Underground: The Future of Coal Mining in Western Canada?

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Why go underground

Increasing strip ratios

Habitat disturbance

Long term remediation costs

GHG constraints

Obligatory Disclaimer

The views expressed in this presentation are my own and may not represent the views of my employer

Firstly, a little about DMT Geosciences Ltd.

Overview

Coke Testing

“SAFEGUARD” Monitoring

Coal Bed Methane (GHG)

DMT Geosciences Limited

Part of the DMT group of companies offering a wide range of mining and geophysics consulting, geotechnical and environmental monitoring and EPC/EPCM services across the mining, petroleum and civil tunneling industries.

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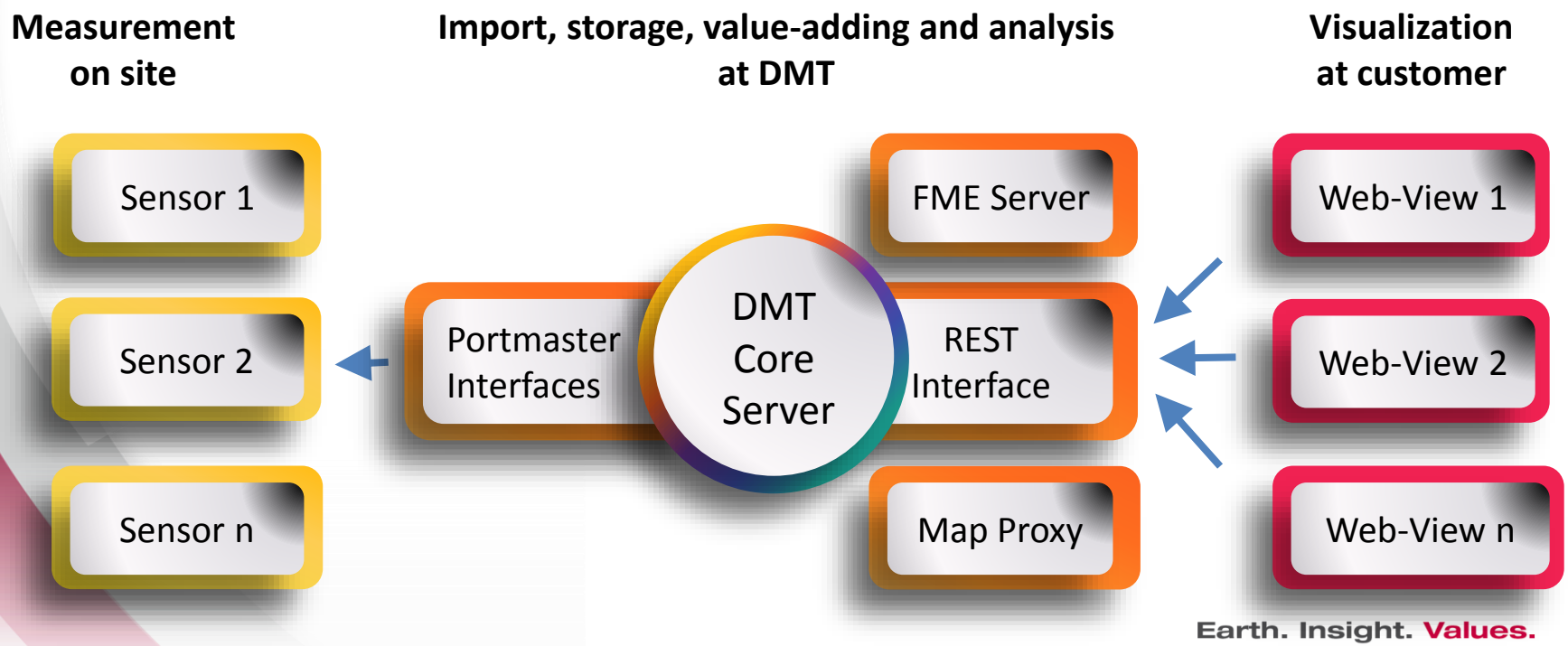
The group has offices and professional staff located in Canada, UK, Germany, Australia, South Africa, India, Indonesia and Russia, with most employees based in Essen, Germany.

Coke Testing Services

Moveable wall oven
1 m x 1.3 m x 450 to 500 mm
500 to 800 kg charge

SAFEGUARD - the IoT Monitoring Sensor Platform

- **Managed service for data processing and geoinformation**
- **Sensor integration, connectivity, IOT sensor hub, dashboard display, smart analysis**
- **Industry 4.0 in construction and infrastructure, industry and mining**



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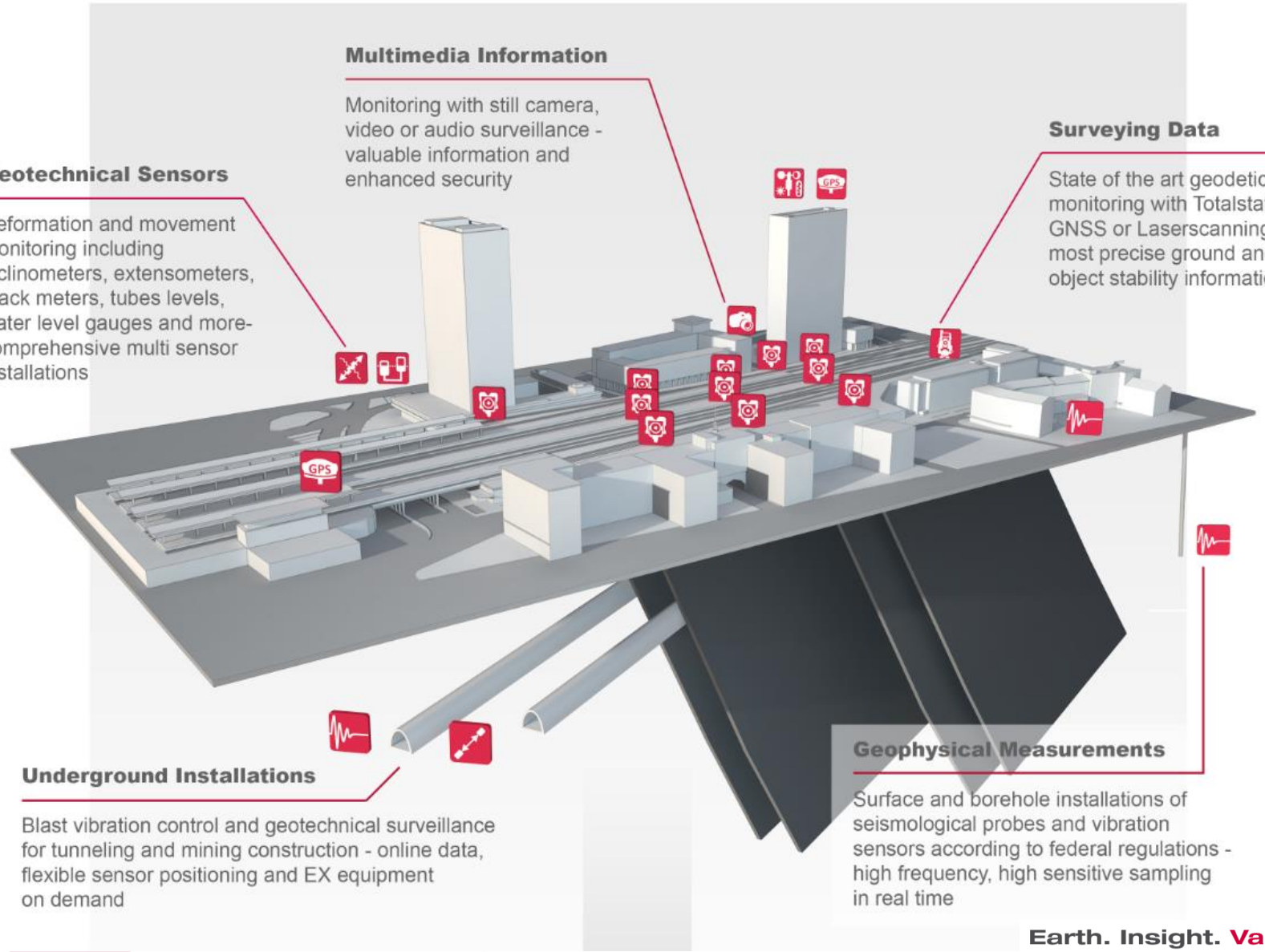

