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PROGRESS REPORT TO THE WASTE MANAGEMENT TASK FORCE 2004

bhpbilliton

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Progress Report to the Task Force for the Review of BHP Billiton Coal Wash Management

December 2004

Background

update?

The Dendrobium Mine Conditions of Consent requires that BHP Billiton submit an annual progress to the initial report into Coal Wash emplacement alternatives. The relevant extract from the Commission of Inquiry is shown in Attachment 1.

These reports were required to be submitted to the then department of Urban Affairs and Planning; now the Department of Infrastructure, Planning and Natural Resources (DIPNR) and to other Government bodies as well as the then BHP Waste Management Task Force.

Several changes have occurred since the COI requirements were made that impact on these requirements:

- BHP Billiton and BlueScope Steel were formed from the demerger of BHP.
- The original intent and operation of the Task Force was no longer valid and the Task Force is under the process of reviewing its original intent and operating criteria in line with these changes.
- DIPNR discontinued Task Force meetings in late September 2004 due to resource issues. The relevant email correspondence is shown in Attachment 2.

Mining and Associated Operations

Significant changes have occurred or will occur shortly in BHPB's mining, logistics and processing which impact on Coal Wash:

- Elouera Mine will cease longwall production in mid 2005 approximately 1 year ahead of previous plans due to the earlier commencement of longwall operations at Dendrobium in early 2005.

- Wongawilli Emplacement Area will reach its maximum capacity in late 2004/early 2005 and emplacement operations will cease at the site. As a consequence Coal Wash from the Dendrobium Coal Preparation Plant (DCPP) will be transported to the West Cliff mine site emplacement area. The Coal Wash will be transported in coal trucks returning from coal deliveries to the Port Kembla Coal Loader or BlueScope Steel.

- Trials of the haulage of Coal Wash to West Cliff and particularly up the Mt Ousley incline were completed in 2004. The trials showed that no water would drain from the Coal Wash during this journey.

- Of note is that full scale haulage of Coal Wash was undertaken in the third quarter of 2004 due to works on Coal Wash out loading facilities at the DCPP. No water leakage occurred in the approximately 200,000 tonnes of Coal Wash that was transported.

- Of note is that there is no net increase in the number of coal trucks using Illawarra roads.

- Upgrade works were commenced on the Dendrobium and West Cliff Coal Preparation Plants. The plants will have respective capacities of 5.2 and 6.5 million tonnes per annum when this work is completed in early 2005

Coal Wash Alternatives

Investigations into alternatives to emplacement have focused on three key areas of the COI requirements with the use of Coal Wash for brick making continuing in very small quantities and Coal Wash use for road pavements or other civil works continuing to be impractical due to heavy competition from other materials and Coal Wash's low performance characteristics.

Some Coal Wash is being used to complete the residential development at Hayward's bay – Yallah and approximately 250,000 tonnes of material will be placed at the site in 2003 – 2004.

The three areas investigated in detail within the report period are:

1. Fill up existing waste emplacement areas

Earlier reports have mentioned the additional volume achieved in Stage 2 of West Cliff Emplacement Area. There have been no developments in sites not owned by BHPB. There continues to be little chance of acquiring these other emplacement areas.

In 2004 BHPB commissioned GHD Longmac to carry out a concept study into the possibility of placing additional Coal Wash on the West Cliff site. The study identified several options, some of which would be considered unpalatable to BHPB and the community and others which have some potential for further investigation. Attachment 3

In 2005, BHPB will utilise consultants to further investigate these options. This option appears to be high potential at the concept stage.

2. Underground Disposal

Work continues into the investigation of underground disposal for the purpose of subsidence control via an Australasian Coal Association Research Project (ACARP) grant. This work is seen to have applicability to the emplacement of Coal Wash underground as it utilizes fly ash pumped into voids created by mining to control subsidence. The August report to ACARP is shown in Attachment 4

A literature, Internet and industry search was also conducted to identify potential knowledge sources for this specialized process. This identified Poland as the only country where large scale emplacement of Coal Wash was carried out. Other countries such as China and the USA dispose of fly ash underground mainly for subsidence control but the material and associated process was considered to be significantly different to that required for Coal Wash.

The process known as "backfilling" takes Coal Wash from the surface and places it in the goaf or void left by longwall mining. Whilst the Polish circumstances are quite different to those of Australia, it was considered that the potential existed for full scale use of a modified process and warranted further study.

Further investigative work identified Professor Jan Palarski, head of The Chair of Clean Mining Technologies at The Technical University of Silesia as the foremost expert in this specialized area.

Professor Jan Palarski – bibliography below – was contacted to assist with increasing BHPB's knowledge of the backfilling process. A visit to Poland by Keith Grimson – Coal Wash Business Manager and Hank Pinkster - Manager Rehabilitation and Infrastructure was arranged at the suggestion of Professor Palarski.

Hank Pinkster was involved in the visit as the prime reason for the large scale emplacement of Coal Wash in Poland is to reduce the impact of subsidence rather than for disposal purposes. It was considered that there could be further learnings for BHPB in this area.

A detailed report of this visit is attached as Attachement 5 as is a presentation from Professor Palarski on backfilling for the purpose of subsidence control in Poland as Attachment 6.

The result of this visit was to continue with the work on lens filling to reduce subsidence and to transfer knowledge across to the backfilling process where applicable.

In terms of backfilling BHPB has sought agreement and Professor Palarski has agreed to visit Illawarra Coal in early 2005 to conduct a feasibility study into the application of Polish backfill techniques and computer modeling to the Australian conditions.

Further work may then flow from Professor Palarski's recommendations.

The presentation made to Illawarra Coal's management team on the trip to Poland and recommendations is shown in Attachment 7

3. Use of Coal Wash for Power Generation

It is of note that the price for coal will rise substantially in the near future. Previous investigations into the use of Coal Wash by northern and western district power stations for electricity generation found that Coal Wash could not compete with local coal production as the cost of transport meant that the cost per energy unit was higher than the locally available coal.

Representations are currently being made to these power stations again to determine if the price increases will make Coal Wash viable as an alternative fuel. This is not considered high potential as there is a requirement for significant infrastructure to be built to allow for the unloading of Coal Wash from trains and the trains would need to pass through the congested Sydney City rail system.

Two proponents of new power station technology have approached BHP Billiton to explain the capability of these new systems. These new systems are complex and sophisticated but offer some hope that the process can be used to produce electricity from Coal Wash.

The failure of Redbank Power Station to gain approval for their expansion has created an air of uncertainty in the power industry in regards to the stringent requirements for emission control. This is particularly so for high ash material such as tailings or Coal Wash.

Nonetheless, discussions continue with interested parties. BHPB is investigating the possibility of tendering for the Coal Wash fired power station. In order for this to occur, there needs to be more certainty that such a proposal would have a reasonable chance of success. BHPB does not have this level of confidence at the moment.

Attachment 1 - Extract from the Commission of Inquiry

5. Coal Wash Emplacement Area, Waste, Hazards Management, and Land Stability

5.1 Stage 3 Coal Wash Emplacement Area

Alternatives to waste emplacement at Area No 3 West Cliff and reporting

(a) The Applicant shall fully evaluate the technical and commercial aspects of using alternatives to the proposed waste emplacement area No 3 at the West Cliff site. The report with recommendations shall be submitted to the Director- General, NPWS, Waste Task Force (the existing task force which reviews BHP waste management), and WdSC no later than 31 December 2003. The report shall consider, but not be limited to:

- Filling up existing waste emplacement areas available to the applicant;
- Underground disposal;
- Coal wash brick;
- Road pavement; and
- Power station use.

(b) From the date of submission of the report, the Applicant shall provide an annual written report to the Director-General, NPWS, Waste Task Force, and WdSC, detailing progress undertaken during that period to pursue alternatives to the use of Emplacement Area No.3. The Applicant shall provide any reasonable additional information relevant to these reports and any other reasonable requirements for the reports, if so requested by the Director- General.

Attachment 2 – Email correspondence between BHP Billiton and the Department of Infrastructure, Planning and Natural Resources

RE: Waste Task Force meetings - Message (HTML)

That's sounds fine. When you put the update together, I will distribute it. In the meantime, we'll put the next meeting on hold. I'll let everyone know formally, and distribute the minutes from the last meeting as well. When the Strategy is updated I'll also criculate that. We're just a bit short of staff at the moment, so work may be a little delayed.

Regards
Renee

Renee Allen-Nerker
Regional Planner
DIPNR
Illewarra & South Coast Office
Phone: 4224 9454 Fax: 4224 9470
Email: renee.allen-narker@dipnr.nsw.gov.au

>>> "Grimson, Keith KG" <Keith.G.Grimson@BHPBilliton.com> 2/09/2004 9:29:45 am >>>

I am overseas at the moment and will not be returning until 4 October. I would like to distribute an update of progress but this does not require a meeting. I can send the update to you for distribution

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From: Renee Allen-Narker [mailto:Renee.Allen-Narker@dipnr.nsw.gov.au]
Sent: Wednesday, 1 September 2004 11:56 AM
To: keith.g.grimson@bhpbilliton.com
Subject: Waste Task Force meetings

Hi Keith,

Due to a lack of resources, we are considering putting the Task Force meetings on hold for a few months, unless the next meeting is likely to provide the group with some important updates, in which case we'll go ahead.

Do you have any significant changes, critical issues or progress at Billiton to report to the group on, on September 9? Or, do you require urgent feedback from the group over any issues?

I will be in contact asap once we have clarified whether the 9 September meeting will go ahead or not.

Regards
Renee

Renee Allen-Narker
Regional Planner
DIPNR
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Attachment 3

GHD Longmac Strategic Study of Regional Emplacement of Coal Washery Reject at West Cliff Colliery.

Illawarra Coal Holdings Pty Ltd
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ABN 49 004 028 077
Registered in Australia

GHD | LM | GHD LongMac
Consulting geotechnical engineers and geologists

16 December 2004

BHP Billiton
Administration Centre
Old Port Road
PORT KEMBLA NSW 2505

Our ref: 21/12950//AV795.doc_Rev1

Attn: Mr Keith Grimson

Dear Sir,

Strategic Study of Regional Emplacement of Coal Washery Reject at West Cliff Colliery

1 Introduction

BHP Billiton is considering the use of West Cliff colliery as a regional coal washery location for ROM Bulli Seam coal from Appin, West Cliff and Douglas Collieries. It would appear that 2.5 Mtpa to 3.0 Mtpa of coal washery reject (CWR) could be produced by washing coal from these collieries, for disposal at West Cliff Colliery (WCC).

Estimates of emplacement capacity remaining in the current Brennans Creek emplacement (adjacent to WCC) are of the order of:

Stage 2	10 Mt
State 3	20 Mt
	30 Mt

This represents about 10 to 12 years life for remaining capacity of the current emplacement landform.

We have been advised that the Dendrobium Commission of Enquiry permitted emplacement of CWR at WCC provided alternatives (such as use in an on-site power station or disposal through underground stowage) were investigated, and reported to the Minister by 2007.

You have advised that the current mining life in the area is about 30 years, representing a need to emplace up to about 90 Mt of CWR for continued operation of the collieries.

GHD-LongMac, together with Olsen Environmental Consulting, were commissioned to consider options available for emplacement of CWR in and around West Cliff Colliery in a broad sense and as a first-pass exercise. This report has been undertaken in line with GHD-LongMac's proposal of 20 May 2004 and BHP Billiton's approval of 29 July 2004 (under P/O P06935).

2 Process

An inception meeting was held at WCC on 20 August 2004. The meeting was attended by:

Keith Grimson and Roger Bowman (BHP-B)
John Smith (OEC)
Andrew Leventhal (GHD-LongMac)

Subject to the broad guidelines (above), the task has involved the appraisal of various landforms to accommodate CWR emplacement in and around the surface facilities at WCC.

Base plans used for this assessment were recovered from the records held by both companies. These are the only plans available at this time to determine emplacement volumes. The plans present relatively wide contour spacings and the base survey details are unknown. This has limited the accuracy of the emplacement estimates and should be treated as no better than about ± 15%. The approximate volumes available for emplacement for each of the options should therefore be treated as a preliminary estimate only. Nevertheless, the approximate volumes are believed to be of sufficient accuracy to permit appraisal of preferred options by BHP Billiton for planning purposes and the identification of constraints. It would be necessary for detailed assessment of the preferred option, or options, to follow.

Landforms for 10 options have been developed from the appraisal. The footprints of the landforms are presented on Figures 1 to 6.

The advantages and disadvantages of each option have been considered, and are presented in the attached Table 1. All options within the main creekline of Brennans Creek would include extension of the cleanwater diversion on the southern side of the creek. The downstream exit point would be at the upstream end of the spillway collecting channel at Brennans Creek Dam. Cleanwater would be harvested from the diversion channel, as required, by diversion into the BCD reservoir (as identified on Figure 4).

The essence of the capacities provided by each option are:

Option	Description	Approximate Emplacement Capacity
1	Stage 2 of Brennans Creek emplacement area	13 Mt 10 Mt remaining
1A	Raised Landform (over Stage 2 footprint)	[0.3 Mt/m raised, for relatively thin overlay, say less than 10m thickness]
1B	Raised Landform (over Stage 1 footprint)	[0.5 Mt/m raised, for relatively thin overlay, say less than 10m thickness]
2.	Stage 3 of Brennans Creek emplacement area.	20 Mt
3.	Downstream extension of Brennans Creek Emplacement to FSL of BCD reservoir.	24 Mt (includes Stage 3 plus extension)
4.	Stage 4 of Brennans Creek Emplacement, occupying unnamed eastern tributary valley.	3 Mt
5.	Downstream extension of Stage 4 to FSL of Brennans Creek Dam.	4 Mt (includes Stage 4 plus extension)
6.	Merged emplacement area covering main and tributary valleys of Brennans Creek (including Stages 3 & 4 and their extensions).	36 Mt
7.	Maximum footprint emplacement which fully occupies Brennans Creek and consumes Brennans Creek Dam.	65 Mt
8.	Four Mile Creek	25 Mt

Option	Description	Approximate Emplacement Capacity
9.	Tributary of Four Mile Creek	25 Mt
10.	Sawpit Gully	40 Mt
11.	Water supply dam on Stokes Creek, downstream of junction with Four Mile Creek.	(estimate of footprint only)

The emplacement capacities for some combined options, which achieve or approach a total capacity of about 90 Mt, are as follows:

Option Combinations	Combined Emplacement Capacity
1+2+4+8+9	10+20+3+25+25 = 83 Mt
1+7+9(+11)	10+65+25 = 100 Mt
1+2+6+8(or 9)	10+20+36+25 = 91Mt

Other combinations may be suitable. However, for emplacement activities to remain within the WCC surface lease area, whilst achieving the target emplacement capacity, it becomes apparent that:

- the emplacement will consume BCD, and therefore an alternative water supply will be required. It is suggested that this source could be minewater or surface water, subject to investigation.
- the emplacement visibility will be increased as a result of a final landform which will be higher than the ridgelines.
- an emplacement landform higher and broader than Option 7 will be required.
- else, emplacement areas outside the surface lease area will be required.

The predominant challenges, notwithstanding the details contained in Table 1, are:

- Management of Brennans Creek Dam, should its role as a water supply dam change to that of a dirty water treatment dam, in recognition of the licensed discharge point at its spillway.
- The challenges of development of an emplacement area, or new water supply dam, within the Dharawal State Recreation Area.

To advance the engineering feasibility of options favoured by BHP Billiton, it will be necessary to improve the survey base plans. Airborne laser survey, with 3-D contour output, would be an appropriate technique to improve the base survey plans in the rugged and forested terrain.

We trust this preliminary appraisal will assist you current planning objectives.

Yours faithfully
GHD-LongMac

Andrew Leventhal
Principal Geotechnical Engineer

Attachments: Table 1
Figures 1 to 6

GHD LongMac
Consulting geotechnical engineers and geologists

Letter

DOCUMENT REVIEW SHEET

Document Reference: G:\Geo_WP Documents\AVdocs\AV795.doc

Date Issued: 16 December 2004

Project: Strategic Study of Regional Emplacement

Prepared by:

Andrew Leventhal

Date:

Reviewed by:

Date:

GHD LONGMAC

STRATEGIC STUDY OF COAL WASHERY REJECT EMPLACEMENT AT WEST CLIFF COLLIERY AS A REGIONAL FACILITY FOR ILLAWARRA COAL

Table 1:

Option No.	OPTION DESCRIPTION	ADVANTAGES	DISADVANTAGES
1.	Stage 2 of Brennans Creek emplacement area Capacity: 13 Mt Estimate 10 Mt remaining	• Is an approved operational emplacement. • Is adjacent to existing washery and handling facilities. • Is situated upon Coal Lease and surface property. • Has masked sight lines. • Is adjacent to water management facilities. • Is remote from residences and Appin township.	• Has finite capacity. • Is situated upon tributary of Georges River.
1A	Raised Landform (over Stage 2 footprint) [Capacity: 0.3 Mt/m raised]	• Takes advantage of "widest" portion of emplacement to increase emplaced volume • Reduces requirement to occupy additional footprint by maximising depth of emplacement	• Final landform may be less compatible with broad morphology of area. • Requires "loss" of vegetated surface already existing to prepare for emplacement. • Requires management of emplacement capping material resource (as this is a scarce commodity in the site's setting). • Will increase the visibility of the emplacement from outside the surface holdings. • Will increase the applied load to underdrainage pipelines (though not expected to be a challenge, but requires confirmation).
1B	Raised Landform (over Stage 1 footprint) [Capacity: 0.5 Mt/m raised]	• as above for Raised Stage 2 landform	• as above for Raised Stage 2 landform, with the exception that the revegetation is older, though is of poorer quality and coverage.

Option No.	OPTION DESCRIPTION	ADVANTAGES	DISADVANTAGES
2.	Stage 3 of Brennans Creek emplacement area. Capacity: 20 Mt	• Is on existing WCC mining lease. • Is on undisturbed land but is an extension of the existing emplacement activities. • Initial use of existing water treatment facilities. • Emplacement dirty water isolated from BCD reservoir. • Emplacement access roads on mine site land. • Minor visual impact as has masked sight lines.	• Emplacement approval required, though this applies throughout all options for "new" emplacements (below). • Flora, fauna and archaeological issues. • Remote water treatment will be required.
3.	Downstream extension of Brennans Creek Emplacement to FSL of BCD reservoir. Approx Capacity: 24 Mt (includes Stage 3 plus extension)	• Is on existing mining lease. • Is on undisturbed land but also is an extension of the existing emplacement. • Initially will use existing water treatment facilities. • Emplacement access roads will be on mine site land. • Minor visual impact.	• Emplacement approval required. • Flora, fauna and archaeological issues. • Remote water treatment will be required. • Emplacement dirty water treatment employs BCD, thereby necessitating change in management of BCD water This is an important issue in regard to the spillway of BCD being a licensed discharge point. • Construction of barrage across upper reach of reservoir requires release of stored water. • Reduction in available capacity of BCD reservoir for use by washery – estimated at about 10% (stc). • Alternate drinking and hygiene wayer required, together with licensed discharge management - see Option 4 below

Option No.	OPTION DESCRIPTION	ADVANTAGES	DISADVANTAGES
4.	Stage 4 of Brennans Creek Emplacement, occupying unnamed eastern tributary valley. Approx Capacity: 3 Mt	• Is on existing mining lease. • Initially will use existing water treatment facilities. • Emplacement access roads on mine site land. • Very minor visual impact.	• Is on undisturbed land. • Emplacement approval required. • Flora, fauna and possibly archaeological Issues. • Remote water treatment will be required. • Relatively small emplacement capacity if low visibility landform is adopted. Clearly, the reverse applies in that a visible landform would be required to increase capacity for emplacement. • As BCD reservoir employed for dirty water management, will need alternative supply of water at WCC pit top. Presume that water will remain adequate for washery and underground purposes. Operation of BCD will need review if it is used in this manner due to spillway being environmental licensed discharge point. • Further reduction in capacity of BCD – estimate of 5% stc.
5.	Downstream extension of Stage 4 to FSL of Brennans Creek Dam. Approx Capacity: 4 Mt (includes Stage 4 plus extension)	• Is on the existing mining lease. • Initial use of existing water treatment facilities. • Emplacement access roads on mine site land. • Very minor visual impact.	• Emplacement approval required. • Flora, fauna and possible archaeological Issues. • Remote water treatment will be required. • Emplacement dirty water treatment employs BCD storage reservoir. • Relatively small emplacement capacity. • Requires alternate water supply for WCC pit top and use underground unless BCD reservoir is partitioned.

