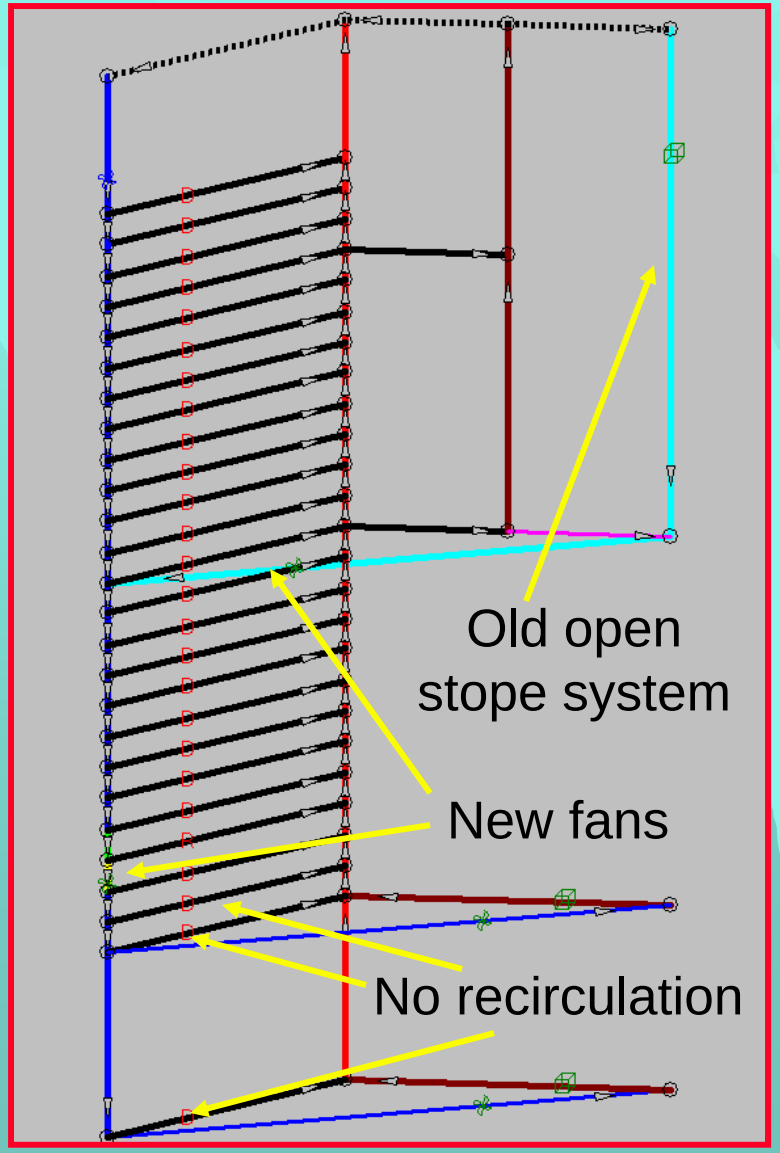
Example b - Existing System



Mine required more air at bottom:

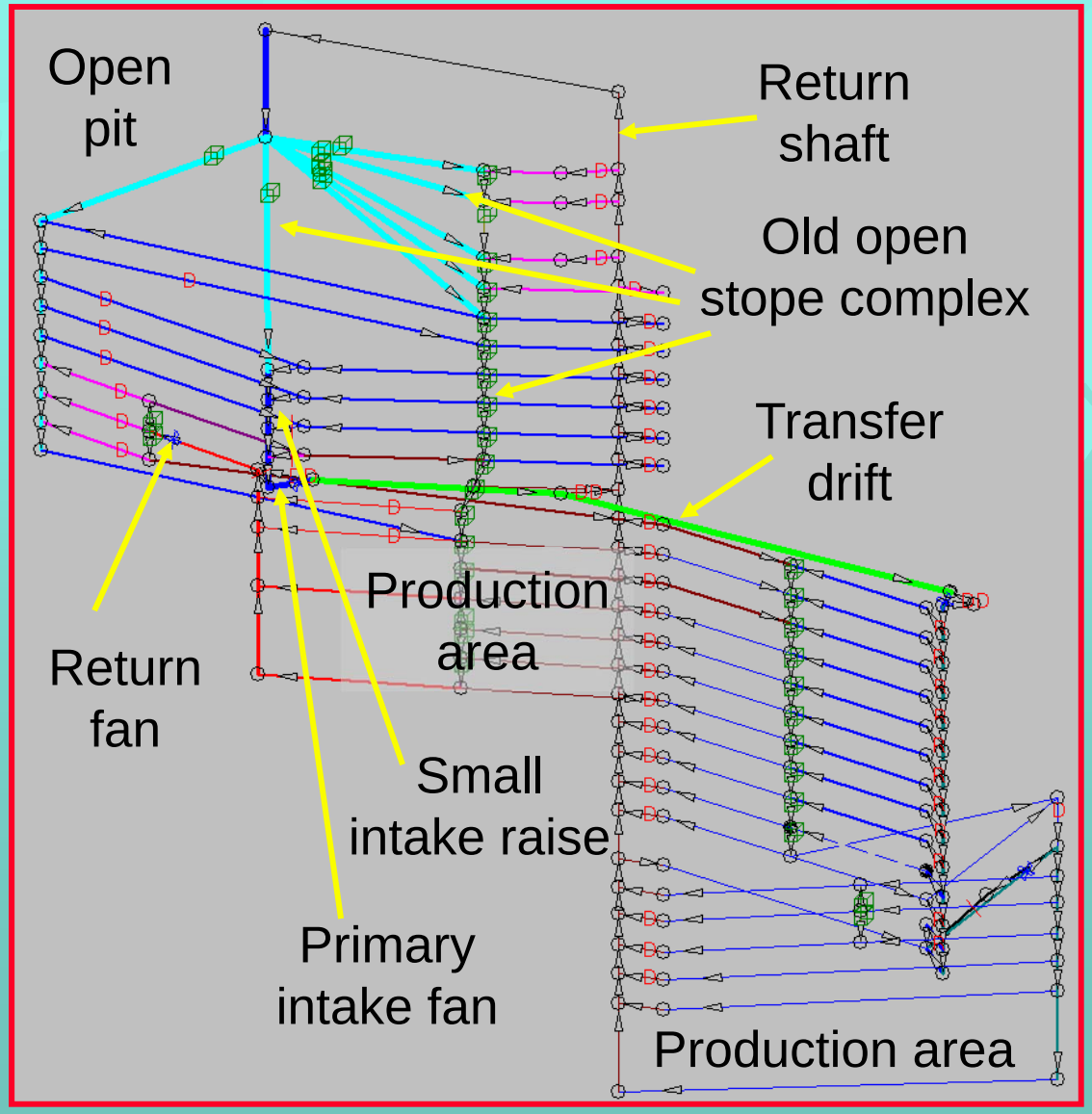
- Relatively inefficient system due to the 23x2 breakthroughs above (<50%)
- Stope bulkheads could not be accessed - other side of open raise
- Fans in bulkheads drawing from lower raise cause recirculation - fire risk

Example b - Options



- Increasing surface fan delivery through existing system of limited use due 46 uncontrollable leakages
- Mine could get more air by drawing through old open stope with an underground booster plus another booster in raise system
- These fans pressurize lower mine eliminating fire risk
- System efficiency increased to 65%