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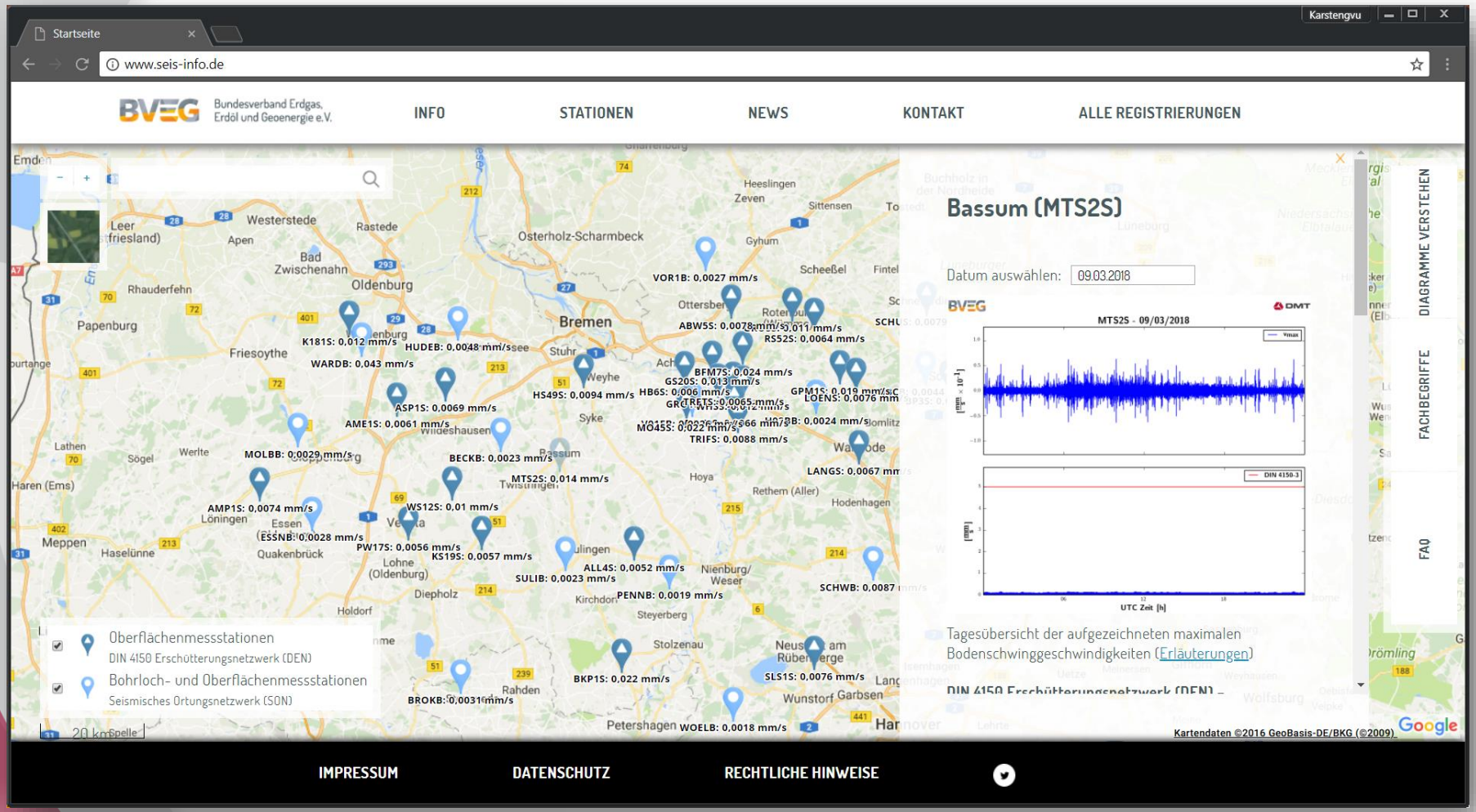
An example of the use of “Safeguard” can be found here:

http://www.seis-info.de/



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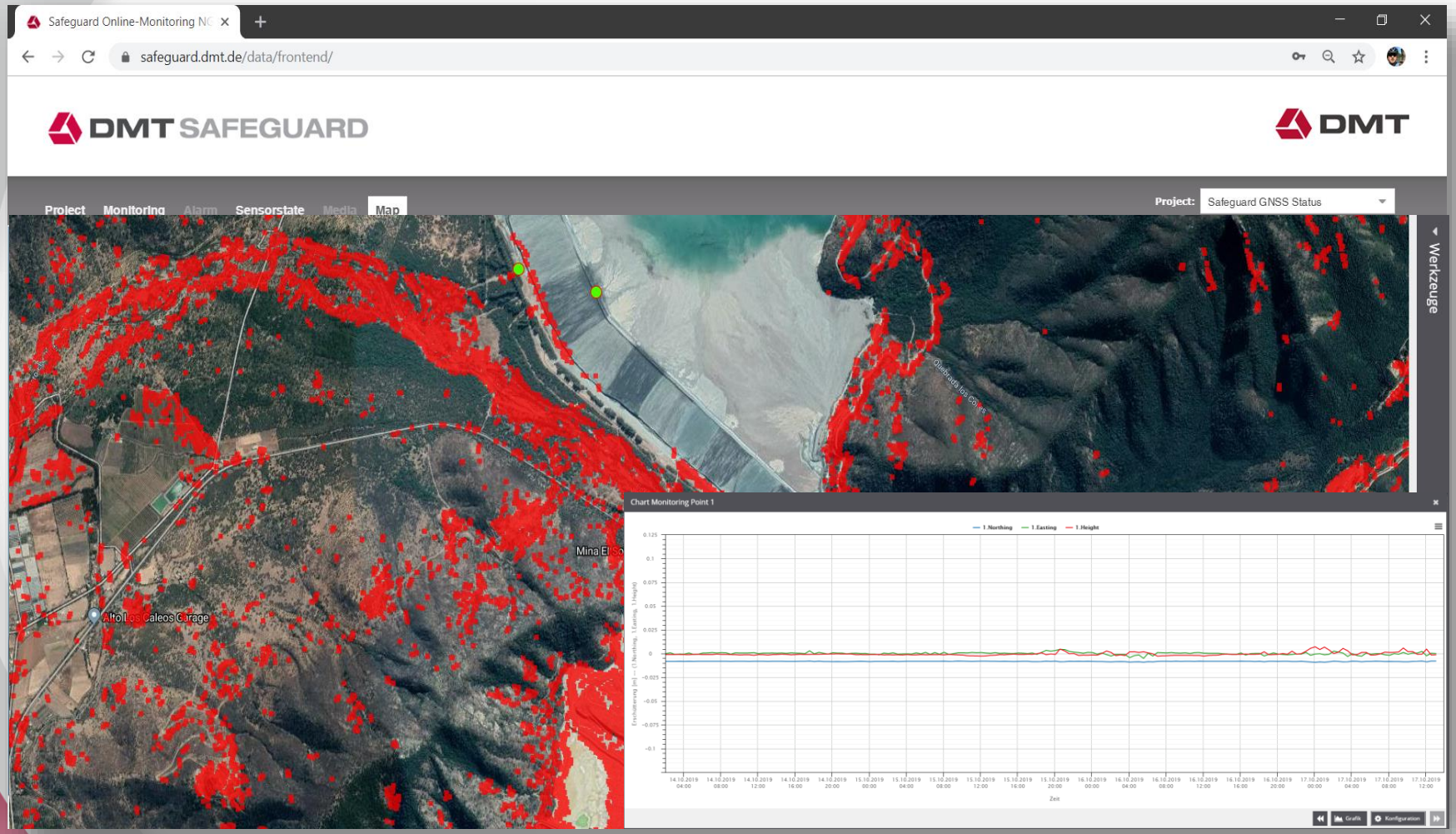