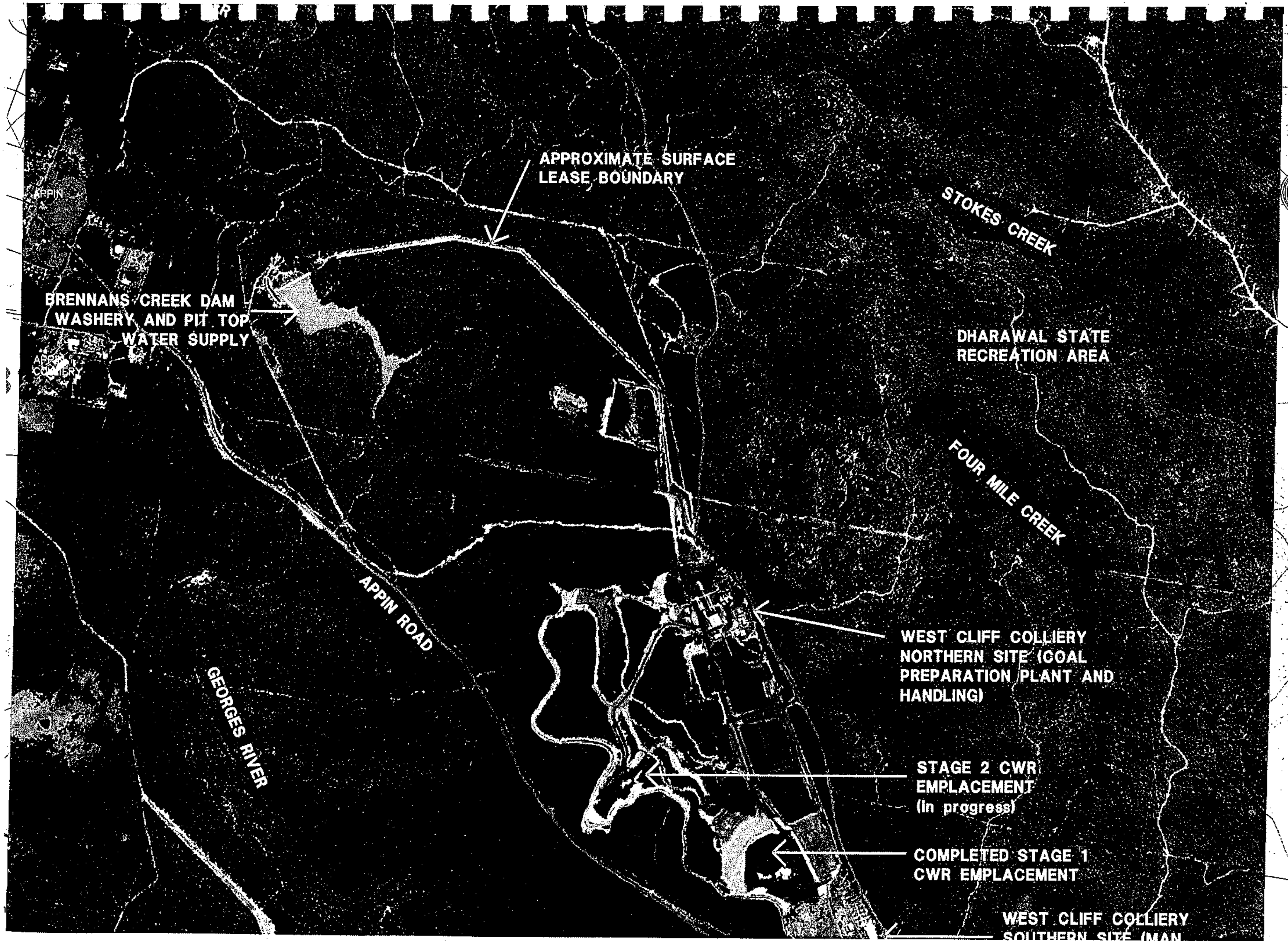
Option No.	OPTION DESCRIPTION	ADVANTAGES	DISADVANTAGES
6.	Merging at the toe area of Stages 3 & 4 (as extended), occupying the upper reaches of BCD reservoir. Approximate Capacity: 36 Mt	• Typically, advantages as above. • Maximises volume whilst maintaining BCD within water management system. BCD reservoir partitioned to operate in part as dirty water treatment pond and part for minewater and CPP use. • Maintains profile of emplacement landform broadly below ridgelines.	• Generally as typically above as to environmental impact and approval requirements. • Loss of about 25% of nominal storage volume of BCD, though mitigated by reality that siltation of upper reaches of reservoir may well have already removed much of this from "live" storage (nett effect possibly 10% reduction). • Remainder of BCD reservoir used for dirty water management – see discussion within Option 4.
7.	Maximum footprint emplacement which fully occupies Brennans Creek and consumes Brennans Creek Dam. Approx Capacity: 65 Mt	• Is on existing mining lease. • Provides large emplacement capacity. • Initially uses existing water treatment facilities. • Emplacement access roads on mine site land. • Minor visual impact.	• BCD storage area used for CWR emplacement. (Alternative mine water supply required, see Option 11). • Option is on undisturbed land as well as that used for current activities. • Emplacement approval required. • Flora, fauna and archaeological issues. • Remote water treatment will be required. • Consumption of BCD by emplacement means that new water supply source for WCC washery and underground is required – see Option 11.

Option No.	OPTION DESCRIPTION	ADVANTAGES	DISADVANTAGES
8.	Four Mile Creek Approx Capacity: 25 Mt	• Minor visual impact. • Emplacement close to CWR source, although not adjoining mine site. • Option provides relatively large emplacement capacity.	• Is located within Dharawal State Recreation area, and outside existing mining lease and surface property. • Emplacement approval required, necessitating EIS process. • Emplacement area is long and narrow. • Is located on undisturbed land and in a clean water catchment area. • Catchment area extends across the Bulli Appin Road and is likely to require stormwater diversion works to direct to adjacent catchment. • Flora, fauna and archaeological issues. • Emplacement access is across Wedderburn Road – minor impact given current use of road. • Remote water treatment would be required, without buffer of reservoir downstream as is provided by BCD for Stages 1, 2, 3 & 4 of the Brennans Creek emplacement.
9.	Tributary of Four Mile Creek Approx Capacity: 25 Mt	• Minor visual impact. • Emplacement close to CWR source, area adjoins mine site land. • Small water catchment area. • Option provides relatively large emplacement capacity.	• Similar to Option 8, without catchment diversion requirement.
10.	Sawpit Gully Approx Capacity: 40 Mt	• Minor visual impact. • Emplacement is close to CWR source, although not adjacent to the mine site. • Option provides relatively large emplacement capacity.	• Similar to Option 8, though without catchment diversion requirement. • Closer to Appin township than other options. • Sawpit Gully contributes directly to the Georges River without the buffer currently provided by BCD for the Brennans Creek emplacement activities.

Option No.	OPTION DESCRIPTION	ADVANTAGES	DISADVANTAGES
11.	Water supply dam on Stokes Creek, downstream of junction with Four Mile Creek. (estimate of footprint only)	• Water supply under control of WCC. • DSC surveillance requirements similar to those for BCD. • No significant riparian rights downstream • Larger catchment than BCD, hence improved reliability for same supply or alternatively likely to service increased demand with same likelihood – ie more drought-proof than currently. • Design and construction of dam embankment and spillway will employ conventional engineering.	• Development approval challenges for dam in Dharawal State Recreation Area. Probably not insurmountable, but will require specific attention, though no less than will be required for Options 8, 9 & 10.
	Alternatively, purchase water from Sydney Water.	• Removes development challenges for dam in Dharawal State Recreation Area.	• Reliability of assured supply may be subject to political and other pressures in the future. • Unplanned price increases for bulk water can be expected.

Abbreviations:

BCD	Brennans Creek Dam	FSL	Full Supply Level (of reservoir of Brennans Creek Dam in this instance)
CWR	Coal washery reject (coarse and fine)	stc	subject to confirmation
DSC	Dams Safety Committee	WCC	West Cliff Colliery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FOUR MILE CREEK
APPIN ROAD
GEORGES RIVER
WEST CLIFF COLLIERY
NORTHERN SITE (COAL
PREPARATION PLANT AND
HANDLING)
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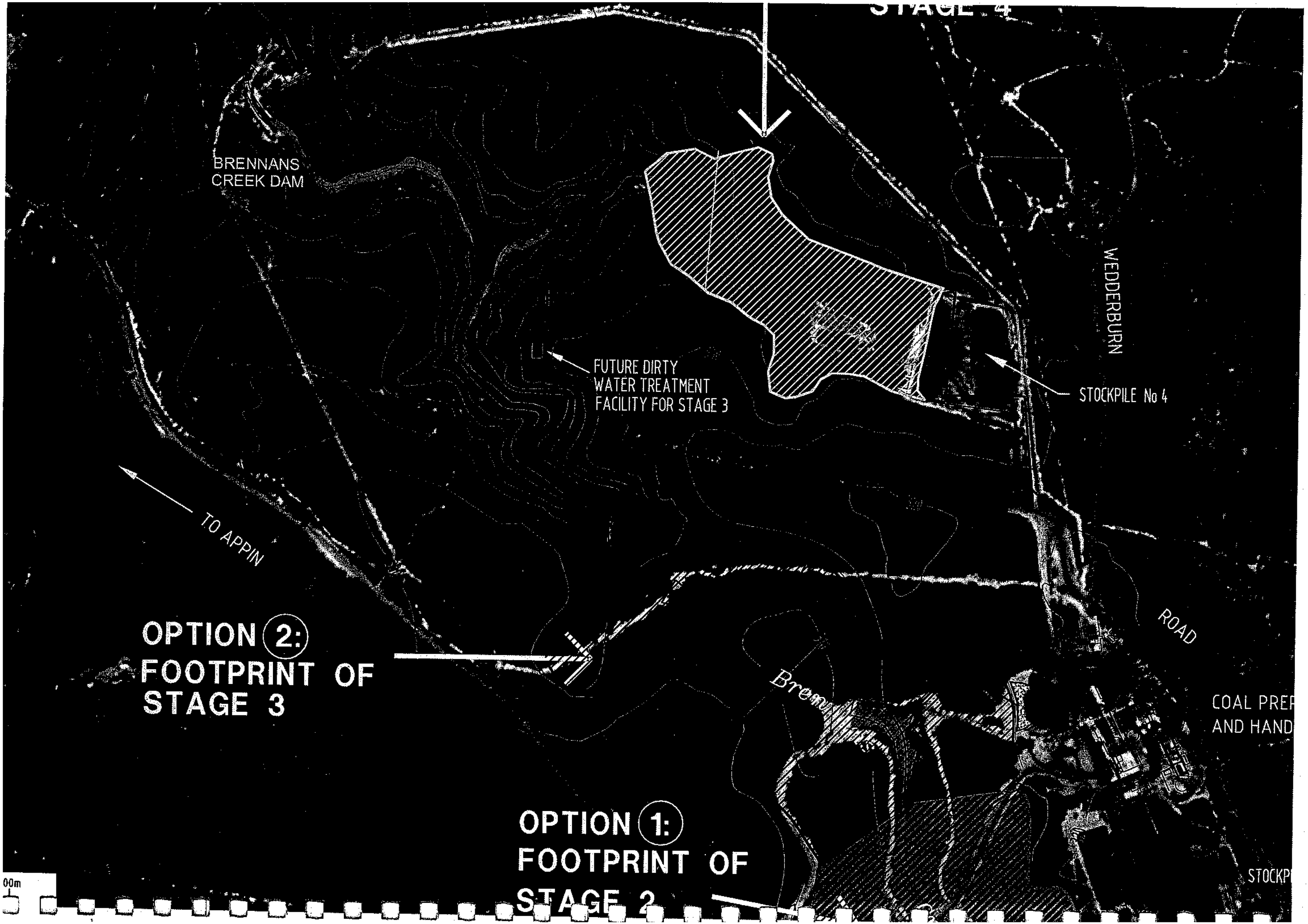
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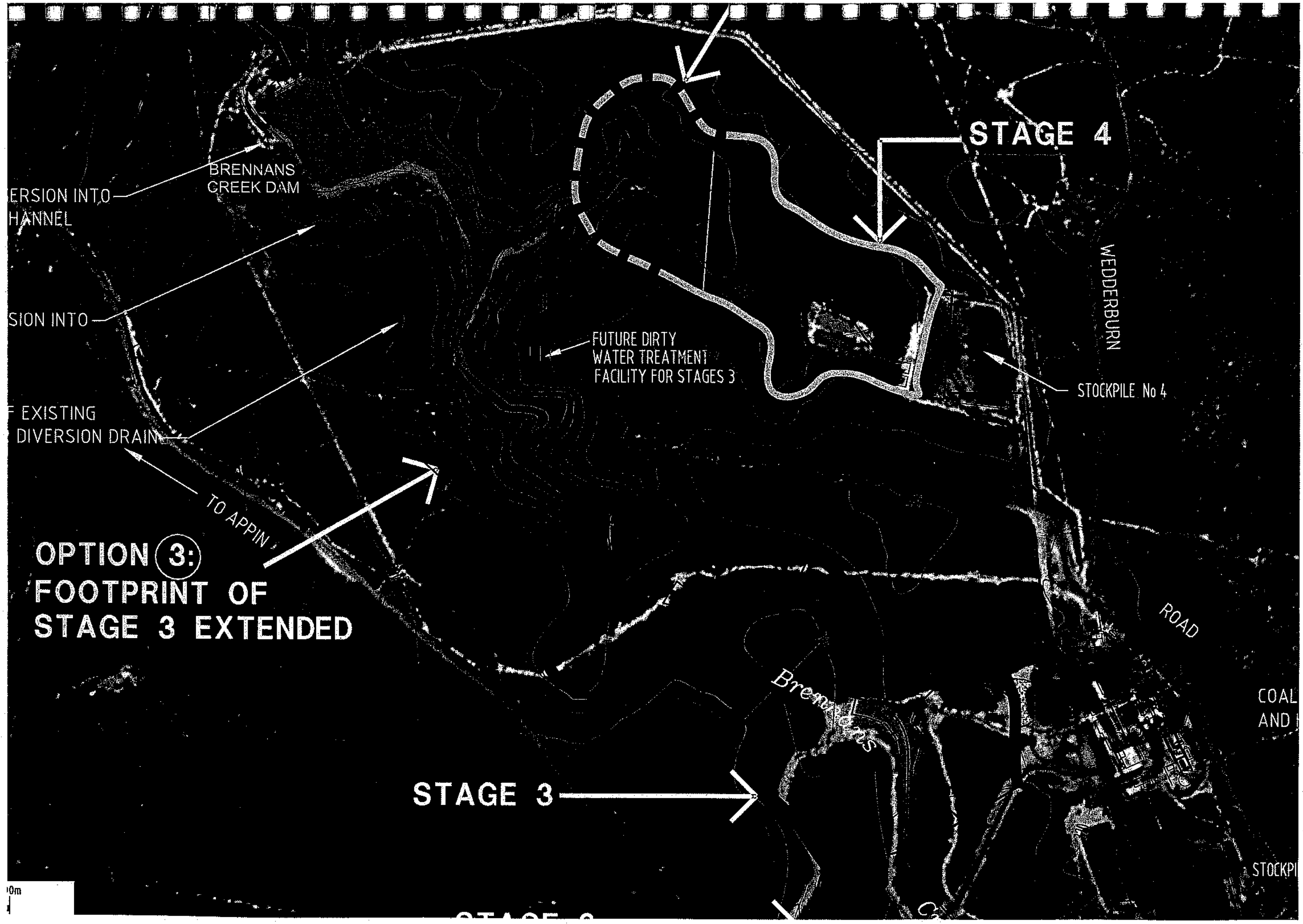

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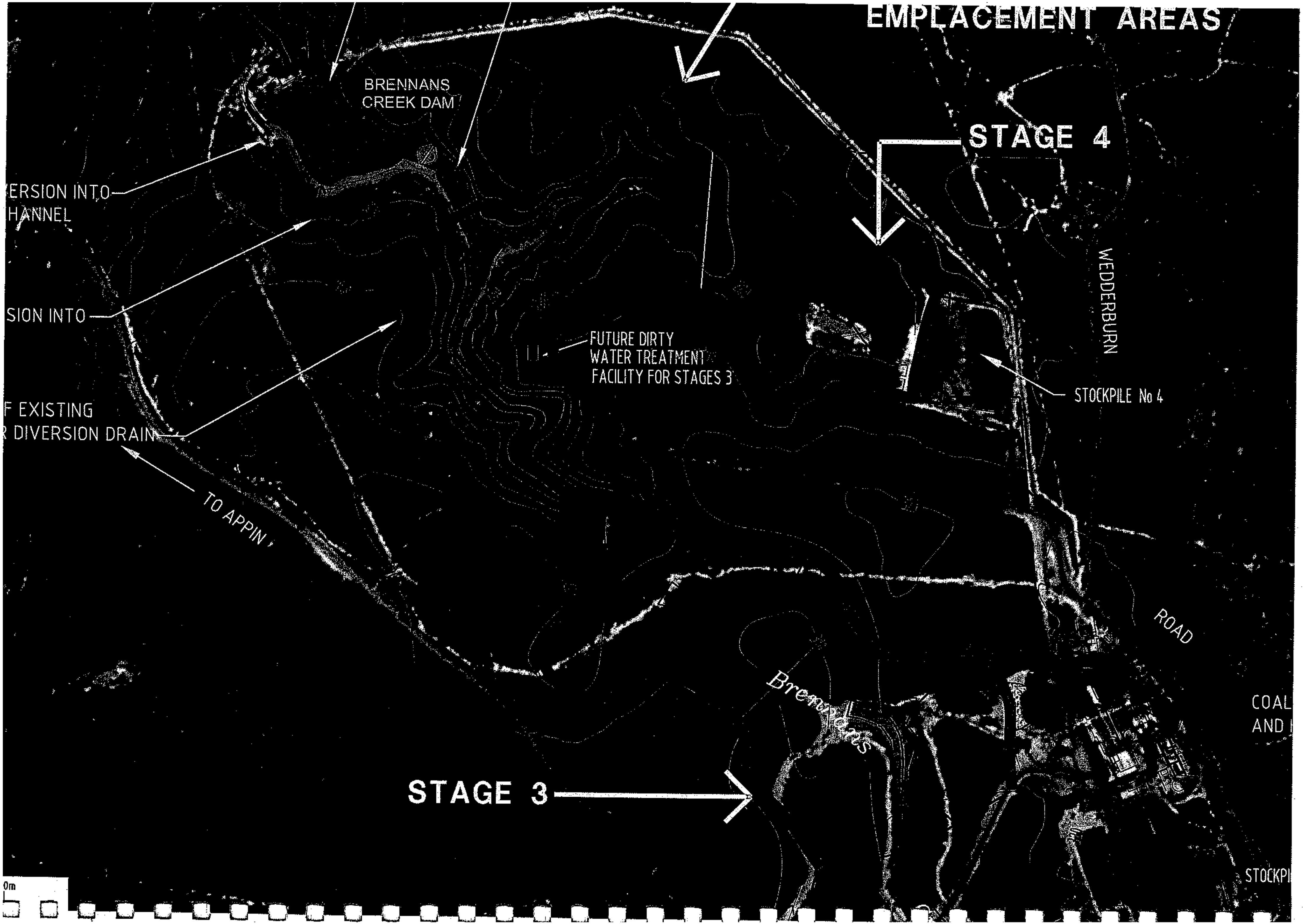

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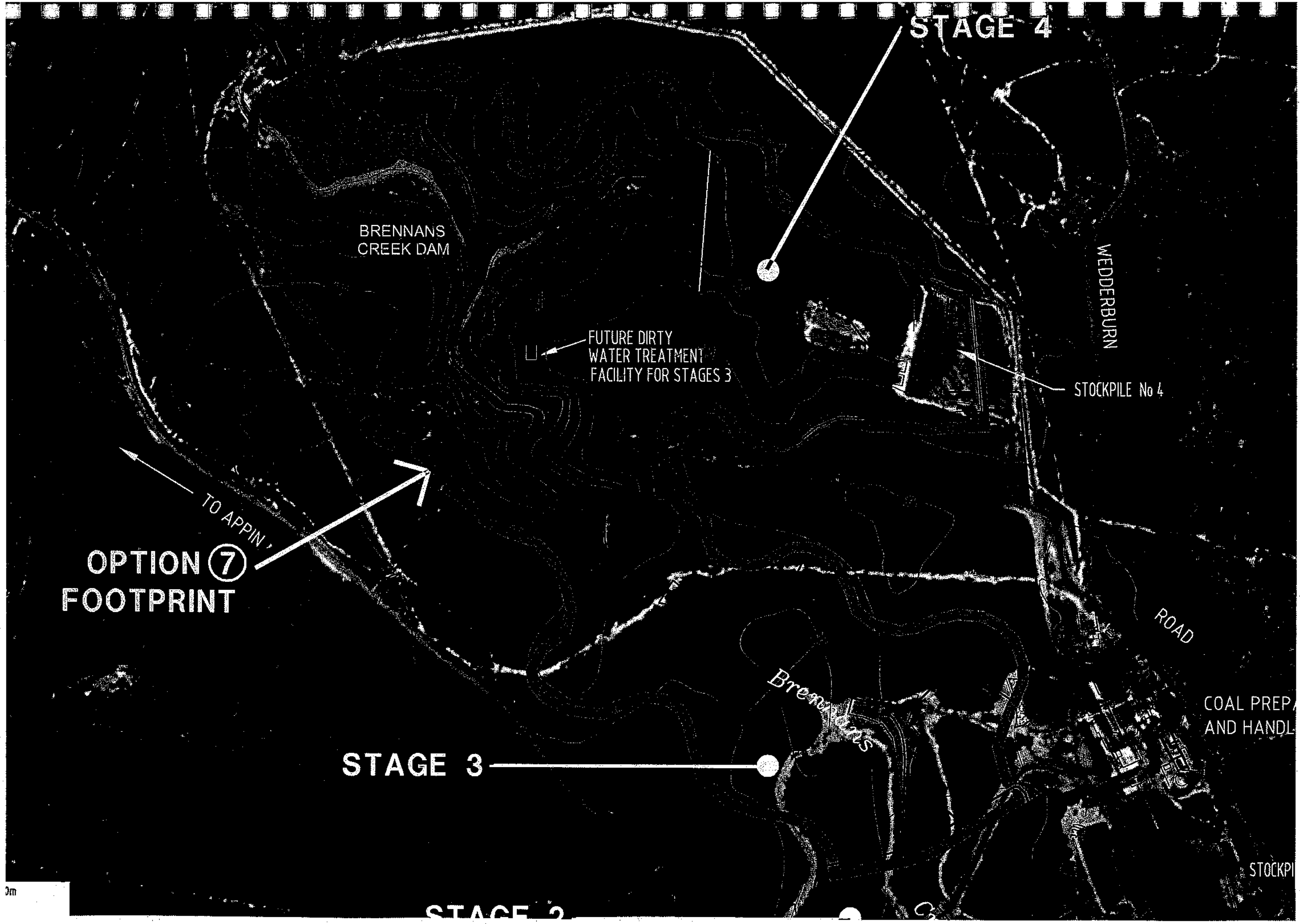
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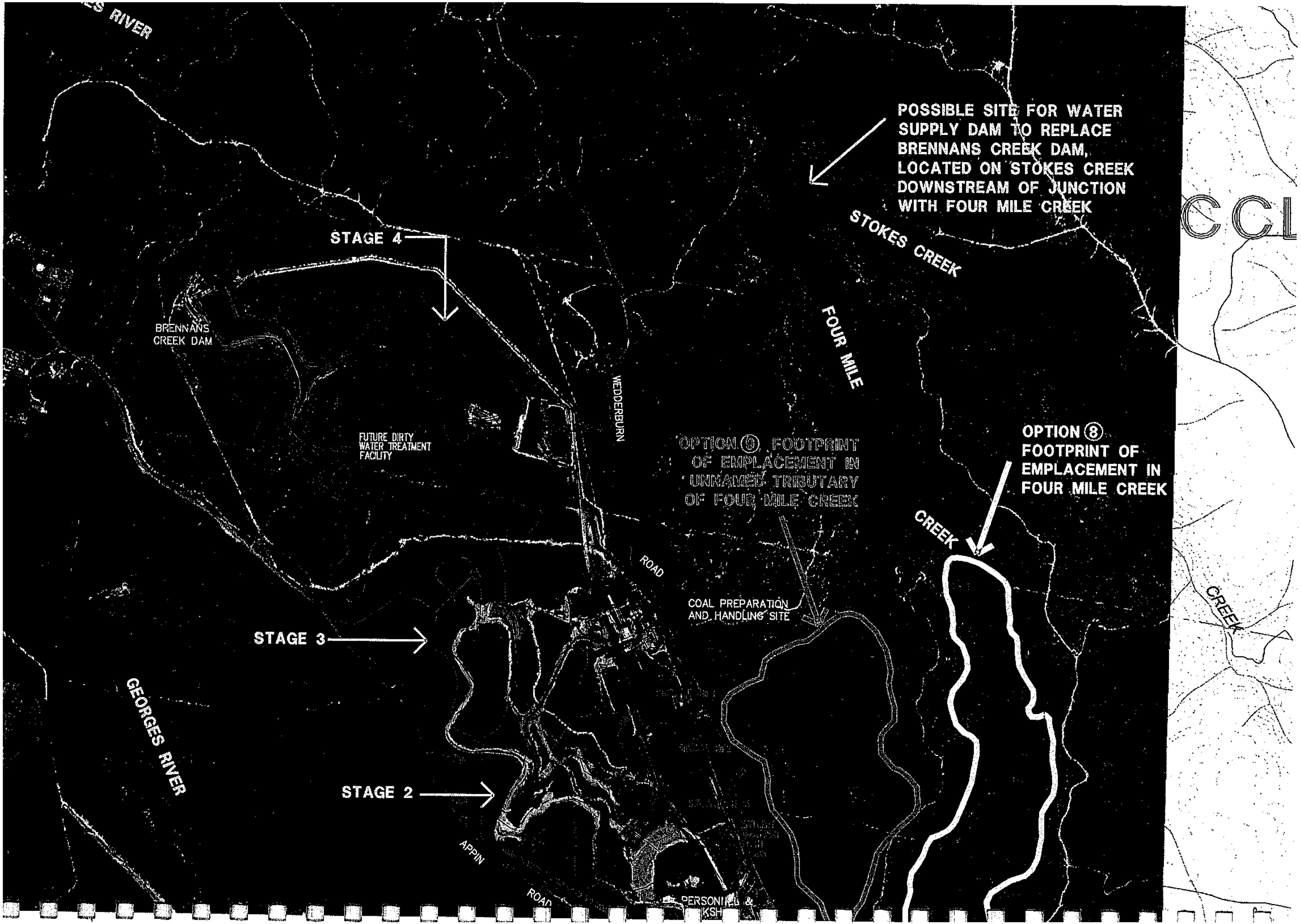