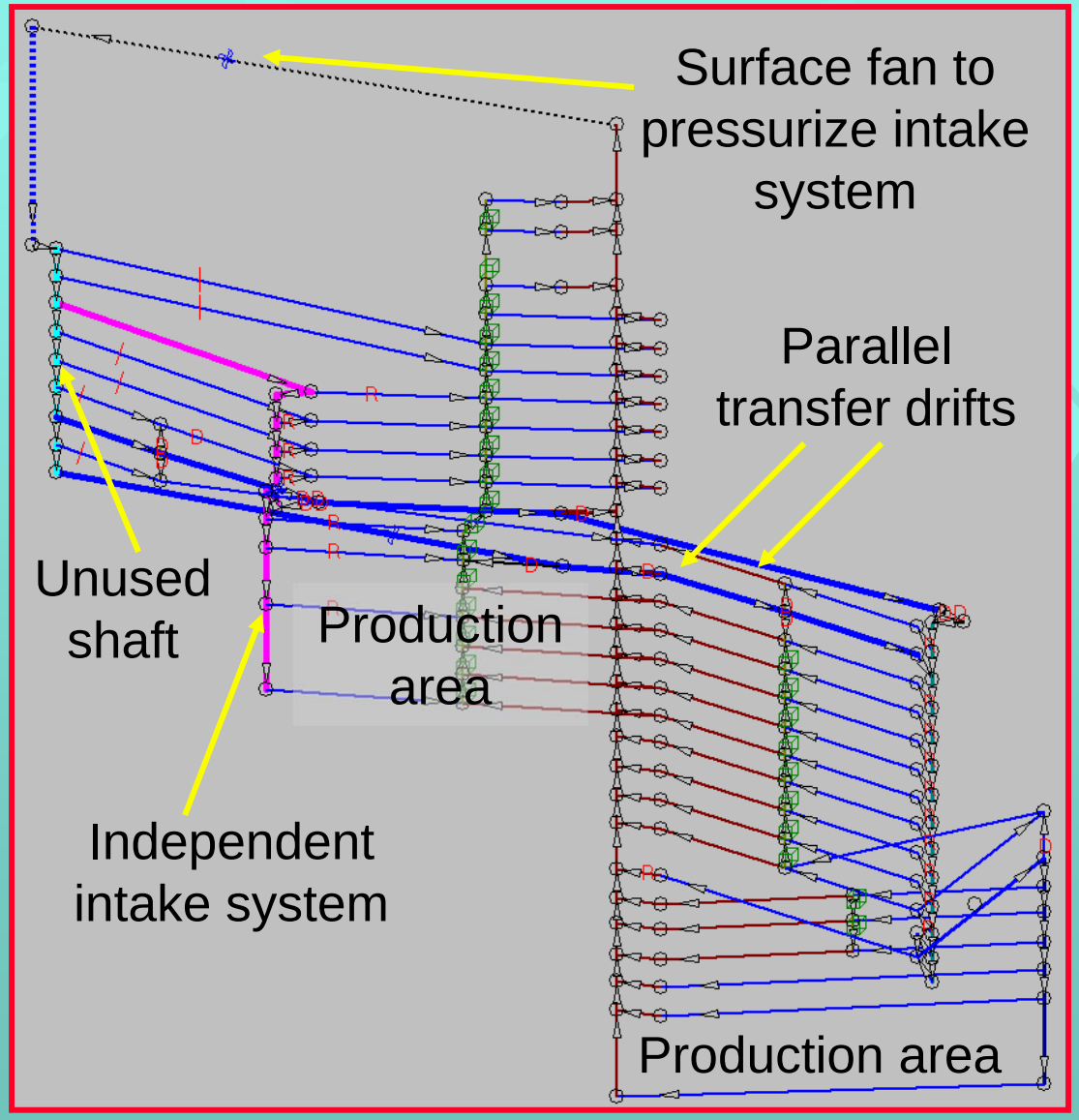
Example c - Original



Mine required more air at bottom:

- Underground primary intake draws air from surface, open pit and exhaust shaft (recirculation)
- Air drawn through tight timbered raise and sent across >1km transfer drift
- Exhaust system also creates recirculation
- Protracted blast clearance times

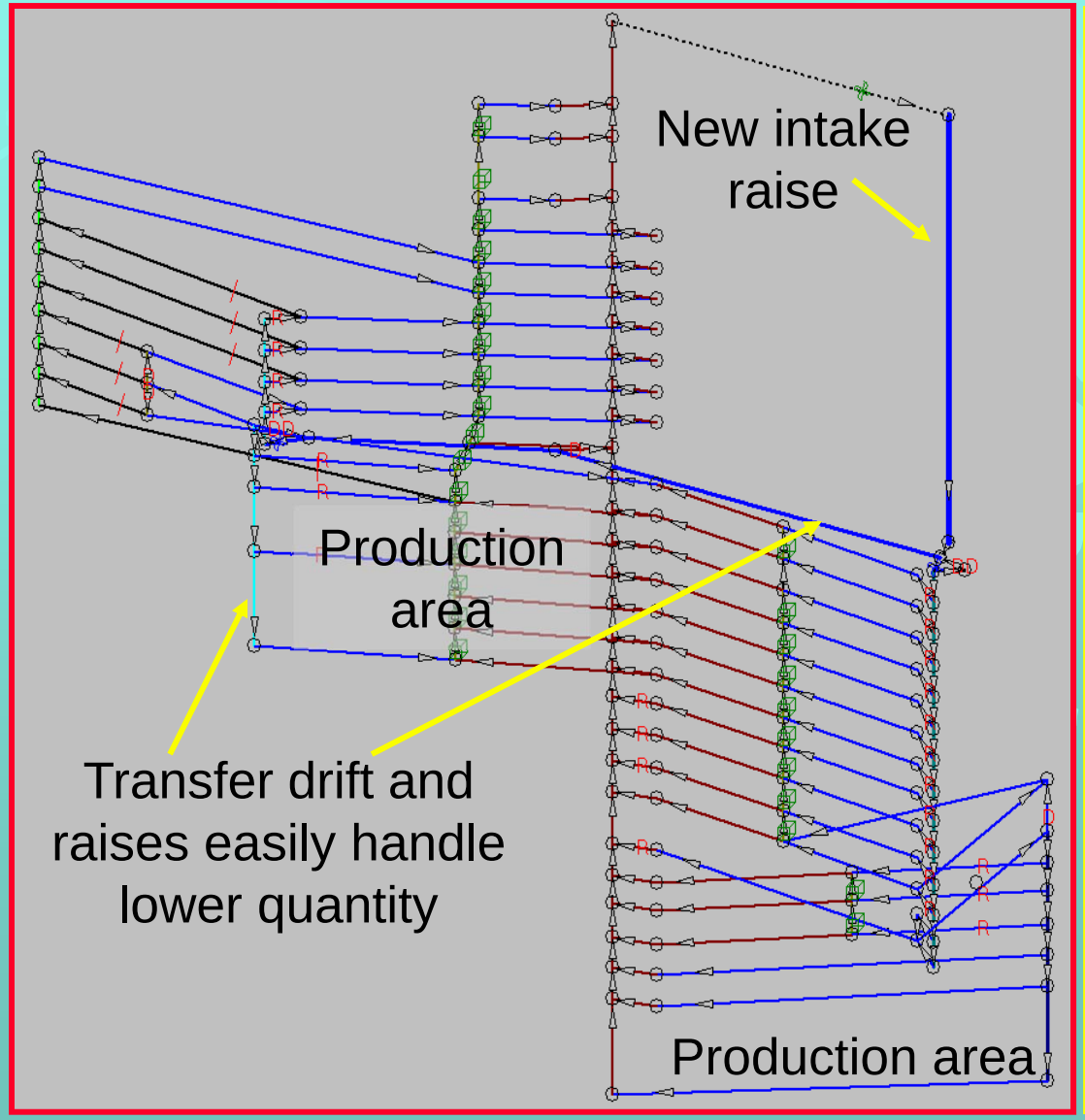
Example c - Option



- Use redundant large shaft instead of tight raise for primary intake
- Split off upper mine intake through tight raises
- Use parallel transfer drift across mine