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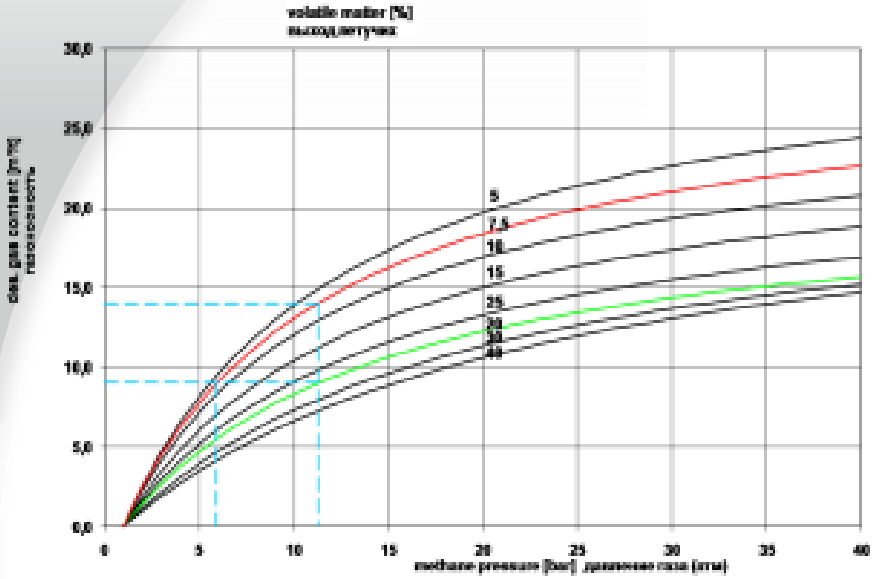
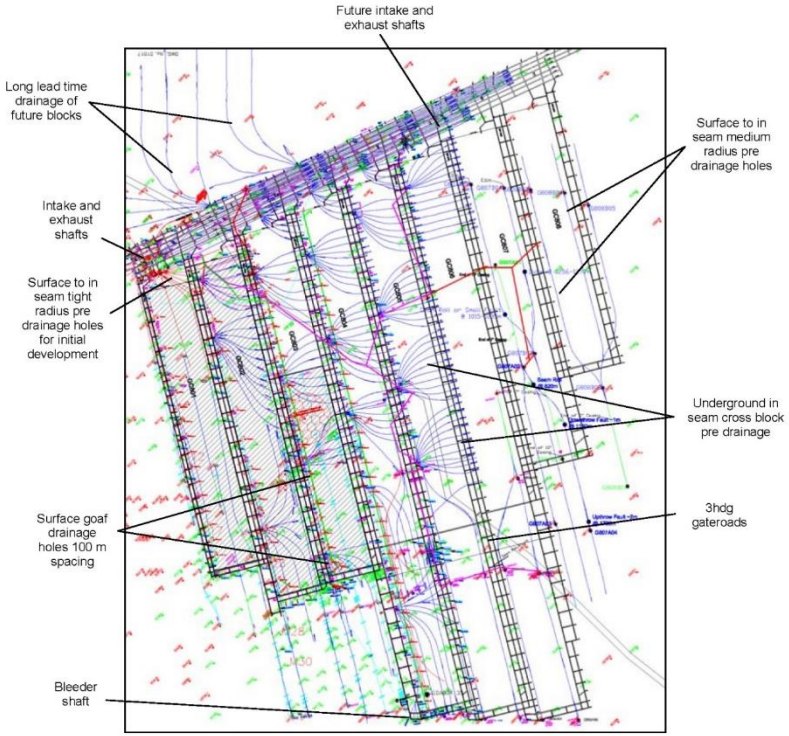


Gas Isotherm testing

VAM oxidisers



Degassing in advance of working

UNDERGROUND

- Art, opinion or organization that exists outside of mainstream society or culture. Also known as “independent” or “counter-culture”
- in simple terms, the opposite of mainstream
- Underground mining is currently the very opposite of mainstream” in western Canada, but it may not be for long
- https://www.urbandictionary.com/define.php?term=Underground retrieved 2019-12-18

UNDERGROUND

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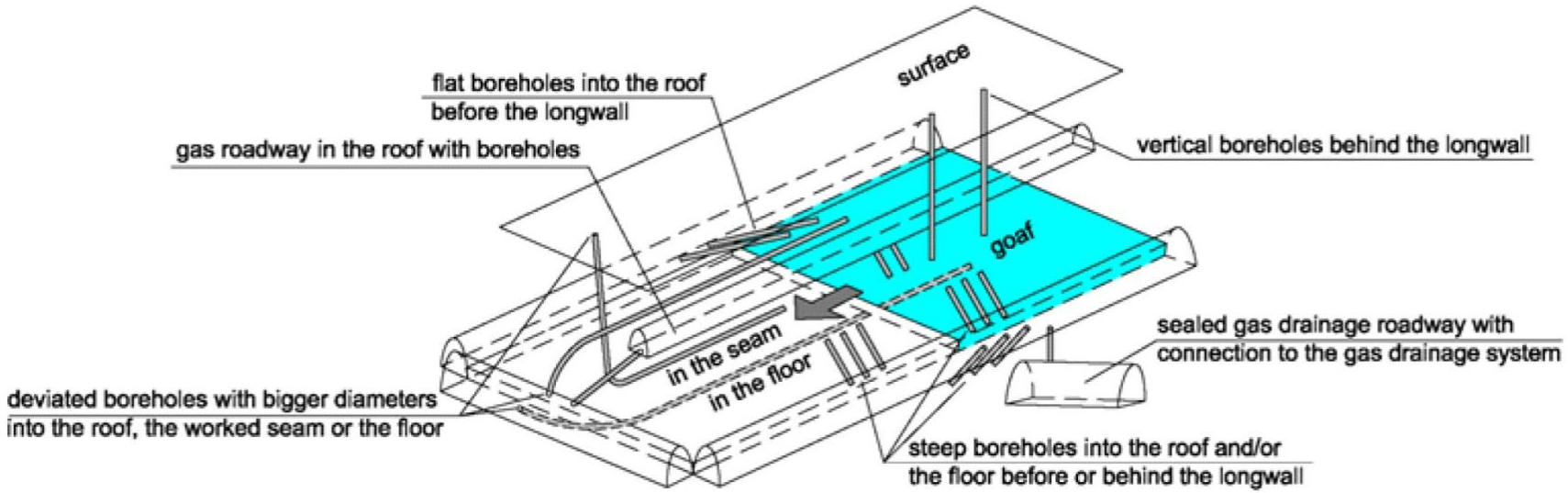
GHG constraints

GHG Control?

- Surface mine methane emissions are uncontrolled.
- Already moves toward accounting in Australia.
- Moving from 25 x to 80 x CO_2eq.