RIVER
POSSIBLE SITE FOR WATER SUPPLY DAM TO REPLACE BRENNANS CREEK DAM, LOCATED ON STOKES CREEK DOWNSTREAM OF JUNCTION WITH FOUR MILE CREEK
STOKES CREEK
STAGE 4
BRENNANS CREEK DAM
FOUR MILE
WEDDERBURN
FUTURE DIRTY WATER TREATMENT FACILITY
OPTION ⑨ FOOTPRINT OF EMPLACEMENT IN UNNAMED TRIBUTARY OF FOUR MILE CREEK
OPTION ⑧ FOOTPRINT OF EMPLACEMENT IN FOUR MILE CREEK
CREEK
ROAD
COAL PREPARATION AND HANDLING SITE
STAGE 3
CREEK
GEORGES RIVER
STAGE 2
APPIN
ROAD

Attachment 4 - ACARP QUARTERLY REPORT-AUGUST 2004
SUBSIDENCE CONTROL USING OVERBURDEN GROUT INJECTION TECHNOLOGY (C12019)

The project aims to assess the feasibility of significantly reducing longwall mining subsidence in Australia by applying the overburden grout injection technology originally developed and used in China. The project is to develop a cost-effective and flexible overburden grout injection system for Australian conditions.

The surface extensometer monitoring of longwall overburden fracturing and movement during mining continued at West Cliff. At Baal Bone, the extensometer monitoring program has been completed at LW23.

Drilling of grout injection and monitoring holes at Baal Bone was completed for the pilot grout injection field trial. The initial bore imaging of these holes using a down-hole camera was also completed to determine strata conditions before mining. Arrangements have been made for fly ash transport and delivery for the trial scheduled for November 2004. Work is currently in progress to source grout making and injection equipment required for the field trial.

Numerical modelling work using COSFLOW continued to study the overburden delamination processes and effects of the overburden grout injection during longwall mining on subsidence.

Attachment 5 - Visit to Poland to assess use of Back fill for subsidence control and emplacement of Coal Wash 20^{th} to 26^{th} November 2004

Keith Grimson – Coal Wash Business Manager and Hank Pinkster - Manager Rehabilitation and Infrastructure

Background

BHP Billiton – Illawarra Coal – (IC) is seeking processes to reduce the impacts of subsidence and to find alternatives to the surface emplacement of Coal Wash. Both impacts have the potential to be reduced by the use of Coal Wash in back filling of mining cavities produced by longwall mining.

Longwall mining extracts coal in blocks of 250 to 300 metres wide and up to 4 kilometres long. As the coal is removed, the overlying rock strata collapse into the void. This fracturing of the strata and collapse leaves voids in between the individual rock pieces. Thus less rock is required to fill the void created by mining. This impact continues upward with less and less rock required to fill the void until the strata can subside without breaking.

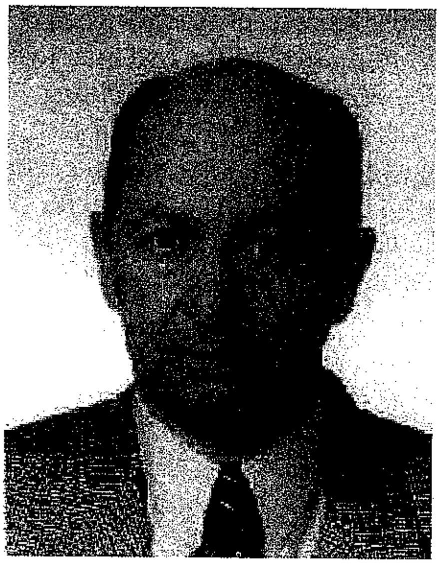
A lens shaped void is then formed with overlying strata gradually relaxing into the space below until the surface strata subside. An approximate guide is that the surface will subside half of the seam height extracted. At the sides of the longwall block, tension and compression can occur as the rock strata bends from fully supported and virgin coal areas into the longwall extraction zone.

Filing of the void behind longwalls to prevent subsidence is the prime reason for the practice of backfilling. Internet, industry and literature searches identified Poland as one of the few mining areas in the world with long experience in the process.

Professor Jan Palarski – bibliography below – was contacted to assist with increasing the IC knowledge of the backfilling process. A visit to Poland by Keith Grimson – Coal Wash Business Manager and Hank Pinkster - Manager Rehabilitation and Infrastructure was arranged at the suggestion of Professor Palarski.

Bibliography – Professor Jan Palarski

Jan Palarski



Jan PALARSKI is a Professor of Mining Engineering, a head of The Chair of Clean Mining Technologies at The Technical University of Silesia in Gliwice, Poland. Prof. Palarski received his M. Sc and Ph.D. degrees in Mining Engineering at the Technical University of Silesia and Dr Hab. at the Technical University (RWTH) in Aachen, Germany.

Prof. Palarski's research interests include underground mining methods, environmental impact assessment in mining regions, geotechnical practice for underground waste disposal and planning for mine closure and rehabilitation. He has published several books and is also the author or co-author of about 200 papers, articles and research reports. Prof. Palarski has participated in approximately 70 major mining projects in Poland and worldwide - dealing with issues such as mining methods, effective planning for mine closure, handling large quantities of mine waste and contaminated water, stabilising and backfilling undermined areas, enhancing the contribution of the mining sector to local and global sustainable development etc.

The timetable for the visit was as below:

- Monday 22.11.2004. mine visit 1 - coal mine "Wieczorek" (mining with backfill)
- Tuesday 23.11.2004. mine visit 2 - coal mine "Pokój" or alternatively coal mine "Wujek" (mining with backfill)
- Wednesday 24.11.2004. equipment & machinery producers - "Carboautomatyka" (automation systems for mining) and "Utex" or alternatively "Polko" (producers of mixture preparation systems).
- Thursday 25.11.2004. consultancy at the University, evening - travel to Wałbrzych
- Friday 26.11.2004. equipment & machinery producers - "Wamag" (producer of crushers and other mining machinery)

Coal mine "Pokój":
Kopalnia węgla Kamiennego "Pokój"
ul. Niedurnego 13, 41-710 Ruda Śląska
tel. +4832 244 6777 fax: +4832 248 7889

Coal mine "Wieczorek":

Kopalnia węgla Kamiennego "Wieczorek"
ul. Szopienicka 58, 40-432 Katowice
tel. +4832 255 7018, +4832 707 6000 fax: +4832 255 5506
www.kopalnia.com.pl

Coal mine "Wujek":
Kopalnia węgla Kamiennego "Wujek"
ul. Wincentego Pola 65, 40-596 Katowice
tel. +4832 208 5000 fax: +4832 251 5570

Company "Utex":
PPUH "Utex" sp. z o.o.
Ul. Podmiejska 1, 44-207 Rybnik
tel. +4832 422 1480 fax: +4832 422 7980
www.utex.rybnik.pl

Company "Carboautomatyka":
Przedsiebiorstwo Kompletacji i Montażu Systemów Automatyki Carboautomatyka S.A.
ul. Budowlanych 168, 43-100 Tychy
tel. +4832 227 5071 fax: +4832 227 4802
www.carbo.com.pl

Company "Wamag":
Zakłady Urządzeń Technicznych "Wamag" S.A.
ul. Prymasa S. Wyszyńskiego 1, 58-309 Wałbrzych
tel. +4874 846 8671 fax: +4874 846 8262
www.wamag.com.pl

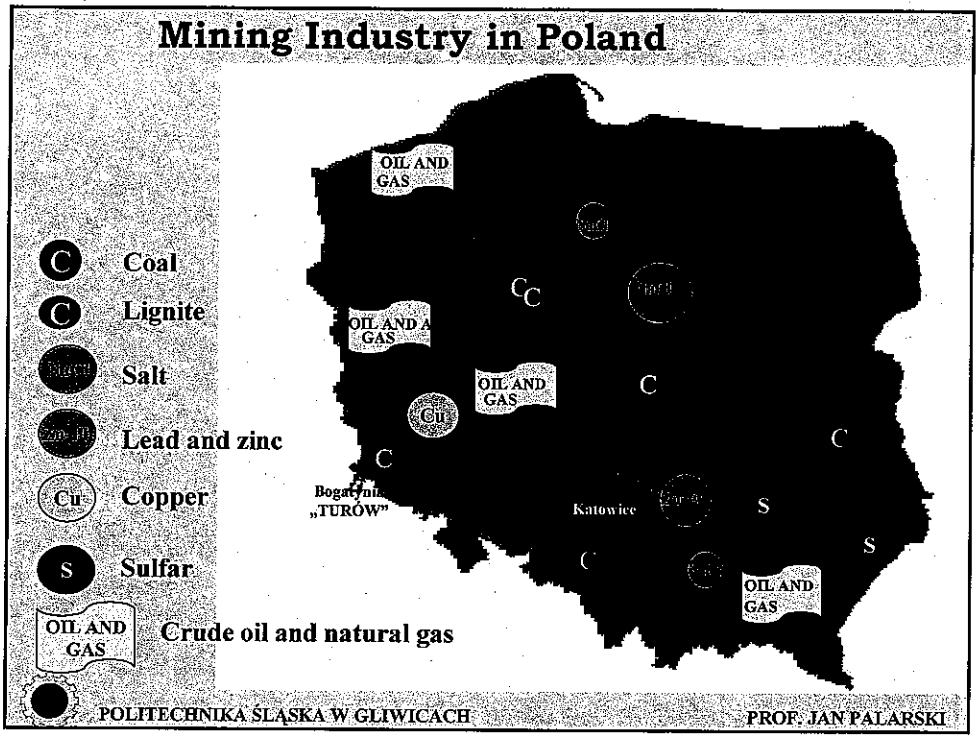
Attachment 6

SELECTION OF FILL SYSTEM FOR LONGWALL IN COAL MINES

- Professor Jan Palarski
  Tel. +48 (0)32 2371442
  Fax +48 (0)322371819
  Email: palarski@rg6.gorn.polsl.gliwice.pl

CONTENTS:

1. INTRODUCTION
2. BACKFILLING IN OPERATING MINES
3. GROUTING OF ROOF FALL ROCKS
4. BACKFILLING OF ABANDONED UNDERGROUND MINES
5. SHAFT FILLING
6. SELECTION OF FILL MIXTURE
7. CONCLUSIONS


Mining Industry in Poland
OIL AND GAS
OIL AND GAS
OIL AND GAS
OIL AND GAS
Cu
Bogatynia „TURÓW”
Katowice
C Coal
C Lignite
Salt
Lead and zinc
Cu Copper
S Sulfar
OIL AND GAS Crude oil and natural gas
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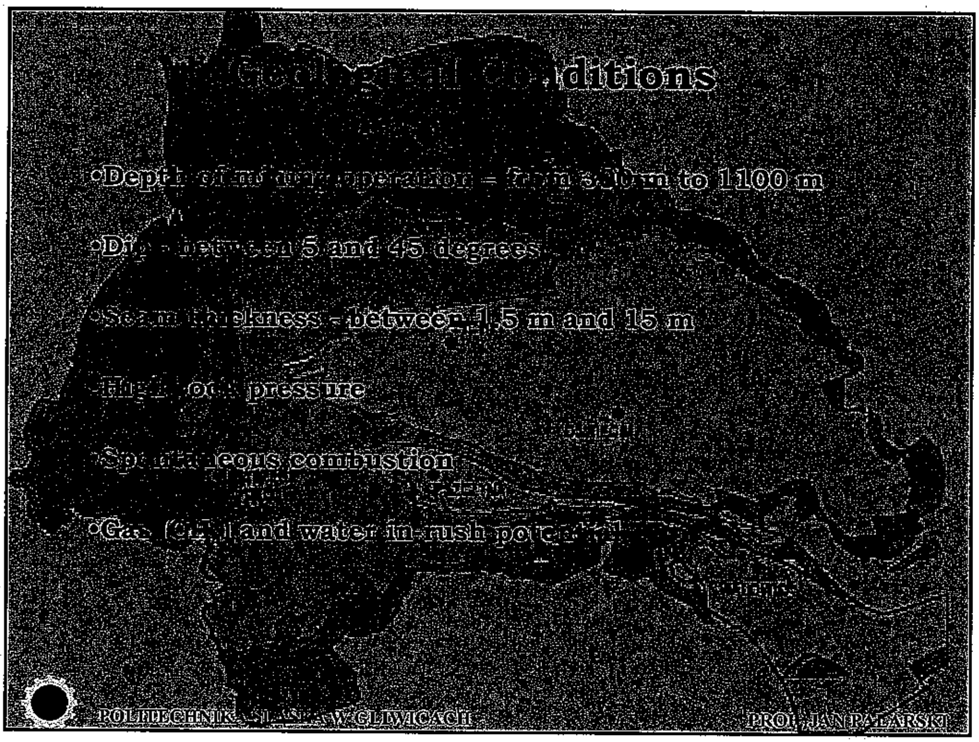
PROF. JAN PALARSKI


ditions
•Depth … to 1100 m
•Di… 5 and 45 degrees
•Seam …ckness - between 1,5 m and 15 m
…pressure
•Sp…eous combustion
•Ga… and water in-rush po…
POLITECHNIKA … W GLIWICACH
PROF. JAN PALARSKI

POLISH COAL INDUSTRY
UNDERGROUND COAL MINING

PARAMETER	UNIT	
[illegible]	[illegible]	[illegible]

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MINING METHODS

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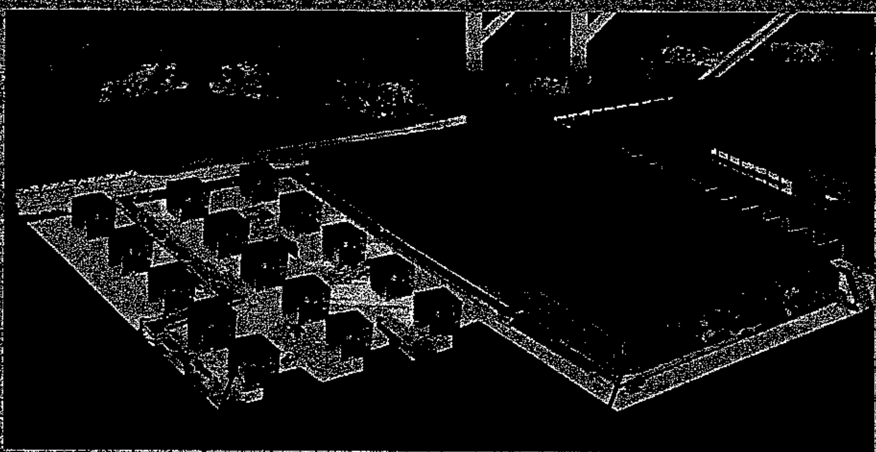
Mining Methods

- Longwall with caving
- Longwall with backfill
- Longwall with grouting of roof fall rock
- Multi-slice longwalling with backfill or grouting



Investment: $3-5M

Longwall panels are solid coal blocks accessed by tunnels
Investment: $30M for face equipment only

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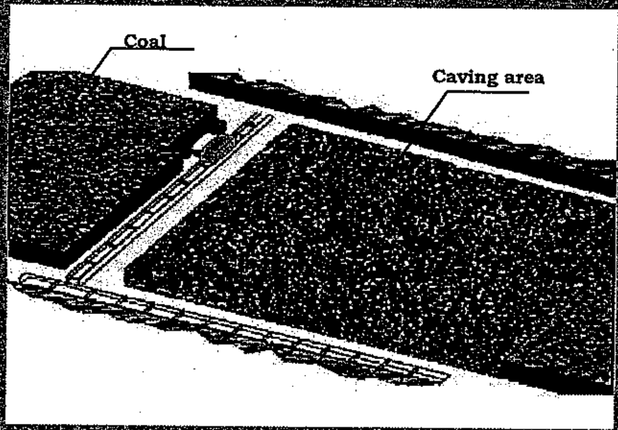
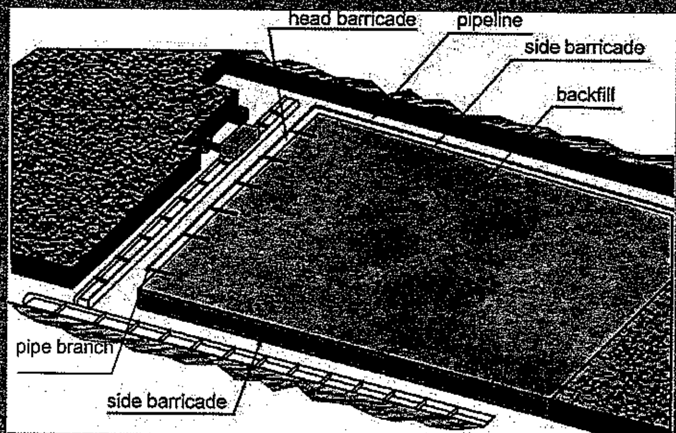
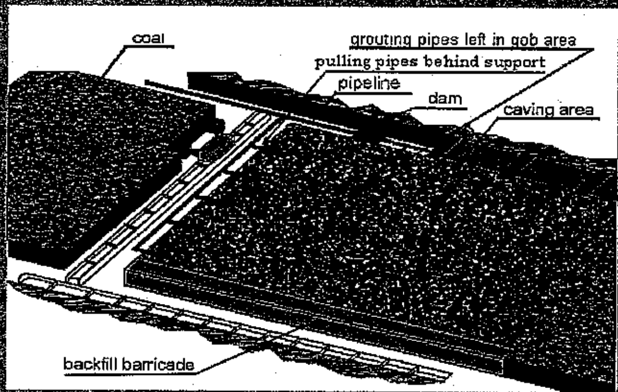
Longwall with Caving



Longwall Mining with Backfill



Longwall Mining with Caving and Grouting of Gob Area



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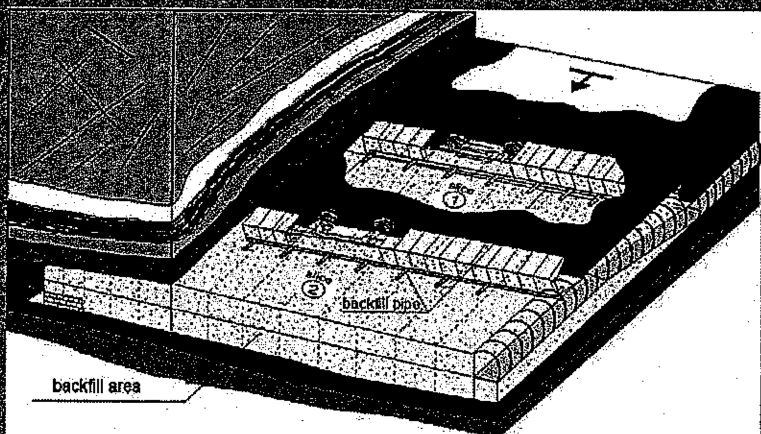
Longwall Faces with Backfill – Ascending Slicing