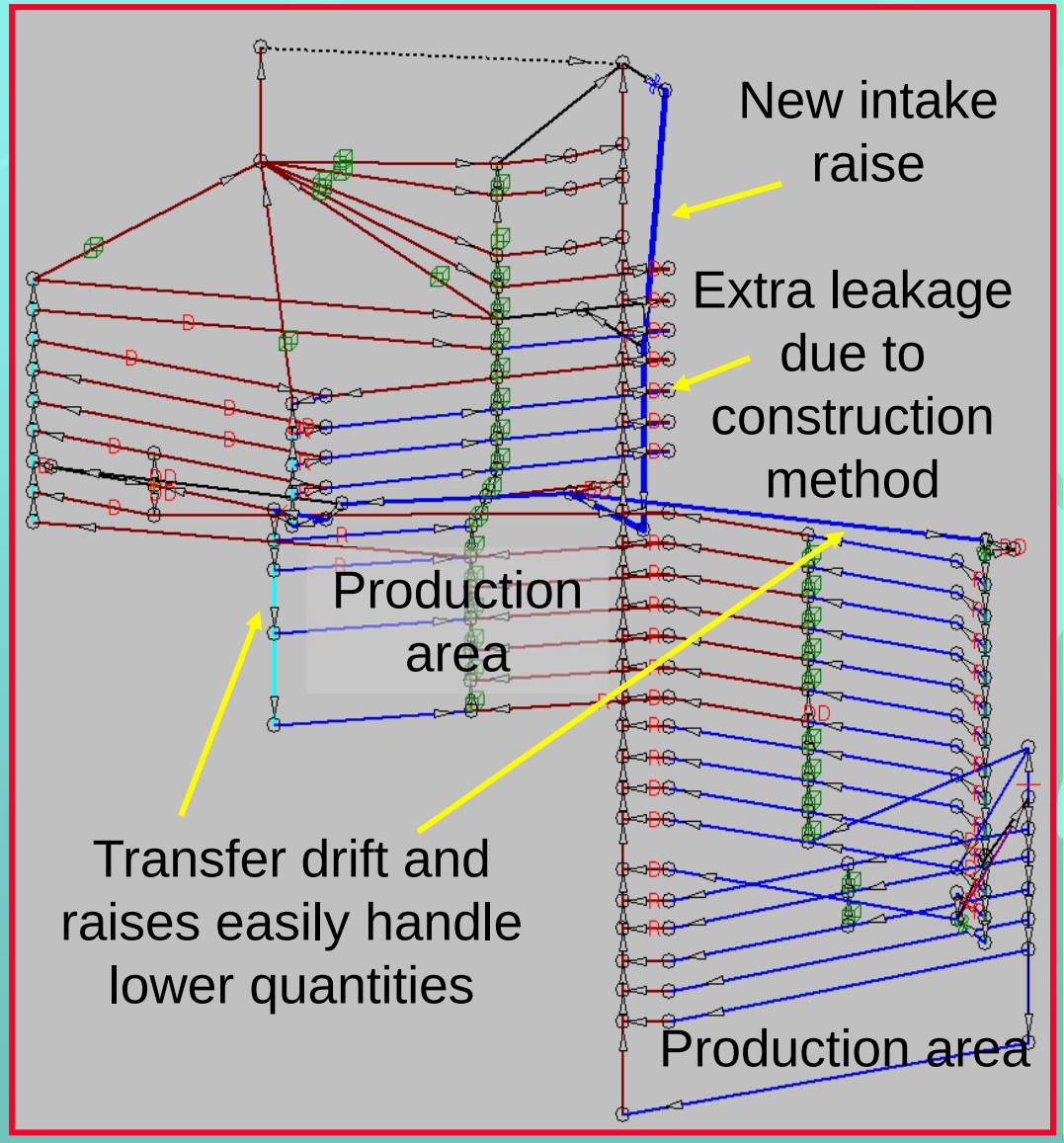
Not feasible - no way to get air to top of old shaft - needed for water storage - timber drying out problem

Example c - Proposed



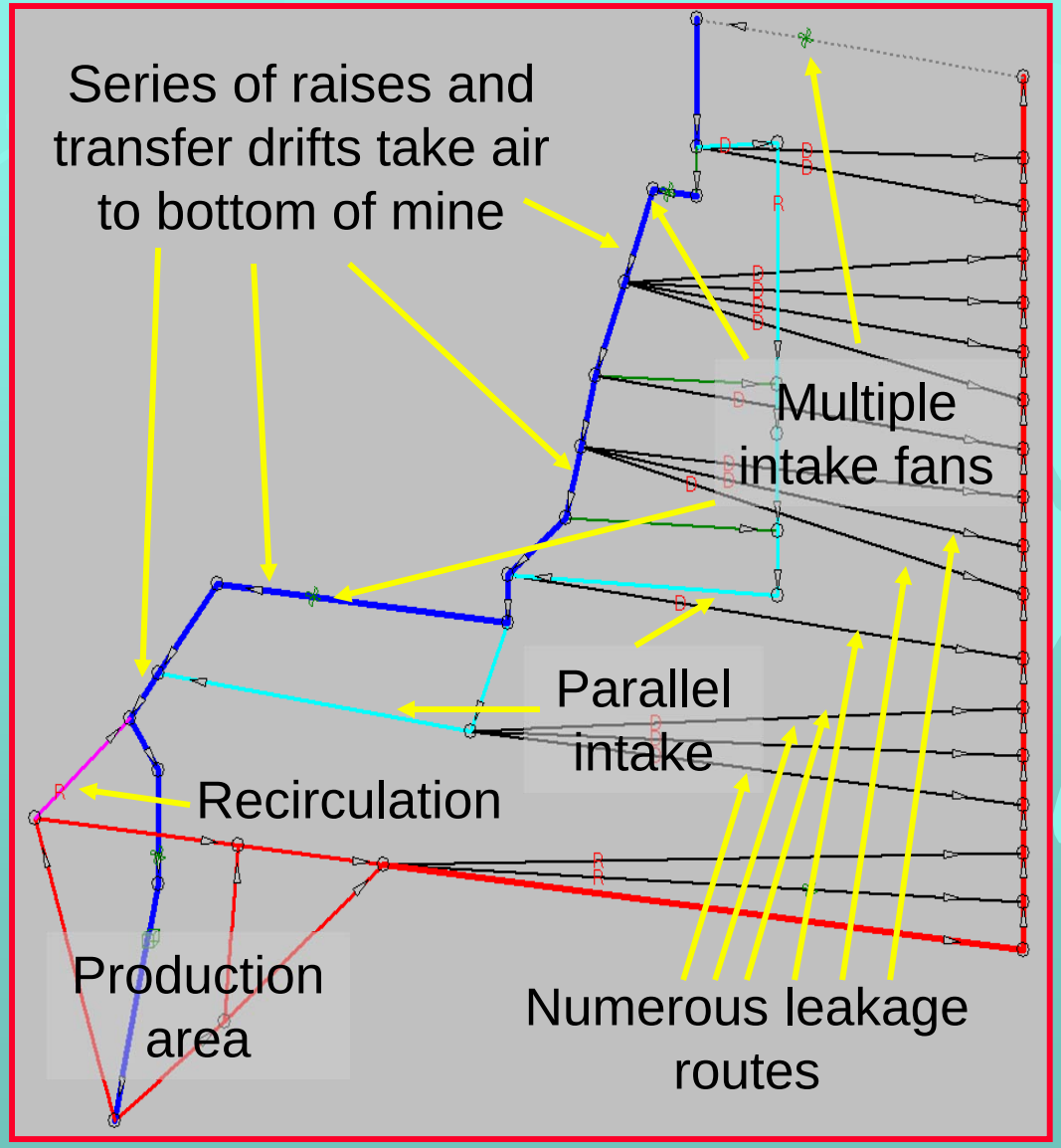
- New fan/intake raise avoids high resistance timbered raise and long transfer
- Transfer drift and old raises used to deliver smaller upper production area need
- System is pressurized
- No recirculation
- Better clearance
- Cheaper system to run for more air