Methane Countermeasures possible underground



Leading to use: Coal Mine Methane co-generation power plant

or conversion to heat and destruction: Ventilating air methane regenerative thermal oxidisers at McElroy Mine in the USA.

Some western Canadian issues affecting underground coal mining

Geology
Regulation
Knowledge
Workforce

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Geology

Regulation

Knowledge

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- Open pit highwalls
- Small structural blocks
- Moderate to steep seams
- Structured seams

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Open pit highwalls

The last gasp of existing operations.

Highwall Mining

Not quite one thing,
nor quite the other.

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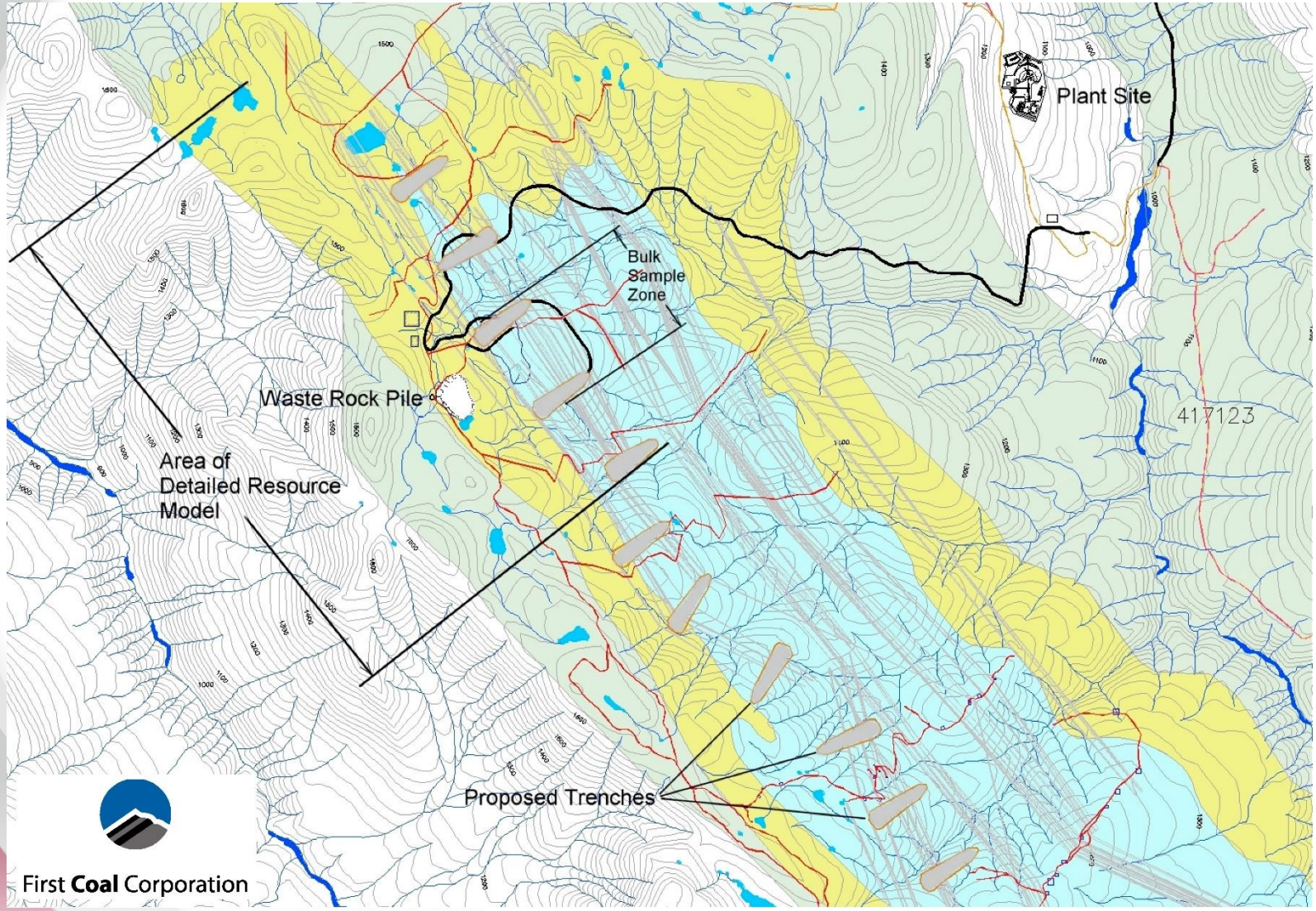
NOVAMINER



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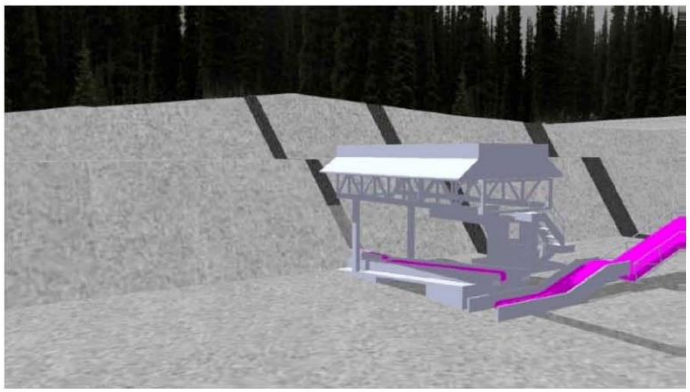
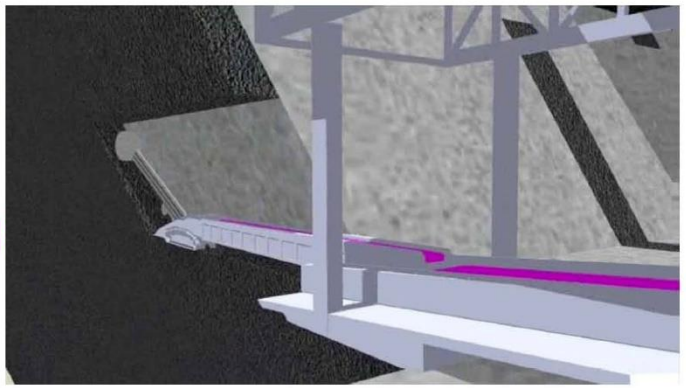
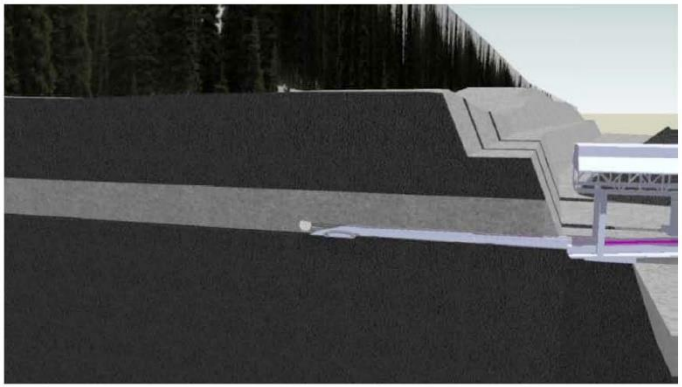
ADDCAR Highwall Mining System modified to operate in thin, steeply dipping seams



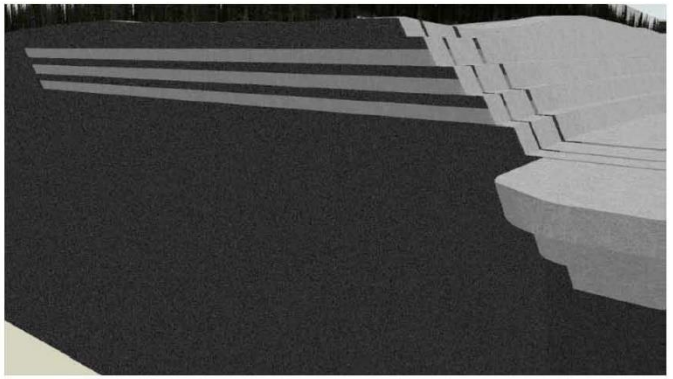
1. Launch vehicle positioned on mine bench in front of steeply dipping seam exposed in highwall