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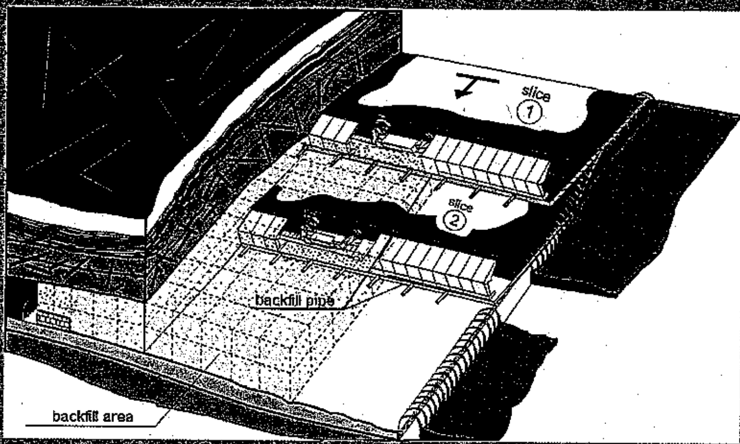
Longwall Faces with Backfill – Descending Slicing



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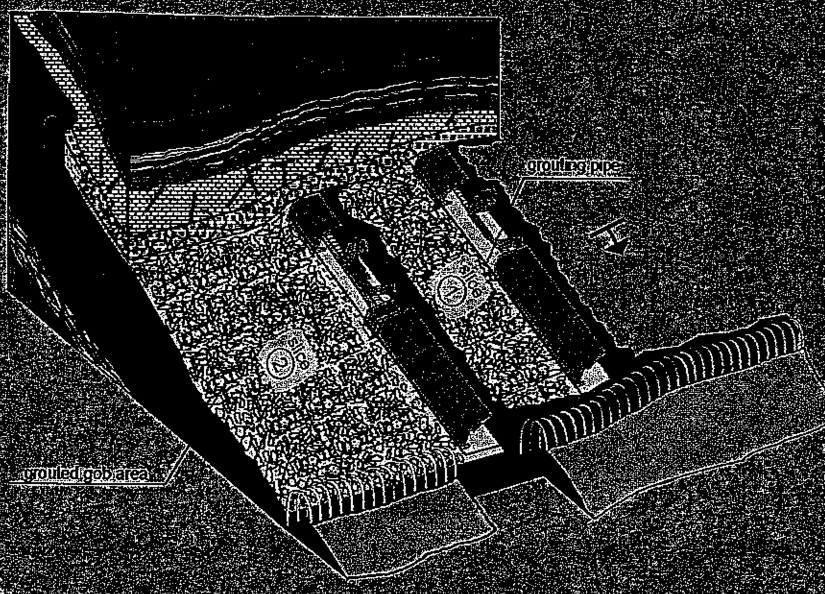

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ENVIRONMENTAL CONSIDERATIONS

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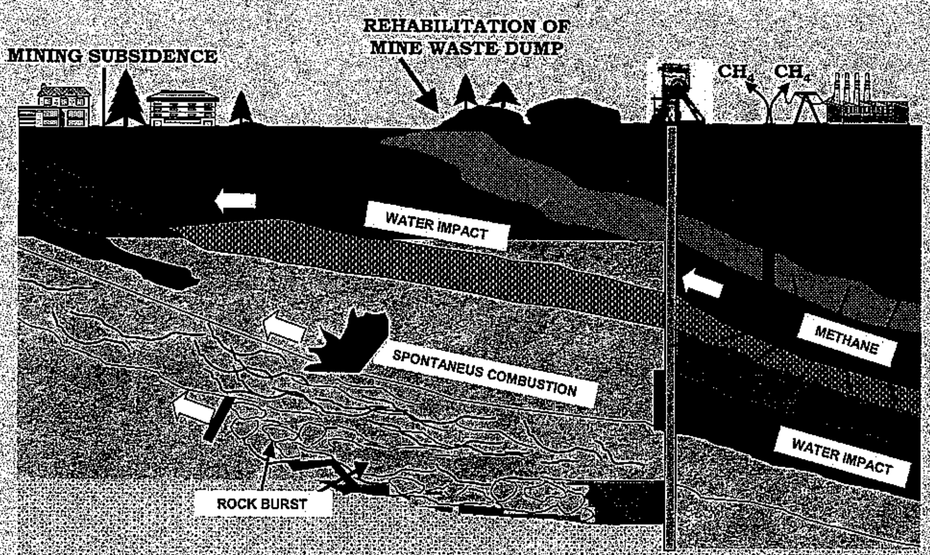
Environmental Considerations



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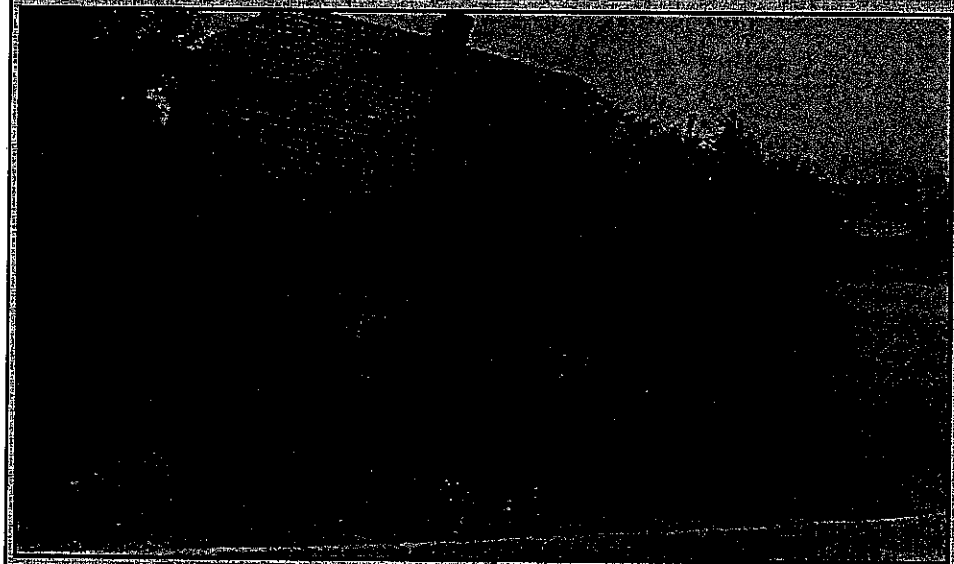
UNDERGROUND MINING – INFLUENCE ON THE SURFACE



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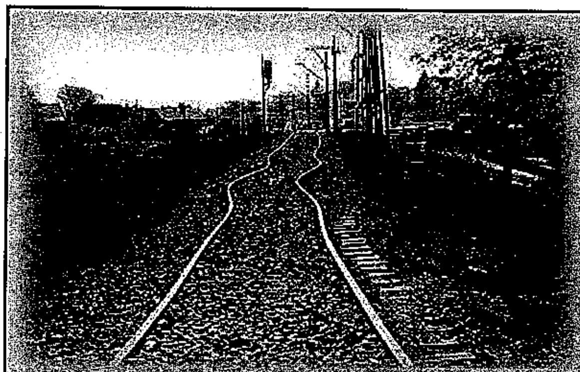
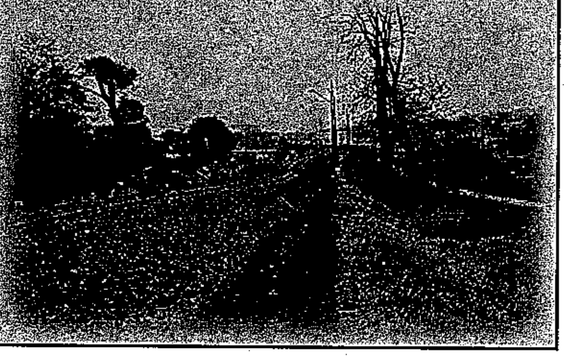
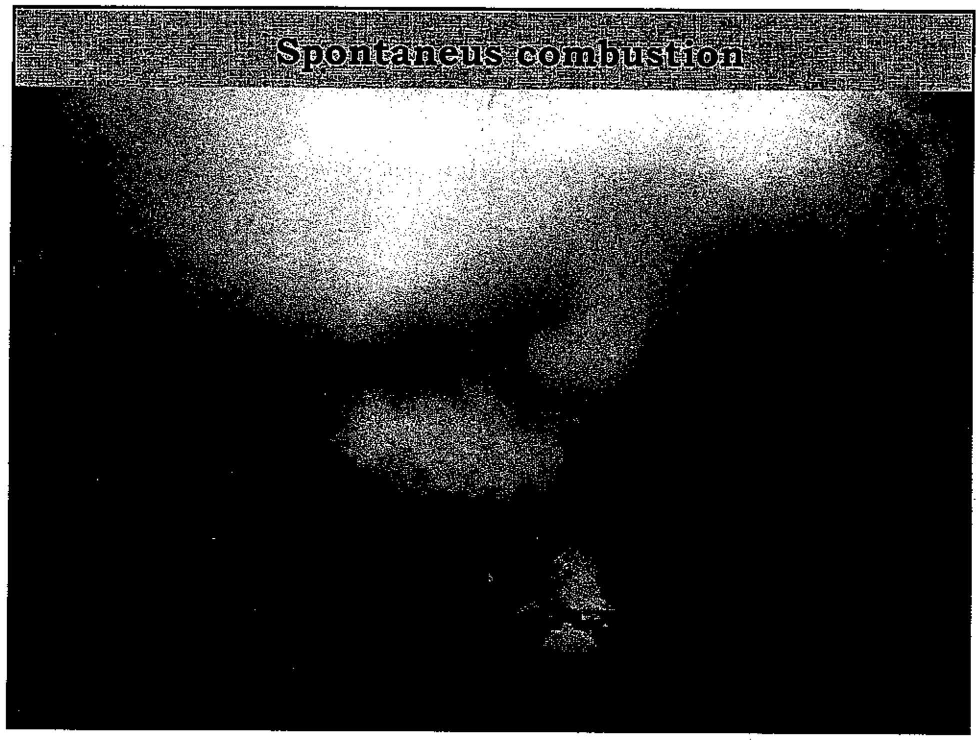
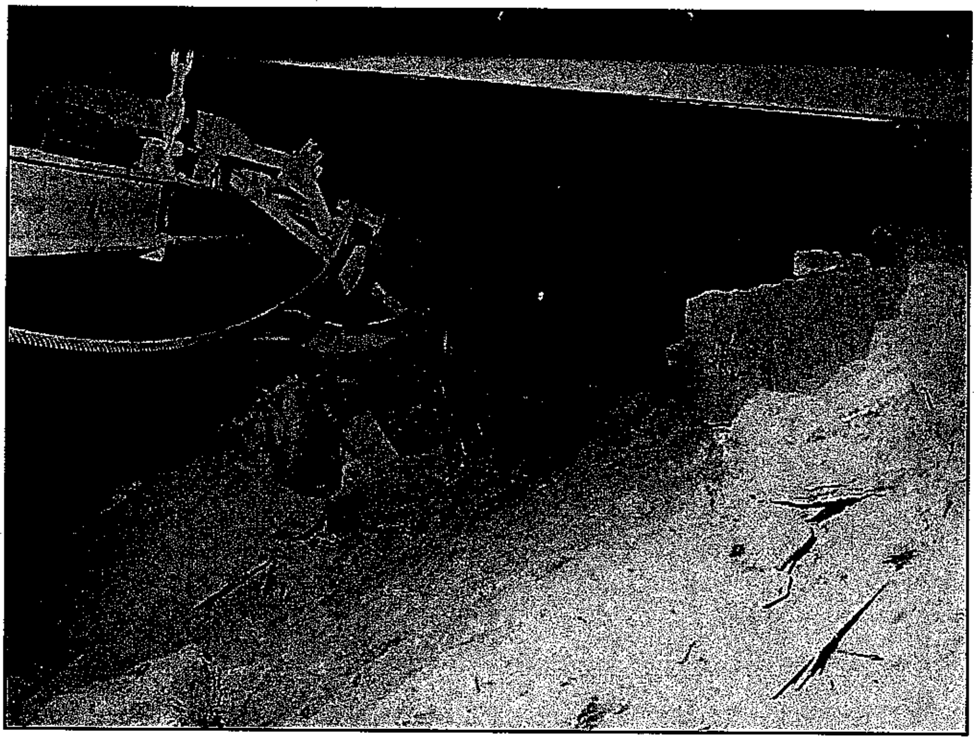


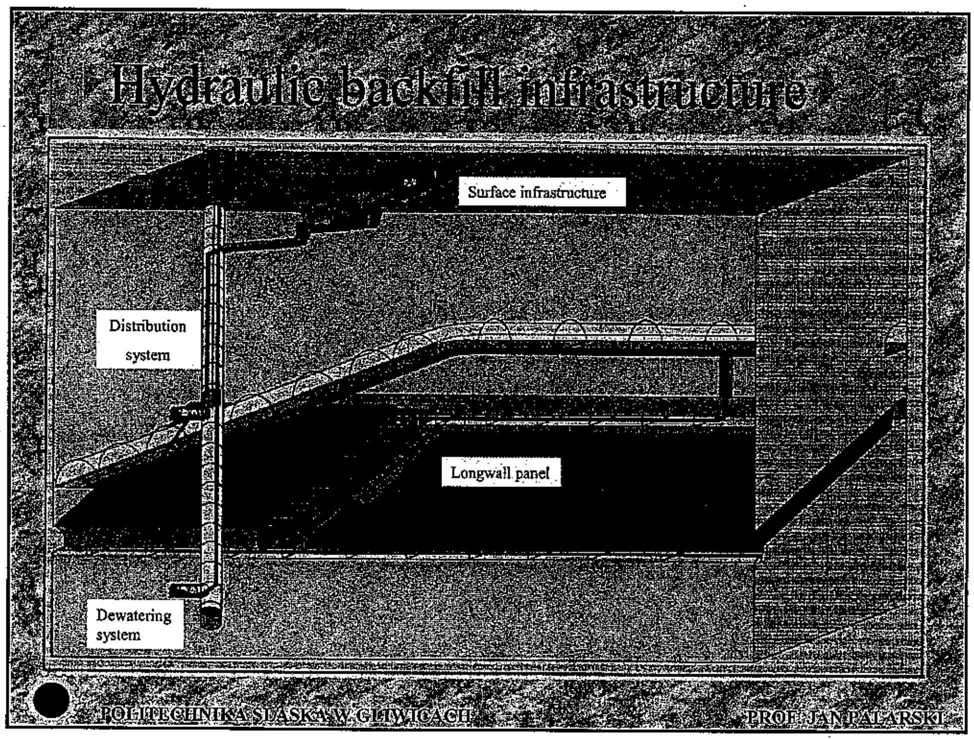
MINING SUBSIDENCE




Spontaneus combustion




HYDRAULIC
BACKFILL


Hydraulic backfill infrastructure
Surface infrastructure
Distribution system
Longwall panel
Dewatering system
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PROF. JAN PALARSKI

Backfill Mixture

BACKFILL MATERIALL	BACKFILL WATER
➢ Crushed waste rock ➢ Tailing ➢ Coal combustion products ➢ Binder material	➢ Mine water ➢ Water with high content of salt, acid, heavy metals and radioactive constituents + binder or neutralization substances

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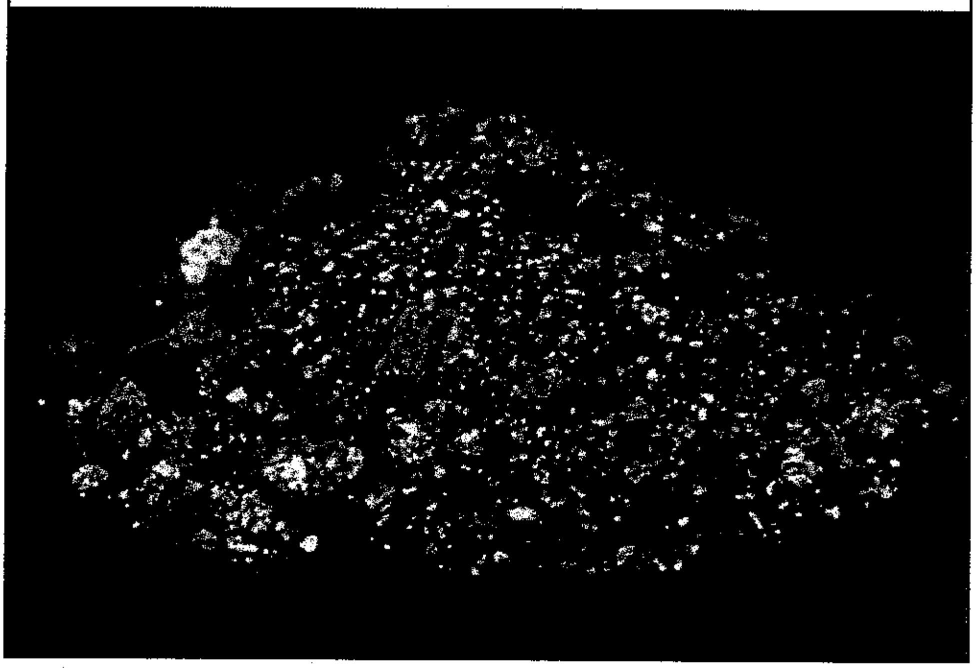
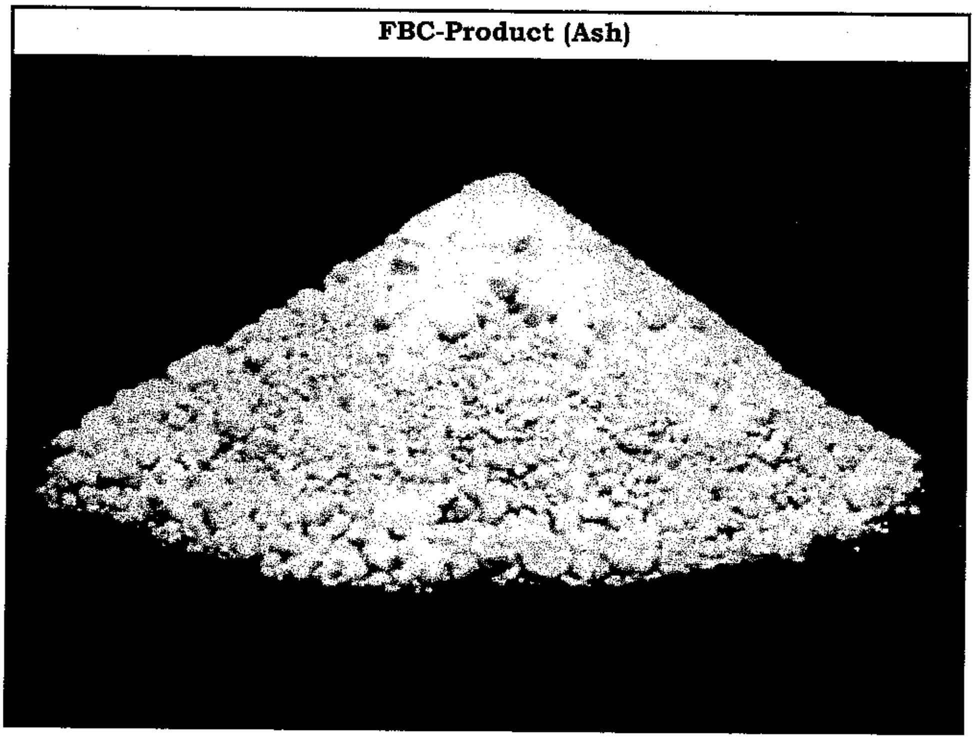
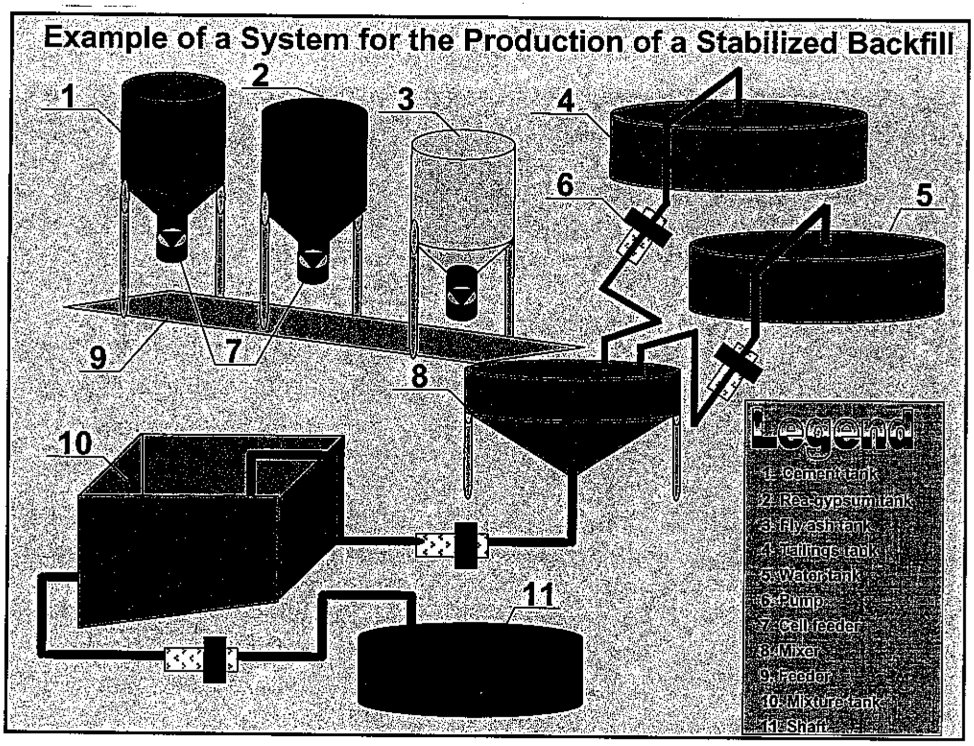
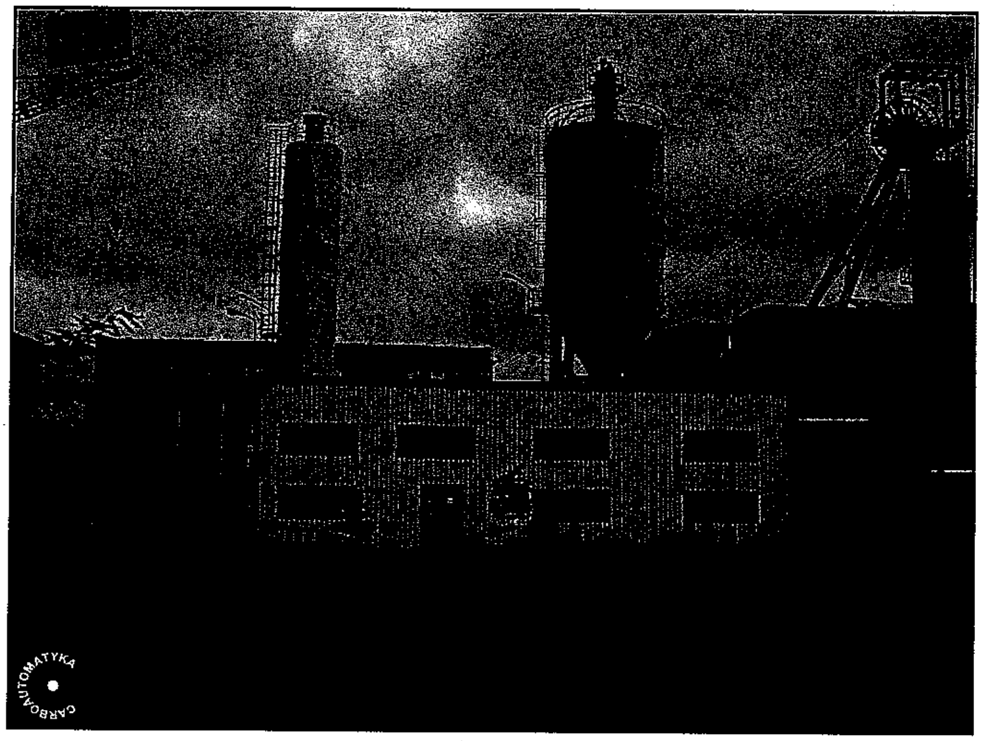
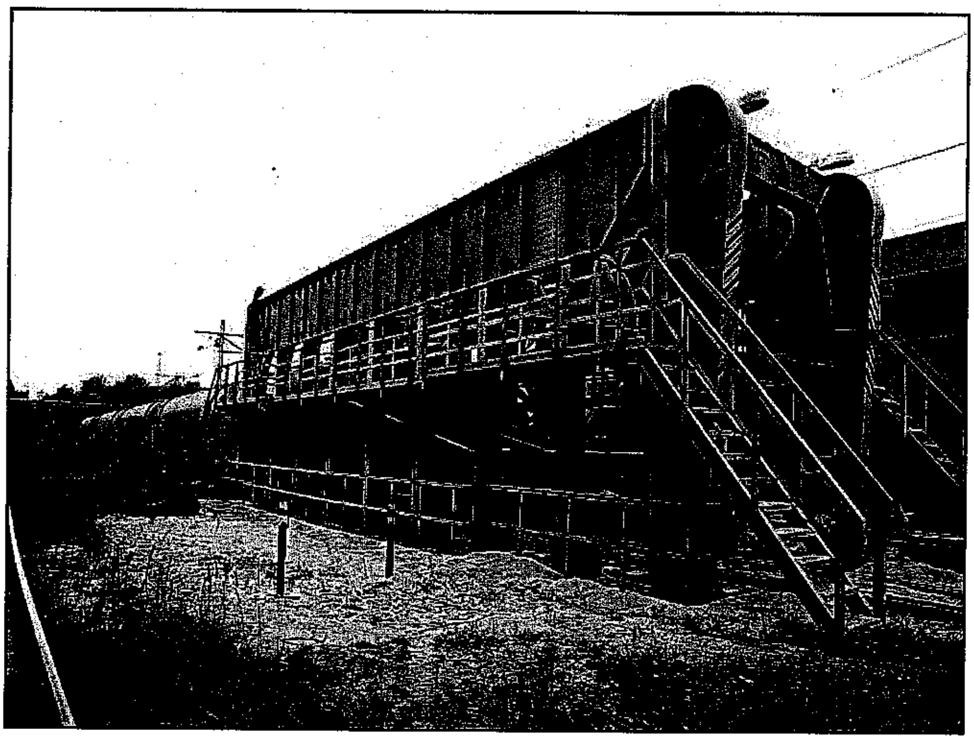
Slag