Example c - Final



- New fan/intake raise close to shaft for potential heat recovery option
- Flow splits in both directions on transfer drift
- Old small raises deliver air upper production area
- System is pressurized
- No recirculation
- Good clearance
- Slightly more costly than Proposed system

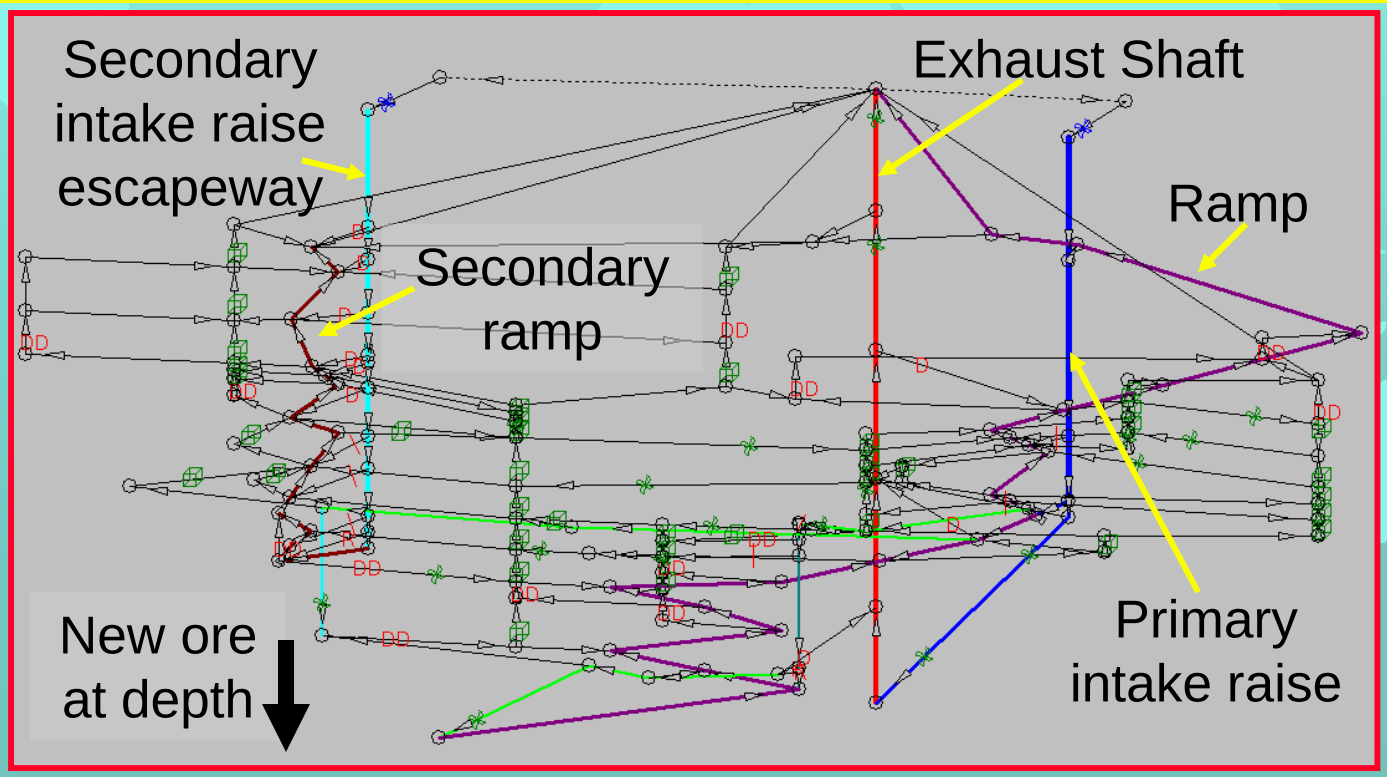
Example d - Initial



- Four fans in series along mine intake route needed to get the air to the bottom
- Leakage routes uncontrollable - old inaccessible stopes
- All fans would have to be upgraded to avoid recirculation
- Bottom fan too large, causes recirculation
- System shows history of “poor” management - needs major overhaul

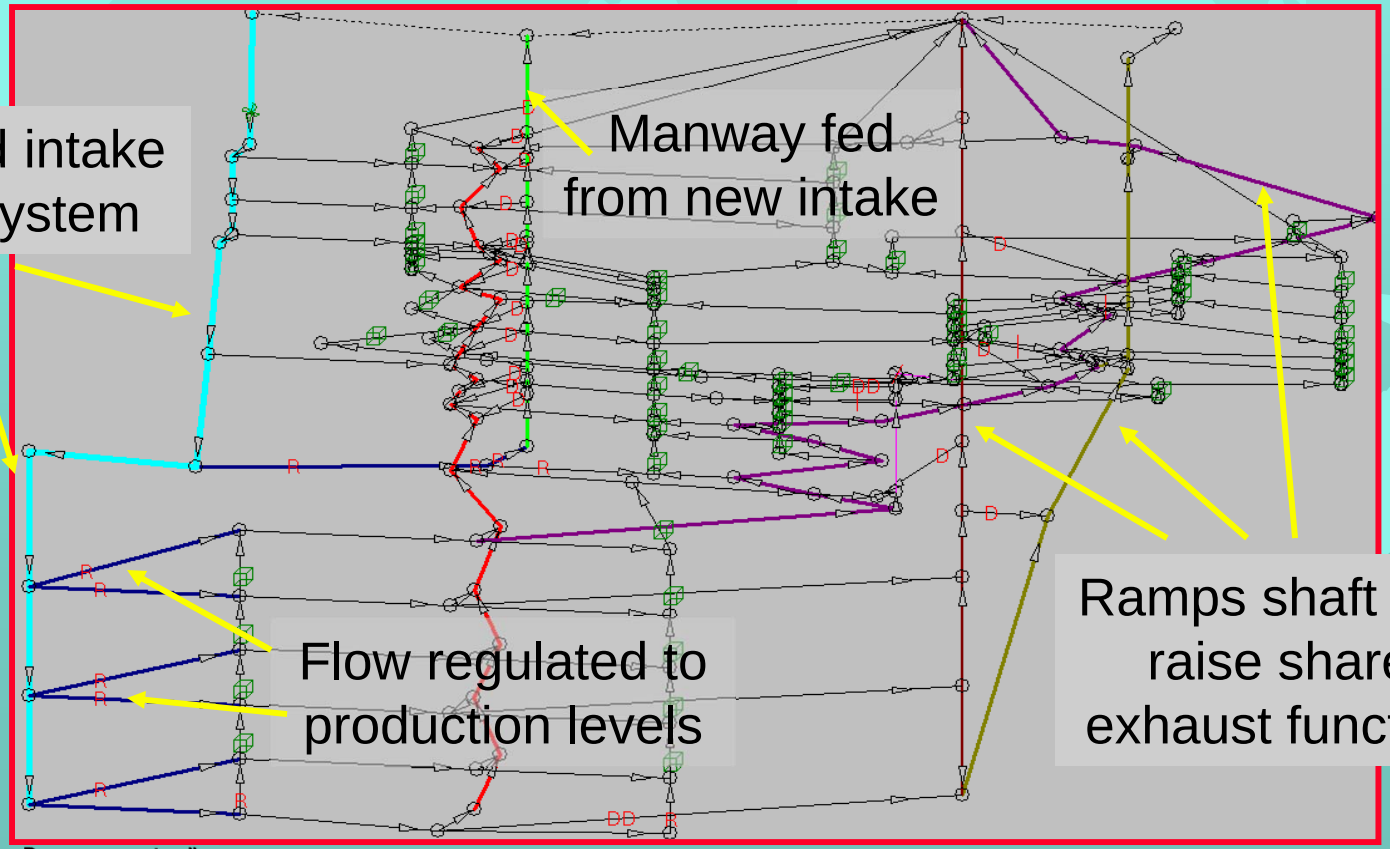
Example e - Initial

- Large wide mine - primary and secondary intake raises, exhausts via central shaft and ramp - needs more air at depth
- Production areas fed from ramp, air returns to ramp, gradual increase in contamination - lots of boreholes and auxiliaries
- Considering new central air raise