2. ADDCAR Highwall mining system penetrating steeply dipping seam



3. Profile of ADDCAR unit retreating from mined entry. Note pillar of coal above mined out entry.



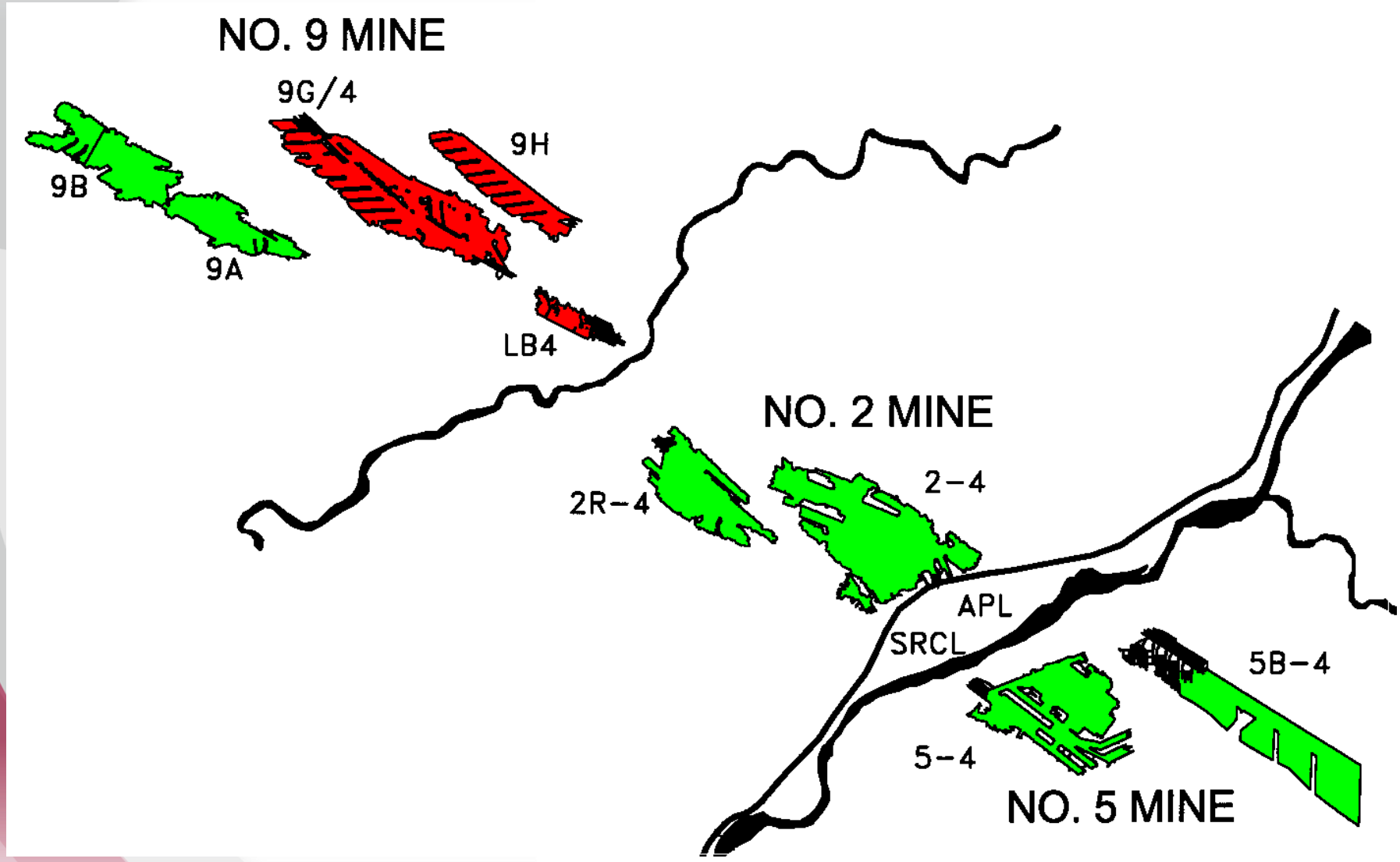
4. Succession of mined out entries and pillars in multiple dipping seams on series of benches.

Highwall mining pre-requisites

- A proactive approach from the start to ensure highwall stability over the miner.
- The proactive approach is also important if underground mine entry is to be made off of a highwall.
- Early collaboration with contractors to ensure that expectations can be met.

- Open pit highwalls
- Small structural blocks
- Moderate to steep seams
- Structured seams

- Small structural blocks – either orphans or parts of a larger field



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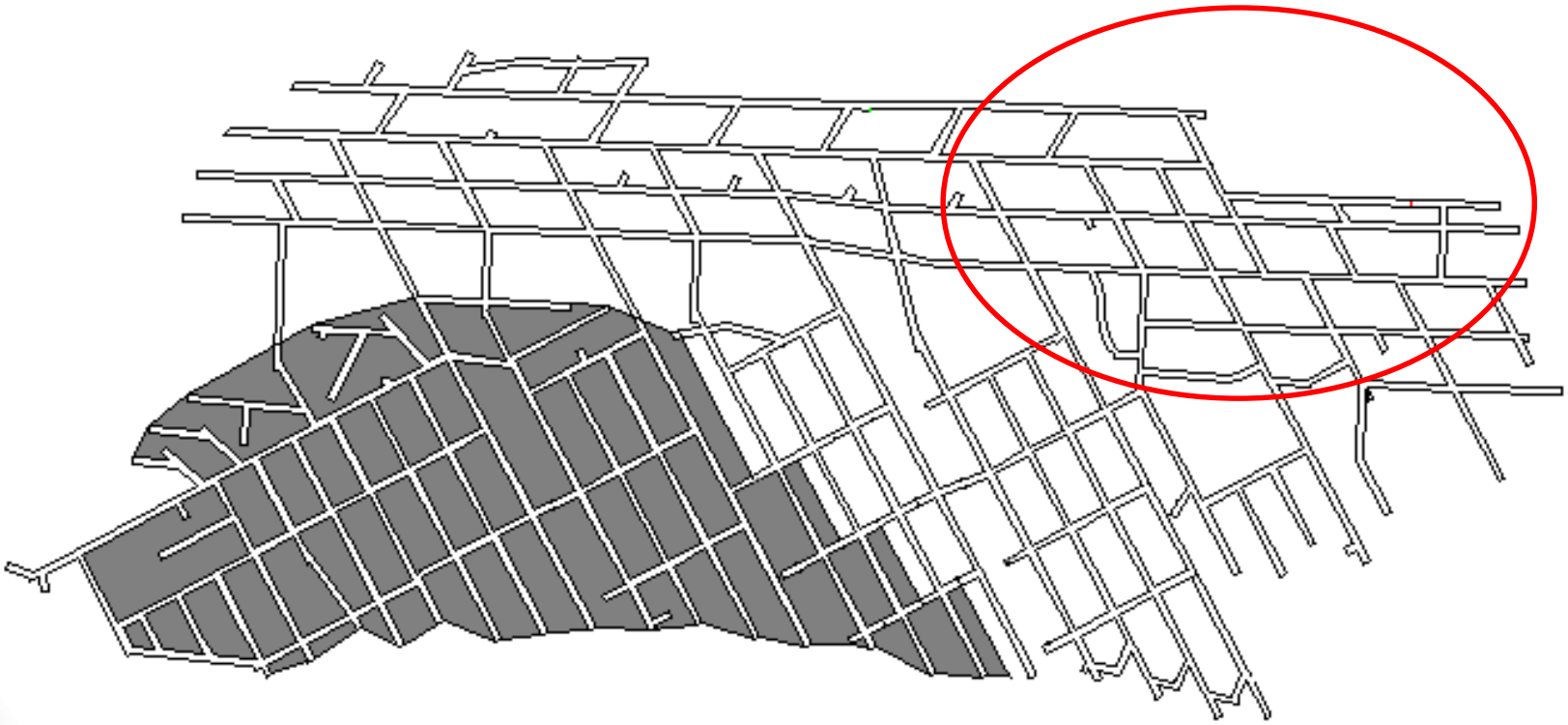

Structural blocks still spring surprises – realignment of main entries due to thrusting

Successful mining of small structural blocks requires

- A different approach to property EA and permitting for small, structurally constrained mines each of which may require different approaches to mining;
- Central infrastructure with de-centralised, itinerant mining fleets. Portal de-shaling or modular plants to reduce haulage.