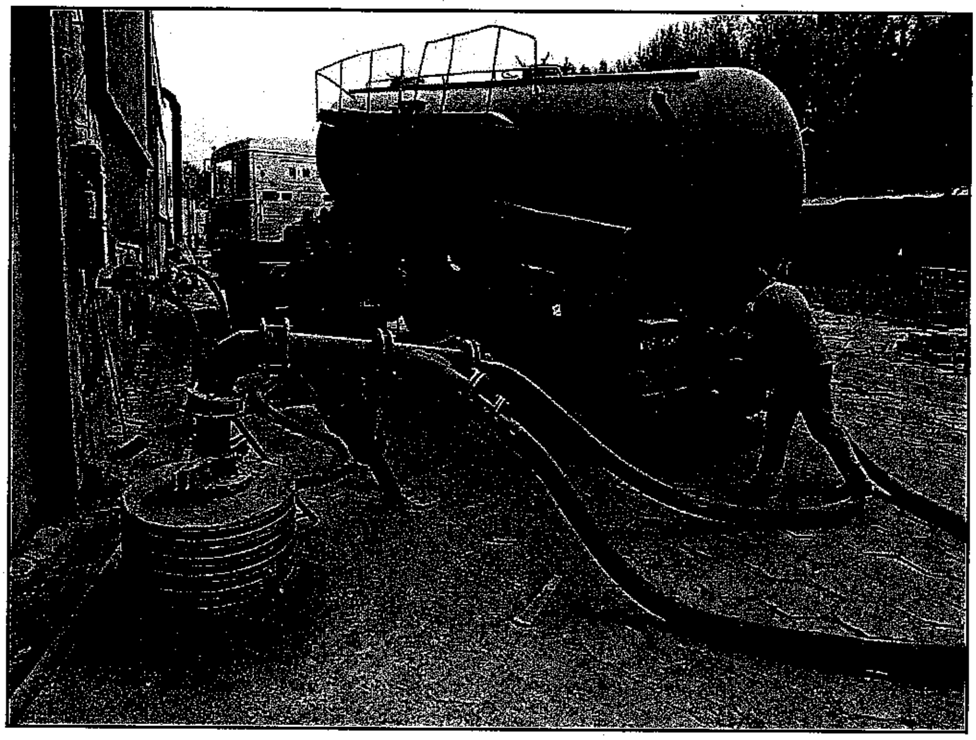


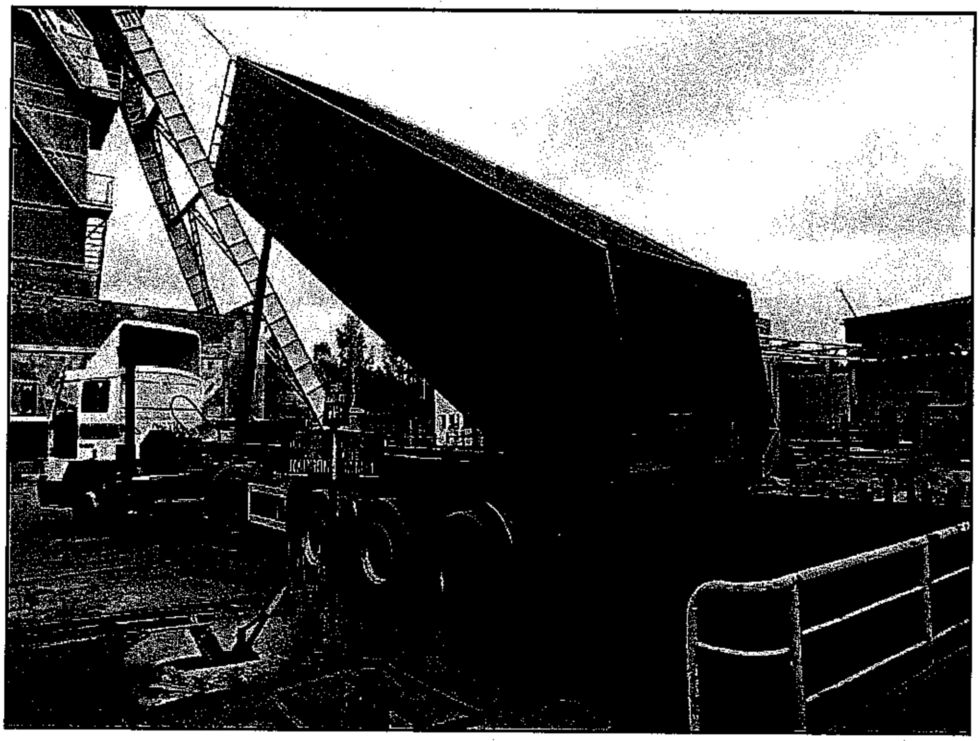

FBC-Product (Ash)

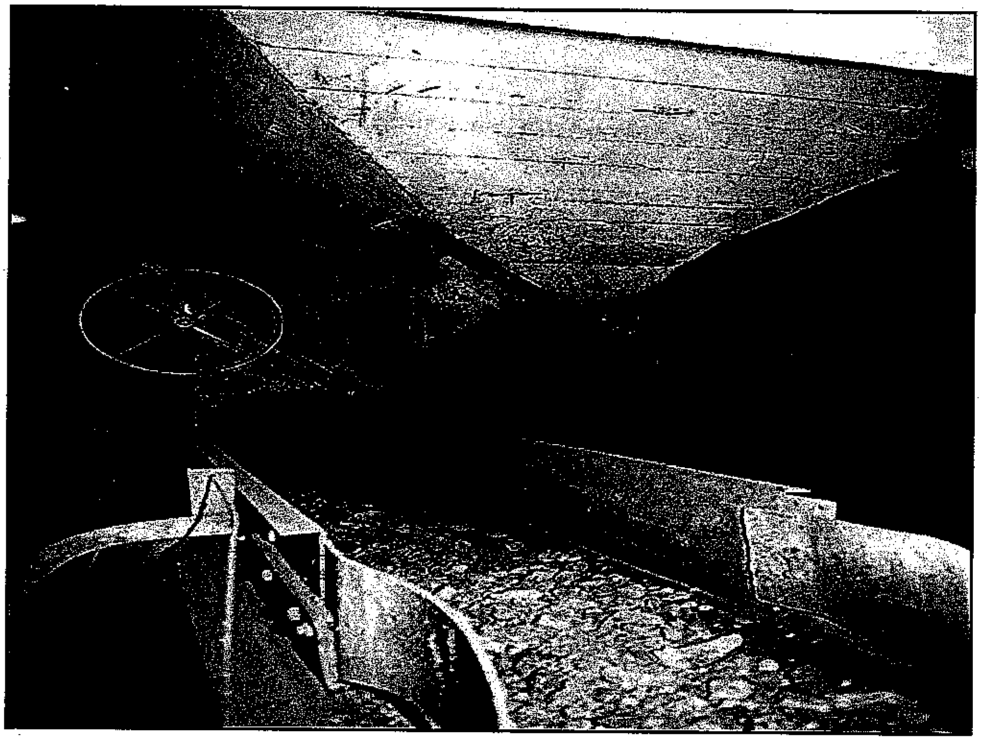

Example of a System for the Production of a Stabilized Backfill
1
2
3
4
5
6
7
8
9
10
11
Legend
1. Cement tank
2. Rea-gypsum tank
3. Fly ash tank
4. Tailings tank
5. Water tank
6. Pump
7. Cell feeder
8. Mixer
9. Feeder
10. Mixture tank
11. Shaft