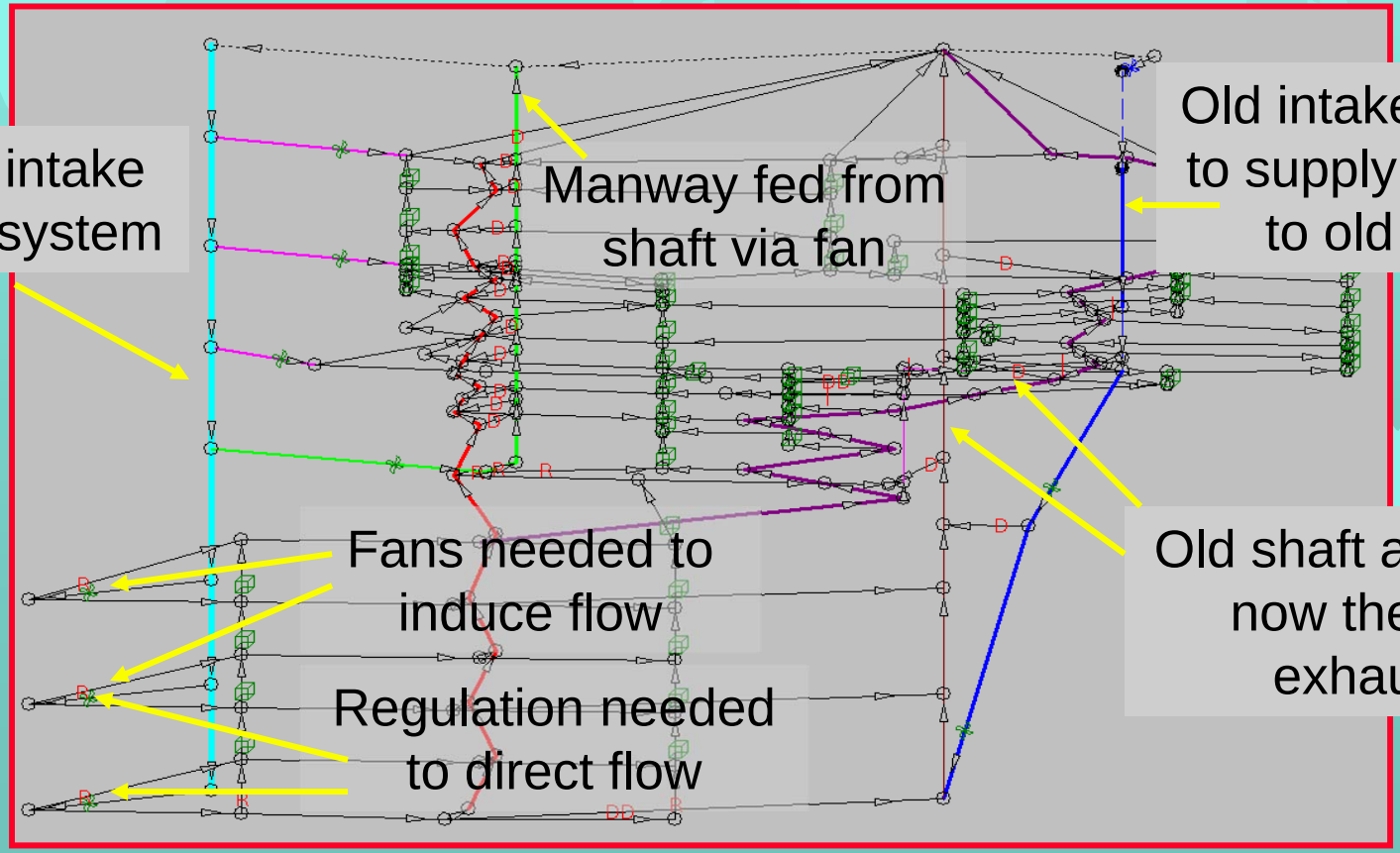
Example e - Recommended

- Proposed new location for bottom mine raise at boundary with single surface fan installation and creating “through” ventilation - all old mine now “exhaust” air except escape manway
- All production levels single pass air - lots of auxiliaries/ducting now redundant



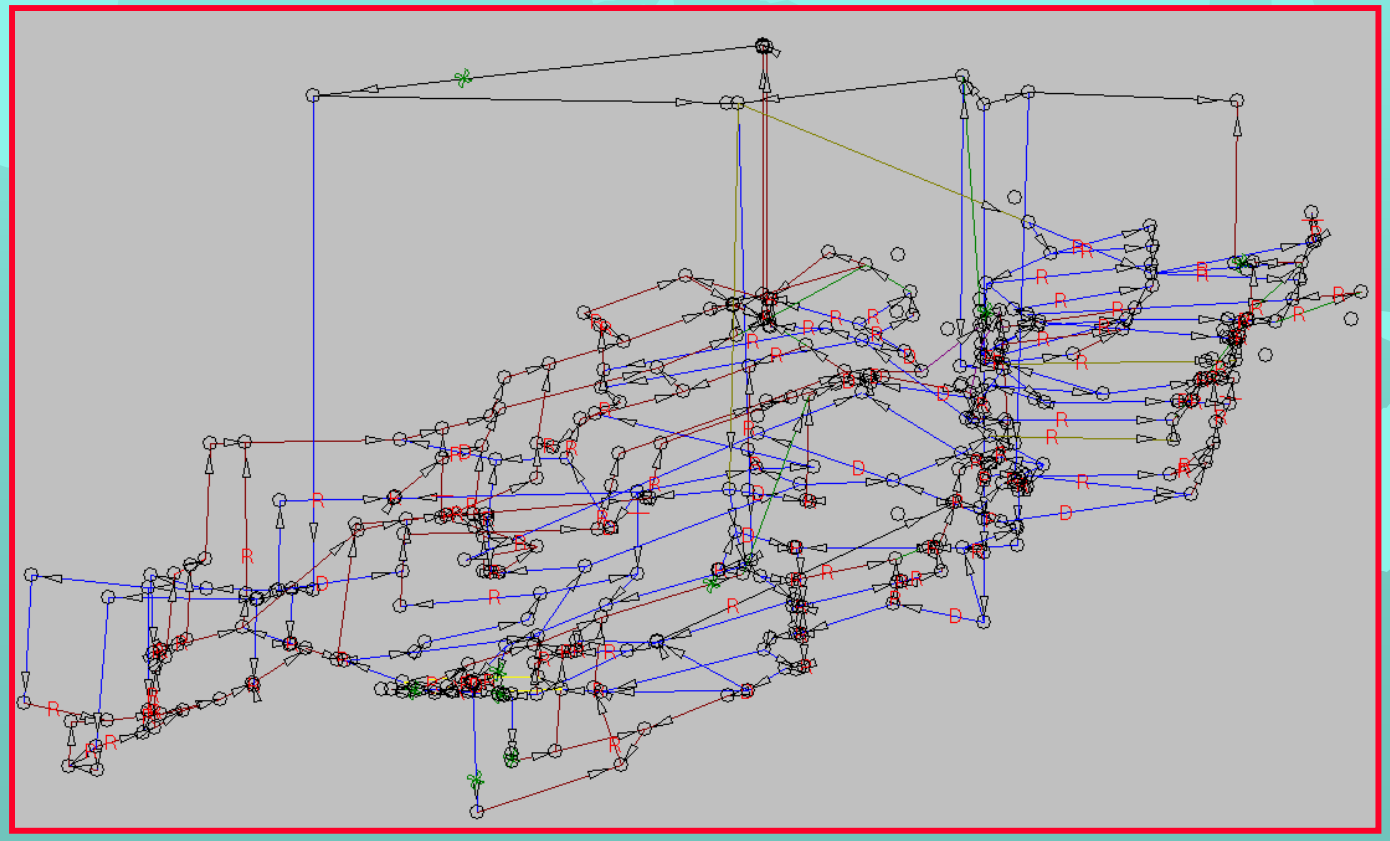
Example e - Considering

- New shaft option for production purposes requires fans on every level - harder to control - more infrastructure
- Old shaft also required independent fresh air - manway pressurized from new shaft