Successful mining of small structural blocks requires

- A flexible mining method or concurrent mines able to maintain production through unexpected conditions; or,
- A working capital large enough to overcome a production slowdown while conditions are overcome.

- Open pit highwalls
- Small structural blocks
- Moderate to steep seams
- Structured seams

Plenty of these in Western Canada

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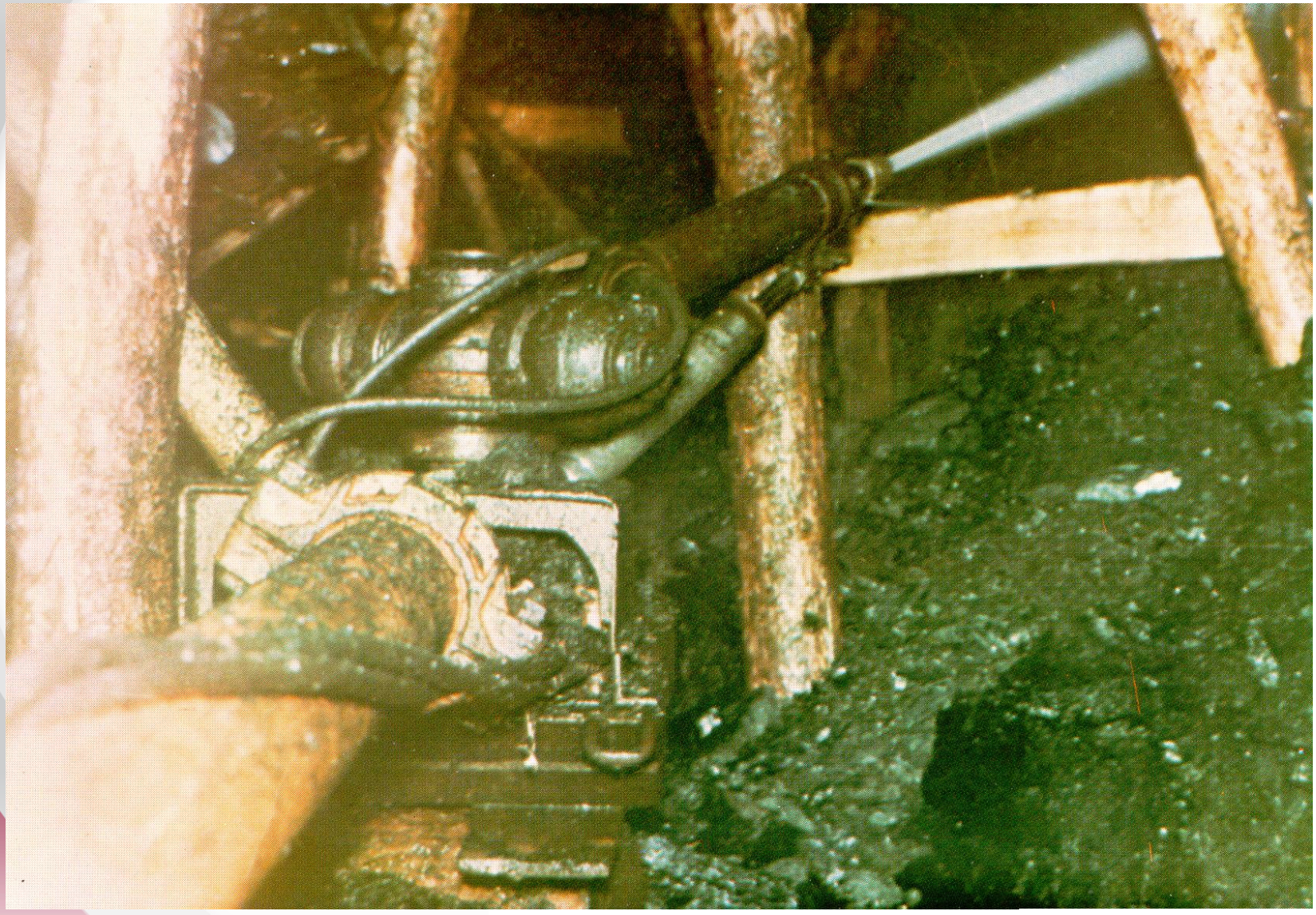
- Hydraulic mining has been used in the past, as well as hand-got “stoping” methods.
- Hydraulic mining may show some future promise if productivity issues can be solved.