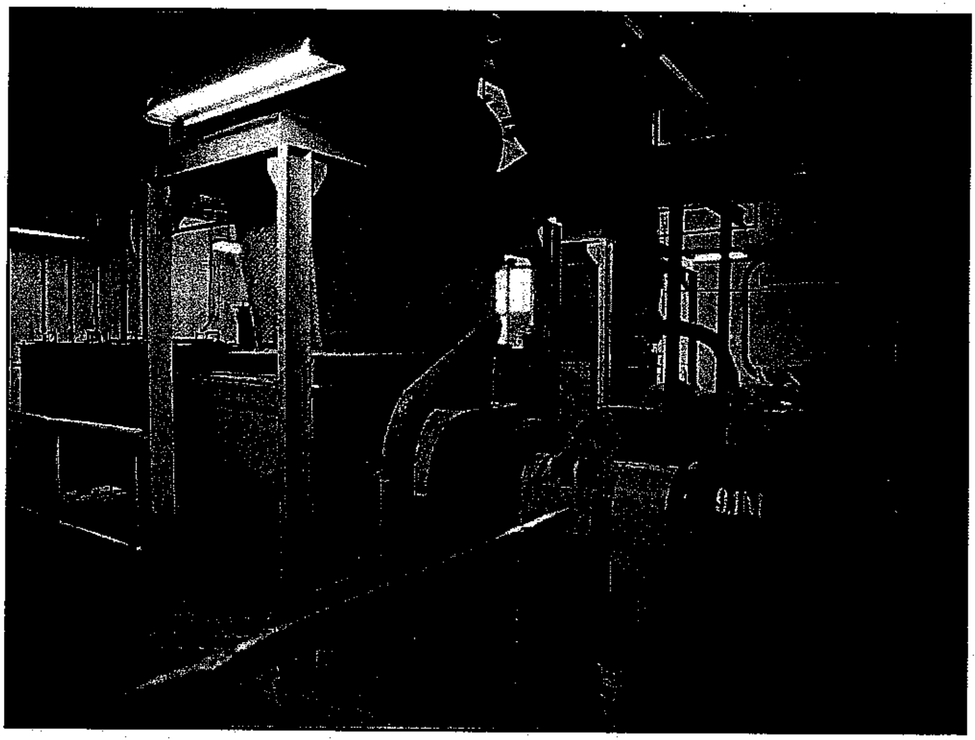

CARBOAUTOMATYKA



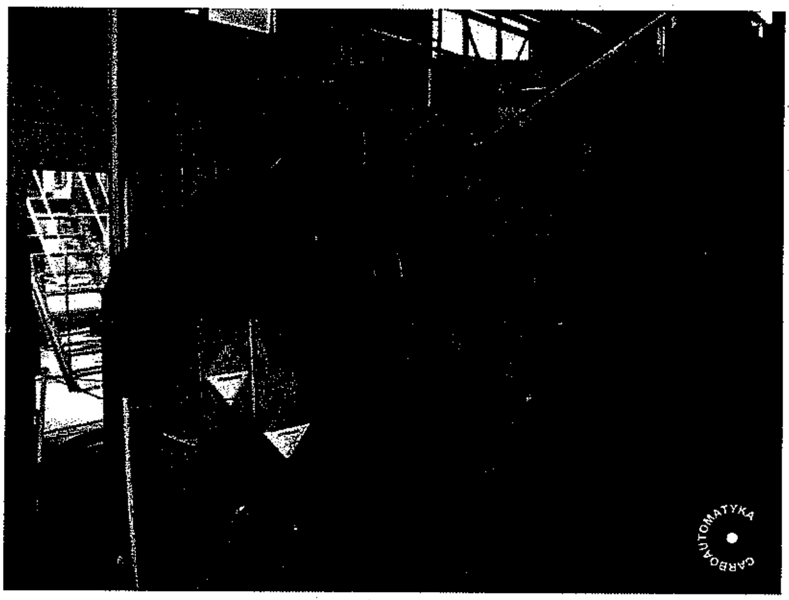


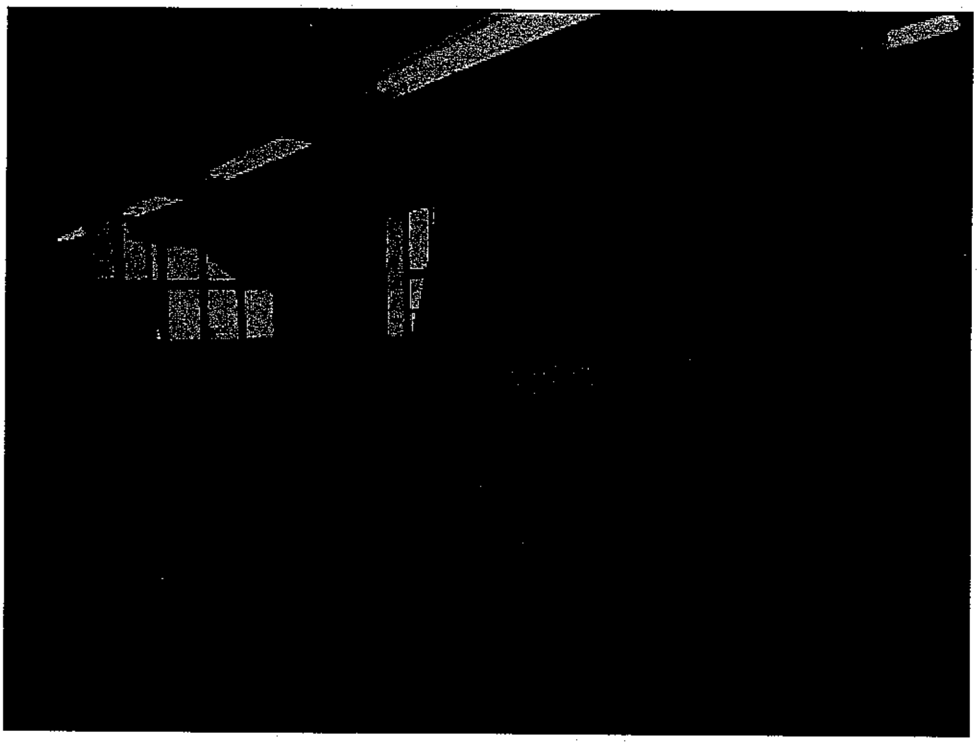


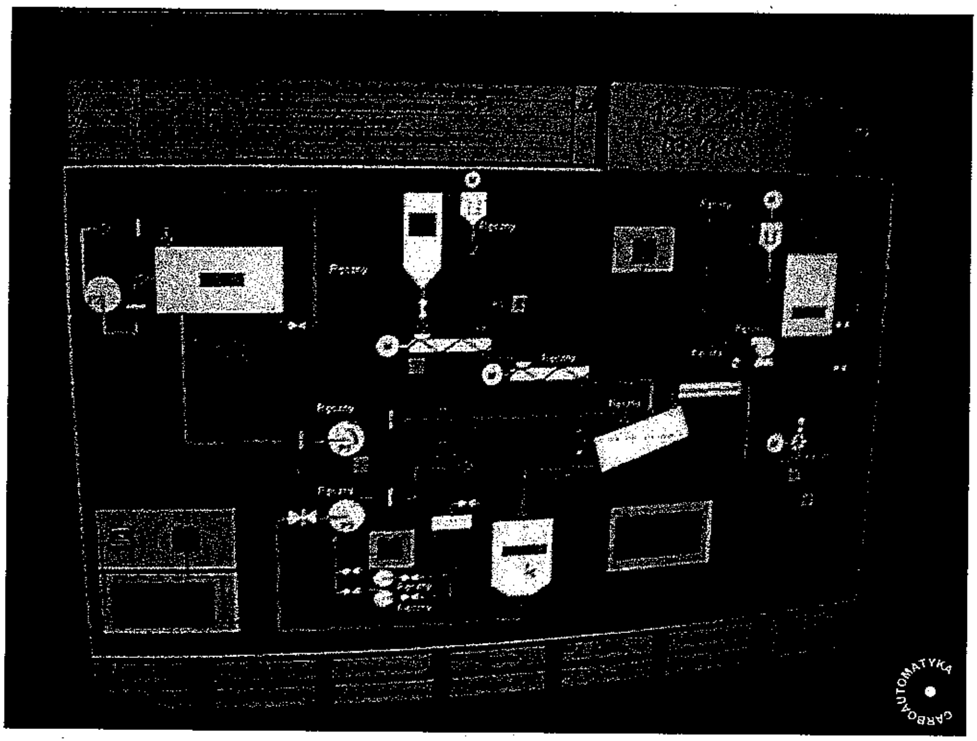


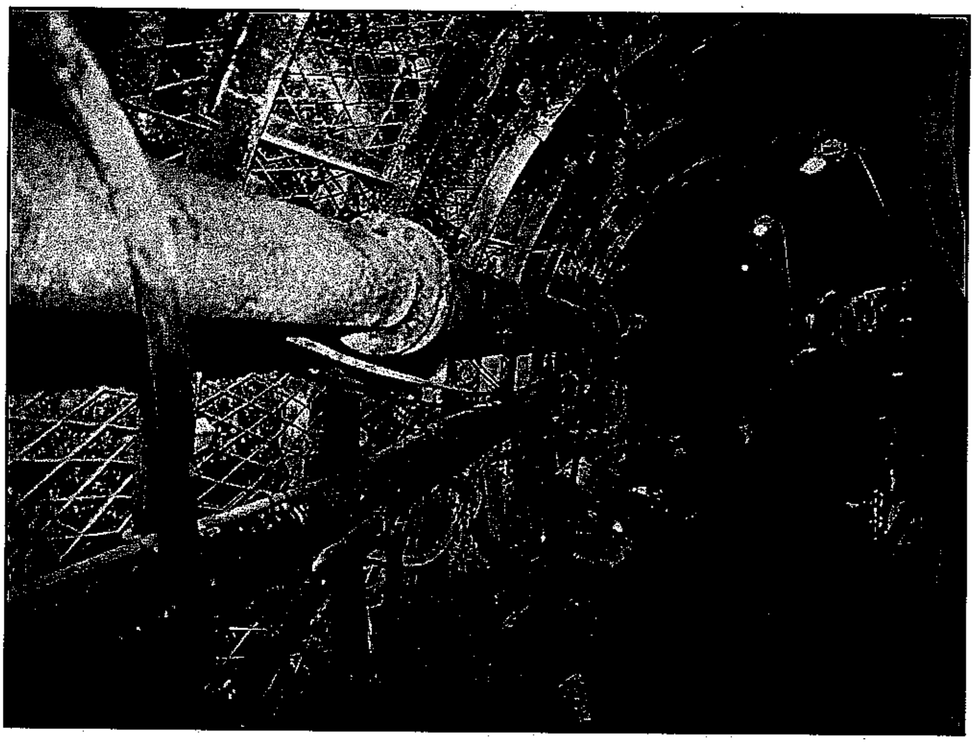


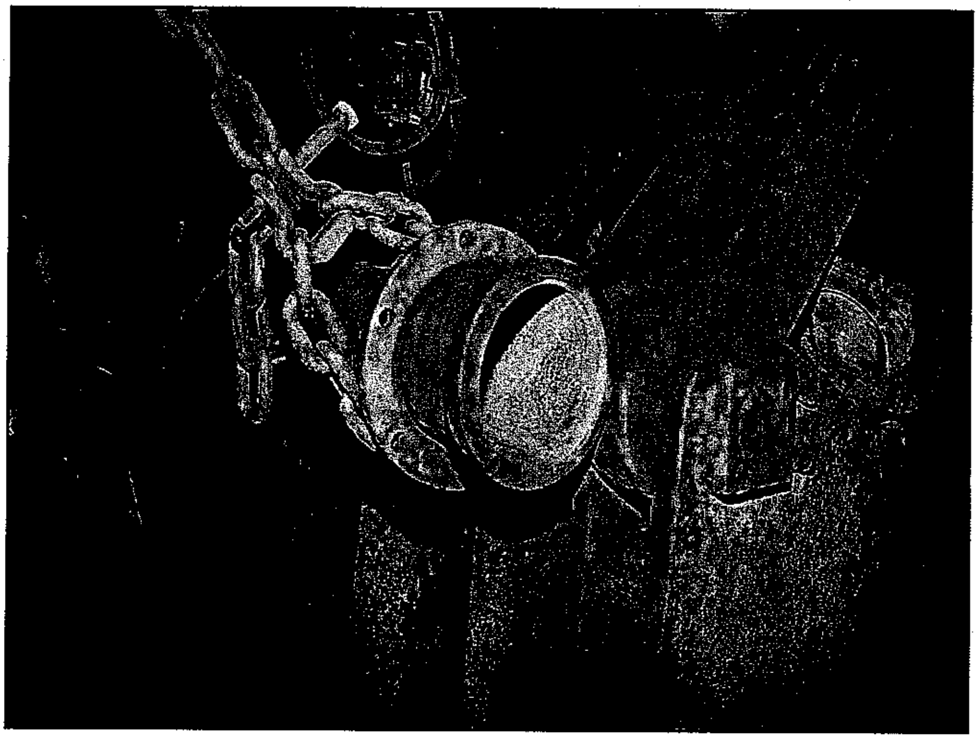
Mixer

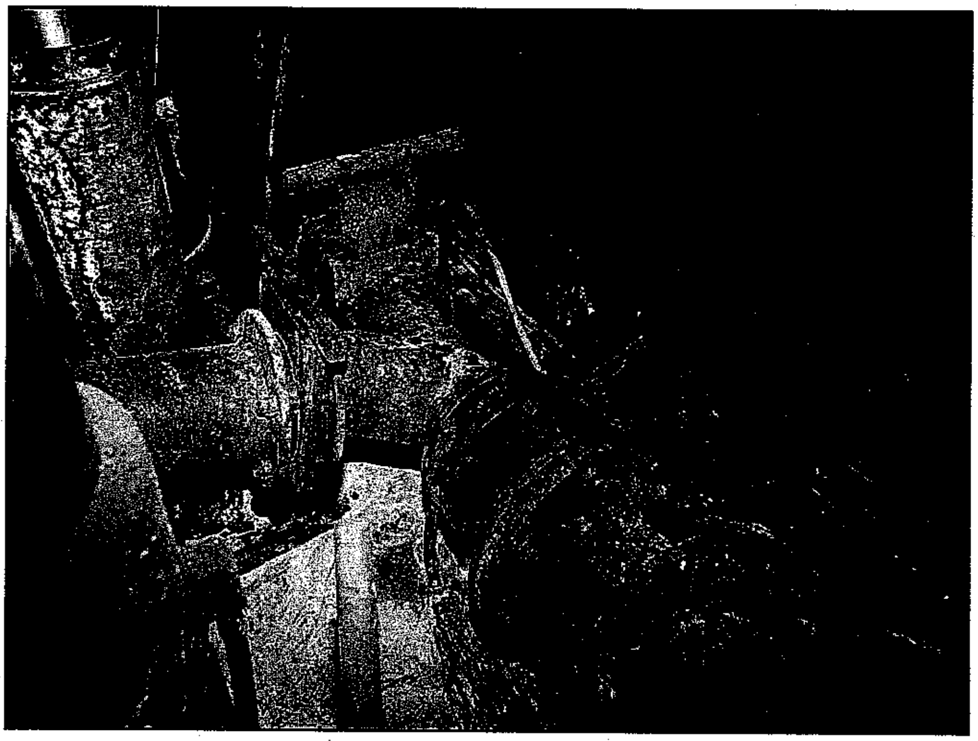


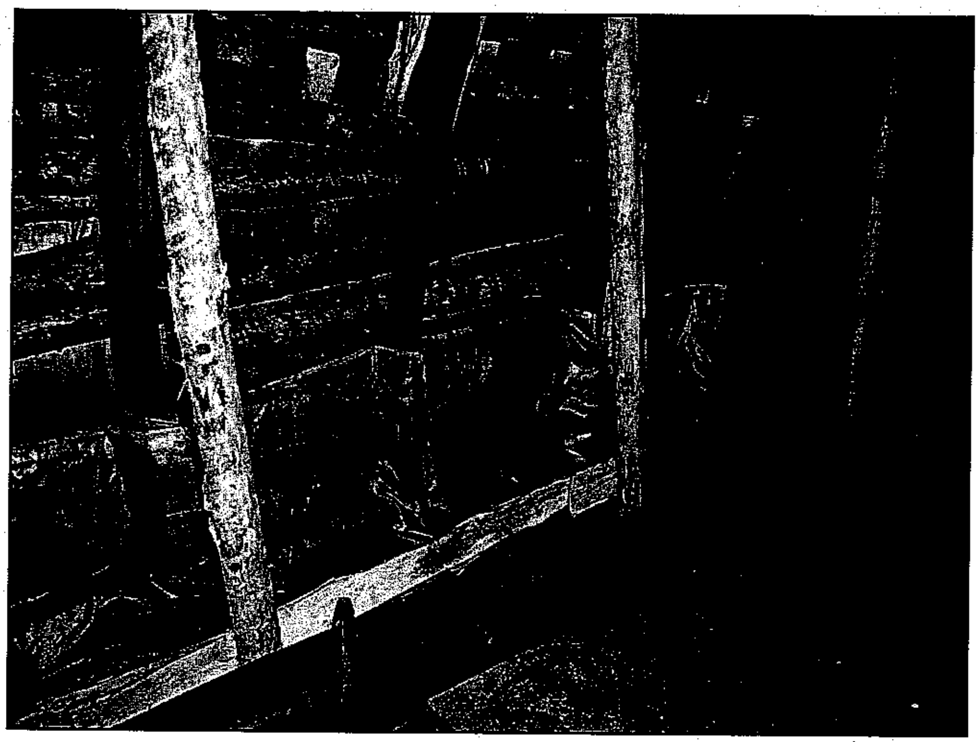


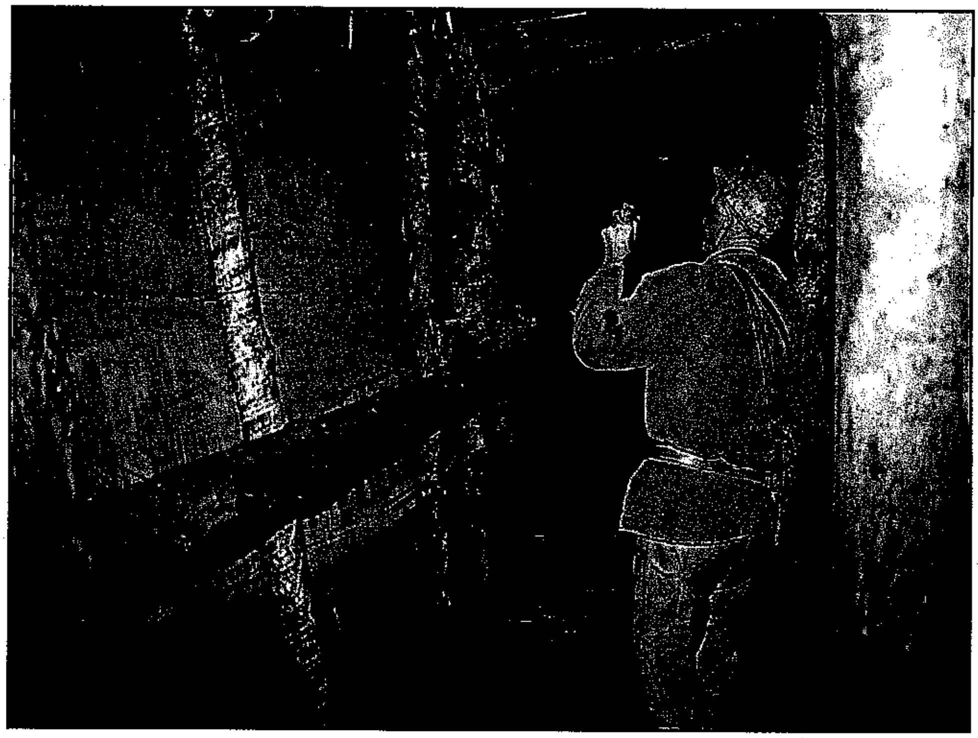

CARBOAUTOMATYKA

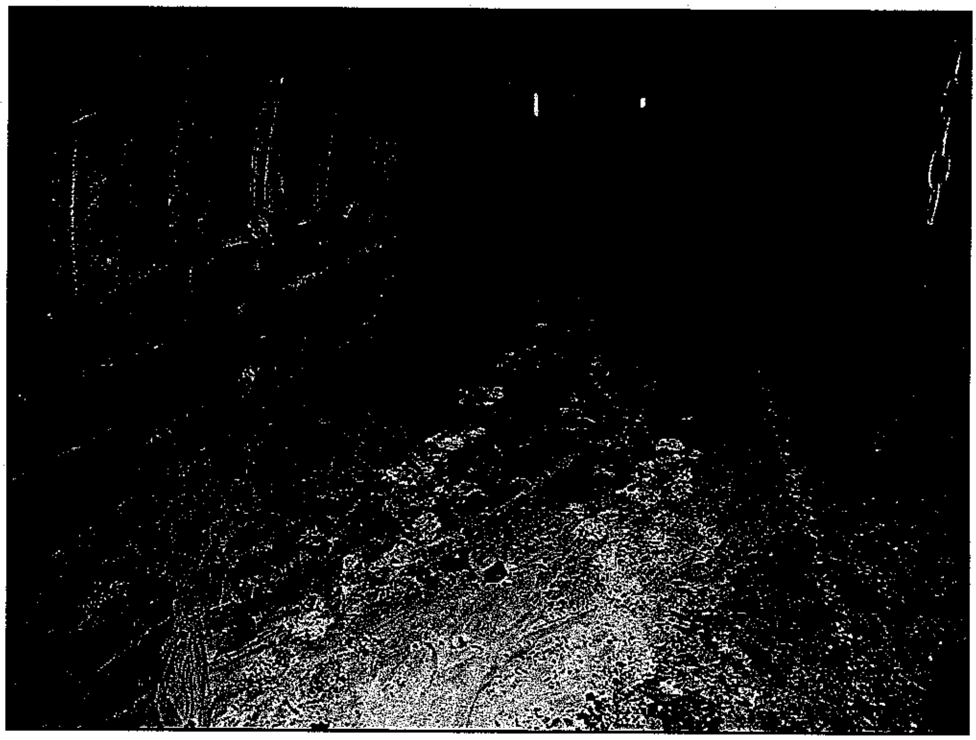








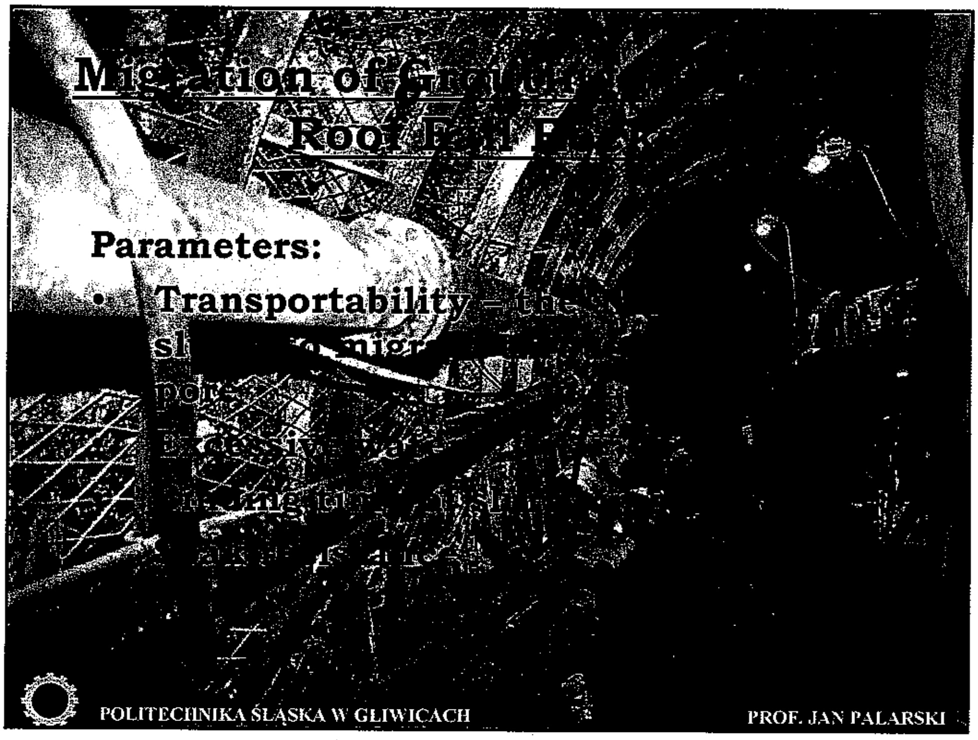




GROUTING OF ROOF FALL ROCK

The Grouting Method of Rock Fall Rocks

- Method is based on longwall with caving.
- Method doesn't need to keep open room behind support.
- Method allows to separate extraction from filling process.
- Fill mixture: fly ash, tailing, binders, polluted water (high salt content).
- Reduction of spontaneous combustion, ventilation problem, damages on the surface and fine waste disposal.


Parameters:
Transportability – the
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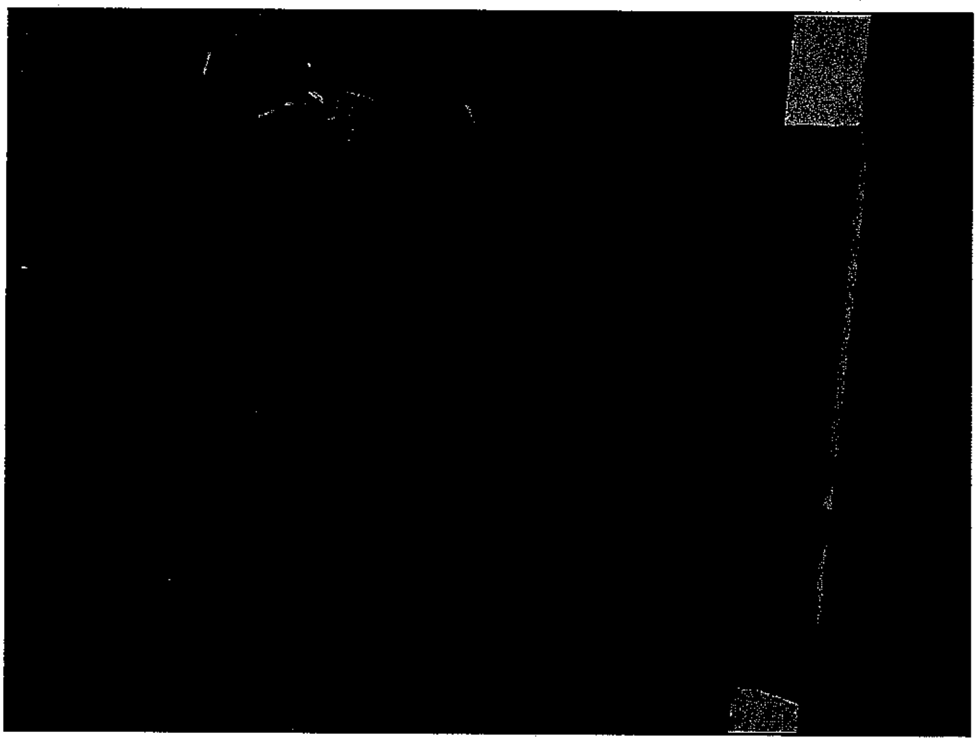
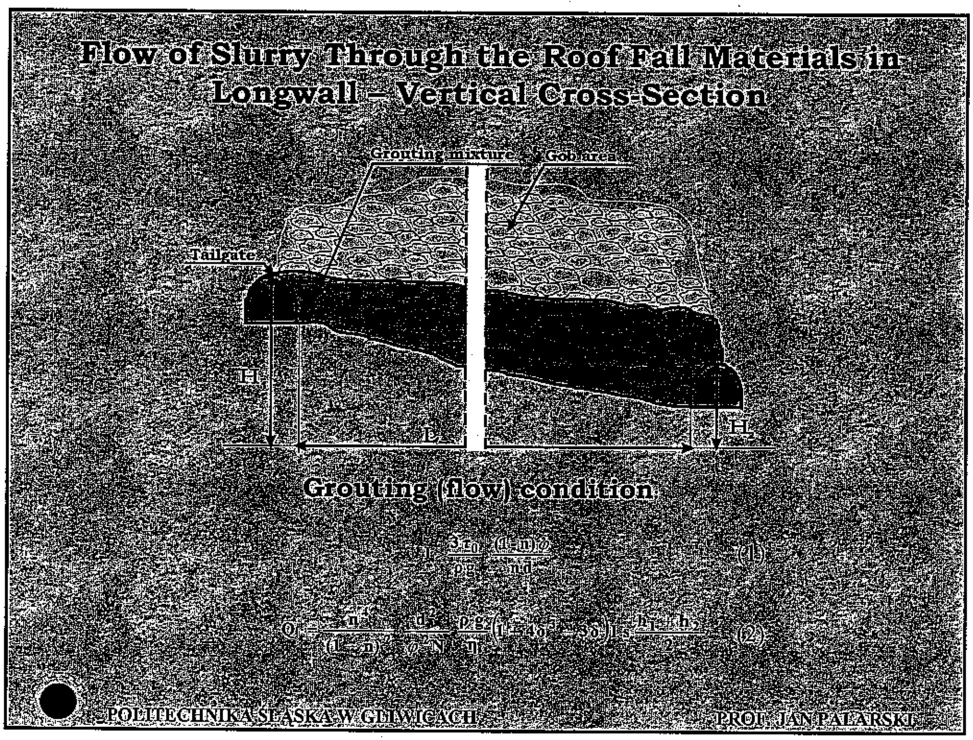
PROF. JAN PALARSKI





Flow of Slurry Through the Roof Fall Materials in Longwall – Vertical Cross-Section
Grouting mixture
Gob area
Tailgate
H
L
H
Grouting (flow) condition
(1)
(2)
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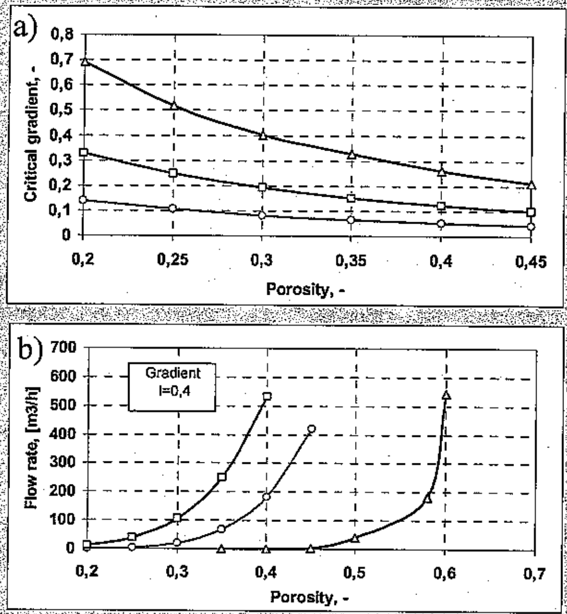
PROF. JAN PALARSKI



Mixture I $\rho_1 = 1400$ [kg/m³]; $\eta_1 = 0{,}07$ [Pa s]; $\tau_0 = 20$ [Pa];

Mixture II $\rho_2 = 1550$ [kg/m³]; $\eta_2 = 0{,}10$ [Pa s]; $\tau_0 = 52$ [Pa];

Mixture III $\rho_3 = 1700$ [kg/m³]; $\eta_3 = 0{,}15$ [Pa s]; $\tau_0 = 120$ [Pa];

Effect of porosity and quality of mixture on critical value of gradient(a) and flow rate (b);
$d = 0{,}15m$; $N = 300$; $h_1 = 1{,}0m$; $h_2 = 0{,}5m$; $s = 1{,}0m$; $L = 200m$; $g = 9{,}81\ m/s^2$