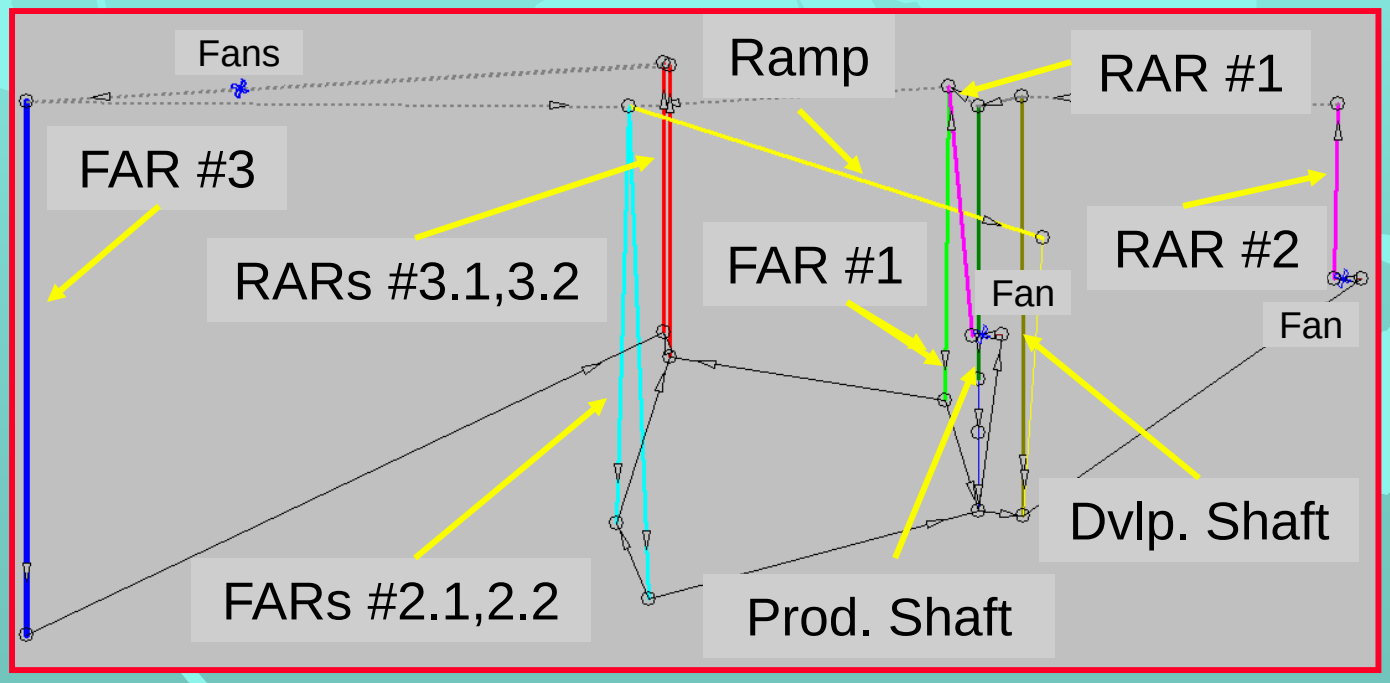
Example f - Initial

- By now you should have noticed the majority of the models used for planning are very simple
- This is an example of a mine with most of its branches included - try finding “cause and effect” here - keep models simple



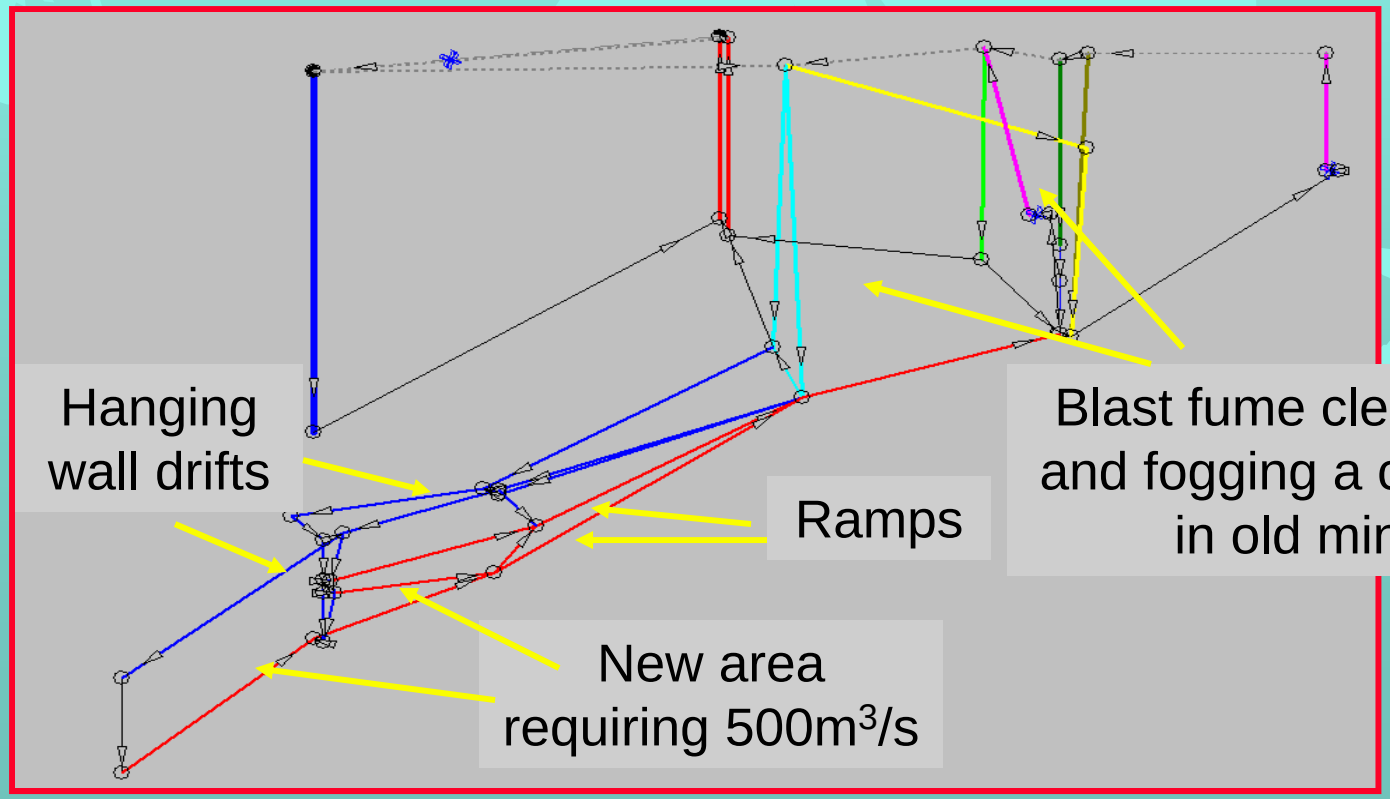
Example f - Simplified

- This is the same network simplified to the basic structure which was adequate to plan an expansion of the mine
- In this model the connections between the intakes and exhausts are composite airways - the resistances derived from the flows and pressure differences