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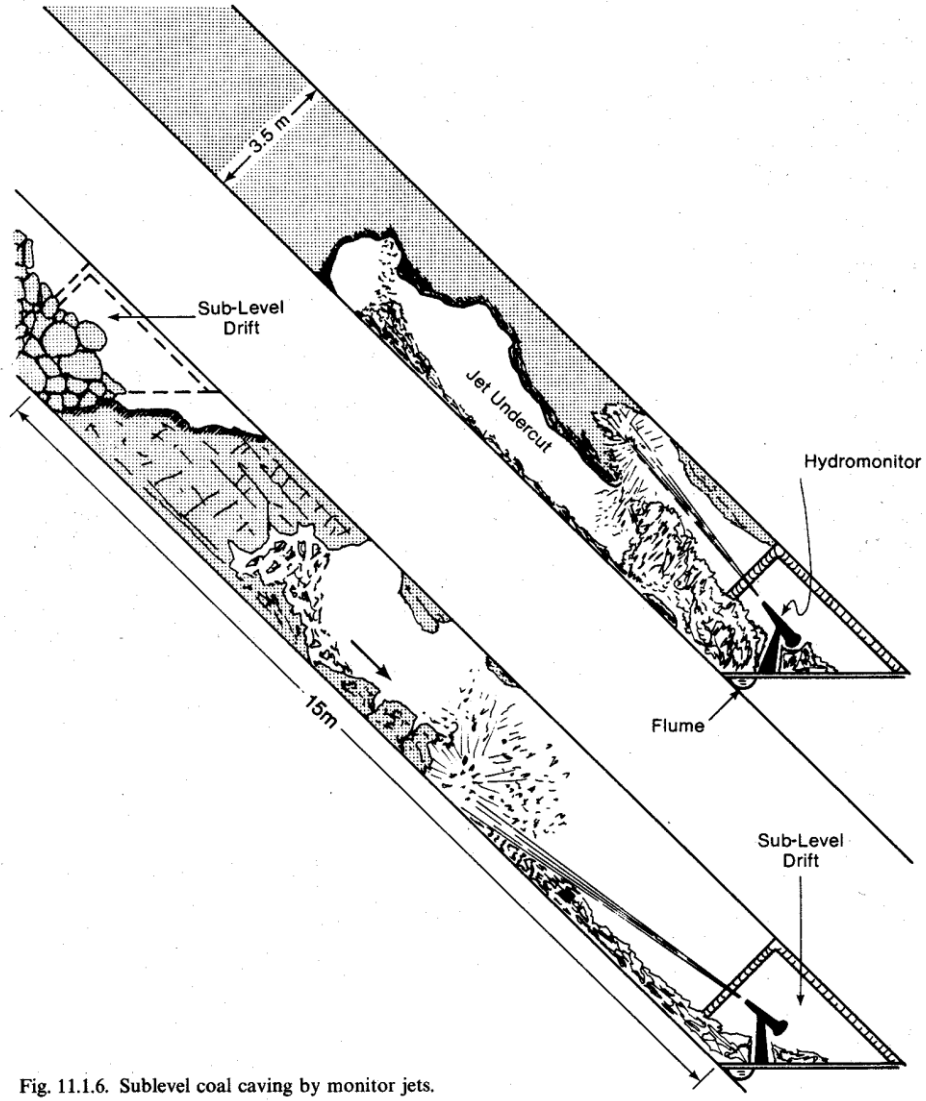
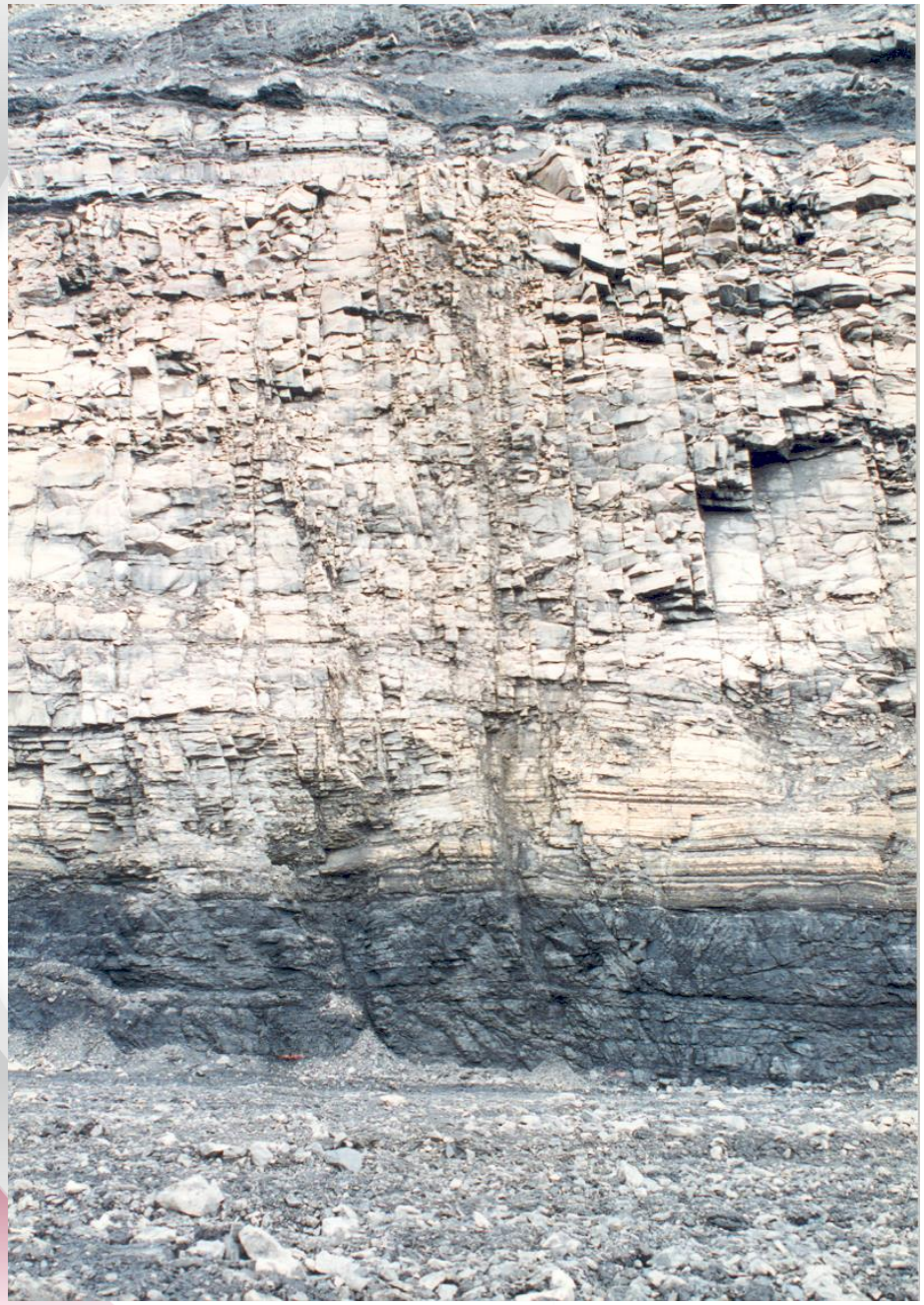


Fig. 11.1.6. Sublevel coal caving by monitor jets.

Steep seam mining

- Methods largely untested in Canada.
- Thicker moderate or steeply dipping seams may be amenable to hydraulic mining.
- Hydraulic mining was widely used in New Zealand small mines, but the industry itself was not sufficiently modernised compared to Australia.
- Technologically challenging (water, filtering, pumping, sumps), but there have been a number of studies for mines completed post Balmer closure.