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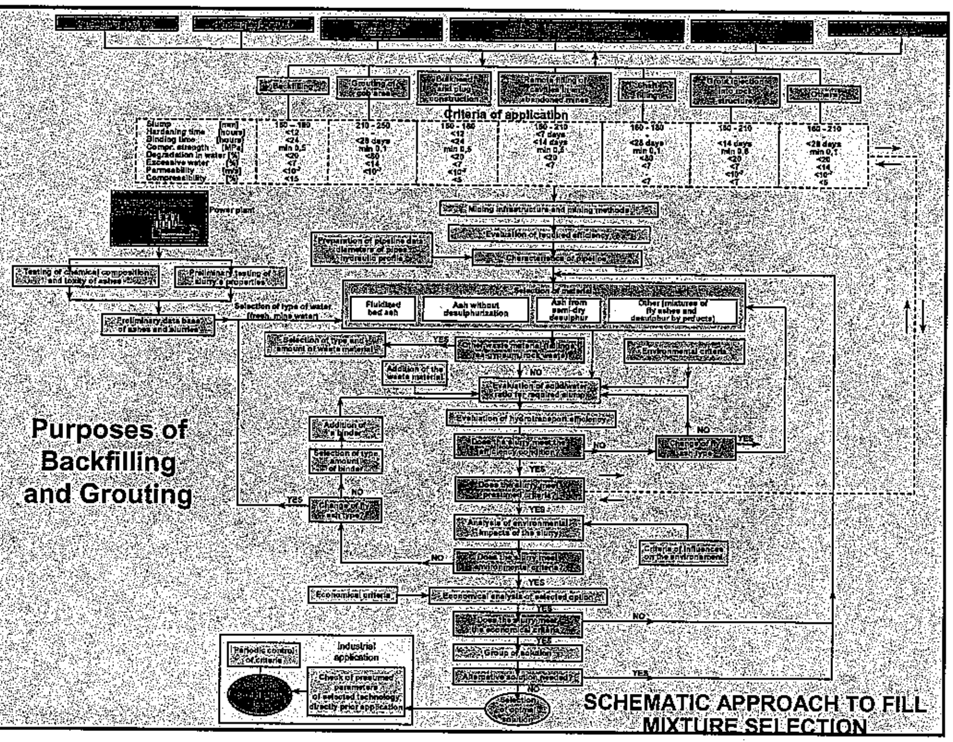

Purposes of Backfilling and Grouting

SCHEMATIC APPROACH TO FILL MIXTURE SELECTION

BACKFILLING ABANDONED UNDERGROUND MINES

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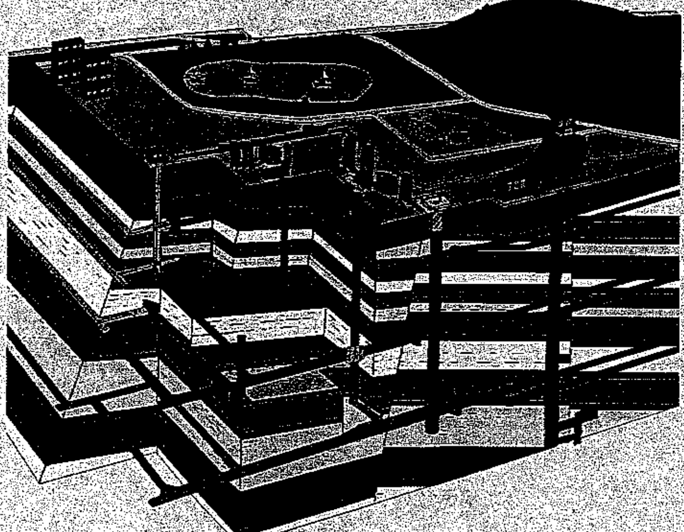
Closure Process of Mine



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Void Filling Through the Borehole
Void
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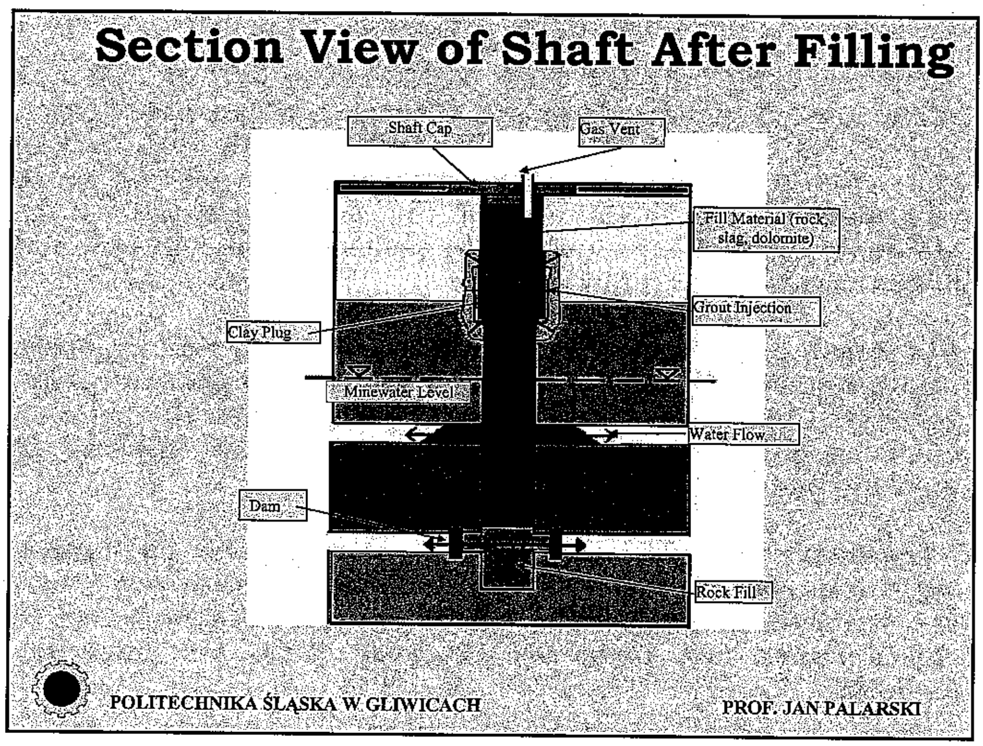
Section View of Shaft After Filling
Shaft Cap
Gas Vent
Fill Material (rock, slag, dolomite)
Grout Injection
Clay Plug
Minewater Level
Water Flow
Dam
Rock Fill
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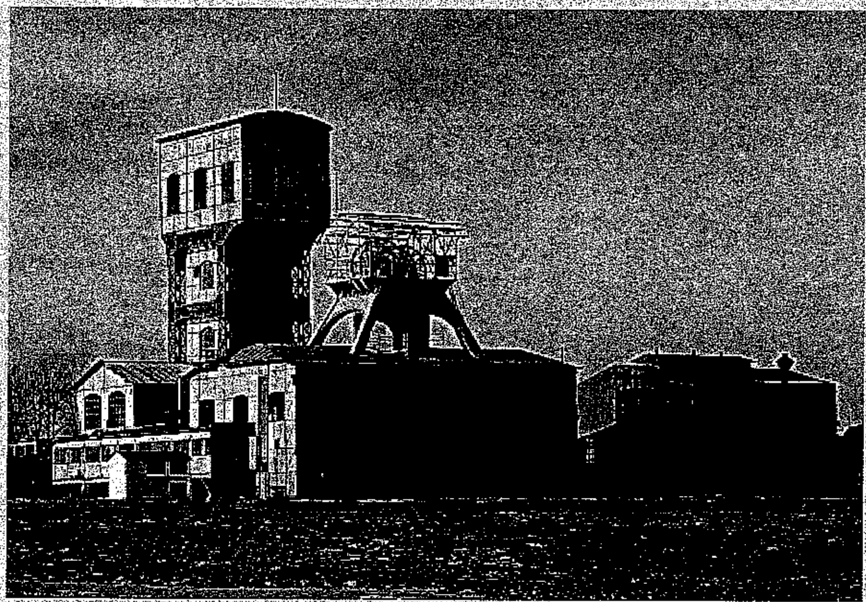
PROF. JAN PALARSKI

Filled shafts KWK „Polska"

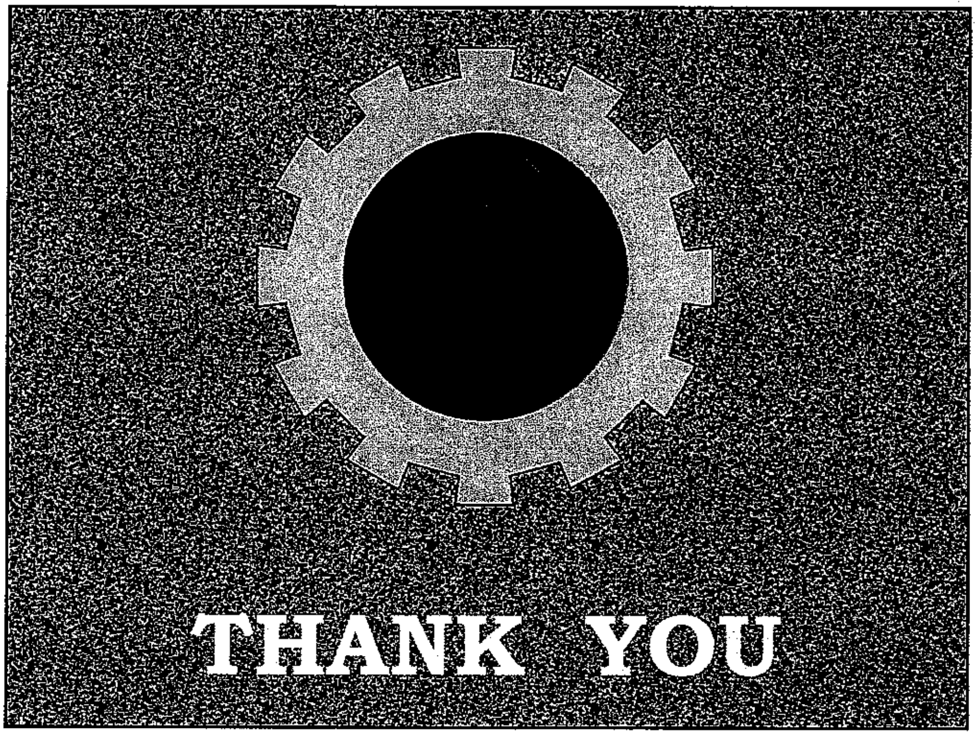


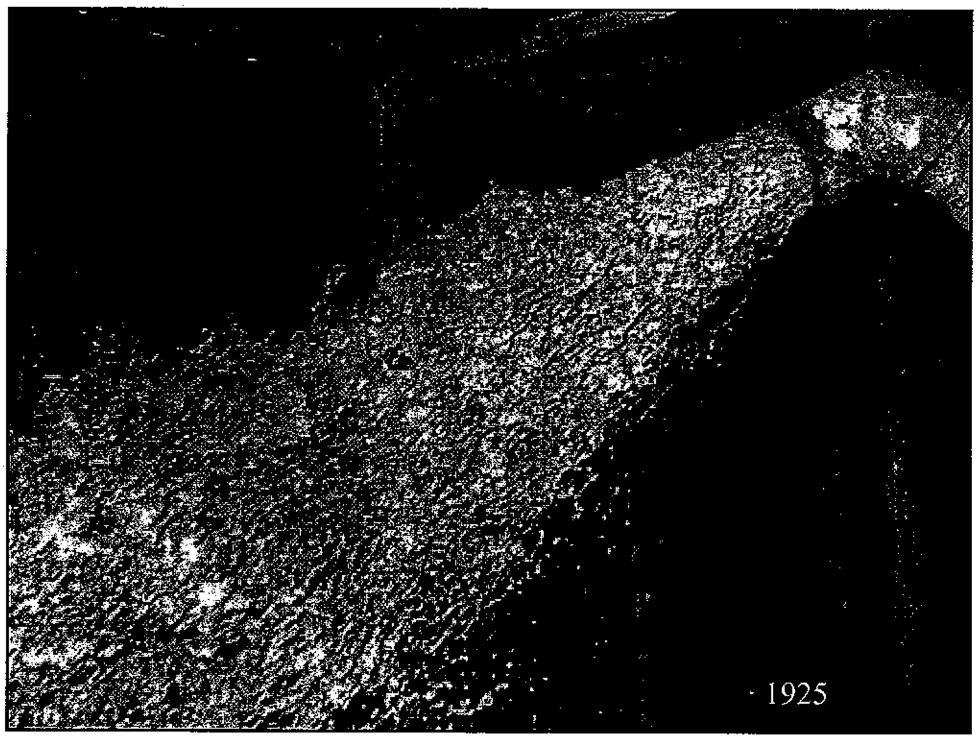
Conclusions

➢Polish mining industry deals with number of technical and economical challenges. In Poland about 20% of the underground mined coal is mined using the longwall methods with backfill and grouting of roof fall rocks which are protective to environment. The main aim of the mining methods is to eliminate waste dumps and tailing ponds from the surface and bind saline water in filling voids.

➢In Polish coal mines, waste development rock, tailing, slime, saline water, various kinds of ashes and desulpharisation by-products from power stations and waste from cement industry allow to produce stabilized and cost effective backfill or grouting material.

➢The mines that are closed create real danger for the surface when improper fill methods of abandoned workings and shafts are introduced. Besides, the special methods of dewatering in closed mines have to be used because of the still operating collieries.


THANK YOU


1925

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Illawarra Coal
Attachment 7

Summary of Observations

Poland Visit November 2004

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Objective of the visit was to:

- view first hand the practice of backfilling longwall goafs
- to understand the conditions, limitations and success of these practices
- to view the methodology and equipment used
- to determine the outcome in terms of use of washery refuse
- to determine the outcome in terms of impact on subsidence
- to meet and discuss with equipment manufacturers
- to meet and discuss with research personnel

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Executive Summary

- Back filling immediately behind supports not transferable to our conditions
  - Inclined seams, productivity impact
- Back filling in broken goaf, away from face worthy of further investigations
- Potential to use surface to goaf gas drainage boreholes or via inseam up holes
- Sand most effective in controlling subsidence – 20% of normal subsidence, Coal wash 40 – 50% for Polish conditions
- Ratio of water related to particle size
  - Coal wash 3 to 1
  - Sand 1 to 1
- Well developed modelling capability for inseam impacts and subsidence reduction
- Recommendation to engage Professor Palarski to develop a concept study
- Initial focus on subsidence mitigation and the transfer implications for coal wash

Mining Context

- Many hundreds of years of mining history
- Historically villages formed near mines, these have since turned into towns and major cities, now existing around many mines
- Mines are government owned and operated
- Previous socialistic structure mines heavily subsidised
- Mines restructured under current government structure
- High unemployment rate – mining creates jobs
- Mining vital to economy, generates modest profits
- Mining costs incorporate remediation costs
- Much effort placed on either backfill or repairs to minimise sterilisation

Mining Conditions of Mines Visited

- Mining depth ranged from 600m to 850m
- There were up to six mining seams being worked
- Seam thickness was typically about 3m but up to 6m
- Up to 9m of subsidence had been recorded (multi seam effects)
- Seam dips of between 6% and 12%
- Longwalls were extracted up dip
- 4 to 6 longwalls were being operated concurrently
- Single entry gate roads were used
- Steel arches were the standard support method
- Most coals were thermal but coking coals were also mined

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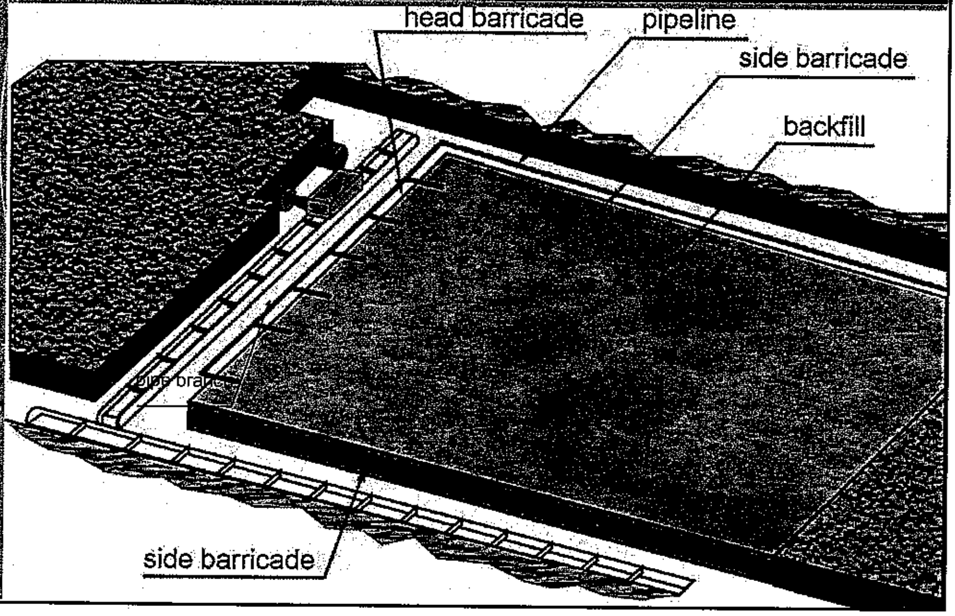
Summary of Operations Visited

- The operations employed between 2500 and 3500 employees
- Mines produced between 2mtpa and 5mtpa
- Each site had extensive infrastructure: washery, heating plants, backfill plants, rail yards, multiple shafts
- The oldest operation commenced in 1752 and the youngest was over 100 years old with an estimated 30 year life left
- Each operation was located in the middle of a town
- Backfill plants were located on the surface pit top areas
- Backfill was reticulated via a pipe network down shafts to each longwall
- Each operation had at least four longwall faces
- Single entry gate roads were employed, arched roadway profiles
- Extensive use of monorail systems

Observations on Backfill Methodology

- Backfill mix was very wet
- Working up dip assisted drainage of water away from the face
- Modified roof supports were required for backfill used to reduce subsidence
- Backfill was placed immediately behind the chock in formed chambers
- This process involved 2 production shifts & 1 backfill / maint shift
- Typical production was 2000 tpd per longwall using this process
- Backfill placed for spon comb control did not interrupt mining process or require modified supports
- This system did require working up dip & cross grade between gates

Longwall Mining with Backfill



Observations on Backfill Installation

- Backfill mix for subsidence control undertaken manually
- Typically used water canons in large below ground bin to mix the desired backfill for the particular circumstances
- Components typically sand, washery waste and fly ash
- Sand provided superior subsidence control characteristics
- Waste rock of up to 25mm fraction used
- Pipe wear was more of an issues when using waste rock, typically would turn pipes 3 x 120º in high wear areas
- Large amounts of water used to pre and post flush lines
- Lines under gravity to LW, typically no uphill sections
- Exclusion zones around pipes whilst active