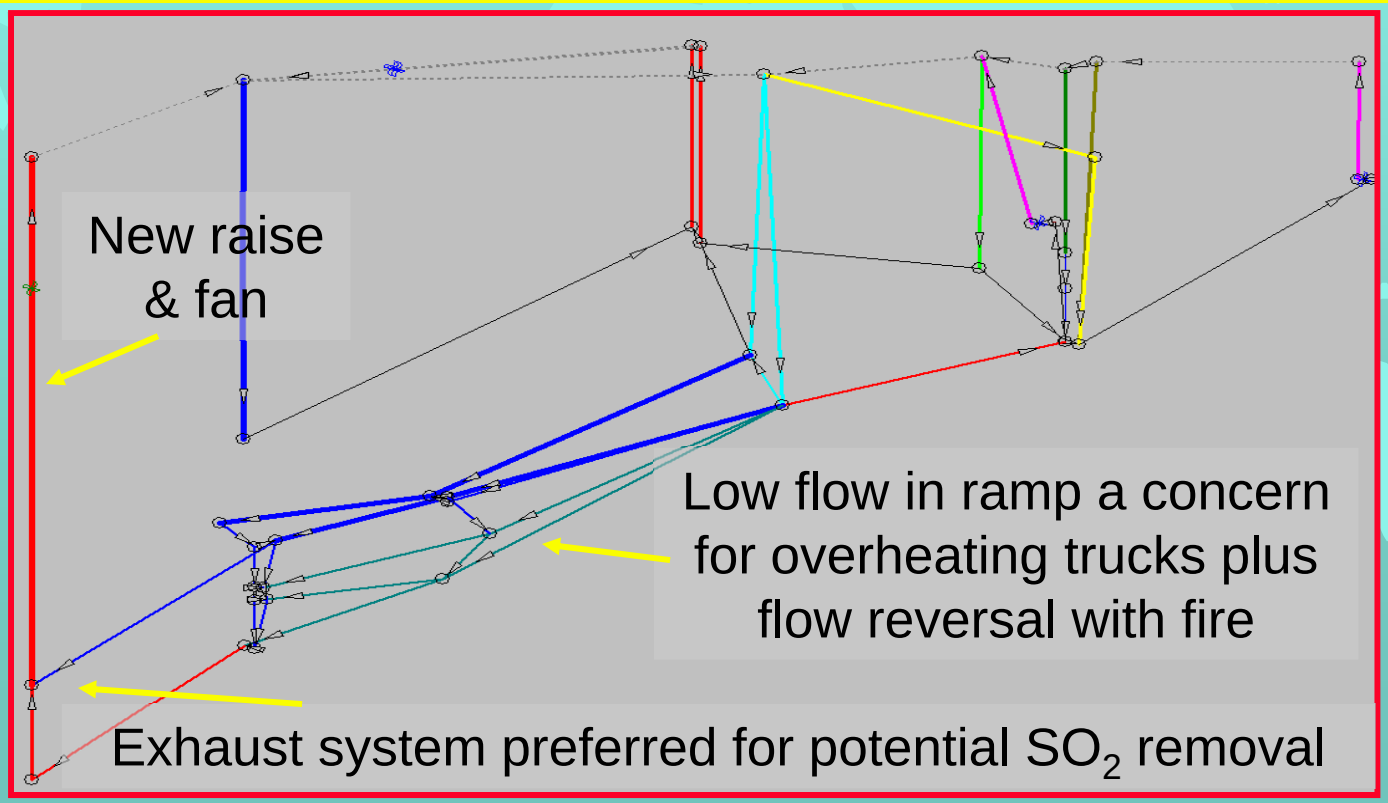
Example f - First Try

- Mine extending deeper and away from existing surface connections - needed additional 500m^3/s for scoops and trucks
- Wanted to deliver fresh air through hanging walls - returning up ramp to be exhausted out old mine
- Not really possible as velocities >16m/s would be needed



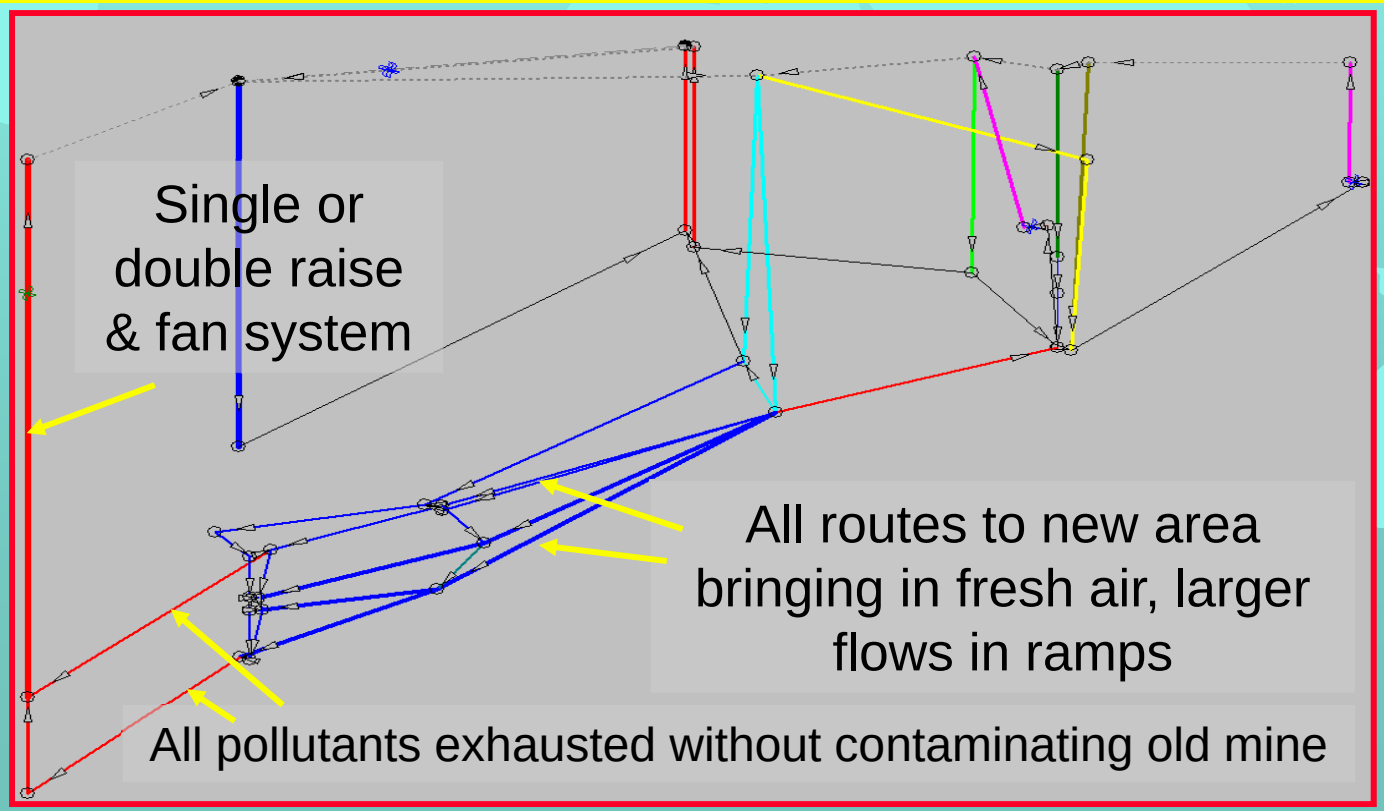
Example f - Second Try

- An analysis of the surface connections showed the mine was short of exhaust capacity - needs new exhaust raise/fan system
- Wanted to deliver most of the fresh air through hanging walls - with low flow in ramp
- Velocities still a concern plus low flows in ramp with large trucks