- Structured seams – structure not revealed by drilling



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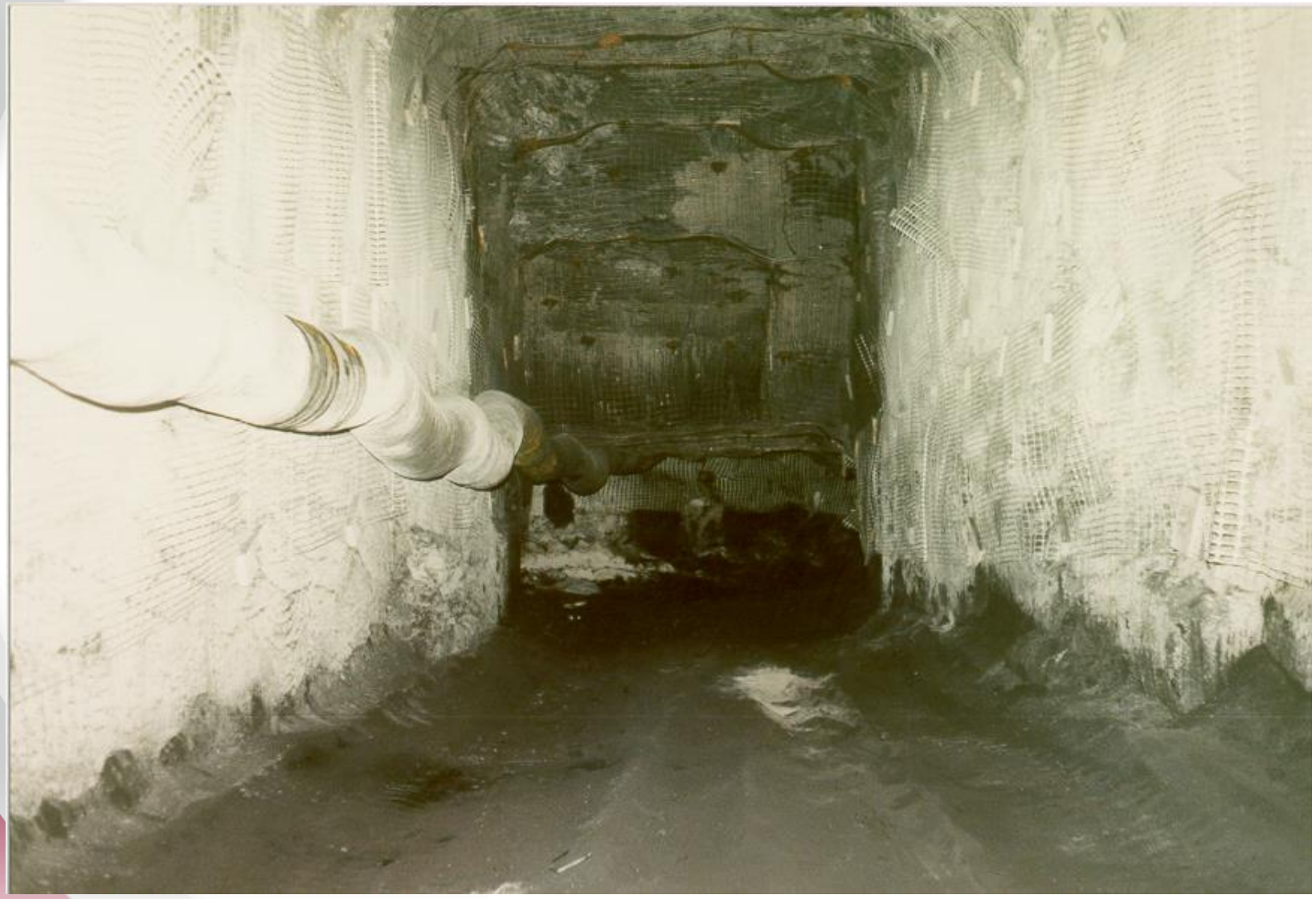
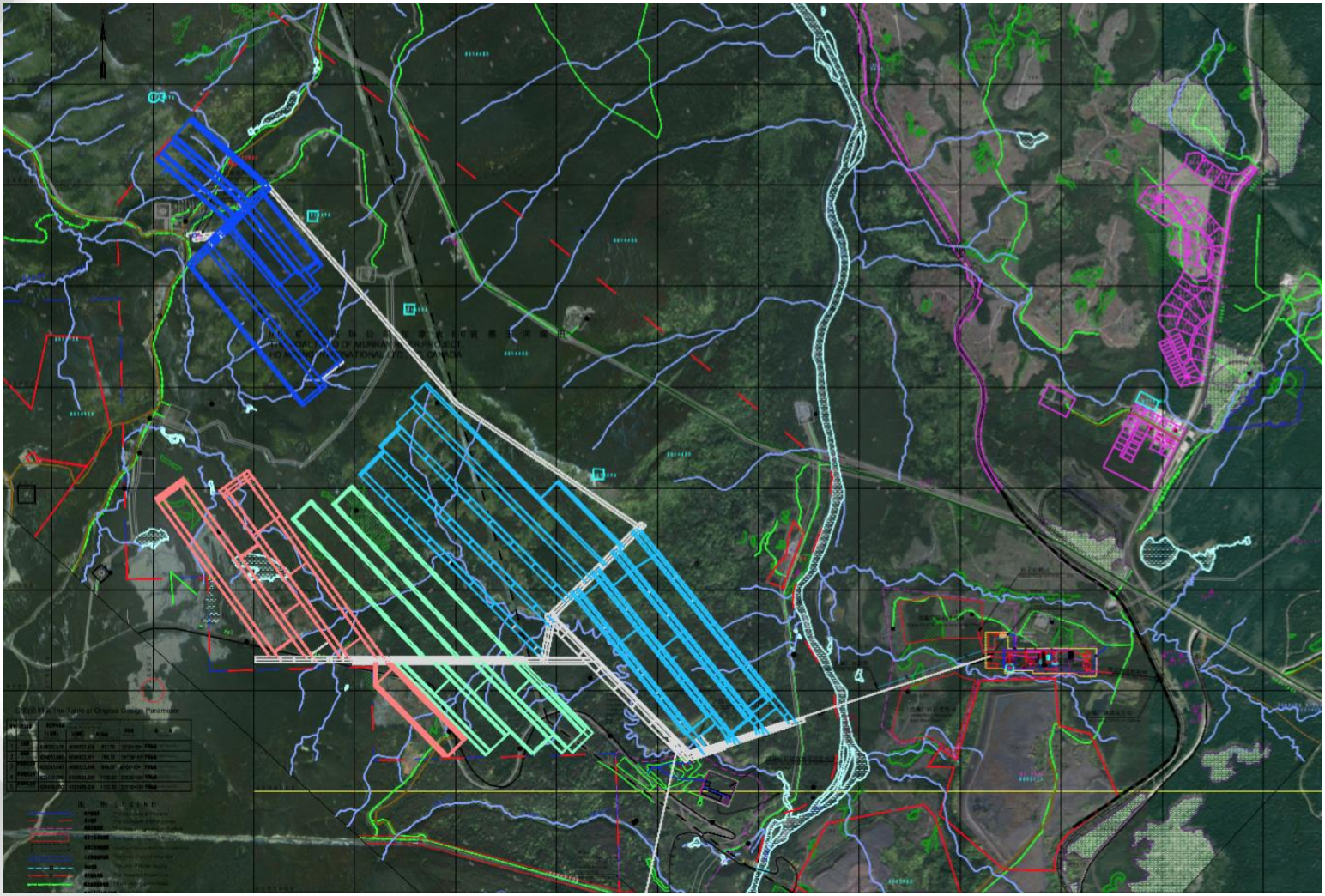


Requires

- Proving roadways, such as gateroads driven for longwall retreat faces,
- Other exploration, or
- a very flexible mining method.

Further exploration of underground properties in western Canada is unlikely to reveal extensive areas of flat thick coal, close to surface, capable of supporting multiple longwalls over decades of mine life…

…unless those longwalls are designed and costed to be stopped, started, shortened or lengthened in short order, as was the case at the recently permitted Murray River Mine near Tumbler Ridge.



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Requirements for western longwalls

- A good understanding of property geology;
- A flexible mining method able to maintain production through unexpected conditions; or,
- A working capital large enough to overcome a production slowdown while conditions are overcome.

Geology

Regulation

Knowledge

Workforce

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Regulation

- Neither the BC HSRC nor the AB OHS Code are fit for purpose as regards modern underground coal.
- Canada is too small a market to sustain its own set of standards, and regulations do not recognise the standards of major overseas suppliers,
- Inspectors are inexperienced. Training them will take time and effort, mostly by mining companies.

Geology
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Knowledge

- Underground mining is virtually extinct, as are most of the practitioners.
- Overseas experience is not the answer. US, Australian, Chinese methods must be adapted for local conditions and regulations
- Operators and their consultants must work with regulators to educate them and help them to the correct answers, not just the owners answers.

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Knowledge
Workforce

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Workforce

- Underground mining is a special skill. Underground mining skills need to be recognised.
- Training is not a 40 hour endeavour followed by box-ticking. Therein lies tragedy.
- Training must be comprehensive, and continuous.
- Recognition programmes covering competency and currency are required – MiHR is going a long way, but not all the way.
- Australia's structured training program allows standardised, self paced technical progression from miner to manager.

Workforce

- Initially contractors or TFWs may be required, but experience in BC has shown that there is enough interest to develop our own workforce.
- There are resources out there that can be harnessed, hopefully collaboratively, to grow an effective underground coal mining community.

Crystal Ball

- Multiple small mines, low capex, low opex, spreading risk, maintaining production.
- Comprehensive cross-company training programmes for workers, officials and regulators.
- Safety codes reflecting modern mining methods and standards, not necessarily CSA based.

Questions?

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