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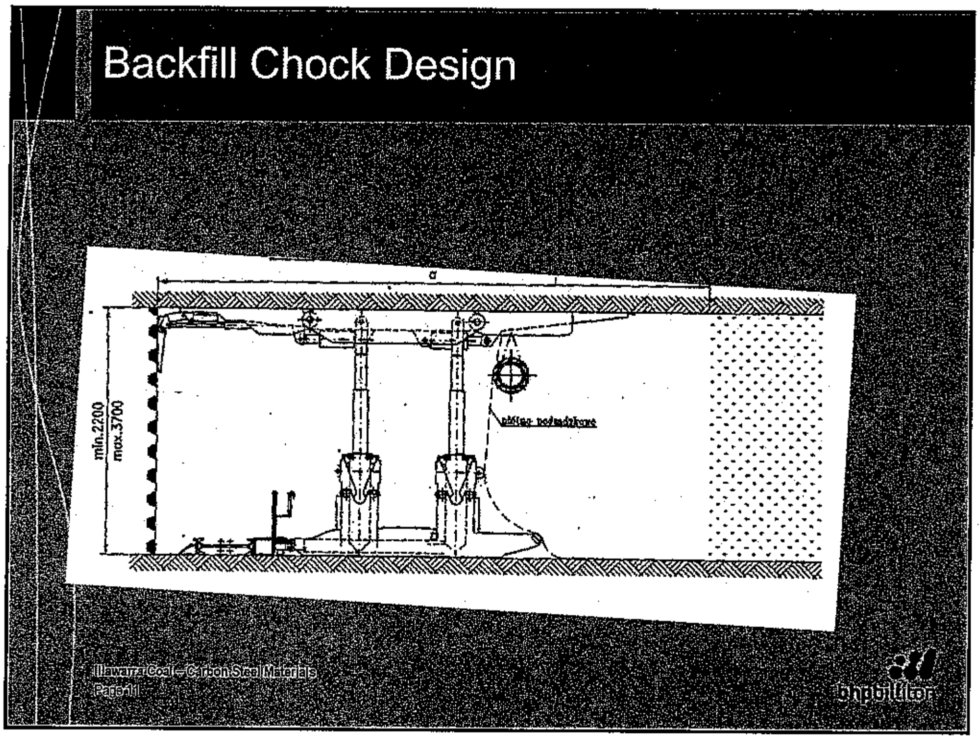
Backfill Chock Design
a
min.2200
max.3700
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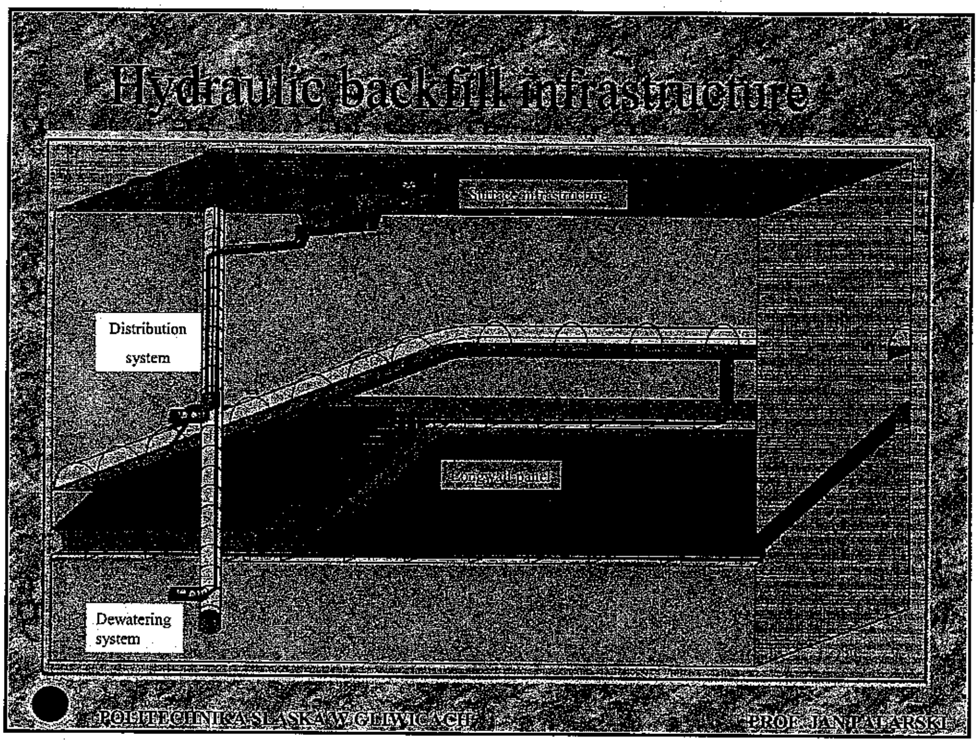
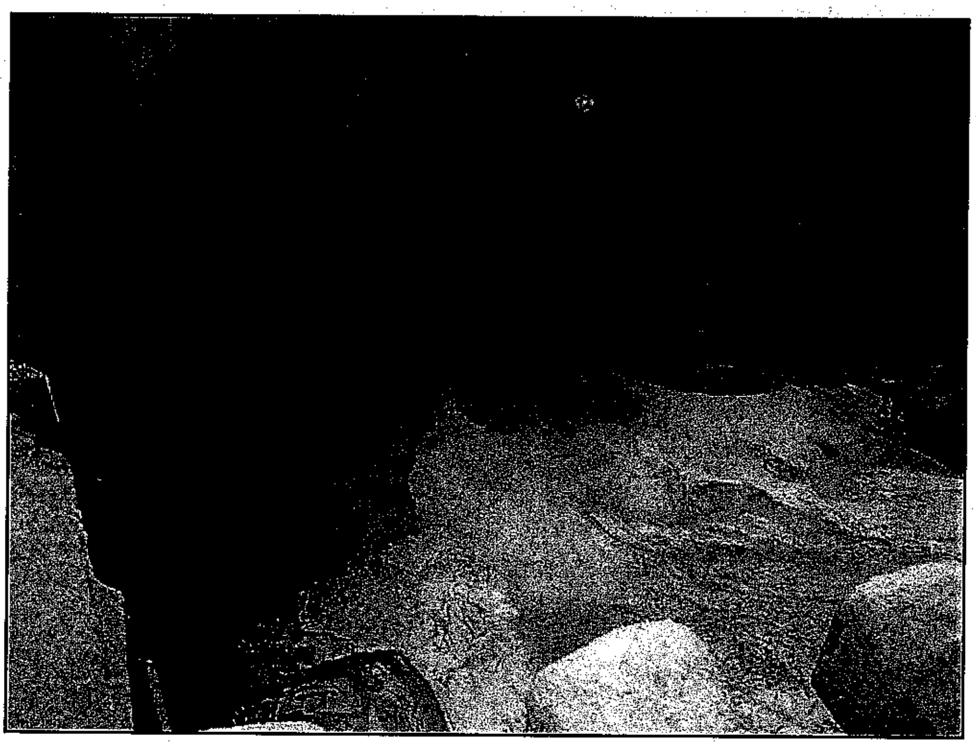
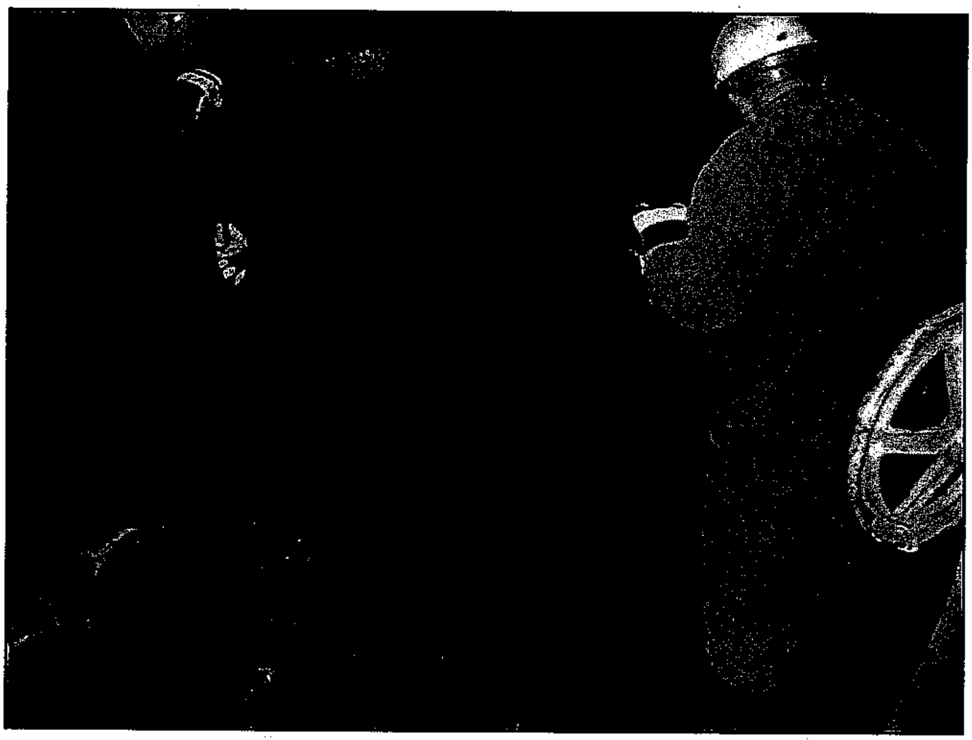
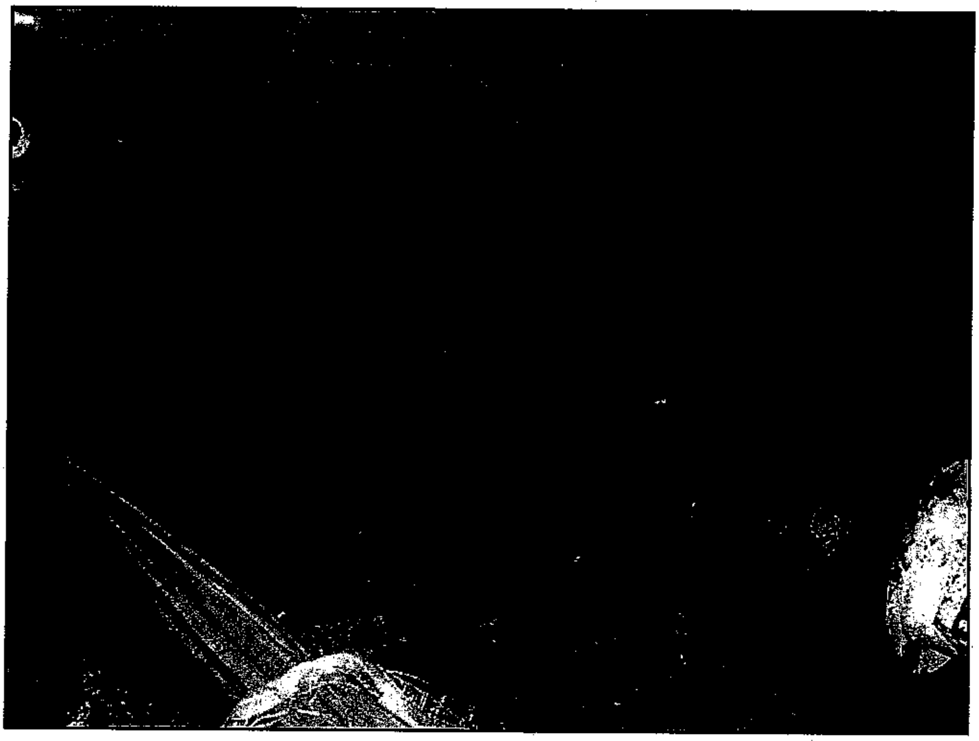
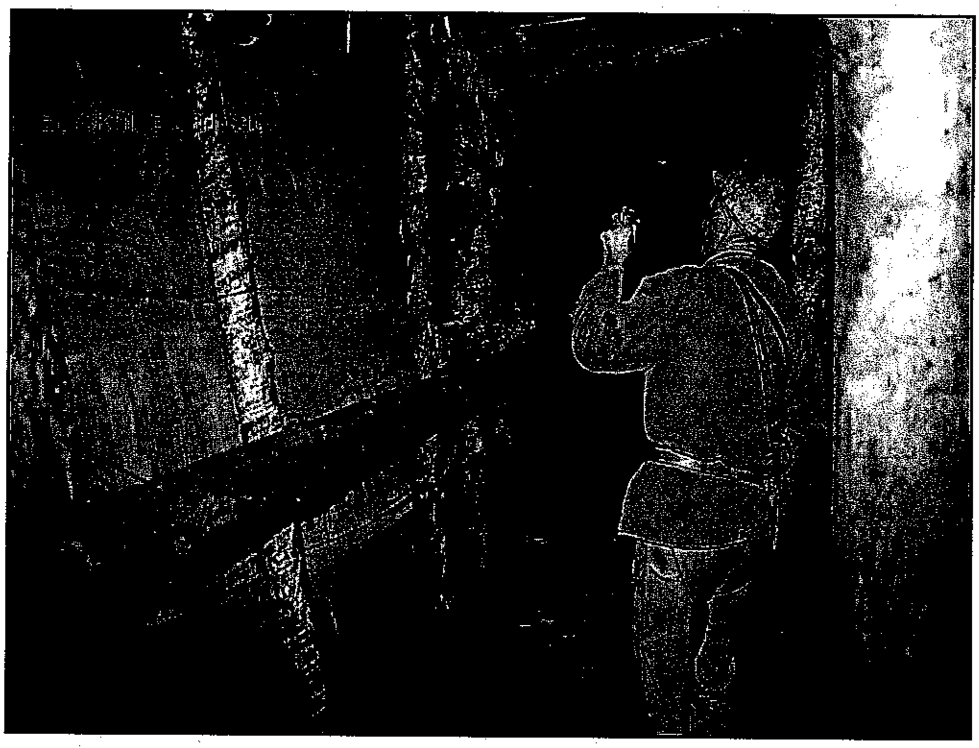

Hydraulic backfill infrastructure
Surface infrastructure
Distribution system
Longwall panel
Dewatering system
POLITECHNIKA SLASKA W GLIWICACH
PROF. JAN PALARSKI







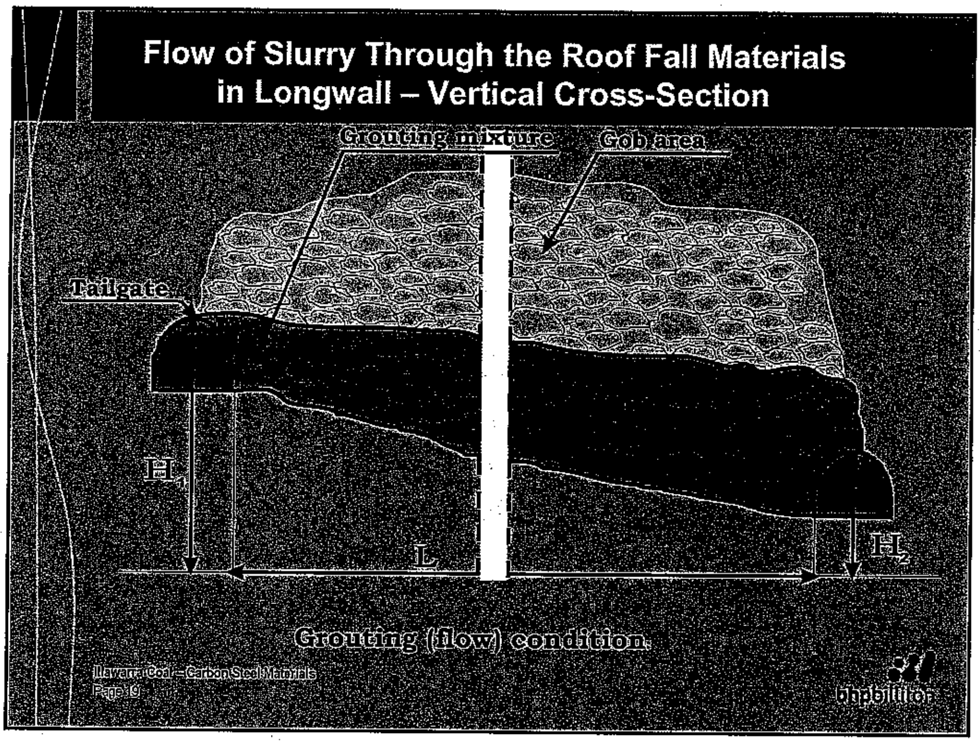


Limitations to Use of Goaf Stowing Backfill Methodology

- Observed operations had significant effect on productivity
  - This was balanced by use of multiple LW's
- Observed operations had specialised LW supports
- Observed processes were very labour intensive
- Large cost associated with backfilling
  - Only 6% Polish mines back fill
- Seam characteristics conducive to backfilling i.e. large dips
- Require sand for maximum subsidence control
- Large water usage for waste rock back fill

Backfill for Spontaneous Combustion Control

- Used fly ash and cement mix
- Modern automated process on surface
- Pipes run in TG and left inbye of face 50m to keep fill off face
- When back pressure raised branch line activated
- Not total goaf filled but slices at about 50m intervals
- No determination of effects on subsidence
- Does not interfere with production process
- Anecdotally fill migrates through goaf readily


Flow of Slurry Through the Roof Fall Materials in Longwall – Vertical Cross-Section
Grouting mixture
Gob area
Tailgate
H1
L
H2
Grouting (flow) condition
Illawarra Coal – Carbon Steel Materials
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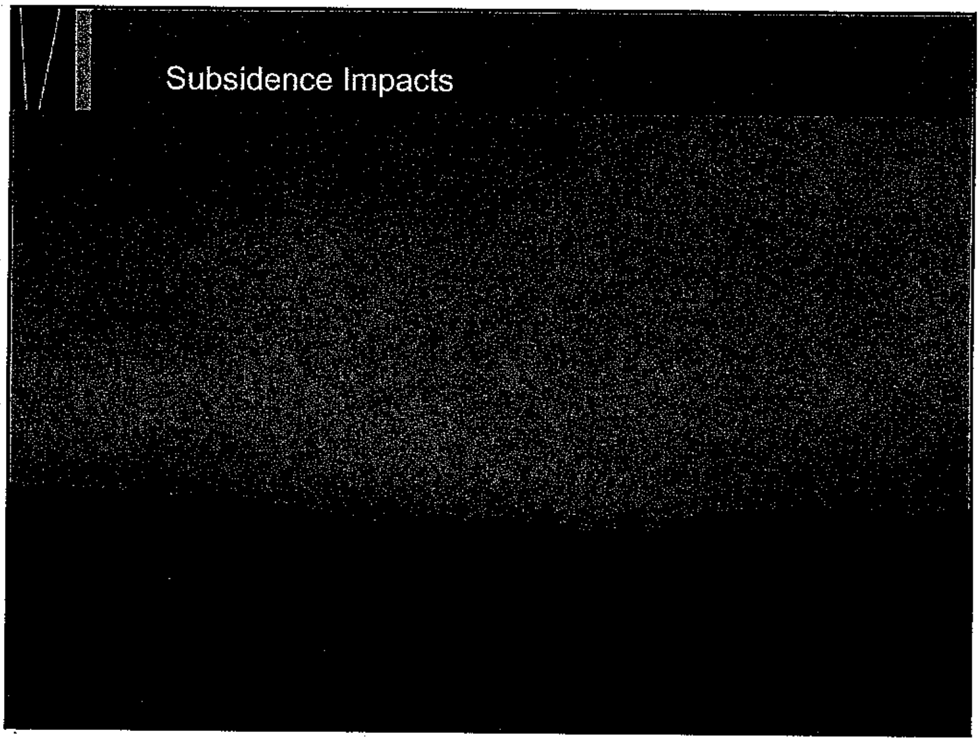
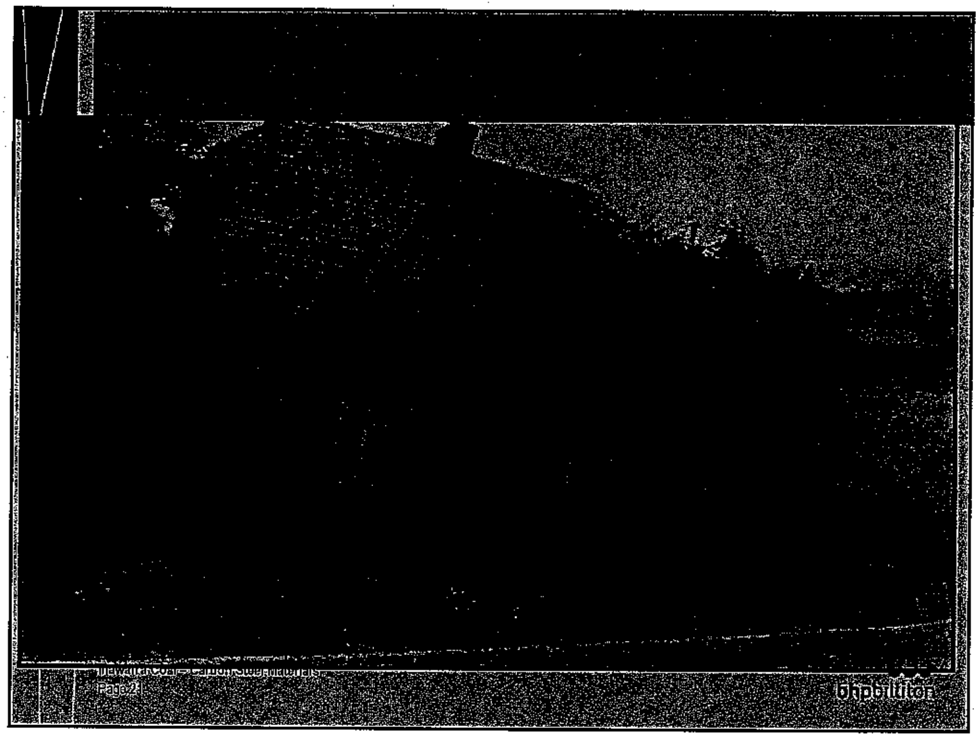

Subsidence Impacts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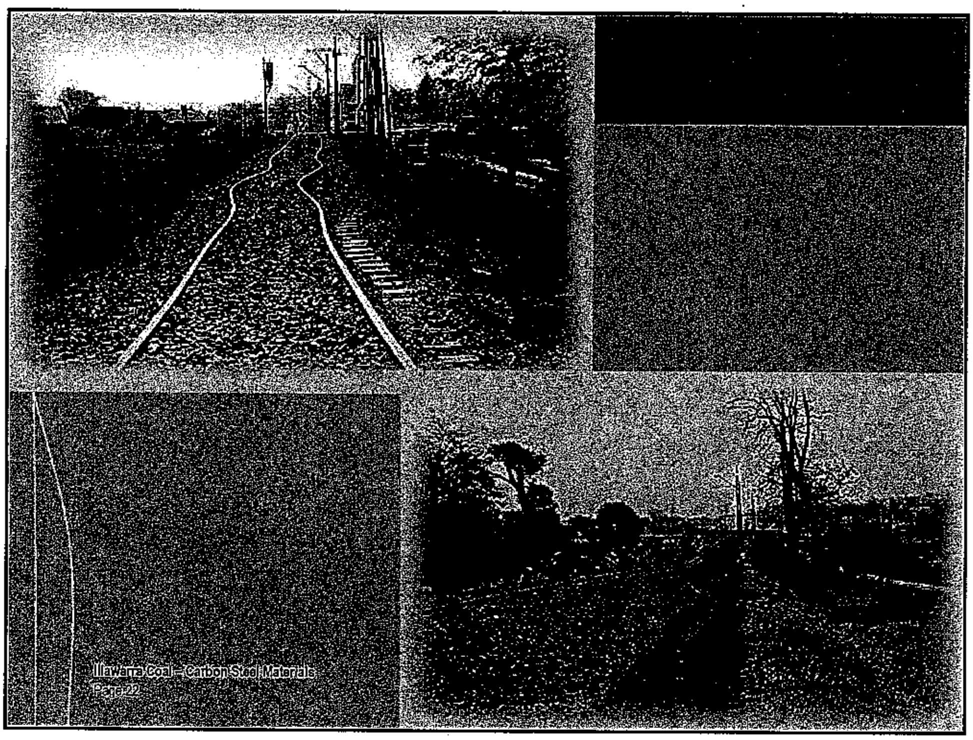
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Opportunities for Further Investigation – Subsidence Control

- Injecting backfill into goaf area
  - Via surface boreholes directly over goaf?
  - Via reticulated backfill pipelines directed into goaf by seam holes?
- This may be undertaken on locations associated with sensitive surface features

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Issues to Address

- Type and consistency of material
- Water use age and management underground
- Effect on mine subsidence
- The parameters to successfully infiltrate the goaf
- Keeping the backfill away from the working face
- Gravity vs assisted transport
- Expense involved with developing trials (vs cost of sterilisation and / or mitigation costs)

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Recommendations

- Investigate the potential to inject into strata / goaf for subsidence control
- Engage Professor Palarski to review and make recommendations as to the potential for strata injection based upon our circumstances
- Use learning from subsidence control investigations to identify the potential of future large scale emplacement of coal wash underground

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