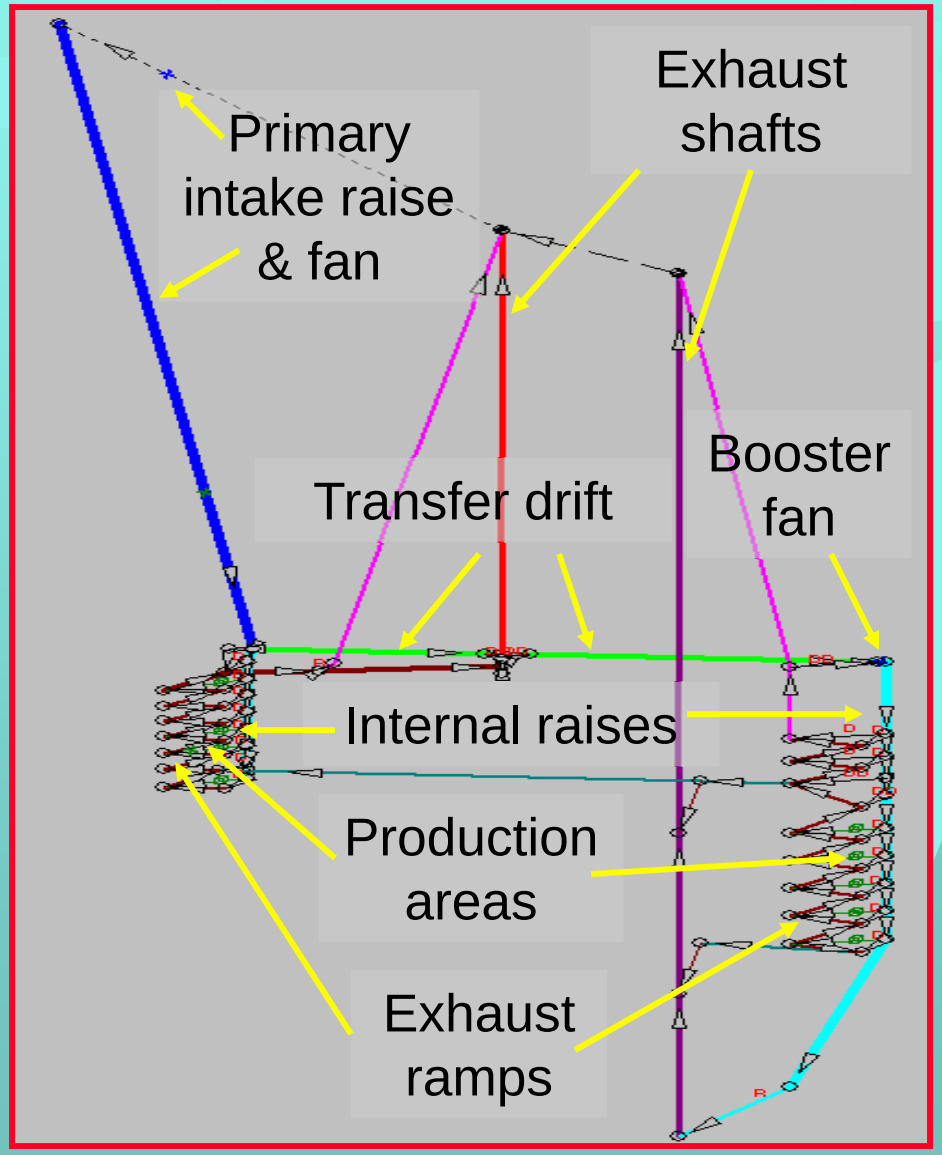


Example f - Final Proposed

- Flow to new area should be split between hanging walls and ramp (decline)
- Mine had to move away from “dedicated” fresh air to every workplace and recognize diesels in ramp required air
- Ramps, due to size, were best route to deliver air.

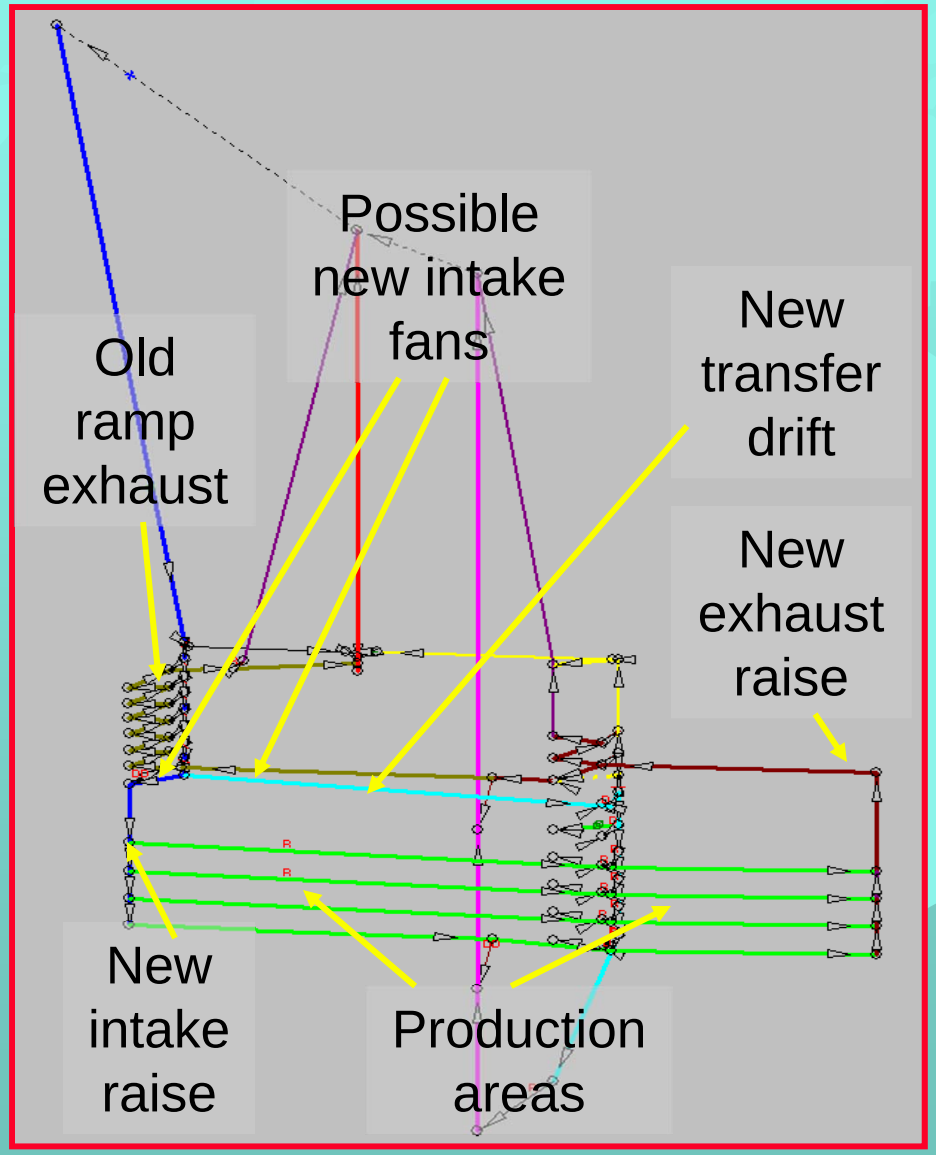


Example g - Initial



- Mine has single intake raise, flow splits to two internal raises, one via transfer drift. Air exhausts via ramps and shafts
- Mine will need more air at depth
- Transfer drift currently needs booster due to size
- Production decision - drift was never increased from small exploration dimensions

Example g - Proposed



- Transfer drift replaced with regular sized production drift lower in mine
- Intake flow still split in two directions
- May need boosters to overcome resistance of old raise
- Upper ramp still needed for exhaust to second shaft
- New intake/exhaust raises required at each end of lower ore zone
- Through ventilation created across levels